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IN THE COURT OF APPEALS
OF THE STATE OF NEW MEXICO

COURT OF APPEALS OF NEW MEXICO
FILED
FEB 18 2013
Wendy F. Jones

SOUTHWEST RESEARCH AND INFORMATION CENTER and MARGARET ELIZABETH RICHARDS,	)	
Appellants,	)	
v.	)	**No. 32,499 Admin.**
STATE OF NEW MEXICO ENVIRONMENT DEPARTMENT,	)	
Appellee.	)	

NOTICE OF TRANSMISSION OF SUPPLEMENT TO THE ADMINISTRATIVE RECORD

Pursuant to Rule 12-209(C) NMRA, and the Stipulation of the parties filed on or about February 13, 2013, the New Mexico Environment Department hereby transmits to the Court of Appeals the enclosed Supplement to the Administrative Record Proper for the above-captioned case. The Supplement consists of one document, entitled "New Mexico Environment Department's Response to Public Comments on the Class 2 Permit Modification Request for the Addition of Shielded Containers," dated November 1, 2012 (Bates numbers 04465-04489), and a modified Index to the Administrative Record Proper referencing the document. The document

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was inadvertently omitted from the original Administrative Record Proper filed on January 2, 2013.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on this 18th day of February, 2013, a copy of the foregoing Notice of Transmission of Supplement to the Administrative Record was sent by electronic mail and first class mail, postage prepaid, to the following:

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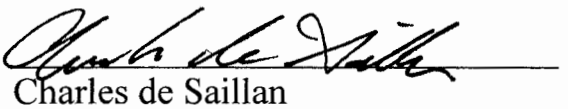

Charles de Saillan
Assistant General Counsel

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(Modified February 18, 2013)

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NEW MEXICO ENVIRONMENT DEPARTMENT'S RESPONSE TO PUBLIC COMMENTS ON THE CLASS 2 PERMIT MODIFICATION REQUEST FOR THE ADDITION OF SHIELDED CONTAINERS

Introduction. The New Mexico Environment Department (Department) is hereby responding to comments it received from the public on the permit modification request (modification) for the addition of shielded containers, dated July 5, 2012. The Department proposes to issue the permit pursuant to its authority under the New Mexico Hazardous Waste Act (HWA), NMSA 1978, §§ 74-4-1 to 74-1-14. On July 12, 2012, the Permittees issued a public notice that the Department would accept comments for 60 days, until September 10, 2012. The Department carefully considered all the comments received. The comments and the Department's responses follow.

1. Comment: I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose.

Response: Table 4.1.1 of the permit limits the volume of RH waste that may be placed in each panel and as an overall total for all the panels. This limit is not being changed in the modification. See forthcoming responses for additional information on RH waste.

2. Comment: Despite what the Department of Energy says, shielded containers could not be handled like contact handled waste because damaged or leaking containers could be too radioactive to over-pack.

Response: The revised permit does include basic requirements for container management and overpacking that are relevant to established conditions that are consistent with Department permit authority. The Permittees have a more detailed and specific technical procedure for container overpacking (WP 05 –WH1010) which includes situations for overpacking a shielded container.

3. Comment: The shielded containers request is not a proper class 2 permit modification. I request the DOE's permit be denied. If this is not so, then I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Response: The regulations, at 40 CFR 270.42 Appendix 1, Item F.3.b, address the modification as requested. The Department has approved similar Class 2 modifications including but not limited to the addition of direct loaded ten drum overpack in November of 2002 and the addition of a standard large box 2 in April 2011. This modification does not substantially alter the existing permit conditions or significantly affect the overall operation of the facility which would warrant a Class 3 modification.

Class 2 modifications provide for public comment by mandating a permit submittal meeting and a sixty day public comments period. In addition to these requirements, the Permittees held a pre-

submittal meeting and additional public meetings. The comments provided during this process do not indicate that any additional significant and/or relevant information would be provided that would warrant a public hearing.

4. Comment: The request is incomplete and does not include important information necessary for the public to adequately comment and for NMED to determine that the modification would protect public health and the environment and comply with other provisions of RCRA and the HWA.

Following are examples of important information that is missing or incomplete or inadequate and some of the questions that need to be answered.

Page 2 of the request states:

> The management and storage requirements of CH TRU mixed waste in the Permit will apply to the waste that arrives at the WIPP facility in shielded containers because the surface dose rate is less than 200 millirems/hr at the time of shipment.

That statement is incorrect. Permit Section 1.5.2. states:

> "Remote-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate of 200 millirem per hour or greater. For WIPP, the surface dose rate shall not exceed 1,000 rems per hour. [Pub. L. 102-579 (1992)]

Thus, regardless of the surface dose rate "at the time of shipment," any container at the WIPP site with a surface dose rate of 200 millirem per hour or greater is remote-handled (RH) waste and must he managed according to the RH waste requirements of the Permit. The request does not appear to recognize that requirement. Because the 30-gallon inner container has a surface dose rate of 200 millirem per hour or greater in each shielded container, there could be one, tens, hundreds, or thousands of such RH waste containers at WIPP. The request provides no technical analysis about the potential for one or more shielded containers with a surface dose rate of less than 200 millirem per hour at the time of shipment to have a surface dose rate of 200 millirem per hour at the time of arrival at WIPP or to have such a surface dose rate at any time at WIPP. Questions that should have been addressed include whether vibration or movement from rough roads could cause shifting or settling of the RH waste such that the surface dose rate changes at the time of shipment to arrival at WIPP; whether there is variation among the generator sites as to how surface dose rates are measured, as compared with how they are measured at WIPP, that give differing results; and whether handling practices at WIPP could result in shifting or settling such that the surface dose rate changes. What circumstances, including accidents and manufacturing errors or quality assurance deficiencies, could result in a shielded container having a surface dose rate of 200 millirem per hour or greater? Not only are there not answers to those questions included in the request, but the request includes no Documented Safety Analysis (DSA) for shielded containers.

Response: All characterization is done at generator sites where there are packaging requirements to minimize shifting for containers already approved by the permit.

The generator sites determine whether a waste falls under the RH or CH waste program, and the Permittees manage it accordingly. Even under the current permit, if containers meet the CH waste criteria, they may be managed in accordance with CH waste criteria and practices irrespective of whether the contents were determined to be RH waste by the generator sites.

This modification provides for the Permittees the option of managing their identified RH waste using a new container, and because this container reduces the dose rate at the container surface to a level consistent with CH waste, the Permittees are allowed to dispose of the waste once accepted at WIPP. That is, if waste meets the criteria for management in CH waste areas, then it can be managed in that area.

See response to Comment 16 regarding the potential for damage or increase in dosage as a result of shipping.

5. Comment: The modification request includes no limits on the amount of remote-handled (RH) waste in shielded containers that can be stored in the Parking Area Unit (PAU) or in the contact-handled (CH) Bay of the Waste Handling Building (WHB), even though such containers will likely have external dose rates that are more than an order-of-magnitude greater than the CH waste that is normally handled. That much higher surface dose rate is never mentioned in the request. The Permit now allows no RH waste in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. Permit Part 3.1.1.2 and Table 3.1.1.

The request is to allow RH waste to be managed in precisely those CH areas in which RH waste is currently, and has always been, prohibited. Yet the request includes no changes regarding Table 3.1.1 and no limits on the number of shielded containers in those areas. Thus, the entire CH Bay Storage Area could be filled with RH waste in shielded containers for up to 60 calendar days.

Response: Once the waste is placed in the shielded container and the surface dose rate is no greater than 200 millirem per hour, the waste is then handled as CH waste. The permit specifies management of waste in the CH waste related areas if the containers in those areas can be managed as CH waste. Using the shielded container, which reduces the dose rate at the surface, allows these containers to be managed in accordance with the permit in CH waste management areas and using CH waste-related management practices.

RH waste distinctions are determined at the generator site when the waste is placed in the original containers. There are specific containers and measurement devices that are used by the generator site before placement of the containers in any canister or shielded container. It is determined by generator shipping requirements. As stated by the Permittees, the RH waste in shielded containers will remain part of the RH waste inventory (the contents having been determined to be RH waste by the generator sites). However, the shielded container changes a "measurement" at the container surface that allows it to meet handling/disposal criteria associated with CH waste. EPA reviewed and approved use of the shielded on August 8, 2011 and stated "...the DOE can treat waste in shielded containers as contact handled (CH) waste for the purpose of facility operations".

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6. Comment: The entire CH Bay Storage Area could be filled with RH waste in shielded containers for up to 60 calendar days. Similarly, the request also includes no changes regarding Table 3.1.2, so the entire PAU could be filled with RH waste in shielded containers and in canisters for up to 59 days, in some cases. Such storage would be in sharp contrast to the storage time limits for the other RH waste not in canisters. Permit Section 3.1.1.10.ii. The request asserts safety, but provides no analysis to show that the 60-day storage time would be protective of public health and the environment, as compared with shorter time limits. The request omits a DSA or other technical basis to demonstrate that such additional storage time beyond 25 calendar days for uncanistered RH waste is protective of public health and the environment. Thus, the request is incomplete.

Response: The request does not require a DSA or other technical basis to demonstrate that additional storage time beyond 25 calendar days for uncanistered RH waste is protective of public health and the environment since the waste meets the criteria for management in CH waste areas by exhibiting the appropriate dose rate at the container surface. Also, see response to Comment 5.

7. Comment: The request does not include the amounts of RH waste that would be managed at WIPP in shielded containers, nor the amount of RH waste that would be managed at WIPP in canisters, nor whether the amount of waste in shielded containers would reduce the number of RH canisters or would allow additional RH waste to be managed. Thus, the public and NMED cannot determine, among other things, the types and amounts of RH waste that would be managed in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. The public and NMED cannot determine how much RH waste in shielded containers would be emplaced in the Underground Hazardous Waste Disposal Units (HWDUs) and how much RH waste in canisters would be in Panels 6, 7, and 8. The request omits a DSA or other technical basis to demonstrate that the requested storage and disposal is protective of public health and the environment. Therefore, the request is incomplete.

Response: Once the waste is in the shielded container and the surface dose rate is less than 200 millirem per hour, the waste can be managed as CH waste. The WIPP Waste Information System will track the volume of RH waste that will be emplaced in the HWDU. Also see response to Comment 5.

8. Comment: The public and NMED cannot determine how much remaining capacity would be available for CH waste in the Underground HWDUs if shielded containers were emplaced. The request Figure 3 (which is not proposed for inclusion in the permit) shows some shielded containers being "randomly placed." However, the request does not describe how "random emplacement" would be accomplished and why shielded containers would be not emplaced if they are received in three three-packs at a time in a shipment with three HalfPACTs. That "normal" operation would result in three-packs being emplaced in locations other than "interstitial" spaces. The request omits a DSA or other technical basis to demonstrate that such "random emplacement" is protective of workers, public health, and the environment. The request includes no information about shielded containers emplaced randomly (or in any other configuration) would make the most efficient use of Underground HWDU capacity. Some CH

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waste emplacement space will be displaced for RH waste in shielded containers, but there is no analysis of how much that might be.

Response: Table 4.1.1 of the permit specifies the volume of RH and CH waste that may be emplaced in each panel. The permit also specifies that there may not be more than 730 RH waste boreholes/panel. It does not mandate a specific percentage of RH to CH waste. The concerns regarding how much remaining capacity would be available for CH waste in the Underground HWDUs are not relevant to this permit modification. As long as the CH and RH waste limits specified in Tables 3.1.1, 3.1.2 and 4.1.1, and relevant provisions of the WIPP permit are complied with, the Permittee may manage the inventory of that waste as appropriate. The requirements for ensuring the table limits are unchanged because, as already discussed, the waste in the shielded containers will meet the CH waste criteria and may be managed in accordance with CH waste criteria.

9. Comment: The number (17,473 shielded containers) stated on page 3 of the request cannot be considered reliable, as it was done 5 years ago and the RH inventory has changed since that time. Moreover, that estimated amount does not account for dunnage containers, which could up to triple the amount of space taken by shielded containers, if each three-pack contains two dunnage containers. Using the estimated amount and adding dunnage containers, therefore, up to 18 percent of the floor space in panels 7-10 could be taken by shielded containers. There is no analysis provided about whether displacing up to that amount of the remaining CH waste in the WIPP Inventory could result in reduction of the permitted amounts of CH waste in panels 7 and 8. Therefore, the request is incomplete.

Response: It is the Permittees responsibility to manage container volumes appropriately and in compliance with the permit. The impact of dunnage on the number of shielded containers that could be emplaced is not a Department concern as long as permit requirements are met. There is no regulatory mandate or WIPP permit requirement to review emplacement of waste with regard to ratios of CH to RH waste other than those specified in Tables 3.1.1, 3.1.2 and 4.1.1. The same applies to dunnage.

10. Comment: Despite extensive discussion in SRIC's December 5, 2011 comments and questions at the June 7, 2012 pre-submittal meeting by SRIC and others, the permittees continue to not discuss a major need for the modification request, despite the requirement that the request explains why the modification is needed. 40 CFR §270.42(b)(1)(iii). That need is to address the permittees' management of WIPP over the past 13+ years in such a way that there is not enough available capacity in the Underground HWDUs for a significant portion of the RH waste in the WIPP Inventory. In Panels 1-5, there are 462 RH canisters emplaced, with a volume of 411.18 cubic meters (462 x 0.89). Panels 6, 7, and 8 have a total capacity of 2,060 canisters (600+730+730), or 1,834 cubic meters, according to Table 4.1.1. Since the permittees have stated that they intend to request a permit modification for panels 9 and 10 to be the same size as panels 1-8, the presumed RH capacity of those two panels would be 1,460 canisters or 1,300 cubic meters. Thus, the total available capacity for RH waste is 3,545.18 cubic meters (411.18+1,834+1,300). That is approximately half of the RH waste legal capacity of 7,079 cubic meters and approximately 2,000 cubic meters less than the amount of RH waste described in the 2011 WIPP Inventory (DOE/TRU-11-3425). (Attachment 1). The actual RH capacity is being

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further limited by the fact that canister emplacement in Panel 6 will be less than half of the 600 cubic meter limit.

Response: See response to Comment 8. The Permit has established RH waste limits that shall not be exceeded.

11. Comment: The fact that there is no[t] enough space for the RH waste in the current WIPP inventory using the current configuration and permit requirements has not been contested by the permittees.[1] How shielded containers relate to meeting the need for capacity for RH waste in the Underground HWDUs must be addressed in an adequate permit modification request. That this major need and the above data are not even mentioned clearly show that the request is grossly incomplete.

Response: The Department disagrees that the need for additional RH waste capacity must be addressed in this permit modification request. As stated above, the concerns regarding how much remaining capacity would be available for CH waste in the Underground HWDUs are not relevant to the Permit or this permit modification. Also see response to Comment 8.

12. Comment: Page 4 of the request states:

> RH TRU mixed waste emplaced at the WIPP facility in shielded containers will remain designated as RH TRU mixed waste in the WIPP Waste Information System (**WWIS**). The emplaced volume will be counted against the RH TRU mixed waste volume limits specified in the Permit.

Proposed revised Permit Section A1-1b(2) states that "Each 30-gallon inner container has a gross internal volume of 4.0 ft3 (0.11 m3)." Since each shipment could contain a single 3-pack of shielded containers, each shipment could have 0.33 cubic meters. Each RH canister holds 0.89 cubic meters. Thus, 100 cubic meters of RH waste in canisters can be handled in 113 shipments, whereas 100 cubic meters of RH waste in shielded containers is handled in a minimum of 304 3-packs, and could require that number of shipments. Therefore, use of shielded containers would substantially increase the number of packages containing RH waste being handled at WIPP, and substantially increase the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. However, those matters are not discussed in the request, and the request is inadequate and incomplete.

Response: As long as the RH mixed waste volume (as accounted for in the WIPP Waste Information System) does not exceed the permitted capacity specified in Table 4.1.1, the number of packages containing RH mixed waste does not concern the Department provided the Permittees remain in compliance with the permit volume limits and other relevant requirements. Inventory management of the permit-allowed CH and RH waste volumes is the responsibility of the Permittees and the concerns regarding how much remaining capacity would be available for

[1] The SRIC analysis, attachment 1, was provided to the permittees on January 26, 2012 (Attachment 2). They have never contested its accuracy, and have agreed with the factual statement that the current configuration does not provide enough actual capacity on more than one occasion.

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CH waste in the Underground HWDUs are not relevant to this permit or this permit modification. Also see response to Comment 8.

13. Comment: Since the permit request provides for no prohibition on dunnage drums, one or two of the 30-gallon inner containers in the shielded container three-pack, the number of containers to be transported to and managed at WIPP could be two or three times the amounts provided in the preceding paragraph. The impact of dunnage drums on the number of shielded containers that could be emplaced, and the amount of space shielded containers could occupy in the PAU, WHB, and Underground SWDU is not discussed in the request. Thus, the amounts described in the request are not accurate and complete, and the request is incomplete.

Response: Dunnage drums are included at the discretion of the generator, are currently used, and have never been a significant concern. In addition, it is the Permittees responsibility to manage container volumes appropriately and incompliance with the permit. As long as the permit requirements are met the concern about the impact of dunnage on the number of shielded containers that could be emplaced is not an issue. As stated earlier, there is no regulatory mandate or WIPP permit requirements to review emplacement of waste with regard to ratios of CH to RH waste other than those specified in the permit. The same applies to dunnage. The flexibility provides the Permittees to arrange waste so that safety is assured.

14. Comment: Instead, the request asserts, but provides no technical analysis, (page 9) for the proposition:

> Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management, storage, and disposal of that waste at the WIPP facility.

Absent any analysis to support the assertion, NMED cannot accept the assertion as stating a need for the modification. Such a proposition could only be true if shielded containers eliminate some RH canisters, for if the same number of canisters are packaged at the generator sites and shipped to WIPP, there are no such reductions.

Response: There would not be a reduction in time and personnel by implementation of this modification assuming that all the allocated bore holes for RH waste would be utilized and additional RH waste would be emplaced using the shielded containers, thus increasing the amount of RH waste potentially managed in each room and the time necessary at the generator sites needed to manage RH waste.

The Department has approved the inclusion of many different CH containers, all designed to provide generator sites with flexibility; this modification provides the Permittees flexibility to allow the generator sites with regard to containers management so this modification is consistent with previously approved Class 2 modifications. Management flexibility is part of a reasonable justification for the modification, provided permit requirements are met. The Department accepts the Permittees statement as adequate.

15. Comment: The second "need" discussed in the request (page 9) is:

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> The Permittees believe the use of shielded containers will be beneficial because the shipment of RH TRU mixed waste in shielded containers in the HalfPACT may be more efficient than shipment in canisters using the RH 72-B Cask.

What the permittees "believe" is not adequate documentation, and it is not an adequate statement of need for the modification. Indeed, shielded containers appear not to be beneficial, especially since shielded containers will compete with use of the storage facilities for CH waste, thereby potentially slowing handling of CH waste. Shielded containers also will displace some actual CH waste capacity in the Underground HWDUs. Of course, use of shielded containers would be extremely detrimental if those containers result in accidents, releases or contamination of the PAU, CH Bay, or Underground HWDUs that disrupt other operations at WIPP. Moreover, there could only be more efficiency if the use of shielded containers reduces the number of RH canisters. But the request does not mention that possibility. Instead, what the Permittees apparently desire is to bring as many RH canisters as possible and additional RH waste in shielded containers. As already discussed, the reality is that shielded containers would increase the amount of RH waste being stored at and disposed of at WIPP.

Response: The Permittee states in Section 3 that the presiding need to accommodate anticipated usage by TRU waste generators. The sentences that follow the statement, the Permittee substantiates the statement with data. The Department considers the statement to be an adequate statement.

16. Comment: The request includes a new section in Attachment A1, A1-1d(4) Handling Waste in Shielded Containers, which states, among other things:

> If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

The request also includes a new section in Part 3, 3.3.1.8. Shielded Container, which states, among other things:

> Shielded containers may be overpacked into a standard waste box or [sic] ten drum overpack.

Those provisions are not valid and cannot be incorporated into the permit. First, a three-pack of shielded containers could not be overpacked into either a standard waste box (SWB) or a ten-drum overpack (TDOP). According to Table A1-2 of the request, a three-pack of shielded containers weighs 7,000 pounds. However, that same table shows that weight exceeds the maximum gross weights of a SWB or a TDOP. Thus, it would be a violation of the permit (and endanger public health and the environment) to allow a three-pack of shielded containers to be overpacked in the proposed containers. Second, a shielded container that is damaged such that in any location its surface dose exceeds 200 millirem per hour should not be overpacked in either a SWB or TDOP because those containers are solely for CH waste. Therefore, overpacking may not be possible for shielded containers. Repair and patching may not be possible for shielded containers. Returning a shielded container not in good condition to the generator site may not be possible, if the damage precludes the HalfPACT from being returned to the generator site. Thus, shielded containers that are not in good condition could be "stranded" at WIPP. The request is

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incomplete in not fully analyzing those possibilities and describing how the situations could be addressed.

If the permittees intend to overpack a single 30-gallon inner container, the request must then discuss how such a situation would comply with the limitations on SWBs and TDOPs and another new proposed provision:

4.3.1.8. Shielded Container
Shielded containers are configured as a three-pack.

A single overpacked shielded container is not consistent with that proposed provision. Nor would the remaining two containers that were not overpacked be consistent with the proposed provision without a dunnage drum.

Response: The permit provides requirements for damaged containers on pages A1-5 and A1-16 that would apply to the shielded containers in the event of a spill or release of hazardous waste.

These comments do not express concern regarding co-detection monitoring or RCRA issues with respect to hazardous waste release or release detection. The commentor is correct that a three-pack of shielded containers could not be overpacked into either a standard waste box (SWB) or a ten-drum overpack (TDOP). The Permittees did not state that a three-pack would be overpacked. The language in the modification states that a shielded container may be overpacked. The Permit requirements shall be meet by the Permittees with respect to weight considerations and other requirements if overpacking is necessary.

The Permittees have a standard operating procedure for CH waste containers that are damaged and/or contaminated. The Permittees have a technical procedure for container overpacking (WP 05 –WH1010) that will be modified to include the situation for overpacking a shielded container.

The revised permit includes requirements for container management and overpacking that the Permittees indicate will be adequate for management of shielded containers. Without evidence to the contrary, the Department accepts the permit (with revisions), with the understanding that the Permittees are responsible for ensuring compliance with the permit and accepting responsibility for violations of the permit.

In addition, under its authority, EPA approved the use of shielded containers on August 8, 2011. EPA found that DOE had fulfilled all documentation requirements set forth by the Agency and had demonstrated that use of shielded containers in the repository would not affect facility compliance with either 40 CFR 191 or 40 CFR 194.

17. Comment: Moreover, the Permit provides that SWBs and TDOPs are for CH waste. To allow shielded containers to be overpacked in those containers requires changes in various other provisions of the Permit, which have not been requested. For example, Permit Section 3.3.1.3, provides that TDOPs may be used to overpack "CH TRU mixed waste." But a damaged shielded container could have a surface dose rate of 200 millirem per hour and could not then be considered to be CH TRU waste. Permit Section A1-1b(1) includes SWBs and TDOPs as CH

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TRU mixed waste, so those provisions would have to be changed to allow overpacking of shielded containers, which are not CH TRU waste. But such a change would be inconsistent with Section A1-1b(2), which relates to RH TRU mixed waste containers, including shielded containers.

Response: The commentor is correct that there is a probability that damaged shielded container could have a surface dose rate of 200 millirem per hour or greater. The Permittees indicate that current management practices will be used and if these practices proved unsuccessful then the Permittees are responsible for subsequent consequences if the permit is violated. This is also true under the current permit for already approved containers and the permit provides procedures for damaged containers on pages A1-5 and A1-16.

18. Comment: Co-permittee U.S. Department of Energy (DOE) has stated another need for shielded containers. Its *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class-C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE/EIS-0375-D), February 2011, states:

> Consistent with this planned change request, this EIS assumes that all activated metal waste and Other Waste - RH would be packaged in shielded containers that would be emplaced on the floor of the mined panel rooms in a manner similar to that used for the emplacement of CH waste. at 2-4.

That need is not discussed in the request, nor is there any discussion of whether, if the request were approved, any further modification in the shielded container provisions would be required. Therefore, the request is incomplete.

Response: The disposal of Greater-Than-Class-C is prohibited at WIPP by the Land Withdrawal Act and was not requested in this permit modification.

19. Comment: SRIC would also note that its comments on the *GTCC DEIS* strongly criticized the document for many legal and technical deficiencies.

Response: Comment noted. Also see response to Comment 18.

20. Comment: The request does not meet the requirements of the HWA and RCRA. 40 CFR §270.42(b)(7)(ii). The request includes numerous changes to the Permit in how RH waste is packaged (using the shielded container), stored in the PAU, opened in the CH Bay of the WHB, examined for contamination and damaged containers, placed on the facility pallet, and emplaced underground. As already noted above, aspects of handling of shielded containers are not completely and adequately described in the request, as required by the HWA and RCRA.

20 NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(1)(iii)) requires that the request explain why the modification is needed. The request fails to discuss, let alone adequately explain, that a major need is to expand the available disposal capacity for RH waste in the Underground HWDUs (see discussion on pages 3-4 above). It is clearly a violation of the HWA and RCRA to not fully explain the need, and the request should be denied. Moreover, the discussion of need in the request is clearly inadequate or erroneous, and does not adequately explain the need.

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As will be further discussed in #2 below, the request also does not meet the requirements for a class 2 modification request. Consequently, the request does not meet the requirements of RCRA and the HWA.

Response: The Department disagrees with this comment. The Department carefully reviewed the requirements of the HWA and RCRA and has determined that the modification adequately addresses handling of shielded containers.

21. Comment: It is clearly a violation of the HWA and RCRA to not fully explain the need, and the request should be denied. Moreover, the discussion of need in the request is clearly inadequate or erroneous, and does not adequately explain the need.

Response: 40 CFR §270.42(b)(1)(iii) states for Class 2 modifications, listed in Appendix I of this section, the permittee must submit a modification request to the Director that: "Explains why the modification is needed". The Department has reviewed the explanation and determined it to be adequate.

22. Comment: The request does not demonstrate that use of shielded containers will protect public health and the environment. 40 CFR §270.42(b)(7)(iii); §74-4-4 NMSA.
The modification request does not discuss the characteristics of RH waste, including that it can have a surface dose rate of up to 1,000 Rem per hour and is highly dangerous to workers and the public. Because of the difficulties of safely permitting RH waste at WIPP, RH waste was not allowed until a Class 3 modification was approved on October 16, 2006, effective November 16, 2006.

Response: See response to Comment 5. The comment is erroneous as once the waste is placed in the shielded container the surface dose rate of the shielded container is no greater than 200 millirem per hour.

23. Comment: As discussed on pages 4-5 above, the use of shielded containers substantially increases the number of packages containing RH waste being handled at WIPP, substantially increases the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. In addition to significantly increasing the operations at the site, those increases pose dangers and increased risk to public health and the environment that are not discussed in the request. The request does not demonstrate that such an increase in the number of packages with RH waste would not endanger public health and the environment. On the contrary, increasing the actual number of RH waste packages could endanger public health and the environment by requiring additional handling of RH waste, thereby increasing exposures and the likelihood of accidents and releases.

Response: It is not known whether the actual number of RH waste-bearing containers would increase or decrease based on the modification because waste shipment is based on generator site management decisions. The number of actual individual containers that would be managed under the modification could increase, but provided permit conditions are met, the permit does

not restrict the number of "types" of containers that can be accepted once approved by the permit. Also see response to Comment 8.

24. Comment: The request (p. 5) states:

> Upon arrival at the WIPP facility, the shielded containers will be processed as CH TRU mixed waste using CH TRU mixed waste handling equipment and operating procedures.

SRIC objects to shielded containers being handled identically to CH waste because RH waste and CH waste are significantly different. Shielded containers will have much higher surface dose rates (an order of magnitude or more) than most CH waste containers. The higher radiation dose in a container could generate gases at a higher rate. The higher radiation dose and different waste characteristics could also generate different gases than CH containers. The higher radiation doses can pose an increased risk of releases to the environment and threat of worker exposures. The permittees should have performed a time motion study for each waste handling step for shielded containers and calculated expected radiation doses and included such study in the request. Such a study could demonstrate that certain procedures should be adopted for shielded containers to minimize personnel exposures, both for workers directly handling shielded containers and for other workers in the PAU, CH Bay, and Underground HWDU. For example, additional worker protective equipment, such as a respirator, may be indicated for personnel doing radiological surveys required by Permit Attachment G3. Specifying additional minimum distances in aisle spaces and limiting the number of shielded containers in the PAU and CH Bay could minimize personnel exposures. Specifying emplacement locations and distances and limiting the number of shielded containers in the Underground HWDU could minimize personnel exposures. Thus, if shielded containers are to be used, revised procedures should be discussed and analyzed to determine the need for changed permit requirements. The permittees reluctance to discuss such requirements may be because they do not want to be subject to class 3 processes. Regardless, technical analysis of these matters should be required to protect public health and the environment.

Response: The Department disagrees with this comment. Shielded containers will have the same surface dose rate restrictions that CH waste containers have. Also see response to Comment 22.

25. Comment: It is not exceeding NMED's authority to recognize the radioactivity in the mixed waste, and addressing radioactivity does not regulate radionuclides. NMED, the permittees, and the public have recognized during the past 20 years since the original draft WIPP permit was submitted that radiation monitoring was an essential part of WIPP's operations and is appropriate and necessary under the HWA. Such monitoring and radiological survey is necessary, and has always been part of the Permit, under the principle of co-detection, to determine whether a potential release of hazardous constituents has occurred. The permittees also have recognized that NMED has authority to include, or not include, RH waste in the WIPP permit. Indeed, the original Permit issued on October 27, 1999 included a prohibition on RH waste. Permit Condition II.C.3.h. The class 3 permit modification, approved on October 16, 2006, removed the RH waste prohibition, but included other provisions that limited RH waste, which were supported by the permittees. Thus, there is both state and federal legal and regulatory authority

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and historic practice that provide that NMED may not approve, or may put various limitations on, RH waste in shielded containers.

Response: EPA's website http://www.epa.gov/osw/hazard/wastetypes/mixed.htm clearly states "The U.S. Nuclear Regulatory Commission (NRC) and the US Department of Energy (DOE) regulate the radioactive portion of mixed waste under Atomic Energy Act (AEA) authority, while EPA regulates the hazardous waste portion of mixed waste under RCRA authority", but in the Land Withdrawal Act, Congress delegated regulatory authority to develop disposal criteria to US EPA (Office of Radiation and Indoor Air), and EPA thus certifies the WIPP facility with respect to compliance with these criteria which include radiological aspects of the waste. The Department is authorized by EPA for the RCRA Program, so the Department regulates the hazardous waste portion of the mixed waste. The Commentor is correct that radiologic monitoring under the principle of co-detection has been used and is still used but it is used as a tool, not as a policy allowing the regulation of the radioactivity.

EPA conducts facility operations inspections and it is these inspections where issues associated with radiologically focused RH waste management would be addressed. EPA certifies the radiological aspects of the waste and implements the inspection criteria of 40 CFR 194 during its own annual facility audits.

26. Comment: If NMED does not deny the request, it must process the request as a class 3 permit modification under 40 CFR §270.42(c). Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(6)(i)(C)), NMED may determine that the modification request must follow the procedures for a class 3 modification because there is substantial public concern about the proposed modification or the complex nature requires the more extensive procedures of class 3. Both requirements are met regarding shielded containers. There is substantial public concern about shielded containers, and there is very substantial public interest in WIPP and RH waste, as has been demonstrated repeatedly over the past 15 years with the WIPP permitting process in which hundreds of people have participated in addition to several organizations, including SRIC, that represent hundreds of other people.

Response: Per 40 CFR 270.42(b)(6)(i)(C)(1), it is the Director (Cabinet Secretary of the Environment Department) who makes the determination whether the public concern is significant as provided under the Hazardous Waste Act 74-4-4.2.I NMSA 1978, "...the secretary determines that there is significant public interest in the minor modification." Comment may be provided to the Secretary but it is the Secretary who makes the decision regarding the significance of the public interest.

27. Comment: The complex nature of using shielded containers also has been demonstrated by the above comments regarding matters that are not adequately discussed in the request. Handling RH waste at WIPP is demonstrably complex and was subject to class 3 modification procedures in 2005 and 2006. Shielded containers would continue the complexity of the existing RH operations and add new procedures. Thus, shielded containers would multiply the complexity of managing RH waste at WIPP.

Response: The Department disagrees that use of the shielded containers is complex. The modification makes language changes to accommodate shielded containers and not process changes to manage these containers.

28. Comment: Also, as noted above on page 3, the permittees previously requested that some RH waste not in canisters be handled at WIPP. As a result of the class 3 permit modification – HWB 06-01 (M) - Permit Section 3.1.1.10.ii was approved to allow RH waste not in canisters to be handled in 55-gallon drums in the Hot Cell. But shorter time limits were established on such RH waste, as compared with CH waste or RH waste in canisters. As part of the class 3 process, more detailed information would be provided as to what time limits should apply if shielded containers are included in the Permit. This complexity requires class 3 processes.

That class 3 modification for RH waste also imposed volume limits on the amounts of RH waste not in canisters that could be in the Hot Cell. Permit Section 3.1.1.11. As part of the class 3 process, more detailed information would be provided as to what volume limits should apply if shielded containers are included in the Permit. This complex situation also requires class 3 processes.

To incorporate shielded containers also requires additional changes to the permit that the permittees have not included in the request. The need for such additional changes also shows the complexity of the request.

Response: See response to Comment 27.

29. Comment: Moreover, on October 24, 2011, NMED Secretary David Martin made a determination that the Los Alamos National Laboratory (LANL) class 2 permit modification request for TA-63 Transuranic Waste Facility would be processed as a class 3 modification (which is ongoing) because of a "long history of substantial public concern regarding the management of hazardous waste at LANL." (Page 2). The NMED Secretary also determined that the modification "would require complex changes to the facility and its operations." (Page 2).

Response: Secretary Martin's decision to process the LANL Hazardous Waste Facility permit modification request as a Class 3 modification was based on different circumstances and cannot be equated to this modification.

30. Comment: There is an even longer history of substantial public concern regarding the management of hazardous waste at WIPP, dating back at least 20 years. That public concern has been manifested repeatedly in the original permitting process, including the public hearing that lasted 19 days in 1999; and in public involvement in numerous permit modification requests over the past 13 years, including the request that allowed RH waste to be managed at WIPP. As already discussed, the use of shielded containers would require complex changes to many aspects of RH management at WIPP.

Response: See response to Comment 27.

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31. Comment: Additionally, other regulations require shielded containers to be a class 3 modification. 40 CFR §270.42, Appendix I.F.1.a requires that a modification "resulting in greater than 25% increase in the facility's container storage capacity..." is a class 3 modification. Also noted above, there are no limits on the amount of RH waste that could be stored in shielded containers in the PAU and CH Waste Bay, so the amount of RH waste allowed in those areas is certainly more than a 25% increase and the amount of RH waste in the WHB can increase by more than 25%.

Response: See response to Comment 8. The amount of waste in the Waste Handling Building (WHB) will not increase and therefore 40 CFR §270.42, Appendix I.F.1.a does not apply.

32. Comment: Regarding the Underground HWDUs, the request (p. 3) states:

> According to Crawford, et.al., 2007[1], 1,922 m3 of RH TRU mixed waste could potentially qualify for shipment in a shielded container.

The existing permitted Underground HWDU capacity for RH waste is 2,635 m3. Table 4.1.1. The amount of RH waste that could potentially be in shielded containers is much more than a 25 percent increase in that storage capacity. Moreover, as described on page 4 and in Attachment 1, even assuming that panels 9 and 10 would be permitted for the maximum number of RH canisters, the capacity would be about 3,545 m3. The amount of RH waste that could potentially be in shielded containers is much greater than a 25 percent increase of that RH container storage capacity.

Response: The cited RH waste disposal capacity limitations apply to both RH waste in canisters and RH waste in shielded containers. Based on site experience through audits, the Department has observed that estimated waste volume and actual waste volume for a given waste stream can differ substantially based on any number of factors. Therefore, the assumption that RH waste capacity will be exceeded based on inventory estimates may or may not prove true, and cannot be a basis for modification denial or elevation.

33. Comment: 40 CFR 270.42, Appendix I F.3.a requires that modifications "[t]hat require additional or different management practices than those authorized in the permit" are class 3. The purpose of shielded containers is to require additional and different management practices for RH waste than those in the Permit. As also discussed on page 8, there should be some different management practices for shielded containers as compared with CH containers. Here again, shielded containers require a class 3 modification.

Thus, based on the HWA and RCRA regulations and because of current NMED practices, shielded containers must be processed as a class 3 modification, if the modification request is not denied.

Response: The Department reviewed management practices with regard to the use of shielded containers and determined that management practices will not change beyond those presented in the modification. This is because shielded containers will be managed in the same manner as the already permitted CH containers.

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34. Comment: The request on page 5 states:

> In order to meet the stacking stability requirements of Permit Attachment A2, Section A2-2b, shielded containers will not be stacked more than two high, and no other waste assemblies or backfill MgO sacks will be placed on top of three-pack assemblies of shielded containers.

However, those stacking requirements are not proposed for inclusion as permit language.

Permit Section A2-1 provides:

> The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Since the request includes no change in that provision and states that shielded containers would be handled as CH waste, other CH waste containers could be placed on top of a 3-pack assembly or a 3-pack assembly could be placed on top of CH TRU mixed waste containers. The request does not demonstrate that such stacking would protect workers or public health and the environment, and indeed the request states that such stacking is not appropriate. SRIC objects to allowing 3-packs of shielded containers to be stacked on top of CH TRU waste containers or to CH TRU waste containers being stacked on top of shielded containers. The Permit should include specific provisions related to handling and stacking of shielded containers. Again, the request does not include a DSA or other technical analysis that stacking of shielded containers in like manner as CH waste is protective of public health and the environment.

Response: The permit language from Section A2-1 allows CH TRU mixed waste containers to be stacked up to three high by stating that waste may be stacked up to three high. It does not require that they be stacked up to three high. It is important to understand that the language as written, allows the Permittees to develop procedures to determine a stacking height as appropriate depending upon certain containers or combination of containers.

35. Comment: The request proposes to revise Permit Part 4, Table 4.1.1 to remove the container equivalent column. SRIC strongly objects to such a revision. The limit on the number of RH TRU canisters, which is indicated in the column, was supported by public comment and technical testimony in the class 3 modification process that added RH waste to the Permit. The information proposed to be stricken is accurate and would remain so if shielded containers were approved. In the request, the permittees have provided no adequate technical basis to remove the column and the limits. The request states that "this column is not used to meet any compliance requirement." (Page 6). There are many parts of the Permit that do not state a "compliance requirement," so that is not a basis to remove the column.

Further, Permit Part 4, Table 4.1.1 as included in the request is not consistent with the current Permit regarding Panel 5 Final Waste Volume, so it could not be included in the Permit.

Response: Permit conditions should be based on regulatory requirements and be enforceable. Redundant information that provides no additional requirements should be avoided. The Department has determined that the container equivalent column merely repeats the maximum capacity requirement and is not necessary or appropriate. It is agreed that the modification Table

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4.1.1 does not show the final waste volume of 15,926.93m^3 CH waste and 153.37m^3 RH waste that is entered in the existing permit. The issued permit will have these entered.

36. Comment: The permittees included in the request Appendix D "Why the Shielded Container Modification is not a Class 3 Modification." At best, the permittees discussion is incomplete. For example, in Part 1 there is no mention that Permit Section 3.3.1 includes seven acceptable storage containers, not solely the four containers included on page D-5 (and pages 8-9 of the request). Thus, three of the permitted storage containers were not included as class 2 modifications. 55-gallon drums and SWBs were part of the original permit application and approved in the 1999 Permit. The RH TRU canister was approved as part of the class 3 modification to permit RH waste.

In the Part 1 discussion, there is no mention of the requirement that increasing facility container storage capacity by more than 25 percent is a class 3 modification. There also is no mention that 40 CFR 270.42(d)(1) specifically allows the permittee to submit a class 3 request even if not sure of the proper classification.

Response: This Appendix was a supplement to the modification and does not have a requirement. The examples provided were adequate as examples.

37. Comment: There is no mention of the requirement that increasing facility container storage capacity by more than 25 percent is a class 3 modification. There also is no mention that 40 CFR 270.42(d)(1) specifically allows the permittee to submit a class 3 request even if not sure of the proper classification.

Response: As previously explained the facility container storage capacity will not be increasing. Also see response to Comment 31.

38. Comment: There also is no mention of the HWA requirement for a public hearing "on a minor permit modification if the secretary determines that there is significant public interest in the minor modification." Section 74-4-4.2.I NMSA 1978. The permittees should have saved themselves, NMED, and the public the time, resources, and inconvenience of twice debating the classification by submitting the request as a class 3 modification.

As regards the Part 2 discussion of stakeholders concerns, it does not fully reflect SRIC's comments of December 5, 2011 or those at the June 7, 2012 pre-submittal meeting. Moreover, the discussion does not reflect the WIPP permit record, which clearly shows substantial public concern regarding the dangers of RH waste and impacts on public health and the environment and that permit requirements regarding RH waste have always included public hearings. There was substantial public concern about RH waste, and support for the RH waste prohibition, during the several year process for issuance of the Permit. There was very substantial public concern about the RH waste permit modification, which was submitted as a class 3 modification request. There was significant public interest in the 2011 shielded containers request, and there is even more significant public concern, and more people commenting, on the current request.

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Response: Public concern regarding RH waste has been expressed at both EPA and the Department hearings and meetings. However, this modification regards container management and the Department has determined that the modification does not constitute a significant change to warrant a Class 3 modification determination and public hearing. The addition of RH waste through a Class 3 permit modification was bundled with other permit changes required by Congress through Section 311 of Pub. L. 108-137. While the public is clearly concerned with RH waste as a whole, the Department reviewed this modification in the context of the modification being sought and agrees that a Class 2 modification is the appropriate class based on the information reviewed.

39. Comment: As described in the request, shielded container three-pack assemblies include items not in CH waste containers. Figure 2 of the request includes a "stiffener," upper and lower "axial dunnage," "radial dunnage," and "pallet," which is also described as a "triangular pallet" (page 5). Figure 2 also shows a "bottom slipsheet." Page 5 of the request also mentions a "plastic reinforcing plate." None of those items are described or incorporated into the Permit, and they may need to be. At a minimum, the request should describe why they should not be incorporated into the Permit.

Slipsheets are typically used with CH waste and are discussed in Permit Section A2-2a(1). The request should clarify whether the shielded container "bottom slipsheet" serves the same purpose as it does for CH waste and whether the "bottom slipsheet" can be used with the forklifts with a push-pull attachment. Page 5 of the request states: "The three-pack assembly will be placed singly on the floor using the slipsheet." However, the request in other places states that shielded containers may also be stacked, so that narrative description is not complete and accurate as regards where the assembly will be emplaced or as to how the slipsheet is used for stacking.

Response: Items such as a "stiffener," "axial dunnage," "radial dunnage," "pallet," "triangular pallet" or "bottom slipsheet" are not included in the permit. It is inappropriate to regulate such items which are not part of the waste. The Permittee must be allowed to use such items as necessary and with flexibility so that workers can be protected.

40. Comment: The proposed changes to Permit Section E-1b(1) are not appropriate. RH waste in shielded containers is to be counted toward the RH waste volume limits. The inspection requirements for shielded containers should be separately described in this section, rather than changing the container inspection requirements for CH and RH waste. Changes proposed for "off-site waste" should not be approved. "Off-site" is the term used in the Permit to distinguish it from "on-site" derived waste. There should be no derived RH waste at WIPP.

Response: The changes proposed do not alter the fact that the waste in the shielded containers will be counted toward the RH waste volume limits. Permit section 2.2.1 explains that the Permittees may receive off-site TRU mixed waste in compliance with the requirements and conditions specified in the Permit. The Permittees may only receive TRU mixed waste from those sites which comply with the applicable requirements of the Waste Analysis Plan (**WAP**) specified in Permit Section 2.3.1 and Permit Attachment C, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)) and as verified through the Audit and Surveillance Program specified in Permit Section 2.3.2.

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Permit section 2.3.5 explains derived waste as any WIPP-generated waste derived from adequately characterized, WIPP-accepted TRU mixed waste generated at an off-site facility. Therefore even under the current permit, there is a possibility of RH derived waste.

41. Comment: SRIC requests a public hearing on any shielded containers modification request. RH waste and shielded containers are a matter of significant interest and concern to SRIC and the public. As demonstrated by these comments, the use of shielded containers would be complex, and stringent measures are required to protect public health and the environment. The complexity of the matters and the incompleteness of the request require a public hearing so that the matters may be adequately examined and questions answered, and the required determinations regarding protecting public health and the environment can be adequately made. Therefore, any permit modification to allow use of shielded containers is a major modification, and SRIC requests a public hearing on the current, or any other, shielded containers permit modification request.

Response: The Department has determined that the shielded container modification falls within the Class 2 designation in 40 CFR 270.42(b) Appendix 1, Item F.3.b. Class 2 modifications provide for public comment by mandating a permit submittal meeting and a sixty day public comments period. In addition to these requirements, the Permittees held a pre-submittal meeting and additional public meetings. The Department has addressed the commentors concerns in this document and does not agree that there are remaining issues that have not been adequately examined.

42. Comment: There is a concerned that the true reason for the Department of Energy's (DOE's) need for this PMR has not been given. It is stated that, "These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment." (Pg. 1) It is unclear if these changes will increase the ability of the Permittees to provide continued protection. Please request that the Permittees explain how the use of shielded containers will increase safety.

Response: The Department accepts the given reason for the modification. The Permittee's do not claim an increase in safety.

43. Comment: Page 9 states, *"The Permittees believe the use of shielded containers will be beneficial because the shipment of RH TRU mixed waste in shielded containers in the HalfPACT may be more efficient than shipment in canisters using the RH 72-B Cask."* Believe? May be? What, if any, are the exact benefits?

Response: The RCRA regulations do not require the Permittee to state the benefits. The Permittees are required to provide an explanation for the need for the change as required by 40 CFR 270.42(b)(1)(iii). The Permittees statement of "believe" is also reasonable for the situation as until fully implemented the analysis cannot be verified. In the sentences that follow the statement, the Permittees go on to substantiate the statement with data. See response to Comment 21.

44. Comment: Page 9 states, "Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management, storage, and disposal of that waste at the WIPP facility." Are expected? What are the exact management, storage, and disposal time and personnel reductions?

Response: This is not relevant to the Permit. The Permit does not regulate activities at the generator sites.

45. Comment: If this PMR is a money-saving measure, please have the Permittees state how much will be returned to the taxpayers annually with the use of shielded containers. We have all already spent much time and effort on this issue.

Response: Fiscal aspects are not addressed in the Permit.

46. Comment: The September 2011 PMR stated, "The use of the shielded containers will enable DOE to significantly increase the efficiency of transportation and disposal operations for RH TRU waste at the Waste Isolation Pilot Plant (WIPP)." This statement is missing from the current July 2012 revision. Has it been decided that shielded containers will not increase the efficiency was operations?

Response: Transportation and efficiency are not regulated by the Permit. The Permittee stated the presiding need for the modification to be to accommodate anticipated usage by TRU waste generators. The Department considers this to be a valid reason.

47. Comment: In the September 2011 PMR, DOE claimed "negligible effect on long-term performance" of the shielded containers. This claim is no longer made. What are the effects of shielded containers on long-term performance?

Response: It appears the commenter is concerned about "long-term" meaning beyond the RCRA post-closure period. If so, then this comment falls outside the Department's authority and US DOE and US EPA are the appropriate regulatory agency to comment.

48. Comment: No mention is given of any thermal effects of remote-handled waste stored in shielded containers. The thermal effects of remote-handled waste stored in shielded containers on the waste matrix at WIPP must be studied.

Response: The thermal distribution discussed during the RH TRU waste permit modification included an explanation of thermal loading and how the volume of waste in a waste Panel meets those criteria. This modification does not alter the amount of RH TRU waste in a Panel.

49. Comment: It seems that we have been getting less information on shielded containers, not more. What we do know is that much of the planned RH space in the walls of underground rooms is not available because DOE brought contact handled waste to WIPP while RH waste was prohibited. Available RH space for emplacement in some of the panels was lost. And, from the time RH waste was permitted, DOE still has not shipped RH waste at a rate sufficient to use the available capacity. Is this PMR an effort

to catch up on lost opportunities to emplace RH in WIPP? In this Permit Modification Request, DOE must state a valid reason to use shielded containers.

Response: The Permittee stated the presiding need for the modification to accommodate anticipated usage by TRU waste generators. The Department considers this to be a valid reason.

The commentor's concern regarding CH vs. RH waste inventory and what capacity there will be for each does fall within NMED's authority. Table 4.1.1 in the Permit specifies the volume of RH and CH waste that may be emplaced in each panel. The Land Withdrawal Act, implemented through EPA's certification criteria, also specifies that:

> 1) No more than 5 percent by volume of the remote-handled transuranic waste received at WIPP may have a surface dose rate in excess of 100 rems per hour,
> 2) remote-handled transuranic waste received at WIPP shall not exceed 23 curies per liter maximum activity level (averaged over the volume of the canister),
> 3) the total curies of the remote-handled transuranic waste received at WIPP shall not exceed 5,100,000 curies, and
> 4) the total capacity of WIPP by volume is 6.2 million cubic feet of transuranic waste.

There are no other federal or state requirements that mandate that any specific percentage of CH to RH waste be emplaced. Therefore, the concerns regarding how much remaining capacity would be available for CH waste in the Underground HWDUs are not relevant to this permit, as it is the Permittees responsibility to ensure that Permit, LWA and EPA criteria are met. As long as the CH and RH waste limits specified in Tables 3.1.1 and 4.1.1 of the WIPP permit are complied with (as well as other relevant permit requirements) the Permittee may manage the inventory of that waste in any combination necessary.

50. Comment: This shielded containers request is NOT a proper Class 2 permit modification. We request a public hearing and that the proposal for shielded containers be treated as a Class 3 modification so that there would be the opportunity for more extensive public comment and a hearing.

Response: See response to comment 26.

51. Comment: Given the inherent increased dangers of RH waste, the need for much more information, the complexity of the changes proposed, and the public concern about RH waste, shielded containers require a Class 3 modification request. This proposal is of more than sufficient significance that NMED should now designate DOE's request as a Class 3 modification and treat it as such.

Response: See response to comments 26 and 27

52. Comment: Contrary to what DOE says, shielded containers cannot be managed in a manner consistent with management of CH waste. This language must be changed in the PMR. There is the simple matter of the radically increased weight involved with shielded

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containers, which logically would call for using different handling procedures than CH wastes.

Response: The weight limitations for management of containers are the same and are dictated by the capacity of the equipment. This is not changed for shielded containers.

53. Comment: The amount of RH waste allowed in the Waste Handling Building would greatly increase. The modification request includes no limits on the number of RH shielded containers that could be in the CH Bay, in effect substantially increasing the amount of RH waste allowed. The exact limits must be stated in the PMR.

Response: See response to Comment 5.

54. Comment: I live in Taos County, and though it is not in the fifty mile radius of a foreseeable disaster, the winds do blow this way. I remember the smell of the fires at Los Alamos a few summers ago, and how the smoke filled the skies. I don't believe there is anything safe about storing the waste, about the safety of shielded containers, or about the transportation of the plutonium rods or bits that would be part of all this. Though our nation needs a solution to nuclear waste, placing it in this pristine environment at the expense of poor and minority communities is wrong. We must all share the burden equally. Those who use the power should be expected to handle their share of the waste, so please don't let more waste come to New Mexico. Perhaps the first peoples walked on these lands in New Mexico some 12,000 years ago. A nuclear accident is not impossible with terrorism threats, poor management at LANL, and a lack of dedicated resources. Our world's history could be obliterated as well as the current occupants of the beautiful southwest. I pay my taxes, and support our constitution. Where does it say, the few should pay for the many? I urge you and this committee to act in accordance with the ordinary people who live here, who have made this area home. I will continue to educate myself and my family and my friends here in Taos [C]Ounty, and around the world about the plans and activities at Area 55 and in New Mexico, generally. The world is with us.

Response: Comment noted.

55. Comment: As a life-long resident of New Mexico, I fully support the DOE/CBFO and Washington TRU Solutions LLC request to utilize a shielded container for the packaging and safe handling of RH waste. This request will not only expedite the ability of DOE/CBFO and its M&O contractor to handle and dispose of remote handled (RH) waste, but it will also further protect the WIPP workforce by reducing the potential for exposure to radiation. In my opinion, this is a "no-brainer" decision in that it reduces the amount of time (and money) spent on handling waste by speeding up the process and it promotes a safer work environment for the waste handlers and radiological technicians.

Response: Comment noted.

56. Comment: I fully support the proposed modification. Using small shielded containers with simplified emplacement underground will reduce worker industrial safety exposure to the handling of remote handled TRU waste compared to the currently approved wall emplacement

methods in the permit. Using small shielded containers that are never opened and minimally handled will also reduce worker radiological exposure. These industrial and radiological safety enhancements are sufficient to approve the proposed modification.

Response: Comment noted.

57. Comment: I fully support the proposed permit modification proceeding as a Class 2 Modification. The proposed changes are simple and do not affect the total RH TRU waste volumes limited in the permit. Prudently expediting this modification will hasten the safety benefits derived from its approval.

Response: Comment noted.

58. Comment: Nuclear Watch New Mexico states: The amount of RH waste shipped to WIPP, stored above ground, and disposed underground would substantially increase. This is simply not true. The permitees are not asking for a change in storage capacity or volume limit. In fact, a prior argument made by some of Nuclear Watch's affiliates is that WIPP is falling behind in its RH disposal, which shielded containers could help remedy.

Response: Comment noted.

59. Comment: Nuclear Watch New Mexico states: Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public. "Might not be able" is interestingly speculative language, and the DOE and its contractors explained how overpack containers would be used during the recent hearings. I believe DOE has adequately explained and demonstrated its ability to handle shielded containers.

Response: Comment noted.

60. Comment: Nuclear Watch New Mexico states: DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste. I don't know what other potential uses of shielded containers the DOE might be considering for the future, but that's an entirely different issue not related to this permit modification. Shielded containers are a tool designed to increase efficiency. Because the waste in the shielded containers will meet all the criteria in the permit, then this argument is like saying we should not allow this waste stream at WIPP because WIPP might want to dispose of more of this waste stream in the future.

Response: Comment noted.

61. Comment: Nuclear Watch New Mexico states: Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request. Shielded containers have never been used because the permit modification has yet to be approved. That's the entire point to the permit modification request,

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and it is a logical fallacy for justifying any opposition. This argument is basically saying we should oppose their use because we oppose their use.

Response: Comment noted.

62. Comment: The arguments currently presented by Nuclear Watch New Mexico in opposition to shielded containers have a feel to them of being obligatory placeholders, made only because the group feels compelled to make some sort of argument in opposition to anything at WIPP. I'd like to also note that the use shielded containers would actually decrease the number of RH trucks transporting waste to WIPP, a point that seems lost on its detractors. In fact, due to the increased transportation and waste handling efficiency, shielded containers will actually lessen the already very small risks to the citizens of New Mexico from WIPP operations, thereby making the Nuclear Watch New Mexico opposition actually opposite to the organization's stated goals.

Response: Comment noted.

3 Comment: I believe the Department of Energy and its contractors have done an excellent job addressing the technical questions asked by the NMED earlier this year and encourage your organization to approve this permit modification request.

Response: Comment noted.

64. Comment (Summarized): The Permittees are proposing to specifically identify and clarify that the shielded container being requested will be an authorized disposal container at the WIPP. The Permittees are providing proposed revised text for consideration for inclusion in proposed Part 3, Section 3.3.1.8 Shielded Container. The proposed text references previously proposed figure A1-37. Figure A1-37 is based on the specific drawing of the shielded container that was approved by the NRD.

Response: This proposed change will be made to the Permit. Condition 3.3.1.8 will have additional language that reads: "Shielded Container" refers to the container depicted in Figure A1-37.

65. Comment: I have always been opposed to transport of radioactive waste in NM!! First of all, as a teacher who was travelling in the summer months and was held up in Gallup, NM for hours, (which was when a truck carrying only inflammable materials overturned near a school). I helped the teachers who were frantic to get the children away from the accident and safely home to their parents. I helped to interview frantic parents and teachers, looking for children who had gone to homes of friends or attempted to WALK home. It was chaos – and THAT wasn't even nuclear. Your conceptions of safety are NOT adequate and will never be with nuclear items. I've gone to the meetings and protested. I have written letters to all sorts of significant people and I've sat in a "SIT-IN" about the WIPP site. You ignore us and do as you please, thinking your latest small concessions are adequate for safety – but you have never been in a real emergency. I was on Mtn. Rescue in Albuquerque for years. I helped relocate people to

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Albuquerque from New Orleans, etc. Adding nuclear danger to the equations is IMPOSSIBLE! WAKE UP and LIVE!!

Response: Comments noted.

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IN THE COURT OF APPEALS
OF THE STATE OF NEW MEXICO

COURT OF APPEALS OF NEW MEXICO
FILED

JAN 02 2013
Wendy F Jones

SOUTHWEST RESEARCH AND INFORMATION CENTER AND MARGARET ELIZABETH RICHARDS

Citizen Appellants,

vs. **Ct. App. No. 32,499**

STATE OF NEW MEXICO ENVIRONMENT DEPARTMENT,

Appellee,

IN THE MATTER OF THE CLASS 2 MODIFICATION FOR SHIELDED CONTAINERS FOR REMOTE-HANDLED TRANSURANIC WASTE AT THE WASTE ISOLATION PILOT PLANT U.S. EPA No. NM4890139088

Appeal from the Southwest Research and Information Center and Margaret Elizabeth Richards (collectively, "Citizen Appellants")

NOTICE OF COMPLETION AND TRANSMISSION OF THE ADMINISTRATIVE RECORD

Hand Delivered to: Lindsay A. Lovejoy, Jr.
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YOU ARE HEREBY NOTIFIED THAT pursuant to Appellate Rule 12-211 NMRA, the Administrative Record in the above-captioned case were completed and transmitted to the COURT OF APPEALS on January 2, 2013.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing Notice of Completion and Transmission of the Administrative Record was mailed to counsel of record on January 2, 2013.

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IN THE COURT OF APPEALS
OF THE STATE OF NEW MEXICO

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Final Draft

Review of DOE Planned Change Request for Shielded Containers for Remote-Handled Transuranic Waste

Contract Number EP-D-10-042
Work Assignment No. 1-02
Revision 4

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December 29, 2010

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LIST OF ACRONYMS

AA	Accident Analysis
AK	Acceptable Knowledge
ALARA	as low as reasonably achievable
AMAD	activity median aerodynamic diameter
AMWTF	Advanced Mixed Waste Treatment Facility
AMWTP	Advanced Mixed Waste Treatment Project
ANL	Argonne National Laboratory
ANL-CCP	Argonne National Laboratory - Central Characterization Project
ANLE-CCP	Argonne National Laboratory – East – Central Characterization Project
ANSI	American National Standards Institute
ARF	airborne release fraction
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials (ASTM International)
ATWIR	Annual Transuranic Waste Inventory Report
BCLDP	Battelle Columbus Laboratory Decommissioning Project
BDR	batch data report
BI	baseline inventories
C&T	Crawford and Taggart
C/kg	coulombs per kilogram
CBFO	Carlsbad Field Office (DOE)
CCA	Compliance Certification Application (WIPP)
CCDF	cumulative complementary distribution function
CCP	Central Characterization Project
CFR	*Code of Federal Regulations*
CH	contact handled
CH-TRAMPAC	Contact-Handled Transuranic Waste Authorized Methods for Payload Control
Ci	curie
CMS	configuration management system
CoC	Certificate of Compliance
cpm	counts per minute
CPR	cellulosics, plastics, and rubber

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CRA	Compliance Recertification Application
CREL	Compliance Recertification Electronic Library
DBR	direct brine release
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
DR	damage ratio
DRC	Document Review and Comment
DRF	document review forms
DSA	Documented Safety Analysis
DTC	dose-to-curie
EDTA	ethylene diamine tetraacetic acid
EPA	U.S. Environmental Protection Agency
FEP	feature, event, or process
FGE	fissile gram equivalent
FGR	Federal Guidance Report
FR	Federal Register
GA	gauge
GE VNC	General Electric Vallecitos Nuclear Center
GM	Geiger Mueller
Gs	standard acceleration of gravity
Gys	gray or grays
HP	health physics
Hz	Hertz
INL	Idaho National Laboratory
INL-CCP	Idaho National Laboratory - Central Characterization Project
keV	kilo electron volt; 1,000 electron volts
kg	kilogram
kPa	Kilo Pascal
LANL	Los Alamos National Laboratory
LANL-CCP	Los Alamos National Laboratory - Central Characterization Project
LBNL	Lawrence Berkley National Laboratory
Le/r	slenderness ratio

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LHS	Latin hypercube sampling
LLNL	Lawrence Livermore National Laboratory
LPF	leak path factor
LWA	Land Withdrawal Act
m	meter
m^3	cubic meter
MAR	material at risk (pg. 67, App. B)
MCNP	Monte Carlo N Particle Transport Code
MeV	million electron volts
MgO	magnesium oxide
MOI	maximally exposed offsite individual
MPa	megapascal
mrem	milliroentgen equivalent man
mR	milliroentgen
M&TE	measurement and test equipment
NCT	normal conditions of transport
NDA	non-destructive assay
NDE	non-destructive examination
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
OD	outside diameter
ORNL	Oak Ridge National Laboratory
ORNL- CCP	Oak Ridge National Laboratory - Central Characterization Project
PA	performance assessment
PABC	Performance Assessment Baseline Calculation
PACTD	Payload Assembly Container Transportation Certification Document
PAVT	Performance Assessment Verification Test
PCR	Planned Change Request
PE Ci	plutonium equivalent curies
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
POC	pipe overpack container
QA	Quality Assurance

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QAPD	Quality Assurance Program Document
QF	quality factor
R	Roentgen
RadCon	radiation control
REDC	Radiochemical Engineering Development Center
rem	roentgen equivalent man
RF	respirable fraction
RH	remote handled
RH-TRAMPAC	Remote-Handled Transuranic Waste Authorized Methods for Payload Control
SC	shielded container
SCA	shielded container assembly
SC&A	S. Cohen and Associates
SCPA	shielded container performance assessment
SI	International System of Units
SNL	Sandia National Laboratory
SRS	Savannah River Site
ST	source term
Sv	sievert
TAAC	TRU alpha activity concentration
TAER	Type A Evaluation Report
TED	total effective areas
TMU	total measurement uncertainty
TRAMPAC	Transuranic Waste Authorized Methods of Payload Control
TRU	transuranic
TRUPAC	Transuranic Package Transporter
USQ	Unreviewed Safety Question
VNC-CCP	Vallecitos Nuclear Center – Central Characterization Project
W	watt
WCO	waste certification official
WCPIP	Waste Characterization Program Implementation Plan
WDS	Waste Data System
WIPP	Waste Isolation Pilot Plant
WWIS	WIPP Waste Information System

EXECUTIVE SUMMARY

This report summarizes SC&A's review of the planned change request (PCR) submitted by the U.S. Department of Energy (DOE) to the U.S. Environmental Protection Agency (EPA) proposing the disposal of some remote-handled (RH) transuranic (TRU) waste in shielded containers on the floor of the disposal rooms at the Waste Isolation Pilot Plant (WIPP), rather than in canisters emplaced in the disposal room walls. The shielded containers have the approximate external dimensions of a 55-gallon drum, and the wall of the proposed container would consist of a lead-shielding layer sandwiched between an inner and outer layer of carbon steel. The dose rate at the surface of the shielded containers will be limited to 200 mrem/hr or less, as specified for contact-handled (CH) TRU waste in the WIPP Land Withdrawal Act, thus permitting DOE to handle the shielded containers as if they contained CH TRU waste. DOE's technical justification for the shielded container PCR was based, in part, on a special shielded container performance assessment (SCPA) designed to show that long-term performance of the repository was not significantly affected by the use of shielded containers.

The baseline selected for comparison with the SCPA was the 2004 Performance Assessment Baseline Calculation (PABC-2004), which provided the basis for EPA's first re-certification of the WIPP (as required every 5 years). At the time the PCR was submitted to EPA, the PABC-2004 was the most recently EPA-approved performance assessment (PA).[1] This baseline PA is designated as SCPA Scenario 1. Since the exact quantity of RH TRU waste that could be placed in shielded containers and meet the 200 mrem/hr surface dose rate criterion is uncertain, DOE chose a bounding approach for the SCPA in which all the RH TRU waste inventory would be emplaced on the floors of the disposal rooms. This was designated as SCPA Scenario 2. Scenario 3 assumed that half of the RH TRU waste would be placed on the disposal room floor in shielded containers and half would be in canisters placed in boreholes in the walls of the disposal rooms. DOE also examined a fourth scenario in which the 77 RH waste streams were treated individually, rather than aggregated into a single stream, which was the approach taken in Scenarios 1, 2, and 3. The mean cumulative complementary distribution functions (CCDFs)[2] for the four scenarios were virtually indistinguishable from each other.

In response to the PCR, EPA advised DOE of requirements that needed to be satisfied before the Agency would consider the PCR, including:

- NRC must approve the shipping container design
- The Department of Transportation must approve the shipping container design
- A safety analysis must be prepared by DOE

SC&A's evaluation of information provided by DOE indicates that these requirements have been adequately addressed.

SC&A conducted a detailed review of possible temperature effects in a shielded container and determined that the temperature rise within a container was small, being only a few degrees.

[1] On November 18, 2010, EPA re-certified that the WIPP remains in compliance with the requirements of 40 CFR 194 (75 **FR** 70584).

[2] CCDFs define the probability of exceeding radionuclide releases of various magnitudes.

SC&A also reviewed the changes to the WIPP baseline inventory and determined that the increases in the amounts of steel; lead; and cellulosics, plastics, and rubber (CPR) materials would increase by 42%, 83%, and 2%, respectively. SC&A also determined that inventory data were correctly integrated into the SCPA.

DOE used shielding calculations conducted with MicroShield® to estimate the quantities of RH TRU that could be considered as candidates for disposal in shielded containers. Based on the PABC-2004 inventory, about 32% of the final RH TRU waste form volume could be packaged in shielded containers, assuming that Cs-137 is the dominant photon emitter. Using an updated baseline inventory for the year ending December 31, 2007, this estimate increased to 97%. SC&A concluded that the MicroShield® analyses performed by DOE in support of the shielded container PCR are well-documented and appropriate for the intended use in scoping those RH TRU waste streams that are candidates for disposal in shielded containers.

Chemistry-related processes that could be affected by use of the shielded containers in the repository include gas generation from anoxic corrosion, gas generation caused by CPR degradation, redox conditions after repository closure, carbon dioxide (CO_2) consumption, and complexation of actinides by organic ligands. The principal effects of the shielded containers on WIPP repository chemistry would be expected to result from the large increases in the inventories of iron and lead, and small increases in cellulosics and plastics from the emplacement materials. Processes such as gas generation from anoxic corrosion of metals and microbial degradation of CPR, establishment of reducing conditions by metals corrosion and CPR degradation, CO_2 consumption by reaction with iron and lead, and competition of aqueous iron and lead species for organic ligand binding sites with actinides were evaluated. The results of this evaluation indicate that the increased iron, lead, and CPR inventories are not expected to have significant negative impacts on PA.

The approach used for the SCPA is similar to that used for previous PA calculation sets. The SCPA uses the same parameters and parameter values that were used in the PABC-2004, except for four constant parameters used only by the code CCDFGF for two of the three waste emplacement scenarios. The new parameters are derived from simple mathematical relationships that were checked for validity during this review and found to be accurately calculated and reported. The new emplacement scheme that would be used for RH waste in shielded containers also affects some of the stochastic variables used in CCDFGF calculations. For example, the probability of intruding RH waste will be affected by the new emplacement scheme. DOE revised the appropriate stochastic variables for the SCPA. The SCPA included three new sets of CCDFGF calculations using revised parameters. This review found no other changes that should have been made to CCDFGF. The run control scripts were reviewed and found to be complete. Furthermore, an independent check on the placement of selected CCDFGF simulations into Sandia National Laboratories' (SNL's) Configuration Management System (CMS) was made during an onsite visit.

A fundamental issue in implementing the use of shielded containers is the ability to determine that the surface dose rate does not exceed 200 mrem/hr. Procedures used throughout the DOE complex were reviewed and summarized. Based on this review, a list of factors that should be considered for inclusion in a complex-wide standardized procedure was proposed.

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In summary, SC&A found that the design basis for the shielded container PCR was technically sound. However, important implementation questions must be addressed. For example, consideration should be given to adopting complex-wide procedures for characterizing the surface dose rate for shielded containers, and the procedures should account for measurement uncertainty to ensure that the 200 mrem/hr surface dose rate limit for CH TRU is not exceeded.

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1.0 INTRODUCTION

On November 15, 2007, the U.S. Department of Energy (DOE) submitted to the U.S. Environmental Protection Agency (EPA) for approval a Planned Change Request[3] (PCR) proposing disposal of some remote-handled (RH) transuranic (TRU) waste in shielded containers on the floor of the disposal rooms at Waste Isolation Pilot Plant (WIPP), rather than in canisters emplaced in the disposal room walls as is presently done (Moody 2007). The currently approved approach for RH TRU disposal is to emplace canisters, each about 120-in long and 26-in in diameter with a 0.25-in steel shell, into holes bored into the walls of the disposal rooms (Dunagan et al. 2007). The empty canisters weigh up to 1,726 lb and can have a maximum gross weight of 8,000 lb when loaded (DOE 2006a).

In contrast, the shielded containers have the approximate external dimensions of a 55-gallon drum (23-in OD by 35.75-in high). The wall of the proposed container consists of an outer layer of carbon steel (0.125 in), a lead-shielding layer (1.0 in), and an inner carbon steel layer (0.188 in). Because various values for the thickness of inner and outer steel shells were quoted in different DOE documents, EPA questioned DOE as to the correct values. This issue has been resolved, as discussed in greater detail in Appendix A. The top and bottom of the container are 3-in thick carbon steel (Dunagan et al. 2007). Each shielded container weighs about 1,851 lb (Crawford and Taggart 2007). The weight of the package including waste contents is limited to 2,260 lb (NRC Certificate of Compliance 9279). The containers are vented to preclude internal pressure build-up. RH TRU waste in 30-gallon drums will be placed in the shielded containers.

The dose rate at the surface of the shielded containers will be limited to 200 mrem/hr or less, as specified for contact-handled (CH) TRU waste in the WIPP Land Withdrawal Act (LWA) (Public Law 102-579). This will permit DOE to process and handle the shielded containers as if they contained CH TRU waste. DOE has stated that even though some fraction of the RH TRU waste will be handled as if it were CH TRU waste, the total amount of RH TRU waste that can be disposed of in the WIPP will remain limited to 250,000 ft^3 (7,079 m^3), as specified in the Agreement for Consultation and Cooperation between DOE and the State of New Mexico (Moody 2007, DOE 1981).

A group of three shielded containers will be assembled at the waste generator site into a three-pack using plastic stretch wrap and a special triangular shipping pallet (Sellmer 2007). It was originally proposed that the three-packs would be stacked three high on the disposal room floor and a supersack of magnesium oxide (MgO) would be placed on top of the stacked containers (Crawford and Taggart 2007). Subsequently, DOE determined that the three-packs would be stacked no more than two high and no MgO supersack would be placed on top of the upper three-pack. DOE will, nevertheless, insure that sufficient MgO is present in each disposal room to insure that the required safety factor of 1.2 is met. In addition, a three-pack will not be placed on another type of container, such as a standard waste box (Moody 2010).

DOE has stated that use of shielded containers will "increase the efficiency of utilization of the WIPP facility by easing the restrictions on waste handling needed during emplacement of RH

[3] EPA Docket: II-B2-31.

waste canisters in the walls of the rooms" (Moody 2007). DOE has elaborated on the reasons for the PCR as follows (DOE 2007b):

> *The emplacement of RH TRU waste in the walls of the disposal rooms is appropriate and necessary for higher activity waste streams; however, there are several reasons why an alternative disposal method is advantageous for lower activity RH TRU waste streams. The drilling and emplacement operations for the RH canisters impede direct access to a room. This is the result of the large specialized equipment required to emplace the canisters into boreholes. Borehole drilling is limited to drilling 1 to 2 boreholes per shift. The borehole drilling equipment also restricts access to the room. The operations are time consuming; it requires one 8-hour shift to emplace a single RH TRU waste canister. A single RH waste canister evolution from receipt of the RH TRU 72B until emplacement in the wall of the underground disposal room requires more than 10 hours. WIPP is limited to a maximum of 6 RH shipments per week just from the operational constraints. In contrast, the CH waste handling processes routinely allow 4-5 shipments (i.e., 3 HalfPACTs per shipment) per day to be received, unloaded and emplaced per day. Panels 1, 2 and 3 have been filled without emplacing any RH TRU waste canisters in the walls, limiting the available wall space for emplacement of RH TRU waste. Thus, the use of shielded containers can improve the efficiency of facility operations by minimizing the disruptions from in-the-wall emplacement of RH TRU waste canisters while providing additional storage locations for some of the RH TRU waste.*

This report summarizes SC&A's technical review of the shielded container PCR. Relevant regulatory and statutory issues regarding handling and emplacement of RH TRU waste are summarized in Section 2. DOE's compliance with approval requirements set by EPA (EPA 2007) are reviewed in Section 3, while DOE's technical justification that the PCR has no significant effect on repository performance is presented in Section 4. In Section 5, SC&A describes its review of how changes to the performance assessment (PA) parameters and codes were implemented. SC&A's review of the impact of the PCR on the waste inventory is provided in Section 6, and SC&A's review of the DOE approach for characterizing which RH TRU waste streams are likely candidates for emplacement in shielded containers is included in Section 7. In Section 8, SC&A reviews the impact of the PCR on repository chemistry, and in Section 9, SC&A reviews temperature effects associated with emplacement of RH TRU waste. Measurement uncertainty is discussed in Section 10, while overall conclusions regarding the technical review are incorporated into Section 11.

2.0 REGULATORY BACKGROUND

The WIPP LWA of 1992 (PL 102-579) defines RH TRU waste as TRU waste with a surface dose rate of 200 mrem/hr or greater, and CH TRU waste as TRU waste with a surface dose rate not greater than 200 mrem/hr. The LWA specifies the following with regards to RH TRU waste destined for disposal at the WIPP:

- Total activity – 5.1 million Ci

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- Maximum activity concentration (averaged over canister volume) – 23 Ci/L
- Maximum surface dose – 1,000 rem/hr
- Surface dose limit – no more than 5% can exceed 100 rem/hr

In addition, the Consultation and Cooperation Agreement between DOE and the State of New Mexico limits the disposal volume for RH TRU waste to 250,000 ft^3 (DOE 1981). (This is converted to either 7,079 m^3 or 7,080 m^3 in various DOE documents.)

The acceptance criterion for the surface dose rate requirement of 200 mrem/hr for CH waste is documented in DOE 2007a (Section 3.3.5) as follows:

> *The external radiation dose equivalent rate of individual payload containers shall be ≤ 200 milliroentgen equivalent man (mrem)/hour (hr) at the surface with the exception of the S100 and S300 pipe overpacks which are limited to ≤ 179 mrem/hr and ≤ 155 mrem/hr, respectively, at the surface (Reference 9, Section 3.2; Reference 14, Section 5.6.2). Internal payload container shielding shall not be used to meet this criterion, except for authorized shielded payload container configurations such as the use of 55-gallon drums containing a pipe component (Reference 9, Section 2.9). Total dose equivalent rate and the neutron contribution to the total dose equivalent rate shall be reported for each payload container in the WWIS.*

The bases for the surface dose rates of 179 mrem/hr for the S100 pipe overpack container (POC) and 155 mrem/hr for the S300 POC are described in the CH TRU Payload Appendices, Rev. 1, May 2005 (http://www.wipp.energy.gov/documents_ntp.htm). In each case, they are a function of an NRC prescribed limit. For the S100 container, it is determined by an external dose requirement of not more than 10 mrem/hr at 2 m from a TRUPACT II container (holding 14 S100s) subjected to free drop damage under normal conditions of transport (NCT). For the S300 container, the limiting surface dose rate is determined by a requirement of an external dose of 2 mrem/hr at 5 m from an undamaged TRUPACT II container (as might be experienced by a truck driver). A very small statistical uncertainty is assigned to each of these limiting surface dose rates, e.g., 155 +/- 0.36 mrem/hr. This is the result of the fact that the analysis is based on Monte Carlo N Particle Transport Code (MCNP) runs whose uncertainty is a function of the number of particles tracked by the code (about 10 million particles).

The CH-TRAMPAC (Contact-Handled Transuranic Waste Authorized Methods for Payload Control) specifies that surface dose rate measurements shall be made with instruments traceable to a national standard (DOE 2005, Section 3.2.2).

The DOE PCR does not impact these statutory or regulatory requirements in any way. Any RH TRU waste that is packaged in shielded containers will be counted against the 7,079 m^3 limit.

Shipments of TRU waste are governed by regulations of the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Transportation (DOT). Shipments of RH TRU waste to WIPP are currently made in RH TRU waste canisters (payload containers) confined within an RH TRU 72-B cask. The RH-TRAMPAC (Remote-Handled Transuranic Waste

Authorized Methods for Payload Control) establishes numerous criteria that the waste must meet when shipped to WIPP. Examples include nuclear criticality requirements, limits on quantities of radionuclides that could be released in a hypothetical accident, and limits on heat from radioactive decay (DOE 2006a). The CH-TRAMPAC establishes companion requirements for CH TRU waste (DOE 2005).

DOE has demonstrated that the shielded containers meet DOT Type 7A packaging and NRC Type B drop tests, and has obtained approval from NRC for HalfPACT shipping containers[4] to transport shielded containers filled with RH TRU waste to WIPP. DOE proposes to ship three shielded containers packaged as a unit in a HalfPACT. EPA advised DOE on December 7, 2007, that the Agency was not prepared to make a final decision on the shielded container PCR until NRC and DOT approvals had been obtained for the HalfPACT (Reyes 2007). As discussed in greater detail in Section 3, these approvals have been obtained.

3.0 EPA REQUIREMENTS FOR PCR CONSIDERATION

After its preliminary review, EPA advised DOE of requirements that needed to be satisfied before the Agency would consider the PCR. These requirements were documented in a letter to DOE dated December 7, 2007 (Reyes 2007) as follows:

- NRC must approve the shipping container design
- The Department of Transportation must approve the shipping container design
- A safety analysis must be prepared by DOE

3.1 NRC Approval

On June 10, 2009, DOE provided EPA with NRC Certificate of Compliance (CoC) No. 9279 that authorized the inclusion of shielded containers in the HalfPACT waste shipping container. NRC required no changes in the design or materials of construction (DOE 2009a). Shielded containers were added to the existing CoC as Revision 5 that was approved by the NRC on May 15, 2009. [5]

Specific changes to the CoC to include shielded containers are as follows:

- 5(a)3 – Drawings – The shielded container is constructed in accordance with Packaging Technology, Inc., Drawing No. 163-008, sheets 1–6, Rev. 1.
- b(2) – Maximum quantity of material per package – (x) 2,260 pounds per shielded container
- 5(b)2 – Maximum number of payload containers per package and authorized packaging configurations – (ix) 3 shielded containers

[4] This cask is currently approved and used for the shipment of CH TRU waste.

[5] Revision 6 to the CoC was approved by the NRC on October 21, 2010 and extends the expiration date to October 31, 2015 "To renew a CoC, a CoC holder at the end of the 5-year approval period would submit a request to NRC with any necessary supporting information describing the capability of the package design to continue to meet technical requirements. After reviewing this information, the NRC would determine whether to grant a CoC renewal." http://www.nrc.gov/materials/transportation/certification.html#4

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These changes do not constitute substantive revisions to the CoC.

3.2 Self-Certification by DOE of Department of Transportation Requirements

DOE's WIPP Waste Acceptance Criteria require that containers meet the requirements of DOT 7A packaging (DOE 2009b). In a January 21, 2009, letter to EPA (DOE 2009c), DOE documented that since the shielded container was a Type A package as defined by DOT, approval by DOT is not required. Rather, DOE can self-certify that the shielded container meets the requirements of 49 CFR 173.410 and 173.412. The shielded container must also meet tests prescribed in 49 CFR 173.465 or 173.466 and the requirements set out in 49 CFR 179.350.

DOE described studies conducted to demonstrate that shielded containers comply with Class A requirements in the June 2008 Type A Evaluation Report (TAER) (WTS 2008). The TAER identifies the analyses, tests, and evaluations performed on the shielded container to demonstrate compliance of the packaging design with the applicable requirements of 49 CFR 178.350.

DOE subjected two test containers to free drop tests from 4 ft above a rigid flat surface, as specified in 49 CFR 173.465. Prior to being dropped, the containers were oriented in positions that should cause maximum damage. Each container was dropped twice. During testing, no significant damage to the packages was sustained. After each drop test, examination of the containers showed that no release of the simulated contents had occurred. Containment of the radiological contents is the criterion for passing the drop test.

The two test containers were subjected to gamma scans to determine if the effectiveness of the shielding had been reduced by the drop tests, in order to inform shippers of potential changes to dose rate as the result of an accident. With the exception of two anomalous readings on one container (one location indicating approximately a 20% increase in shielding effectiveness and a second indicating approximately a 20% decrease in shielding effectiveness), the straight-line through-wall gamma scan readings in the body of the container demonstrated less than 20% change in shielding effectiveness as a result of the drop tests. Sectioning of the containers after testing revealed no indications of lead slump or lead movement as a result of the drop tests. The anomalous shielding readings were found to have resulted from imperfections in the casting of the prototypes.

In lieu of the physical stacking test required under § 173.465(d), DOE performed an analytical calculation assuming that six containers were stacked on top of the target container, thereby increasing the axial load by 20% above that specified in § 173.465(d). This axial load of 13,560 lbs was assumed to be borne solely by the inner cylindrical shell of the shielded container. Using procedures documented in ASME Boiler and Pressure Vessel Code Case N-284-1, DOE calculated that the axial load would not cause buckling of the inner shell.

Section 173.465(e) specifies a physical penetration test in which a 1.25-in diameter bar weighing 13.2 lb is dropped from a height of 3.3 ft or more onto the shielded container. In lieu of the physical test, DOE performed a calculation showing that the outer shell must be 0.015 in or less to be penetrated by the test bar. Since the thickness of the outer shell is 0.12 in, an ample margin of safety exists.

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With regard to vibration testing, DOE asserts that because of the robust nature of the shielded container, it would meet the vibration testing requirement of 49 CFR 178.608. This requirement specifies that the waste package be tested on a vibrating table for 1 hour at a frequency that causes the shielded container to be raised above the table by about 0.063 in. DOE did not subject a shielded container to vibration testing and, instead, based its compliance opinion on the following reasoning (WTS 2008, Section 4.2.5):

> *The stiffness of the 3 in. thick lid and base, and the greater than 1 in. thick steel/lead/steel body sidewall is such that resonant frequencies would not be encountered during normal condition transport. The 15 closure bolts, when preloaded to the torque requirements referenced herein, would not loosen or otherwise be significantly affected by vibration conditions. Other miscellaneous components are either welded, press-fit, or otherwise secured in place and not significantly affected by vibration conditions and/or not critical components serving a containment or shielding function in the package.*

3.2.1 EPA Comments on Self-Certification Documentation

Based on its review of the self-certification testing described in Section 3.1 above, EPA submitted several comments to DOE for clarification/resolution. EPA's comments and DOE's responses are provided below (Patterson 2010):

EPA Comment 1

DOE described studies conducted to demonstrate that shielded containers comply with Class A requirements in the June 2008 Type A Evaluation Report (TAER) (WTS 2008). The TAER identifies the analyses, tests, and evaluations performed on the shielded container to demonstrate compliance of the packaging design with the applicable requirements of 49 CFR 178.350. According to Section 3.1 of the TAER:

> *Determination of the response of a point radiation source subject to movement within the package and any associated effects on radiation levels are not provided in this document. Drop test damage information is provided in Section 4.2.2 for use by the shipper in determining whether a significant change in radiation level would result for a specific payload.*

This raises the question as to how the shipper would determine whether a significant change in radiation could result for a specific payload. We presume that, if no significant damage occurs during drop testing and no tracers or other materials are released, significant changes in radiation levels would not result. If this is the intent, why is it not so stated? What is the burden imposed on the shipper? The TAER would benefit if this ambiguous statement were clarified.

This excerpt also raises the question as to where movement of point sources of radiation is addressed and what actions must be taken to prevent such movement.

Similarly, in Section 3.2, the authors note that:

> *Damage information is provided to assist the shipper in evaluating the possible dose rate changes at the surface of the package for the intended payloads to be shipped.*

The same concerns as outlined above apply here.

EPA Reference

WTS 2008. *Shielded Container Type A Evaluation Report*, ECO No. 11834, Rev. 0, Washington TRU Solutions LLC, Carlsbad, New Mexico, June 2008.

DOE Response

Changes in radiation levels at the surface of the container are dependent on two factors during transportation. One is damage to the packaging, which is addressed in the SCA (Shielded Container Assembly) TAER with testing performed before and after the 4-foot drop tests, and discussed in Section 4.2.2.4, Shielding. There was no significant reduction of shielding effectiveness as a result of the drop tests. The other factor is the location of a point gamma radiation source within the SCA. It is the responsibility of the shipper to ensure that there is adequate bracing within the 30-gallon internal payload container such that the point radiation source doesn't move during transportation to cause a significant increase (20%) in the external radiation levels. This is addressed in Sections 2.4, 5.1, and Appendix A, Section 4.6.3. Specific loading instructions are not addressed in the SCA TAER, as that is not the intent of the document. The SCA TAER references the SCA Handling and Operation Manual, WP 08-PT.16, which does provide specific loading instructions, in Sections 2.4, on page 4-11, and in Section 5.1. WP 08-PT.16 is also referenced on WTS drawing, 165-F-026. These references are provided to inform the shipper that the SCA must be loaded and closed in accordance with those specific instructions in order for a loaded SCA to be certified as a Type A Packaging. While changes to the SCA TAER are not deemed necessary, the Handling and Operation Manual will be revised to further instruct the shipper to securely fasten and position contents within the 30-gallon internal payload container in a manner to prevent a significant increase in the level of radiation at the external surface of the SCA as a result of movement during transport.

DOE References

SCA Handling and Operation Manual, WP 08-PT.16
WTS drawing, 165-F-026

EPA Comment 2

With regard to vibration testing, DOE asserts that because of the robust nature of the shielded container, it would meet the vibration testing requirement of 49 CFR 178.608. This requirement specifies that the waste package be tested on a vibrating table for 1 hour at a frequency that causes the shielded container to be raised above the table by about 0.063 in. DOE did not subject

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a shielded container to vibration testing and, instead, based its compliance opinion on the following reasoning (WTS 2008, Section 4.2.5):

> *The stiffness of the 3 in. thick lid and base, and the greater than 1 in. thick steel/lead/steel body sidewall is such that resonant frequencies would not be encountered during normal condition transport. The 15 closure bolts, when preloaded to the torque requirements referenced herein, would not loosen or otherwise be significantly affected by vibration conditions. Other miscellaneous components are either welded, press-fit, or otherwise secured in place and not significantly affected by vibration conditions and/or not critical components serving a containment or shielding function in the package.*

This quotation contains several unsupported statements including:

- Resonant frequencies would not be generated
- Properly torqued bolts would not be loosened by vibration
- Press fit items would not be significantly affected by vibration

DOE needs to provide the technical basis for these suppositions.

DOE Response

(1) Generally a resonant frequency of 500Hz or more is considered inconsequential to normal transport conditions. A simplified calculation as well as a finite element analysis (FEA) model both show that the lid has a resonant frequency of approximately 1,300Hz, which is therefore out of this range.

(2) A calculation of the worst-case clamping load of the 15 closure bolts shows a force of 88,000 lbs. This corresponds to 262 Gs of acceleration required to lift the lid.

(3) The only two press fit items are protective plugs used to keep water from collecting in two areas, the filter port and the threaded lift interface holes. During transport, the SCA is required to have a DOT Type A compliant filter vent installed; therefore, the filter port plug is not used and is of no concern. The threaded lift interface holes are still plugged during transport, but only to prevent the collection of water or debris, since they are not part of the containment boundary (reference WTS drawing, 165-F-026-W1, see Section C-C). It should also be noted that for our intended use of the SCA, inside of a Type B package during transport, the container will not be exposed to the elements either.

DOE Reference

WTS drawing, 165-F-026

EPA Comment 3

In lieu of the physical stacking test required under § 173.465(d), DOE performed an analytical calculation assuming that six containers were stacked on top of the target container, thereby

increasing the axial load by 20% above that specified in § 173.465(d). This axial load of 13,560 lbs was assumed to be borne solely by the inner cylindrical shell of the shielded container. Using procedures documented in ASME Boiler and Pressure Vessel Code Case N-284-1, DOE calculated that the axial load would not cause buckling of the inner shell. However, NRC's current position on Code Case N-284-1 (NRC 2007) is that use of this case by licensees to evaluate canisters and transportation casks is permissible only if it has been reviewed and approved by NRC. Given NRC's concerns about the Case, DOE should demonstrate that the errata, misprints, recommendations, and errors identified in NRC 2007 do not unfavorably affect the TAER calculations.

Reference

NRC (U.S. Nuclear Regulatory Commission) 2007. *ASME Code Cases Not Approved for Use.* Regulatory Guide 1.193, Rev. 2. October 2007.

DOE Response

When analyzed by calculating the slenderness ratio (Le/r) of the geometry, the SCA has a ratio of 9.36, which is well below the limit for a geometry to be considered short and wide (Le/r<30). Therefore this geometry would be bounded by a normal axial stress calculation, which shows a safety factor to yield when loaded to 13,560 lbs of 19:1 against the outer shell, which has the smaller cross sectional area of the two shells. Therefore it is more than reasonable to assume that the design of the SCA is not affected by the regulatory stacking test by a large margin.

It should also be noted that NRC Regulatory Guide 1.193 is specific to 10 CFR 50, which governs NRC-licensed "Nuclear Power Plants." Also, in the HalfPACT SAR, Section 2.6.7, ASME Code Case N-284 is specifically used and cited for the buckling calculations of the containment boundary of the HalfPACT, which is an NRC-approved and licensed Type B package.

3.2.2 DOE Self-Certification Conclusions

Based on review of the DOE self-certification activities and responses to EPA comments, SC&A concludes that DOE has met the self-certification requirements for SCAs.

3.3 Safety Analysis

Subsequent to EPA's letter of December 7, 2007 (EPA 2007), discussions were held between the Agency and DOE to refine the safety analysis requirements. Based on these discussions, it was agreed that "the results of typical Unreviewed Safety Question (USQ) analysis, written such that a technical reviewer without a nuclear safety background could more easily understand the safety analysis, will adequately address their [EPA's] concerns" (DOE 2010a). Based on this understanding, DOE provided four documents as being equivalent to the technical content of a typical USQ analysis:

- *Summary of Nuclear Criticality Safety Evaluation for Shielded Containers at the WIPP*, WIPP-025 (DOE 2010a, Enclosure 3).

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- *WIPP Accident Analysis Calculations for Events Involving Releases from the Gamma Shielded Container*, WIPP-031 (DOE 2010a, Enclosure 4).
- *Fire Analysis of the Shielded Container for the Waste Isolation Pilot Plant, Carlsbad, New Mexico*, WIPP-032 (DOE 2010a, Enclosure 2).
- A white paper entitled: *Summary of the Safety Impact Analysis for the Lead Shielded Container* (DOE 2010a, Enclosure 1). This paper summarizes the results from WIPP-025, WIPP-031, and WIPP-032.

Based on concerns that the original white paper did not adequately cover loss of lead shielding from a fire, DOE provided *Summary of a Revised Safety Impact Analysis for the Lead Shielded Container Assembly* in December 2010 (DOE 2010b).

The safety analysis determined whether use of shielded containers would result in any changes to the radiation dose received by certain onsite workers or the maximally exposed offsite individual in various accident scenarios. The basis of comparison was the WIPP Documented Safety Analysis (DSA) that considered a variety of waste containers. The WIPP DSA evaluated fires, explosions, loss of confinement, direct radiation exposures, criticality, and externally initiated and natural phenomena. From these scenarios, DOE determined those that were applicable to shielded containers.

Twenty-seven fire-related scenarios were determined to be applicable to shielded containers. Of these, DOE analyzed the worst-case fire scenarios and found that the worst-case scenarios for shielded containers had no greater consequences than scenarios already evaluated in the DSA. Since this was the case, DOE concluded that it was not necessary to evaluate the other selected fire scenarios, since the worst-case scenarios were bounding. The bounding scenario was a fire resulting in the loss of both the lead shielding and of the SCA's ability to physically contain waste. In its accident analysis, DOE calculated the radiation exposure of both the maximally exposed offsite individual (MOI) and an onsite worker, using the same process employed for other waste containers. It should be noted that direct gamma radiation exposure resulting from loss of lead shielding was not evaluated (DOE 2010a, Enclosure 2, Section 7.1). Because any fire would force workers to leave the immediate area, and because of the greater dose impact of inhaled radionuclides, the *Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* (DOE 2006e, Appendix A, Section A.3) identifies the airborne pathway as being of primary concern for nonreactor nuclear facility safety. The DOE analysis of fire accidents is considered in detail in Appendix B of this document.

Four criticality scenarios were considered for shielded containers. DOE determined that the possibility of nuclear criticality being achieved was incredible (i.e., had a probability of $<10^{-6}$/yr of occurring). DOE also examined the probability of radiation exposure from surface contamination or from direct radiation and determined that the frequency of occurrence of such events was no greater for shielded containers than had been determined for other containers in the DSA. The shielded containers will have the same limits for Fissile Gram Equivalent (FGE) mass and Plutonium-Equivalent Curies as a 55-gallon drum containing CH TRU waste. These limits are set by the HalfPACT Safety Analysis Report (DOE-CBFO 2008). Thus, there is no

increase in the quantity of transuranic radionuclides that could be released from a disruptive physical event.

In summary, DOE concluded that the handling and emplacement of shielded containers does not increase the probability or consequences of any event considered in the DSA. Based on the review presented here, SC&A agrees with this conclusion.

4.0 DOE JUSTIFICATION FOR USE OF SHIELDED CONTAINERS

DOE's technical justification for the shielded container PCR was based, in part, on a special shielded container performance assessment (SCPA) designed to show that long-term performance of the repository was not significantly affected by the use of shielded containers (Dunagan et al. 2007). The SCPA involved five sequential steps, as quoted in the referenced document (Dunagan et al. 2007):

(1) Evaluate WIPP PA baseline assumptions, models, and parameters to determine which are affected by the use of shielded containers

(2) Develop an analysis design to incorporate necessary modifications to the baseline approach

(3) Develop necessary parameters for the SCPA

(4) Execute WIPP PA codes

(5) Conduct an analysis of results, including a comparison with baseline predictions of long-term repository performance

4.1 Evaluation of Impact of Shielded Containers on WIPP Baseline PA Assumptions

In Step 1 of the SCPA, DOE considered nine components of the WIPP PA that might be affected by the PCR. DOE's list of components and their possible impact on PA is reproduced here as Table 3-1 (Dunagan et al. 2007, Table 6). Based on a detailed discussion of each item, DOE developed the SCPA modeling approach summarized in Table 4-2 (Dunagan et al. 2007, Table 8). EPA has reviewed the basis for the modeling decisions and is in general agreement with the technical arguments presented by DOE. Further discussion of inventory changes is presented in Section 6 of this report, while a detailed discussion of chemical conditions is presented in Section 8. Codes used for the SCPA modeling are discussed in Section 5.

Table 4-1: Components of WIPP PA that could Potentially be Affected by Shielded Containers

Component	Possible Implementation Issue
Contents of waste materials	Will the use of shielded containers affect the contents of waste materials and waste material mechanical properties?
Emplacement and container materials	Will the use of shielded containers affect the amount of steel and CPR materials associated with emplacement and container materials?
Room closure	Will the use of shielded containers affect room closure and the porosity of the waste areas?
Chemical conditions	Will the presence of lead in the shielded containers affect chemical

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Table 4-1: Components of WIPP PA that could Potentially be Affected by Shielded Containers

Component	Possible Implementation Issue
	conditions and actinide solubilities?
Waste emplacement	Will loading schemes and disposal schedules associated with the shielded containers present inconsistencies with the assumption of random waste emplacement?
Repository temperature	Will the use of shielded containers affect the repository temperature and heat distribution?
Impact of waste location on release mechanisms	Will emplacement RH waste on the floor of disposal rooms make it more/less accessible to release mechanisms?
Impact of shielded container properties on release mechanisms	Will the physical characteristics of the shielded containers affect release mechanisms?
Location of RH waste streams	Will the location of RH waste streams, on the floor versus in the walls, affect normalized release from the repository?

Table 4-2: SCPA Approach to Modeling Issues Listed in Table 4-1

Component	Possible Implementation Issue
Contents of waste materials	DOE does not propose to modify the waste materials that will be emplaced in the WIPP, so the SCPA will use the waste inventory and mechanical parameters from the CRA-2004 PABC, since they will not be affected by the use of shielded containers.
Emplacement and container materials	The SCPA will use the CRA-2004 PABC emplacement parameters for steel and CPR materials, since the small change to these quantities caused by the use of shielded containers will not significantly affect repository performance.
Room closure	The SCPA will use the CRA-2004 PABC porosity surfaces that were calculated with the Standard Waste Model, since repository performance is relatively insensitive to the structural rigidity of waste and waste containers.
Chemical conditions	Because the presence of lead is expected to have a generally beneficial effect on chemical conditions and decrease actinide solubilities, the SCPA will conservatively use the CRA-2004 PABC actinide solubilities that were calculated without explicitly including the effect of lead.
Heterogeneity of waste emplacement	The SCPA will assume that the stacks of CH and shielded containers are randomly distributed, since mean releases are insensitive to uncertainty in the spatial arrangement of the waste.
Repository temperature	The use of shielded containers does not affect any baseline assumptions pertaining to repository temperatures, so the SCPA will not make any modifications to these baseline assumptions.
Impact of waste location on release mechanisms	The SCPA will assume that RH waste in shielded containers is accessible to all release mechanisms.
Impact of shielded container properties on release mechanisms	The SCPA will follow the baseline approach of assuming that all waste containers instantly fail, so the SCPA conservatively will not take credit for the physical properties of the shielded containers.
Location of RH waste streams	The SCPA will model RH emplacement with three scenarios: (1) All RH waste in the walls (2) All RH waste on the floor (3) Half of the RH waste in the wall and half of the RH waste on the floor These three scenarios will use a single, "average" RH waste stream.

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Table 4-2: SCPA Approach to Modeling Issues Listed in Table 4-1

Component	Possible Implementation Issue
	One additional calculation will model all 77 individual RH waste streams on the floor.

4.2 Modeling Scenarios

The baseline selected for comparison with the SCPA is the Performance Assessment Baseline Calculation 2004 (PABC-2004), which was the most recent EPA-approved PA at the time the PCR was submitted. The PABC-2004 served as the basis for EPA's recertification of the WIPP in 2006. The PABC-2004 results demonstrated that RH TRU waste, when emplaced in the walls of the disposal rooms, is a minor contributor to possible releases from the WIPP repository. For example, there is a 10% probability that total normalized releases from all waste will exceed 8.86E-02 EPA units, while there is also a 10% probability that normalized releases from RH TRU waste will exceed 3.55E-04 EPA units (Dunagan et al. 2007, Table 5). Thus the impact of RH TRU waste on PA is more than two orders of magnitude less than that of CH TRU waste when RH waste is emplaced in the room walls. The PABC-2004 baseline is designated SCPA Scenario 1 by DOE.

Since PABC-2004 has been issued, two additional major PAs have been completed by DOE—the 2009 Compliance Recertification Application PA (CRA-2009) and the Agency-mandated PABC-2009. EPA examined the documentation related to these two PAs as part of its recertification review and concluded in a November 18, 2010, Federal Register notice that the WIPP remained in compliance with the regulatory requirements. The mean CCDF developed for CRA-2009 shows a very slight increase in the mean normalized releases as compared to the PABC-2004 (DOE 2009d, Appendix PA, Figure PA-84). The CCDFs for PABC-2009 were marginally different from those for the CRA-2009, with total normalized releases being slightly lower at high probabilities and higher at low probabilities (Camphouse 2010). Table 4-3 compares the mean normalized releases from the three PAs:

Table 4-3. Mean Total Releases from Various Performance Assessments

Probability	Performance Assessment	Mean Total Release (EPA Units)	Release Limit (EPA Units)
0.1	PABC-2004	0.09	1
0.1	CRA-2009 PA	0.1	1
0.1	PABC-2009	0.09	1
0.001	PABC-2004	0.60	10
0.001	CRA-2009 PA	0.72	10
0.001	PABC-2009	1.10	10

Thus, it does not appear that more recent modeling renders the use of PABC-2004 as the shielded container analysis baseline as inappropriate.

Since the exact quantity of RH TRU waste that could be placed in shielded containers and meet the 200 mrem/hr surface dose rate criterion is uncertain, DOE chose a bounding approach for the SCPA in which all the RH TRU waste would be emplaced on the floors of the disposal rooms. This was designated as SCPA Scenario 2. SCPA Scenario 3 assumed that half of the RH TRU

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waste would be placed on the disposal room floor in shielded containers and half would be in canisters placed in boreholes in the walls of the disposal rooms.

DOE compared the mean CCDFs for Scenarios 2 and 3 against the PABC-2004 Baseline (Scenario 1). The comparisons were made based on mean total releases and mean releases from cuttings and cavings, direct brine releases, and spallings releases separately. Differences among the three scenarios were essentially indistinguishable, based both on consideration of specific release mechanisms and total releases (Dunagan et al. 2007, Figures 8, 9, 10, and 11). Although the differences were very small, direct brine releases from Scenario 2 were slightly less than similar releases calculated in the PABC-2004. DOE attributed this slight difference to the fact that the conditional probability of a drilling intrusion hitting an excavated area, given that the intrusion was within the repository berm area, was less for Scenario 2, because the excavated area was smaller (i.e., less RH area in the walls of the disposal rooms).

In Scenarios 1, 2, and 3, DOE assumed that all of the RH TRU waste was combined into a single composite waste stream. To test the significance of this assumption, DOE implemented Scenario 4 that was similar to Scenario 2, except that all 77 waste RH TRU waste streams were treated individually. As in the PABC 2004, waste was assumed to be emplaced in a random, heterogeneous manner, because PA release mechanisms are insensitive to the spatial arrangement of emplaced waste (Hansen at al. 2004). DOE showed that there were no differences between the mean total releases for Scenarios 2 and 4 (Dunagan et al. 2007, Figure 12).

5.0 REVIEW OF SCPA CALCULATIONAL PROCEDURES

The previous section described DOE's general approach to modeling the impacts of shielded containers on repository performance. In this section, we take a detailed look at the parameters used; the computer codes used, including their qualification; and the results obtained. The SCPA takes a bounding approach to assessing the impact of using shielded containers for the disposal of RH waste. The results of PABC-2004 (Leigh et al. 2005) represent performance of the repository with all of the RH waste emplaced in the walls of the repository. The additional set of calculations that were performed for the SCPA assume that some fraction of the RH waste is placed on the disposal room floors in shielded containers and the remaining fraction is placed in the walls of the disposal rooms. To isolate the impact of the shielded containers on repository performance, the SCPA is designed to deviate as little as possible from the PABC-2004.

The SCPA analysis is intended to answer the following question:

- How is long-term repository performance affected by emplacement of RH waste in shielded containers?

As discussed in Section 4.1, the only baseline parameters and assumptions that DOE modified to represent the emplacement of RH waste in shielded containers were those parameters and assumptions related to the location of RH waste. No other parameters or assumptions from the PABC-2004 were modified. Consequently, the only PA codes that DOE activated for the SCPA were those codes related to the execution of CCDFGF and EPAUNI. The CCDFGF code determines the consequences of the releases for the various scenarios, and EPAUNI calculates

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radionuclide decay. These codes were rerun as necessary for the SCPA scenarios described in Section 4.2.

The approach used for the SCPA is similar to that used for previous PA calculation sets. The SCPA begins with an analysis of the features, events, and processes (FEPs) that may or may not have a bearing on the performance of the repository. As discussed in Section 4.1, the use of shielded containers does not have any major impact on PA implementation, and no FEPs are affected. The "retained" FEPs are formulated into scenarios that are modeled. Scenarios are modeled using conceptual models that represent the physical and chemical processes of the repository. The conceptual models are implemented through a series of computer simulations and associated parameters that describe the natural and engineered components of the disposal system (e.g., site characteristics, waste forms, waste quantities, and engineered features). The computer simulations are developed from conceptual models. The results of the simulations quantify the magnitude and probability of potential releases of radioactive materials from the disposal system to the accessible environment over the 10,000-year regulatory period.

The following subsections detail the approach that the SCPA used.

5.1 Parameters

The SCPA uses the same parameters and parameter values that were used in the PABC-2004, except for a few constant parameters that are used only by the code CCDFGF for two of the three waste emplacement scenarios, as follows:

- Scenario 2 – Placing all of the RH waste with the CH waste in the disposal area
- Scenario 3 – Placing half of the RH waste with the CH waste in the disposal area, while half of the RH waste remains in the walls

To evaluate these scenarios, the parameters that were changed are REFCON:FVW and REFCON:AREA_RH (Dunagan 2007).

The parameter REFCON:FVW represents the fraction of the repository volume occupied by waste in the CCDFGF. In the PABC-2004, REFCON:FVW is set to 0.385 and is unitless (Kirchner 2007a).

REFCON:FVW was calculated for the PABC-2004 by dividing the total volume of CH wastes, REPOSIT:VOLCHW, by the excavated storage volume of the repository, REFCON:VREPOS. Because the repository volume occupied by the waste will be different from that assumed in the PABC-2004, DOE developed four new parameters to simulate the two scenarios described above.

Two of the four new parameters represent the fraction of the repository volume occupied by waste. One of the new parameters, REFCON:FVW_ALLRH, represents the repository volume occupied by waste with all of the RH waste inventory volume included with the total CH waste volume on the repository floor. This parameter is calculated in a manner similar to

REFCON:FVW, but with the inclusion of the total volume of RH wastes, and has a value of 0.402.

The second of the new parameters represents the repository volume occupied when half of the RH waste inventory volume is included with the total CH waste volume. This parameter is calculated in a manner similar to REFCON:FVW, but with the inclusion of half of the value of parameter REPOSIT:VOLRHW. This parameter, REFCON:FVW_HALFRH, has a value of 0.394.

The two remaining new parameters represent that area of RH waste disposal in the model CCDFGF called REFCON:AREA_RH in the PABC-2004 simulations. The value for this parameter in the PABC-2004 is 1.576×10^4 m^2 and is representative of all of the RH wastes in the wall of the repository (Helton 1996). This value is calculated by multiplying the expected number of canisters of RH wastes in the repository (8,000) by the footprint of an RH waste canister, 1.97 m^2, to determine the area of RH waste disposal (Helton 1996).

The fourth parameter represents the area of RH waste disposal when all of the RH waste is included with the CH waste on the repository floors. This parameter is called REFCON:AREA_NORH and has a value of 0.

Table 5-1 lists the new parameters that were created for the SCPA and their values. These parameters were used in the place of REFCON:FVW and REFCON:AREA_RH, since REFCON:FVW and REFCON:AREA_RH were calculated assuming that all RH waste would be placed in the walls.

Table 5-1: Parameters Created for the SCPA

Material	Property	Value (Units)	Description
REFCON	FVW_ALLRH	0.402 (none)	Fraction of repository volume occupied by CH and RH waste in CCDFGF model (Scenario 2).
REFCON	FVW_HALFRH	0.394 (none)	Fraction of repository volume occupied by CH waste and half of total RH waste in CCDFGF model (Scenario 3).
REFCON	AREA_NORH	0 (m^2)	Area for RH waste disposal in CCDFGF model when all RH waste is included with CH waste on repository floors (Scenario 2).
REFCON	AREA_HAFRH	7.880E+03 (m^2)	Area for RH waste disposal in CCDFGF model when half of total RH waste is included with CH waste on repository floors (Scenario 3).

DOE presents the derivations of the new parameters in Dunagan (2007). The parameters are derived from simple mathematical relationships that were checked for validity during this review and found to be accurately calculated and reported.

5.2 PA Computer Codes

5.2.1 Latin Hypercube Parameter Sampling

The LHS computer code is used to sample those PA parameters which are represented by distributions in order to account for subjective uncertainty. Three replicates of 100 vectors each

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are used for the SCPA, as well as the identical random seed and parameter ordering from the PABC-2004 Latin hypercube sampling (LHS) calculations. Use of these random seeds and orderings results in identical sampled parameter values for parameters that are common to both the PABC-2004 and SCPA. Consequently, results from the SCPA can be compared with those from the PABC-2004 on a vector-by-vector basis.

The SCPA uses the same sampled parameters that were used in the PABC-2004, and the SCPA does not introduce any new parameters that need to be sampled. Thus, LHS was not re-run, and the SCPA uses the results from the PABC-2004 LHS calculations. These results are documented in Kirchner (2005).

DOE's approach of keeping the random seed identical to the PABC-2004 LHS calculations allows meaningful comparisons to be made between the resulting vectors. Otherwise, it would be difficult to differentiate between changes due to parameters sampled independently from those associated with the shielded container scenarios.

LHS Version 2.41 was used to support the SCPA and PABC-2004. In January 2005, the LHS code was revised to Version 2.42 in order to describe the normal, lognormal, student, and logstudent distributions. These revisions to the code would not have impacted the SCPA results obtained with LHS 2.41.

5.2.2 Inventory: EPAUNI

Leigh et al. (2005) gives a comprehensive description of the inventory that was used for the PABC-2004. Modifications to this inventory to account for the use of shielded containers are described in Section 6.

For the PABC-2004, the code EPAUNI is used to calculate waste stream activities at a set of times (Fox 2005), and the results of these calculations are input to the CCDFGF code. The code is run once for CH waste streams and once for RH waste streams. The SCPA required three new sets of EPAUNI calculations, as follows:

(1) For Scenario 2, all waste streams (CH and the "average" RH) are included in a single EPAUNI calculation

(2) For Scenario 3, all CH waste streams and half of the "average" RH waste stream are included in a single EPAUNI calculation

(3) For Scenario 4, the 77 individual RH waste streams are included in a single EPAUNI calculation

This review found that there are no other changes that should have been made to EPAUNI. The run control scripts in Appendix B of Dunagan et al. 2007 for EPAUNI were reviewed and found to be complete. Furthermore, an independent check on the placement of selected EPAUNI simulations into SNL's Configuration Management System (CMS) was made during an onsite visit on August 6, 2008.

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5.2.3 Salado Flow: BRAGFLO

The two-phase flow code BRAGFLO simulates the brine and gas flow in and around the WIPP repository and incorporates the effects of disposal room consolidation and closure, gas generation, brine consumption, and inter-bed fracturing in response to gas pressure. The SCPA uses the PABC-2004 waste material parameters. In addition, the SCPA BRAGFLO calculations use the baseline porosity surface calculations from SANTOS. Thus, the presence of the shielded containers will not affect PABC-2004 BRAGLFO calculations. The SCPA uses PABC-2004 BRAGFLO results documented by Nemer and Stein (2005).

The new waste configuration may result in a baseline porosity surface that is different than that calculated with SANTOS and input into BRAGFLO for the PABC-2004. The impacts of waste containers with a higher rigidity than that of the Standard Waste Model used in the CCA was considered by both the Agency and DOE during the approval of supercompacted waste. Park and Hansen (2003) considered the impacts of incompressible containers on the results of PA. The rigidity of the containers was found to diminish room closure, resulting in higher porosities. These higher porosities would cause lower room pressures which, in turn, would result in smaller release volumes. Hansen et al. (2004) showed that the results of PA are relatively insensitive to container rigidity, and that the Standard Waste model results in the highest repository pressures and releases.

Therefore, although the BRAGFLO result may have been different if the rigidity of the shielded containers was reflected in the model, using the PABC-2004 approach for the SPCA would lead to conservative results.

BRAGFLO Version 5.0 was used to support the SCPA and PABC-2004. In 2007, a number of changes were made to BRAGFLO from Version 5.00 to Version 6.00 in accordance with a paper by Hansen and Stein (2005), which describes changes that should be made to PA models to accommodate a more realistic evolution of the WIPP underground. The changes made to BRAGFLO included changes to the disturbed rock zone, brine availability, MgO precipitation, room closure, and formulations pertaining to the capillary pressure versus saturation, which impact the physical and chemical characteristics of the WIPP disposal rooms. These revisions to the code would not fundamentally change the SPCA results obtained with BRAGFLO 5.0.

5.2.4 Actinide Mobilization: PANEL

Actinides mobilize in WIPP brines as dissolved species and species sorbed onto colloids as calculated with the PANEL code. The SCPA uses the PABC-2004 actinide solubilities, so the presence of the shielded containers does not affect actinide mobilization calculations by PANEL from the PABC-2004. DOE uses the PABC-2004 PANEL results, documented in Garner and Leigh 2005, for the SCPA.

PANEL Version 4.02 was used to support the SCPA and PABC-2004. In April 2005, PANEL was revised to Version 4.03 to allow setting the default panel brine volume via MATSET. These revisions to the code would not have impacted the SCPA results obtained with PANEL Version 4.02.

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5.2.5 Salado Transport: NUTS and PANEL

The WIPP radioisotope mobilization and decay code NUTS is used to simulate the transport of radionuclides through the Salado Formation. DOE maintains that the use of shielded containers will not affect PABC-2004 NUTS results, since the SCPA uses the PABC-2004 BRAGFLO results. The SCPA uses the PABC-2004 NUTS results, as documented in Lowry 2005.

The DOE approach is reasonable, and no changes to NUTS for the SCPA appear to be warranted.

NUTS Version 2.05A was used to support the SCPA and PABC-2004. In 2007, NUTS 2.05A was revised to NUTS 2.05C, where the format of the date and time was revised in order to avoid run-time errors, because the time argument of DATE_AND_TIME was too short. These revisions to the code would not have impacted the SCPA results obtained with NUTS 2.05A.

Radionuclide transport to the Culebra for the E1E2 intrusion scenario (BRAGFLO scenario S6) is calculated by running the PANEL code in "intrusion mode" (PANEL_INT). DOE indicates that the use of shielded containers does not affect PABC-2004 PANEL_INT results, since the SCPA uses the PABC-2004 BRAGFLO results. The PABC-2004 PANEL_INT results used in the SPCA are documented in Garner and Leigh 2005.

The DOE approach is reasonable and no changes to NUTS and PANEL for the SCPA appear to be warranted.

5.2.6 Culebra Flow and Transport: MODFLOW and SECOTP2D

SCPA Culebra flow and transport calculations are identical to PABC-2004 results, since DOE assumes that their conceptual models are not affected by the presence of shielded containers. DOE therefore uses the Culebra flow and transport results from the PABC-2004 for the SCPA. These results are documented in Lowry and Kanney 2005.

This approach is reasonable and no changes to MODFLOW and SECOTP2D for the SCPA appear to be warranted.

SECOTP2D Version 1.41 was used to support the SCPA and PABC-2004. In 2005, SECOTP2D was revised to SECOTP2D 1.41A to correct several formatting issues. These revisions to the code would not have impacted the SCPA results obtained with SECOTP2D 1.41.

5.2.7 Spallings: DRSPALL

Spallings volumes from a single borehole intrusion are calculated by DRSPALL at initial repository pressures of 10, 12, 14, and 14.8 MPa. Since the PABC-2004, as well as the SCPA, conservatively assumes that the shielded containers (and all others) instantaneously fail when the WIPP facility is closed, the presence of shielded containers will not impact either the waste material properties or the DRSPALL results. Thus, DOE uses the spallings results that were calculated by DRSPALL for the PABC-2004 and documented in Vugrin 2005a for the SCPA.

The effect that placement of RH waste on the waste room floors has on spallings releases is addressed in the SCPA CCDFGF calculations (Section 5.2.10).

DRSPALL Version 1.0 was used to support the SCPA and PABC-2004. In January 2004, DRSPALL Version 1.0 was revised to DRSPALL 1.10, in which the following modifications were made:

- Cosmetic changes
- Bypassing the bounds checking
- Changing the upper bound on the far-field stress from 15E+06 to 18E+06 to accommodate future initial conditions

These revisions to the code would not have impacted the SCPA results obtained with DRSPALL 1.0.

5.2.8 Cuttings and Cavings: CUTTINGS_S

The code CUTTINGS_S has two major functions for WIPP PA: (1) calculation of cuttings and cavings volumes from a single borehole intrusion, and (2) interpolation of DRSPALL volumes to calculate spall volumes in the scenarios for drilling intrusions. Since the SCPA conservatively assumes that the shielded containers (and all others) instantaneously fail when the WIPP facility is closed, the presence of shielded containers will impact neither the waste material properties nor the cuttings and cavings volumes predicted in PABC-2004 CUTTINGS_S. Thus, DOE uses the PABC-2004 CUTTINGS_S results, documented in Vugrin 2005b, for the SCPA. The effect that placement of RH waste in the waste rooms has on spallings and cuttings and cavings releases is addressed in the SCPA CCDFGF calculations (Section 5.2.10).

This approach is reasonable for the SCPA.

CUTTINGS Version 5.04 was used to support the SCPA and PABC-2004. Since 2004, CUTTINGS has undergone a number of upgrades involving the removal of unneeded functionality in order to improve maintainability, changes to reduce the number of input files needed, and the determination of the radius of turbulent flow. The most recent version of CUTTINGS is 6.02. These revisions to the code would not fundamentally change the SPCA results obtained with CUTTINGS 5.04.

5.2.9 Direct Brine Release: BRAGFLO_DBR

For the PABC-2004, BRAGFLO is run in the direct brine release (DBR) mode (BRAGFLO_DBR) to calculate the volumes of brine in DBRs. DOE assumes that since the SCPA uses the PABC-2004 BRAGFLO and CUTTINGS_S results, the presence of shielded containers will not impact the DBR results. Therefore, the SCPA uses the BRAGFLO_DBR results from the PABC-2004. These results are documented in Stein et al. 2005.

This is a reasonable approach, and no changes to BRAGFLO_DBR for the SCPA appear to be warranted.

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5.2.10 CCDF Construction: CCDFGF

The code CCDFGF assembles the release estimates from all other components of the WIPP PA system to generate CCDFs of releases. In doing so, the code incorporates the stochastic uncertainty associated with drilling events. Stochastic uncertainty pertains to unknowable future events, such as intrusion times and locations that may affect repository performance, and is treated by generating random sequences of future events.

The new emplacement scheme that would be used for RH waste in shielded containers affects a few of the stochastic variables used in CCDFGF calculations. For example, the probability of intruding RH waste will be affected by the new emplacement scheme. Thus, DOE re-evaluated all of the parameters and stochastic variables used by CCDFGF for the SCPA to determine if they would be affected by the emplacement of shielded containers, and appropriate changes were included in the SCPA. The SCPA includes three new sets of CCDFGF calculations using revised parameters. One set of calculations was completed for each of the emplacement scenarios that are discussed in Section 4.2 and above. This review found that there are no other changes that should have been made to CCDFGF. The run control scripts in Appendix B of Dunagan et al. (2007) for CCDFGF were reviewed and found to be complete. Furthermore, an independent check on the placement of selected CCDFGF simulations into SNL's CMS was made during an onsite visit on August 6, 2008.

CCDFGF Version 5.0A was used to support the SCPA and PABC-2004. In June 2004, the code was changed from Version 5.0A to Version 5.01 to reflect changes involving the confidence intervals assigned to the drilling rate that were changed from 90% to 99.5%. The most recent version of the code, however, was issued in December 2004 (Version 5.02). This new version includes changes to the Function FindSeries (i.e., a block in the IF-THEN-ELSE construction was removed and a check is made within the remaining block to ensure that 0 is never returned). These revisions to the code would not have impacted the SCPA results obtained with CCDFGF 5.0A.

5.3 PA Results

The PABC-2004 results represent the repository performance using baseline assumptions and parameters (Scenario 1). DOE compared the results of SCPA Scenarios 2 and 3 with the PABC-2004 results to assess the potential impacts of shielded containers on repository performance. The results from the SCPA Scenarios 2 and 4 were compared to assess the sensitivity of the explicit representation of individual waste streams on releases. For each set of comparisons, DOE evaluated the CCDFs generated from the modeling studies.

DOE presents total normalized releases for the SCPA scenarios, with a discussion of the cuttings and cavings, spallings, and direct brine releases (Dunagan et al. 2007). Specifically, the mean CCDFs for Replicate 1 of these release mechanisms are presented. The releases through groundwater transport for all scenarios were found to be insignificant, as in the PABC-2004.

DOE ran SCPA Scenario 2 for three replicates, while Scenarios 3 and 4 were run for one replicate. DOE asserts that the trends observed for Replicate 1 comparisons hold for Replicates

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2 and 3, as well, so they are not shown. The mean CCDFs for Replicates 2 and 3 of Scenario 2, however, are shown in Appendix A of Dunagan et al. 2007.

DOE's results from SCPA Scenarios 2 and 3 are compared to the PABC-2004 results in Section 5.3.1 below. These scenarios were modeled to determine if the packaging of RH waste in shielded containers affects baseline estimates of releases. In Section 5.3.2, DOE's comparison for SCPA Scenarios 2 and 4 is discussed, indicating whether the explicit representation of RH waste streams yields significantly different results from calculations that model RH waste with a single composite waste stream.

5.3.1 Comparison of Scenarios 2 and 3 to the PABC-2004

The results of the SCPA Scenario 2 represent the long-term repository performance when all of the RH waste is placed in shielded containers on the floor of the repository. The results of the SCPA Scenario 3 represent the long-term repository performance when half of the RH waste is placed in shielded containers on the floor of the repository and the remaining half is placed in canisters in the walls of the repository. When SCPA Scenarios 2 and 3 are compared to the results from PABC-2004, the effects of the location of the RH waste can be evaluated.

As part of this review, a visual comparison was made of the mean CCDFs for total cuttings and cavings, spallings, and DBR normalized releases for Replicate 1 of SCPA Scenarios 2 and 3 with those from the PABC-2004. This comparison found that the means are virtually indistinguishable between SCPA scenarios and the baseline. In addition, the horsetail plots for Scenario 2, Replicate 2 of the SCPA, were visually compared with Replicate 2 of the PABC-2004 (Vugrin and Dunagan 2005). The overall distributions were comparable, indicating higher percentile values for the distributions were similar.

DOE indicates that the mean DBR CCDFs have no significant differences between SCPA scenarios and the PABC-2004. Based upon Figure 5-1 (from Dunagan et al. 2007), this assertion also appears to be supported. However, as shown in that figure, the mean DBRs for SCPA Scenario 2 are consistently the smallest, and the mean DBRs for the PABC-2004 are consistently the largest, but the differences are minor.

The frequency and magnitude of DBRs are typically highest when a brine pocket has previously been intruded, since the additional brine that enters the repository in these scenarios generally results in high pressures and brine saturations, conditions leading to DBRs. Thus, DOE explains the trend in DBRs by evaluating the probability of hitting a brine pocket. Given that an intrusion intersects the berm area, the conditional probability that a borehole penetrates a Castile brine pocket is the product of two factors: (1) P(E|B), the conditional probability that the excavated area is intruded given that the berm area is intersected, and (2) the sampled GLOBAL:PBRINE value. The PABC-2004 and SCPA scenarios used identical sampled GLOBAL:PBRINE values, so the trend in mean DBRs is caused by the differences in P(E|B). P(E|B) is defined to be the sum of the RH and CH excavated areas, divided by the berm area as shown below.

$$P(E|B) = \frac{\text{CH Area} + \text{RH Area}}{\text{Berm Area}}$$

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Since the PABC-2004 has the largest RH area, the probability of intersecting a brine pocket (when the berm area is intersected) is higher than for Scenarios 2 and 3 and, consequently, the PABC-2004 model resulted in the largest mean DBRs. Similarly, SCPA Scenario 2 had the lowest DBRs, since that calculation used the smallest RH area.

DOE also indicates that even though the PABC-2004 had the largest mean DBRs at all probabilities, the difference between the DBRs for the PABC-2004 and the SCPA scenarios was still extremely small and not large enough to discernibly impact mean total releases.

DOE satisfactorily explains the differences between the various scenarios, and their assertion that the differences are small is supported by the results presented in Figure 5-1.

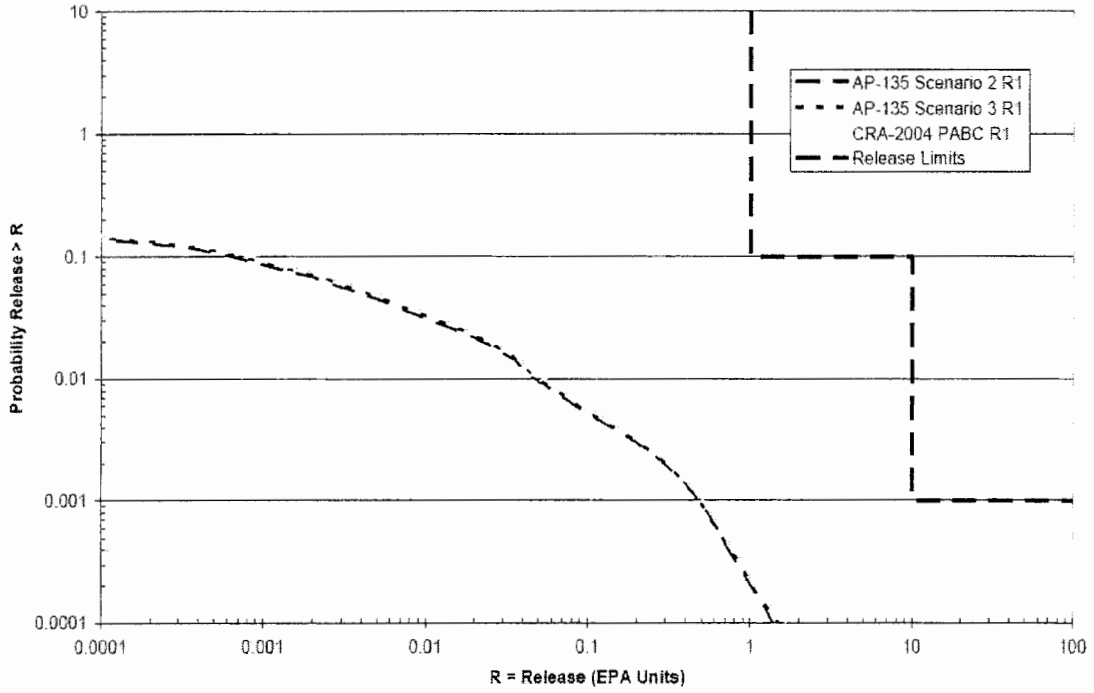

Figure 5-1: Mean DBRs from SCPA Scenarios 2 and 3 and PABC-2004, Replicate 1

(Dunagan et al. 2007)

5.3.2 Comparison of Scenarios 2 and 4 to the PABC-2004

DOE compares the results of the SCPA Scenario 2 and Scenario 4 to determine the impact on releases when RH waste is modeled with two different approaches. SCPA Scenario 2 calculations use a single composite RH waste stream to represent all RH waste streams, while SCPA Scenario 4 calculations explicitly represent all of the 77 individual RH waste streams. There are no other differences between the two calculations.

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The total normalized releases for SCPA Scenarios 2 and 4, Replicate 1, are compared in Figure 5-2. DOE concludes that modeling the use of shielded containers with explicit representation of all 77 individual RH waste streams caused no differences of practical significance on the mean releases.

DOE's conclusion is supported by the results presented in Figure 5-2, in which the mean total releases for each of the scenarios are virtually indistinguishable from one another.

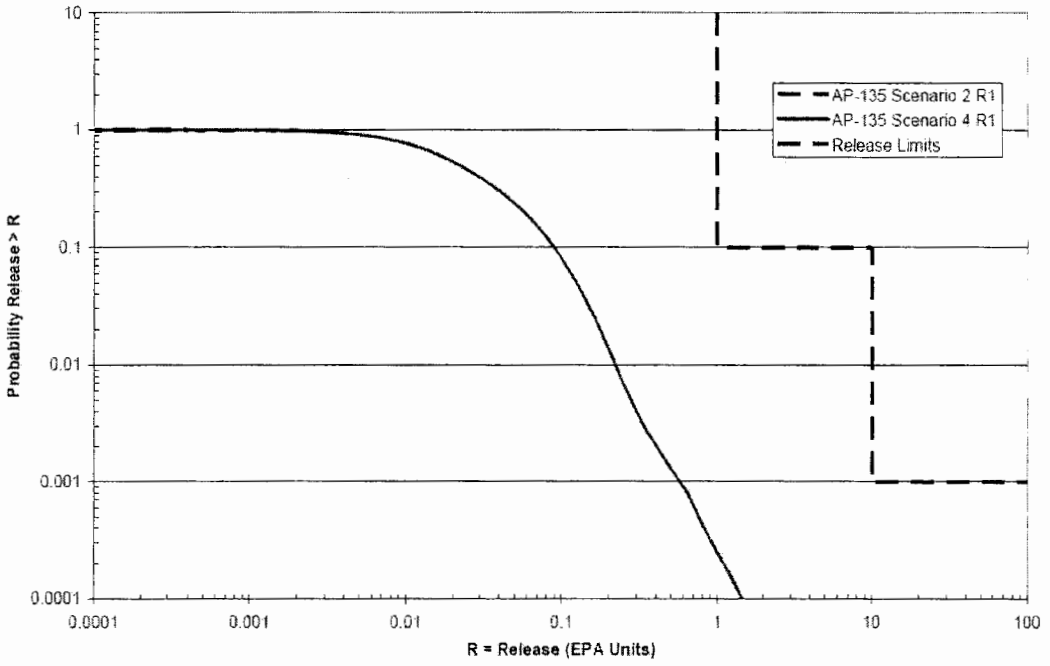

Figure 5-2: Mean Total Releases from SCPA Scenario 2 and Scenario 4, Replicate 1

(Dunagan et al. 2007)

5.3.3 Deviations from Analysis Plan AP-135

Prior to conducting the SCPA, DOE prepared analysis plan AP-135 documenting the proposed modeling studies (Dunagan and Vugrin 2007). DOE made four deviations from AP-135. One deviation was the container design, where the thickness of the steel lid and bottom were increased from 2.75 in to 3 in. This change was captured in the steel estimates (Crawford and Taggart 2007).

The second deviation from AP-135 was the addition of calculations to assess the impact of RH waste on releases. DOE reran CCDFGF using the PABC-2004 files (Leigh et al. 2005) with the fraction of repository volume occupied by waste (REFCON:FVW) set equal to zero. By setting this parameter equal to zero, the contributions from cuttings, cavings, and spallings releases from CH waste were eliminated from the total release results. This allowed DOE to evaluate the

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impact of the RH waste on total releases, because the current baseline (PABC-2004) only attributes RH cuttings releases to the total release results. Therefore, the cuttings output of this set of calculations represents the total releases from RH waste.

The third deviation from AP-135 is that additional qualified codes that were not explicitly called out in AP-135 were used in the SCPA calculations (Table 5-2). DOE used these additional codes to capture the parameter changes that were required for the analysis.

The fourth deviation pertains to DOE's consideration of several changes to the WIPP PA technical baseline, as described in AP-132 (Vugrin and Nemer 2007). The Shielded Container Analysis Plan (AP-135) indicates that the DOE intended to submit a PCR to the EPA that would contain a set of modifications to WIPP PA models and parameters that the DOE would like to include in the WIPP PA technical baseline. DOE performed those calculations, but does not present the results. DOE has decided not to continue with the peer review of the proposed PA changes.

5.4 Software

The SCPA was performed using the same codes used in the previous compliance performance calculations (i.e., PABC-2004) and listed in Table 5-2. These codes were executed on the WIPP PA Alpha Cluster, which is described in Table 5-3.

The verification, testing, and documentation of all of these codes have been conducted during previous reviews and found to be adequate (TEA 2005).

Additionally, commercial off-the-shelf software, such as MATHEMATICA®, MATLAB®, MATHCAD®, Excel®, Access®, Grapher®, or Kaleidagraph®, running on MS Windows XP®-based PC workstations may be utilized.

Table 5-2: Computer Codes Used for SCPA

Code	Version	Build Date	Executable
CCDFGF	5.02	13-DEC-2004	CCDFGF_QB0502.EXE
EPAUNI	1.15A	03-JUL-2003	EPAUNI_QA0115A.EXE
PRECCDFGF	1.01	07-JUL-2005	PRECCDFGF_QA0101.EXE
POSTLHS	4.07A	25-APR-2005	POSTLHS_QA0407A.EXE
MATSET	9.10	29-NOV-2001	MATSET_QA0910.EXE
GENMESH	6.08	31-JAN-1996	GM_PA96.EXE

Table 5-3: WIPP PA Alpha Cluster

Node	Hardware Type	CPU	Operating System
CCR	HP AlphaServer ES45 Model 2	Alpha EV68	Open VMS 8.2
TDN	HP AlphaServer ES45 Model 2B	Alpha EV68	Open VMS 8.2
BTO	HP AlphaServer ES40	Alpha EV68	Open VMS 8.2
CSN	HP AlphaServer ES40	Alpha EV68	Open VMS 8.2
GNR	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2
MC5	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2
TRS	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2

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TBB	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2

5.5 Applicable QA Procedures

A review of the applicable WIPP QA procedures was conducted and is summarized below.

- Analyses will be conducted and documented in accordance with the requirements of NP 9-1, *Analyses*.

  A review of the documents relevant to NP 9-1 was conducted and we found that the appropriate procedures were followed, thereby meeting the NP 9-1 requirements (Dunagan et al. 2007, Long 2007).

- All software used will meet the requirements laid out in NP 19-1, *Software Requirements* and NP 9-1, as applicable.

  A previous EPA review of the software concluded that the requirements of NP 19-1 were met for each of the codes used to support SCPA (TEA 2005).

- The analyses will be reviewed using NP 6-1, *Document Review Process*.

  Documentation of the review process was examined and found to be appropriate and consistent with NP 6-1 requirements (Kirchner 2007b and 2007c, Chavez 2007a and 2007b, Moo Lee 2007a and 2007b, Fox 2007, Trone 2007, and Clayton 2008).

- All required records will be submitted to the WIPP Records Center in accordance with NP 17-1, *Records*.

  During a site visit on August 6, 2008, the records were reviewed and found to be properly archived in the WIPP Records Center in accordance with NP 17-1.

- New and revised parameters will be created as discussed in NP 9-2, *Parameters*.

  A review of the documents relevant to the parameter development was conducted and found that the procedures followed satisfactorily met NP 9-2 (Dunagan 2007, Chavez 2007a, Moo Lee 2007a, and Chavez 2007b).

6.0 IMPACT OF WASTE INVENTORY

As was discussed in Section 4 of this report, DOE made a bounding assessment to be used in the PA for the PCR that all of the RH TRU waste would be placed in shielded containers on the disposal room floor, rather than in canisters in the boreholes in the room walls. Estimates of the resulting inventory changes were made based on the assumption that all RH TRU waste was packaged in shielded containers.

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The PCR will have no impact on the inventory of radionuclides contained in the RH TRU waste. The only difference is that some portion of the RH TRU radioactivity will be emplaced on the disposal room floor, rather than in boreholes in the walls of the disposal rooms. However, the quantities of lead, steel (iron) and cellulosics, plastics, and rubber (CPR) will be affected. An estimate of the quantities of these materials, based on the assumption that all of the RH TRU waste is emplaced in shielded containers, was developed by Crawford and Taggart (2007). Their estimates are summarized in Table 6-1, together with comparable estimates from the 2004 PABC-2004 (Leigh et al. 2005, Table 12), the 2007 Baseline Inventory (ATWIR 2007), and the 2008 Baseline Inventory[6] (ATWIR 2008). From Table 6-1, it can be seen that the PCR would add more lead, steel, and CPR to the WIPP inventory than included in any of the three reference inventories.

Table 6-1: Estimates of Quantities of Steel, Lead and CPR in RH TRU Waste Packaging and Emplacement Materials

Material	Based on PCR		Based on PABC-2004 Inventory		Based on 2007 Inventory		Based on 2008 Inventory	
	Packaging (kg)	Emplacement (kg)	Packaging (kg)	Emplacement (kg)[a]	Packaging (kg)	Emplacement (kg)	Packaging (kg)	Emplacement (kg)
Lead	2.70E07	0	2.97E06	0	3.82E04	0	2.48E04	0
Steel	2.56E07	0	3.82E06	0	4.32E06	0	4.46E06	0
Cellulosics	0	2.40E04	0	0	0	0	0	0
Plastics	1.13E05	4.29E05	2.19E04	0	7.79E04	0	9.91E04	0
Rubber	0	0	0	0	0	0	0	0

a - All emplacement materials identified in Leigh et al. 2005 assumed to be associated with CH TRU waste.

However, these inventory increases must be examined from the perspective of the total quantities of each material associated with both RH TRU and CH TRU waste, not just those associated with RH TRU packaging and emplacement materials. The PABC-2004 inventory provides an appropriate basis for comparison, since the PABC-2004 CCDFs are used as the baseline for comparison with the SCPA CCDFs. Details from the PABC-2004 are included in Table 6-2 (Leigh et al. 2005). Material densities are converted to masses, assuming a volume of 1.685E05 m^3 for CH–TRU waste and a volume of 7.079E03 m^3 for RH TRU waste.

[6] This inventory is also documented in PAIR 2008 and was used in the PABC-2009.

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Table 6-2: Masses of Selected Materials in the PABC-2004 Inventory

Material	CH Waste		RH Waste		Total
	Density (kg/m^3)	Mass (kg)	Density (kg/m^3)	Mass (kg)	Mass (kg)
Steel in Waste	110	1.85E07	59	4.18E05	1.89E07
Cellulosics in Waste	60	1.01E07	9.3	6.58E04	1.01E07
Rubber in Waste	13	2.19E06	6.7	4.74E04	2.24E06
Plastics in Waste	43	7.24E06	8.0	5.66E04	7.30E06
Lead in Waste	150[a]	2.53E07	74[a]	5.24E05	2.58E07
Steel in Packaging	170	2.86E07	540	3.82E06	3.24E07
Cellulosics in Packaging	0	0	0	0	0
Rubber in Packaging	0	0	0	0	0
Plastics in Packaging	17	2.86E06	3.1	2.19E04	2.88E06
Lead in Packaging	0.013	Negligible	420	2.97E06	2.97E06
Cellulosics in Emplacement	—	2.07E05	—	0	2.07E05
Plastics in Emplacement	—	1.48E06	—	0	1.48E06

a - Assumes that "lead/cadmium" waste stream is all lead (Crawford 2005).

From Table 6-2, it can be calculated that the total steel mass in the PABC-2004 inventory is 5.14E07 kg. If all of the steel in the RH packaging (3.82E06 kg) were replaced by an amount of steel assuming that all of the RH waste was packaged in shielded containers (2.56E07 kg per Crawford and Taggart 2007, Table 8), the net increase in steel inventory would be 2.18E07 kg (2.56E07 – 0.38E07) and the total steel inventory would be 7.32E07 kg (5.14E07 kg + 2.18E07 kg), an increase of 42%.

Similar results for other materials of interest are summarized in Table 6-3. Data in columns 2 and 3 are derived from Table 6-2; data in column 4 are taken from Table 6-1; data in column 5 are the differences between columns 3 and 4; data in column 6 are the sum of columns 2 and 5; and column 7 results are obtained by dividing data in column 5 by those in column 1. It is clear from Table 6-3 that large increases in the masses of steel and lead will result from the PCR, but that the increase in the total CPR mass is only about 2%.

Table 6-3: Increase in Mass of Steel, Lead, and CPR Materials Used in PCR as Compared to PABC-2004

Material	Total Mass in PABC-2004 (kg)	RH Mass in PABC-2004 Pack/Emplace (kg)	RH Mass in PCR Pack/Emplace (kg)	Change in Mass PCR vs. PABC-2004 Pack/Emplace (kg)	Total PCR Mass (kg)	Increase in Mass PCR vs. PABC-2004 (%)
Steel	5.14E07	3.82E06	2.56E07	2.18E07	7.32E07	42
Lead	2.88E07	2.97E06	2.70E07	2.40E07	5.28E07	83
Cellulosics	1.04E07	0	2.40E04	2.40E04	1.04E07	0.23
Plastics	1.17E07	2.19E04	5.42E05	5.20E05	1.22E07	4.4
Rubber	2.24E06	0	0	0	2.24E06	0

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The very small increase in CPR is of no consequence, because DOE adjusts the amount of MgO added to the disposal rooms to maintain a constant MgO Excess Factor of 1.2 (Reyes 2008). This procedure ensures that sufficient MgO is available to sequester all CO_2 generated by microbial degradation of CPR.

Comparable data to that in Table 6-2 are included in Table 6-4 for the PABC-2009 inventory.

Table 6-4: Masses of Selected Materials in the PABC-2009 Inventory

Material	CH Waste		RH Waste		Total
	Density (kg/m^3)	Mass (kg)	Density (kg/m^3)	Mass (kg)	Mass (kg)
Steel in Waste	81	1.36E07	170	1.20E06	1.48E07
Cellulosics in Waste	40	6.74E06	22	1.56E05	6.90E06
Rubber in Waste	5.6	9.44E05	6.6	4.67E04	9.91E05
Plastics in Waste	38	6.40E06	28	1.98E05	6.60E06
Lead in Waste	150[a]	2.53E07	74[a]	5.24E05	2.58E07
Steel in Packaging	190	3.20E07	630	4.46E06	3.65E07
Cellulosics in Packaging	5.1	8.59E05	0	0	0
Rubber in Packaging	0	0	0	0	0
Plastics in Packaging	16	2.86E06	14	9.91E04	2.96E06
Lead in Packaging	0.0	0	3.5	2.48E04	2.48E04
Cellulosics in Emplacement	1.34	2.26E05	—	0	2.26E05
Plastics in Emplacement	6.59	1.11E06	—	0	1.11E06

a - Assumes that "lead/cadmium" waste stream is all lead (Crawford 2005).

From Table 6-4, it can be calculated that the total steel mass in the PABC-2009 inventory is 5.13E07 kg, a value virtually identical with 5.14E07 kg for PABC-2004. No new data were available for lead in the waste, so the same estimate was used as in Table 6-2. As will be discussed in Section 8, the presence of iron and lead in the repository is expected to have a beneficial effect by contributing to the establishment and maintenance of reducing conditions. Consequently, any incremental changes associated with the PAIR 2008 inventory used in the PABC-2009 were not evaluated further.

As part of this review, the inventory-related data in Crawford and Taggart 2007 and Dunagan et al. 2007 were examined. The inventory data and calculations in Sections 4 and 6 of Crawford and Taggart 2007, including data in Tables 4, 5, 6, 7, and 8, were verified and traced to their sources. The inventory data in Dunagan et al. 2007, particularly in Sections 3.1.2 and 3.1.4.1 of that report, were similarly examined and verified.

7.0 RADIOLOGICAL CHARACTERIZATION OF CANDIDATE WASTE STREAMS FOR SHIELDED CONTAINERS

Due to the fact that the dose rate would be limited to 200 mrem/hr on the surface of shielded containers, not all of the RH TRU waste streams identified in DOE/TRU-2006-3344 (DOE 2006c) could be packaged in shielded containers. DOE (i.e., Los Alamos National Laboratory-

Carlsbad Operations, or LANL-Carlsbad) performed a scoping analysis (Crawford and Taggart 2007) to estimate which of the RH TRU waste streams are potential candidates for disposal in shielded containers. The final determination as to which RH TRU waste would actually be packaged in shielded containers would be made based upon the measured surface dose rate once the waste has been placed inside the container. The DOE analysis is for planning purposes only.

For the scoping analysis, LANL-Carlsbad focused only on the gamma component of RH TRU waste, and ignored any neutron contribution to the surface dose rate. This is appropriate for this level of scoping, as the neutron dose contribution to the total surface dose rate is expected to be small. For example, DOE 2006b, Section 2.4.1.2, states that, "The shielding [for the hot cell complex] is designed for an internal gamma surface dose rate of 400,000 Rem/hr and for an internal neutron surface dose rate of 45 Rem/hr." In other words, the expected neutron dose rate is only about 0.01125% of the total estimated dose. A similar statement was made in the WIPP technical basis for external dosimetry (Bradley et al. 1993):

> *The neutron component of the total external radiation exposure for RH TRU is expected to be a small percentage of the total gamma exposure. If one looks at the ratio of the maximum neutron dose rate to the maximum total allowed dose rate (270 mrem/hr per 1,000,000 mrem/hr), the expected neutron dose rate is only 0.027% of the total estimated dose.* (See discussion in Section 6.3 below).

Since (1) the scoping analysis is limited to photon/gamma rays, (2) the shielded containers have a simple cylindrical geometry, and (3) the container walls are sufficiently thick to shield any weak gamma rays (i.e., Bremsstrahlung is not a concern), this analysis is ideally suited for the point-kernel analysis method used by MicroShield®:

7.1 MicroShield® Quality Assurance

MicroShield® is a comprehensive photon/gamma ray shielding and dose assessment program that is widely used for designing radiation shields.[7] It was originally developed by Grove Engineering, which was acquired by Areva NP (formerly Framatome ANP, Inc.). MicroShield is an enhanced adaptation of ISOSHLD II, a proven mainframe gamma shielding code developed at Pacific Northwest Laboratory (PNL) in the mid-1960s.

On file at the LANL-Carlsbad records center are (1) LOC-MIC-01, Rev. 0, *MicroShield 6 Requirements Memorandum*, (2) LOC-MIC-02, Rev. 0, *MicroShield Verification & Validation Report*, supplied by Grove Engineering, and (3) LOC-MIC-03, Rev. 0, *MicroShield 6 User's Manual*, also supplied by Grove. The LANL-Carlsbad records center also has the Installation and Checkout forms (QP19-2-2) that document the installation of MicroShield on two computers (PN1164783 and PN1165337), including the successful results running each of the 24 test cases on each computer. Each of these documents is also available in the Compliance Recertification Electronic Library (CREL), and have been reviewed and found to be acceptable.

[7] To avoid redundancy, the registered trademark symbol ® is not included with subsequent references to MicroShield, but is understood as included.

Additionally, Document Review Forms (DRF) are completed whenever a problem or error occurs during the MicroShield (or any other software) installation. Presently, there are nine MicroShield-related DRFs on file at the LANL-Carlsbad records center. A check of these DRFs during a visit to the LANL-Carlsbad records center found them to be properly implemented.

7.2 MicroShield Dimensions

Figure 7-1 shows a schematic of the RH TRU waste shielded container (Day 2008). It has been designed to hold a single 30-gallon drum having outside dimensions consistent with those of a 55-gallon drum. For comparison purposes, the dimensions of DOT-17C 30-gallon and 55-gallon drums are given in Table 7-1.

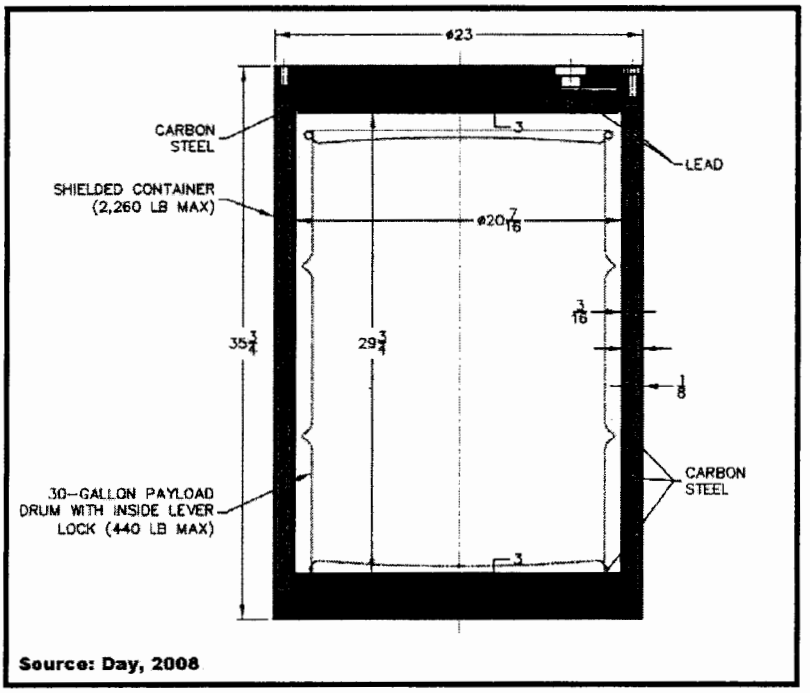

Figure 7-1: Shielded Container

Table 7-1: DOT-17C Drum Dimensions

Dimension	30-gallon drum		55-gallon drum	
	Interior	Exterior	Interior	Exterior
Height (in)	28.0	29.5	33.25	35.00
Diameter (in)	18.0	20.0	22.25	24.00

Source: DOE 1996

Table 7-2 gives the dimensions LANL used in MicroShield, and indicates that LANL has slightly over-estimated the radius of a 30-gallon drum, resulting in a drum volume closer to 35 gallons. The effect of this on the MicroShield analysis is two-fold. First, the larger radius would place the source nearer to the dose receptor, thereby tending to slightly increase the calculated dose. Second, since a 1-Ci source was specified for each MicroShield analysis, the

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larger volume would result in a reduced concentration, thereby slightly decreasing the calculated dose. In reality, it is unknown where the source would be inside the 30-gallon drum, and that uncertainty would be much larger than any uncertainty introduced by this slight overestimate of the radius.

Table 7-2 also indicates that the distance to the dose point was slightly shorter (i.e., conservative), when compared to the distance estimated by SC&A.

Table 7-2: MicroShield Dimensions

Parameter	LANL	SC&A
30-gallon drum Dimensions		
Height (in)	27.7	28
Radius (in)	9.6	9
Volume (in^3)	8,092	7,125
Volume (gal)	35.03	30.85
Shielded Container Dimensions		
Diameter (in)	20.4375	N/A
Height (in)	29.75	N/A
Side Dose Point Distance (in)		
Waste	9.645	9.000
Air	0.542	1.219
Steel	0.188	0.188
Lead	1.000	1.000
Steel	0.125	0.125
Total	11.50	11.53
Top Dose Point Distance (in)		
Waste	27.69	28.00
Steel	3.00	3.00
Air	1.06	1.75
Total	31.75	32.75

LANL Source: Crawford and Taggart 2007, page 27

7.3 RH TRU Significant Radionuclides

The WIPP RH TRU waste streams contain approximately 126 radionuclides (DOE 2006c). Rather than perform the MicroShield analysis for each radionuclide, LANL decided to limit the analysis to only those radionuclides that have a significant contribution to the dose, either because of their relative abundance in the waste and/or because they are significant photon/gamma ray emitters.

LANL used 'gamma factors' from the "Radiological Health Handbook" (Shleien 1992) to determine which radionuclides to include in their MicroShield analysis. This resulted in the list of 14 radionuclides given in Table 7-3, taken from INV-SAR-08, Table 3 (Crawford and Taggart

2007). Rather than repeat the LANL calculations, it was decided to rank the radionuclides based on information provided in *Federal Guidance Report No. 12* (FGR 12) (Eckerman and Ryman 1993).

FGR 12, Table A.1, presents (along with other data) the average photon energy (MeV) per nuclear transformation. The Table A.1 photon energy was used to rank the 126 RH TRU radionuclides, with the resulting rankings shown in column 3 of Table 7-3 for the same suite of radionuclides as initially selected by LANL. The relative rankings were based on the product of the average photon energy and the curie density from DOE 2006c, Table 32.

Table 7-3: Significant RH TRU Radionuclides

Nuclide	Curies per 200 mrem/hr‡	Energy Rank	Neutron*	RH/CH Ratio
Cs-137	2.0	1	No	
Co-60	0.12	2	No	
Eu-152	0.39	3	No	
Eu-154	0.29	4	No	
Am-241	208,855	5	Yes	1.4× Lower
Cs-134	0.64	6	No	
Cm-247	10	9	No	
Pu-238	2,855,368	10	Yes	15.9× Lower
Pu-240	9,365,050	11	Yes	2.5× Lower
Cm-244	697,800	13	Yes	4.1× Higher
Pu-243	1,396	17	No	
Cm-243	213	28	Yes	29.6× Higher
Th-229	4,435	39	No	3.2× Higher
Pu-239	151,240	97	Yes	4.6× Lower

‡ Source: Crawford and Taggart 2007, Table 3
* Source: DOE 2006c, Table 5.1

Using the photon energy ranking, 10 of the same 14 radionuclides would be selected as significant. The four LANL significant radionuclides not selected by the FGR 12 photon energy ranking were Pu-243, Cm-243, Th-229, and Pu-239. The four radionuclides selected by the FGR 12 photon energy ranking, but not included as significant by LANL, were Eu-155 (7), Tl-208 (8), Bi-212 (12), and Sb-125 (14). As will be discussed subsequently, additional MicroShield runs were made to determine the significance of the four radionuclides identified by the FGR 12 photon energy ranking.

Table 7-3 also shows which of the 14 LANL-identified significant radionuclides are neutron emitters, as identified by RH TRU 72-B Cask SAR, Rev. 4, Table 5.1 (DOE 2006d). As Table 7-3 demonstrates, half of the radionuclides identified by LANL as significant for analysis of the shielded container are not neutron emitters, and four of the seven neutron emitters have lower average RH concentrations than CH concentrations, as indicated in the right-hand column of Table 7-3 (the concentrations used to perform this comparison were taken from DOE 2006c, Table 32). The right-hand column of Table 7-3 shows that, with the exception of Cm-243, Cm-244, and Th-229, the average neutron dose rate from RH TRU is expected to be less than from

CH TRU due to the lower concentrations of neutron emitters. This is additional confirmation that ignoring the neutron contribution to the shielded container surface dose rate is appropriate for this scoping analysis. Again, it is pointed out that the final determination as to which RH TRU waste would actually be packaged in shielded containers would be made based upon the measured gamma and neutron dose rates.

7.4 MicroShield Gamma Energy Distribution

MicroShield is provided with a library of photon/gamma ray distributions for 497 radionuclides, including all of the radionuclides listed in Table 7-3. MicroShield also provides the user with the capability to specify a unique photon/gamma ray distribution for up to 25 energies. By comparing the MicroShield supplied gamma distributions to the latest distributions available from the Lawrence Berkeley National Laboratory (LBNL) website (LBNL 2008), LANL determined that the MicroShield photon/gamma ray library provides accurate data for most of the significant RH TRU radionuclides, with the exception of the five radionuclides listed in Table 7-4.

Table 7-4: MicroShield Gamma Distributions

Nuclide	MeV	(Photons/sec)/Ci	% of Total Energy Activity
Am-241	0.026345	8.8800E+08	2.853%
	0.033205	3.9220E+07	0.159%
	0.059537	1.3283E+10	96.429%
	0.069231	6.6348E+07	0.560%
Cm-244	0.056867	1.0544E+07	100.000%
Pu-238	0.055303	1.7504E+07	100.000%
Pu-239	0.11291	1.7606E+07	100.000%
Pu-240	0.054327	1.9412E+07	100.000%

LANL obtained the latest gamma distributions for these 5 radionuclides from the LBNL website, and adjusted them as necessary to correspond to MicroShield's 25 energy distribution limits. Crawford and Taggart (2007), pages 31 through 35, show the resulting energy distributions determined by LANL.

A check of the LANL-derived Pu-238 gamma spectrum is presented in Table 7-5. The left two columns of Table 7-5 show the gamma energy data obtained from the LBNL website for Pu-239, while the middle column is simply the product of the left two columns. The second from the right column (% of Total Energy Activity) is the value from the middle column divided by the sum of the middle column values. The right-hand column adjusts the "% of Total Energy Activity" values to account for the gammas, whose "% of Total Energy Activity" values were too small to be included directly into MicroShield. This adjustment is necessary, because the LBNL website lists 172 gamma energies associated with Pu-239, whereas MicroShield can only accept 25 different gamma energies. Because these 147 gammas range from 13.8 keV to over 1 MeV, it is appropriate to distribute them over the entire range of gamma energies.

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Comparing the "Adjusted" column of Table 7-5 to the Pu-239 energy distribution determined by LANL on page 34 of Crawford and Taggart 2007 shows good agreement. Similar agreement was found when the LANL-derived gamma spectra for Am-241, Cm-244, Pu-238, and Pu-240 were checked.

Table 7-5: Calculated Gamma Spectrum for Pu-239

MeV	Fraction	Energy Act (Mev)	% of Total Energy Activity	Adjusted
0.038661	0.000105	4.06E-06	6.907%	7.527%
0.046204	7.4E-06	3.42E-07	0.582%	0.634%
0.051624	0.000271	1.40E-05	23.804%	25.942%
0.056828	1.13E-05	6.42E-07	1.093%	1.191%
0.077598	4.1E-06	3.18E-07	0.541%	0.590%
0.09878	1.22E-05	1.21E-06	2.050%	2.235%
0.103032	2.3E-06	2.37E-07	0.403%	0.439%
0.11537	4.6E-06	5.31E-07	0.903%	0.984%
0.116258	5.97E-06	6.94E-07	1.181%	1.287%
0.129297	6.31E-05	8.16E-06	13.882%	15.129%
0.144201	2.83E-06	4.08E-07	0.694%	0.757%
0.203545	5.69E-06	1.16E-06	1.971%	2.148%
0.332842	4.94E-06	1.64E-06	2.798%	3.049%
0.336113	1.12E-06	3.76E-07	0.641%	0.698%
0.345008	5.56E-06	1.92E-06	3.264%	3.557%
0.367072	8.9E-07	3.27E-07	0.556%	0.606%
0.368557	8.8E-07	3.24E-07	0.552%	0.601%
0.375045	1.55E-05	5.83E-06	9.917%	10.807%
0.380173	3.05E-06	1.16E-06	1.973%	2.150%
0.38275	2.59E-06	9.91E-07	1.687%	1.838%
0.39256	2.05E-06	8.05E-07	1.369%	1.492%
0.393136	3.5E-06	1.38E-06	2.341%	2.551%
0.413707	1.47E-05	6.06E-06	10.319%	11.246%
0.422598	1.22E-06	5.16E-07	0.877%	0.956%
0.451483	1.89E-06	8.55E-07	1.455%	1.586%
Various	3.28E-05	4.84E-06	8.241%	N/A

7.5 Potential Shielded Container RH TRU Waste Volume

SC&A independently ran MicroShield with Cs-137 and obtained exactly the same results as obtained by LANL. SC&A also ran MicroShield for the four radionuclides identified above in Section 6.3, but not analyzed by LANL (i.e., Eu-155, Tl-208, Bi-212, and Sb-125).

To evaluate the potential contribution of each radionuclide to the RH TRU shielded container surface dose rate, the maximum activity loadings for the 17 radionuclides were compared to the 30-gallon drum loading, based on the volume-averaged RH TRU waste concentration from DOE/TRU-2006-3344, Table 32 (DOE 2006c). As Table 7-6 shows, Cs-137 is the only radionuclide whose drum activity loading (column 4) based on its volume-averaged

concentration (column 3) exceeds its MicroShield calculated maximum activity loading for the 200 mrem/hr limit (column 2).

Table 7-6: Surface-Dose Limiting Versus Volume-Averaged Activity Loading

Nuclide	Curies per 200 mrem/hr[‡]	RH Conc (Ci/m^3)[†]	RH Drum Activity (Ci)[††]	Drum Activity/Limit
Cs-137	2	60	6.78	3.39
Co-60	0.12	0.26	0.02938	0.244833
Eu-152	0.39	0.33	0.03729	0.095615
Eu-154	0.29	0.16	0.01808	0.062345
Cs-134	0.64	0.015	0.001695	0.002648
Tl-208*	0.0539	0.00069	7.8E-05	0.001446
Bi-212*	1.77	0.0019	0.000215	0.000121
Cm-247	10	0.0067	0.000757	7.57E-05
Sb-125*	6.66	0.00069	7.8E-05	1.17E-05
Am-241	208,855	2	0.226	1.08E-06
Pu-239	151,240	0.74	0.08362	5.53E-07
Pu-243	1,396	0.0066	0.000746	5.34E-07
Cm-243	213	0.000071	8.02E-06	3.77E-08
Cm-244	697,800	0.15	0.01695	2.43E-08
Pu-238	2,855,368	0.54	0.06102	2.14E-08
Pu-240	9,365,050	0.22	0.02486	2.65E-09
Th-229	4,435	0.000026	2.94E-06	6.62E-10
Eu-155*	6.50E+10	0.049	0.005537	8.52E-14

[‡] Source: Crawford and Taggart 2007, Table 3
[†] Source: DOE 2006c, Table 32 (decayed to 2001)
[††] Product of column 3 and volume of 30-gallon drum
* Radionuclide not included in the LANL analysis

Although the average Cs-137 RH TRU waste concentration would exceed the surface dose rate limit if it were used to fill a 30-gallon drum, because the actual Cs-137 RH TRU waste concentration is expected to range from 1.6×10^{-6} to 7.530 Ci/m^3, some volume of RH TRU waste containing Cs-137 would be suitable for shielded container disposal. In fact, Figure 7-2 shows that about 32% of the final RH TRU waste form volume could be packaged in shielded containers, assuming that Cs-137 is the dominant photon emitter. Figure 7-2 is based on the individual RH TRU waste stream Cs-137 concentrations given in DOE 2006b, Appendix J, and a total RH TRU disposal volume of 7,080 m^3. Figure 7-2 shows two curves; the solid line curve is based on the Cs-137 concentrations for all of the RH TRU waste streams presented in DOE 2006c, Appendix J, while the dotted curve is based on only those RH TRU waste streams listed in Crawford and Taggart 2007, Table 10. Table 10 of Crawford and Taggart (2007) lists only those waste streams that would meet the 2-Ci limit for Cs-137. The large "step" in the middle of the DOE 2006c Appendix J curve is due to a single waste stream, RP-W016 "PUREX TRU

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Cladding Removal Solids," which has a final form volume of 3,943.6 m^3 and a Cs-137 concentration of 19.1 Ci/m^3.[8]

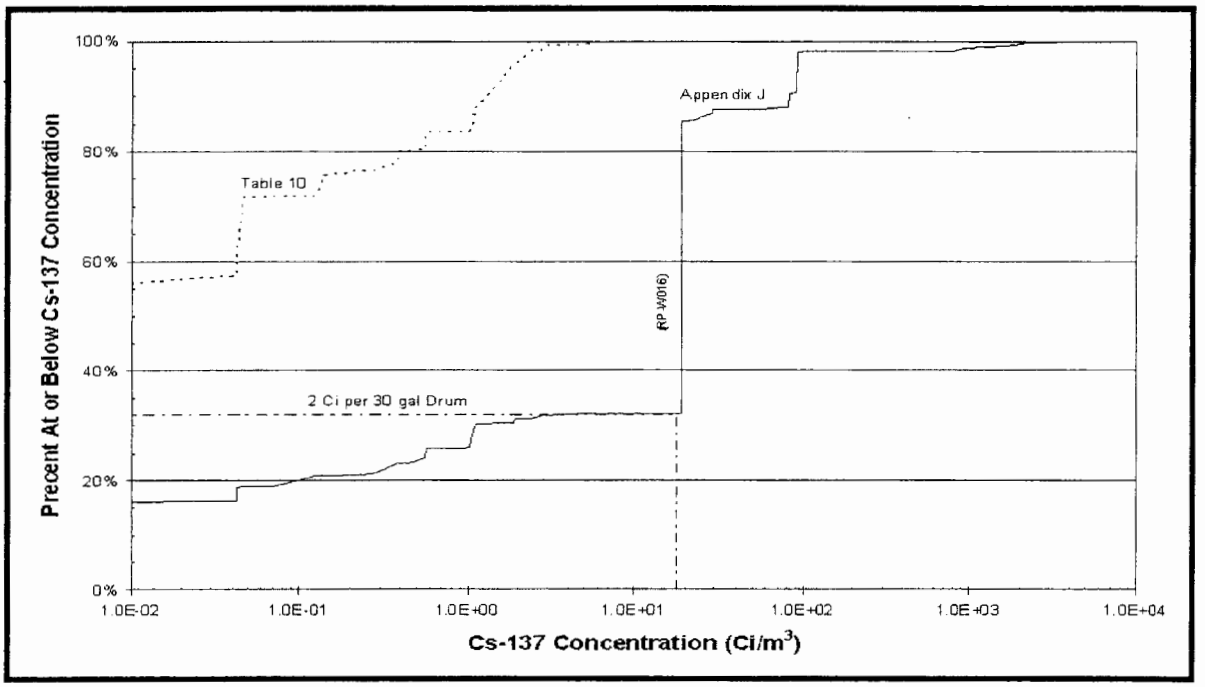

Figure 7-2: RH TRU Waste Stream At or Below the Limiting Cs-137 Concentration

Of course, the LANL analysis (Crawford and Taggart 2007) and this critique are for planning purposes only, and the final determination as to which RH TRU waste would actually be packaged in shielded containers would be made based upon the measured gamma and neutron dose rates.

7.6 Impact of 2008 Revised Transuranic Waste Baseline Inventory

Crawford and Taggart (2007) performed all of their analyses based upon the WIPP RH TRU inventory as given in DOE 2006c (i.e., the PABC-2004 inventory). In 2009, DOE issued the 2008 inventory report, Performance Assessment Inventory Report – 2008 (INV-PA-08),[9] which updated and revised both the CH TRU and RH TRU WIPP waste inventories as of December 31, 2007. This section looks at the effect, if any, of the revised RH TRU inventory on the shielded container analysis.

First, the 121 radionuclides that are reported in both PABC-2004 and INV-PA-08 were compared. Table 7-7 shows that for 55 radionuclides, the INV-PA-08 inventories are lower than the PABC-2004 inventory, while for 66 radionuclides, they are higher. The table also shows that

[8] This waste stream, which is a Hanford tank waste, has been removed from the 2007 inventory (ATWIR 2007), together with all other tank wastes, until a determination is made as to whether these wastes are TRU or high-level waste.

[9] Also referred to as PAIR 2008, which was the baseline inventory for the PABC-2009 required by EPA as part of the 2009 compliance re-certification.

the inventories for only 16 radionuclides changed by less than a factor of 2, while 40 (or one-third) of the radionuclides had their inventories change by over a factor of 1,000. The results from Table 7-7 are applicable to both the radionuclide concentrations and the total inventory.

Table 7-7: Summary Comparison of 2004 and 2008 Baseline Inventories

Factor Difference	INV-PA-08 Lower	INV-PA-08 Higher	Total
Less Than 2	5	11	16
Between 2 and 5	9	9	18
Between 5 and 10	3	2	5
Between 10 and 100	14	17	31
Between 100 and 1,000	8	3	11
Greater Than 1,000	16	24	40
Total	55	66	121

Table 7-8 is similar to Table 7-7, except that it focuses on the 14 radionuclides analyzed by Crawford and Taggart (2007). Table 7-8 shows that for three of the analyzed radionuclides (Th-229, Cm-243, and Pu-238), the INV-PA-08 inventories are greater than the PABC-2004 inventories; five of the analyzed radionuclides (Pu-240, Pu-239, Cm-244, Am-241, and Cs-137) had their inventories reduced by less than an order of magnitude; and two of the analyzed radionuclides (Pu-243 and Cm-247) had their inventories reduced by more than eight orders of magnitude.

Table 7-8: Comparison of 2004 and 2008 Baseline Inventories by Radionuclide

Radionuclide	2004 Inventory / 2008 Inventory	Radionuclide	2004 Inventory / 2008 Inventory
Th-229	0.044	Cs-137	4.76
Cm-243	0.24	Eu-154	14.2
Pu-238	0.75	Co-60	150.3
Pu-240	1.57	Eu-152	875.3
Pu-239	1.80	Cs-134	967.7
Cm-244	2.44	Pu-243	3.0E+08
Am-241	3.16	Cm-247	3.0E+08

The FGR 12, Table A.1, ranking of the RH TRU radionuclides (see Section 7.3) was re-performed using the revised concentrations from INV-PA-08, Table A-1, with the results presented in Table 7-9.

Table 7-9 compares the original ranking by Crawford and Taggart (2007) [C&T] with the rankings done in this report (based on FGR 12), using both the 2004 and 2008 baseline inventories (BI). Table 7-9 shows that regardless of the ranking method, Cs-137 is always in the first position, and Co-60 and Am-241 are always in the top five. Four other radionuclides (Pu-238, Pu-240, Eu-152 and Eu-154) are ranked in the top 14 for all three rankings. Four radionuclides (Th-229, Pu-238, Pu-243, and Cm-243) are outside of the top 14 for the FGR 12 rankings using both the 2004 and 2008 baseline inventories. Finally, three radionuclides

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(Cs-134, Cm 244, and Cm-244) move from being ranked in the top 14 when ranked using FGR 12 and the 2004 inventory to outside the top 14 using FGR 12 and the 2008 inventory.

Table 7-9: Significant RH TRU Radionuclides – 2008 Baseline Inventory

Nuclide	Curies per 200 mrem/hr‡	Energy Ranking		
		C&T 2007	2004 BI FRG 12	2008 BI FGR 12
Cs-137	2	1	1	1
Am-241	208855	2	5	2
Co-60	0.12	3	2	4
Pu-239	151240	4	97	129
Pu-238	2855368	5	10	7
Cs-134	0.64	6	6	25
Eu-154	0.29	7	4	3
Pu-240	9365050	8	11	13
Eu-152	0.39	9	3	10
Cm-244	697800	10	13	16
Cm-243	213	11	28	22
Cm-247	10	12	9	81
Pu-243	1396	13	17	85
Th-229	4435	14	39	21

‡ Source: Crawford and Taggart 2007, Table 3

Using Table 7-9, it is seen that 7 of the 14 C&T-selected radionuclides would also be selected as being significant, based on the 2008 inventory (INV-PA-08) and FGR 12 ranking. The remaining seven radionuclides selected by the 2008 BI/FGR 12 ranking, but not selected by C&T, were Bi-214(5), Tl-208(6), Pb-214(8), Bi-212(9), Pb-212(11), Sb-126m(12), and Eu-155(14).

Additional MicroShield runs were made for Bi-214, Tl-208, Pb-214, Bi-212, Pb-212, Sb-126m, and Eu-155 to determine their limiting drum activities. Likewise, in order to get an idea of the potential contribution of each significant radionuclide from INV-PA-08 to the RH TRU shielded container surface dose rate, the maximum activity loadings for all 21 C&T and 2008 BI/FGR 12 radionuclides were compared to the average 30-gallon drum loading, based on the volume-averaged RH TRU waste concentration given in INV-PA-08, Table A-1. As Table 7-10 shows, none of the average radionuclide activity loadings exceed their MicroShield calculated maximum activity loading (i.e., the RH average drum activity in column 5 divided by the limiting curies for a 200 mrem/hr dose in column 3 is less than unity, as shown in column 6).

Table 7-10: Surface Dose Limiting Versus Volume-Averaged Activity Loading – 2008 Baseline Inventory

Nuclide	2008 BI FGR 12 Rank	Limiting Curies per 200 mrem/hr‡		RH Conc (Ci/m^3)†	RH Drum Activity (Ci)††	Drum Activity/Limit
Cs-137	1	2	C&T	12.6	1.4238	0.7119
Am-241	2	208855	C&T	0.633	0.071529	3.42E-07
Eu-154	3	0.29	C&T	0.0113	0.001277	0.004403
Co-60	4	0.12	C&T	0.00173	0.000195	0.001629
Bi-214	5	1.48E-01	Added	0.00256	0.000289	0.001961
Tl-208	6	0.053905	Added	0.00102	0.000115	0.002138
Pu-238	7	2855368	C&T	0.722	0.081586	2.86E-08
Pb-214	8	3.62E+01	Added	0.00256	0.000289	7.99E-06
Bi-212	9	1.77E+00	Added	0.00285	0.000322	0.000182
Eu-152	10	0.39	C&T	0.000377	4.26E-05	0.000109
Pb-212	11	1.06E+06	Added	0.00284	0.000321	3.02E-10
Sb-126m	12	7.45E-01	Added	0.000233	2.63E-05	3.53E-05
Pu-240	13	9365050	C&T	0.14	0.01582	1.69E-09
Eu-155	14	6.5E+10	Added	0.00449	0.000507	7.81E-15
Cm-244	16	697800	C&T	1.23	0.13899	1.99E-07
Th-229	21	4435	C&T	0.00385	0.000435	9.81E-08
Cm-243	22	213	C&T	0.0271	0.003062	1.44E-05
Cs-134	25	0.64	C&T	0.132	0.014916	0.023306
Cm-247	81	10	C&T	1.99E-11	2.25E-12	2.25E-13
Pu-243	85	1396	C&T	1.97E-11	2.23E-12	1.59E-15
Pu-239	129	151240	C&T	1.1	0.1243	8.22E-07

‡ Source: C&T = Crawford and Taggart 2007, Table 3; Added = this analysis

† Source: INV-PA-08, Table A-1

††Product of RH Conc and volume of 30-gallon drum

Similar to the PABC-2004 inventory (DOE 2006c), even though the average Cs-137 concentration based on the INV-PA-08 inventory is below what would be allowable in a shielded container, the individual RH TRU waste stream Cs-137 concentrations range from <0.001 to 3,140 Ci/m^3 (INV-PA-08, Appendix B). Therefore, it is expected that the shielded container would not be usable for some fraction of the RH TRU waste. Figure 7-3 shows that about 97% of the final form waste volume from INV-PA-08, Appendix B, could be packaged in shielded containers, assuming Cs-137 is the limiting radionuclide.

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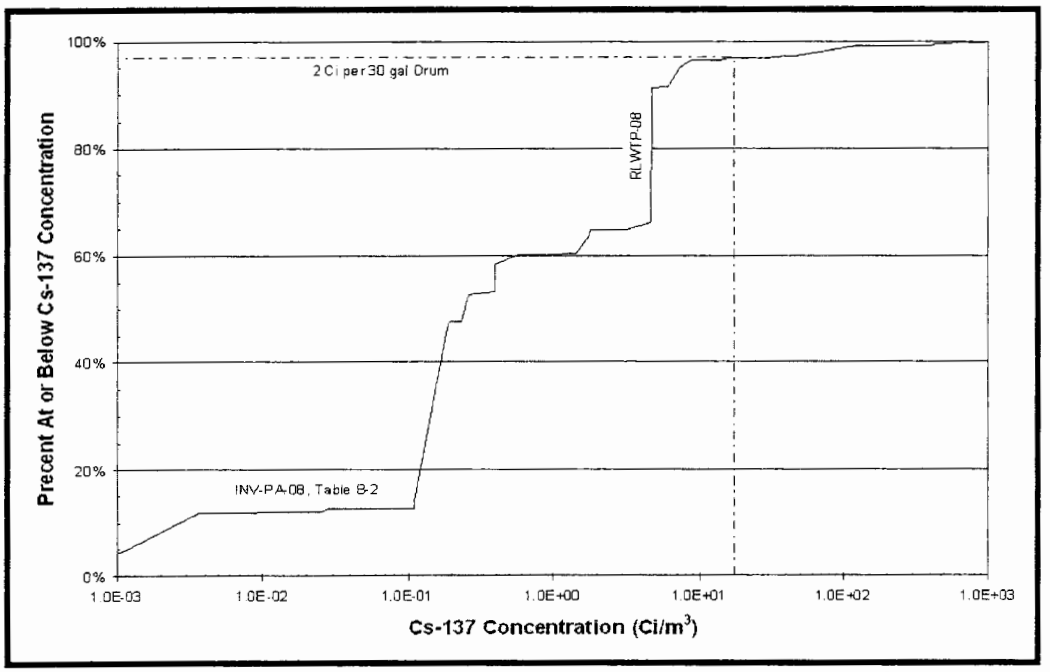

Figure 7-3: Fraction of RH TRU Waste Streams At or Below the Limiting Cs-137 Concentration Based on 2008 Inventory

Both PABC-2004 and INV-PA-08 assumed that the disposal volume of RH TRU is limited to 7,080 m^3, which is consistent with the DOE agreement with the state of New Mexico (DOE 1981).

In INV-PA-08, waste stream RLWTP-08 at an estimated volume of 1,777.74 m^3 contributes 25% to the total RH waste volume, and with an estimated inventory of 8,430 Ci has a Cs-137 concentration of 4.7 Ci/m^3 or 0.54 Ci per 30-gallon drum, which is well below the drum limit of 2 Ci. Waste stream RLWTP-08 is not listed in PABC-2004; instead waste stream RP-W016 at an estimated 3,943.6 m^3 contributes 54% to the total waste volume, and has a Cs-137 concentration of 19.1 Ci.m^3 or 2.16 Ci per drum, which is above the drum limit for 200 mrem/hr. Waste stream RP-W016 is not listed in INV-PA-08, because the Hanford Office of River Protection tank wastes were reclassified as potential wastes. Waste stream RLWTP-08 was a newly identified waste stream at the time the year-end 2006 inventory was prepared. It projected RH debris from the not-yet-operational Hanford Waste Treatment Plant.

Clearly, the radionuclide inventory of RH TRU waste is very uncertain (as evident from the large changes shown by Table 7-7 and Table 7-8), which leads to uncertainty in the amount of RH TRU waste that can ultimately be packaged in shielded containers. Thus, the amount of RH TRU estimated to be disposed of at WIPP should be re-examined for each annual inventory estimate.

Nonetheless, we believe that the MicroShield analyses performed by DOE in support of the shielded container PCR are well-documented and appropriate for the intended use in scoping those RH TRU waste streams that are candidates for disposal in shielded containers.

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8.0 IMPACT OF SHIELDED CONTAINERS ON REPOSITORY CHEMICAL CONDITIONS

The use of shielded containers for RH waste disposal in WIPP will significantly increase the quantities of steel and lead, and will slightly increase the amount of CPR in the repository (Section 6.0). The potential effects of these changes on repository chemistry were addressed by Dunagan et al. (2007). The chemistry-related processes that could be affected by use of the shielded containers in the repository include anoxic corrosion gas generation, gas generation caused by CPR degradation, redox conditions after repository closure, carbon dioxide (CO_2) consumption, and complexation of actinides by organic ligands. These processes are discussed in the following sections.

8.1 Anoxic Corrosion

Anoxic corrosion of iron-bearing alloys (i.e., steel) is expected to begin in the WIPP shortly after closure, following consumption of the limited amount of oxygen remaining in the repository by metal corrosion or aerobic degradation of CPR. Anoxic corrosion of iron in the waste containers and waste is expected to produce hydrogen gas (H_2) through the reactions:

$$Fe + (x+2)\ H_2O \rightarrow Fe(OH)_2 \cdot xH_2O + H_2$$
$$Fe + H_2S \rightarrow FeS + H_2$$

Corrosion of other metals in the repository could also generate H_2. For example, anoxic corrosion of lead could take place via the reactions (Wall and Enos 2006):

$$Pb + H_2O \rightarrow PbO + H_2$$
$$3\ PbO + H_2O \rightarrow Pb_3O_4 + H_2$$

Aluminum in the repository could also corrode and generate hydrogen via reactions such as:

$$Al + 3\ H_2O \rightarrow Al(OH)_3 + 1.5\ H_2$$

Anoxic corrosion of metals such as aluminum and lead in the waste were assumed to be insignificant for the CCA/PAVT and CRA-2004/PABC-2004 gas generation calculations, because of the small amounts of these metals in the repository compared to the large amounts of steel and iron in the waste and waste containers (Wilson et al. 1996).

Dunagan et al. (2007) considered the likely effects of the shielded containers on the amounts of steel and lead in the repository. However, the potential effects of these increased quantities of corrodible metal on anoxic corrosion gas generation rates were not addressed.

Although Dunagan et al. (2007) did not discuss the potential effects of increased quantities of corrodible metal on gas generation, this issue was considered during EPA's review of AMWTF compressed waste disposal (TEA 2004). At the request of EPA, Stein and Zelinski (2004) performed a series of BRAGFLO calculations to assess the effects of higher iron surface area and resulting anoxic corrosion rates on total gas generation, gas pressure, and brine saturation.

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Calculations were carried out using the previously assumed 6 m^2 value for ASDRUM, as well as values 2.2 or 10 times this initial value. The higher assumed surface areas resulted in higher gas generation rates from anoxic corrosion and lower brine saturations. These lower brine saturations led to lower rates of gas generation from microbial degradation of CPR and anoxic corrosion. The increased values of ASDRUM resulted in slightly higher total gas generation and pressures during the first 1,500 to 2,500 years of the repository regulatory period, followed by slightly lower total gas generation and pressures. TEA (2004) agreed with the assessment by Stein and Zelinski (2004) that total repository releases are unlikely to significantly increase due to an increased iron surface area, and may decrease because of lower long-term pressures and brine saturations.

It should be noted that the Stein and Zelinski (2004) calculations were performed using microbial gas generation rates and probabilities assumed for the CCA PAVT. For the PABC-2004, long-term microbial degradation rates were assumed to be lower than in the CCA PAVT, and the probability of significant degradation of cellulosics in the repository was increased from 50% for the CCA PAVT to 100% for the PABC-2004. It is likely that the conclusions reached by Stein and Zelinski (2004) remain valid, despite these changes in microbial gas generation parameters for the PABC-2004. This assumption is reinforced by the fact that in none of the PABC-2004 realizations was all, or even most, of the iron consumed in 10,000 years (Nemer and Stein 2005, Figure 6-10). If increased iron in the repository from shielded containers resulted in increased iron surface area, the initial corrosion rate and gas generation rate would be higher. However, the process would be self-limiting, because increased repository pressure would prevent additional brine inflow and anoxic corrosion and microbial degradation would cease.

8.2 CPR Degradation

Use of shielded containers for RH waste disposal will not affect the CPR content of the waste, but will increase the amounts of emplacement cellulosics and plastics; emplacement of the shielded containers will increase the total CPR inventory by about 2% (Section 5.0). Dunagan et al. (2007) concluded that this relatively small increase in CPR inventory would not significantly affect the results of PA, based on previous PA calculations that investigated the effects of a 2.5-fold increase in CPR inventory (Dunagan et al. 2005). Although this PA (i.e., Dunagan et al. 2005) was carried out using the microbial degradation probability and rate parameters previously used for the PAVT and not the parameters used for the later PABC-2004, this conclusion should still be valid for the current, smaller microbial degradation rates. Consequently, because of the very small change in CPR inventory, use of the shielded containers is unlikely to have a significant effect on microbial gas generation in the repository.

8.3 Redox Conditions

Oxic corrosion of iron and aerobic microbial CPR degradation in the repository are expected to consume oxygen, creating relatively reducing repository conditions within 100 years of closure (DOE 2004a, Appendix PA Attachment SOTERM). Anoxic iron corrosion and anaerobic microbial degradation are expected to occur subsequently and maintain these reducing conditions. The assumption of reducing conditions in the repository is used qualitatively to constrain the oxidation states of the actinides in PA.

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Because the lead inventory was relatively small compared to the large amounts of iron in the waste and waste containers, the potential effects of lead corrosion on repository chemistry were considered to be less important than iron for the PAVT and the PABC-2004. As summarized by Dunagan et al. (2007), Wall and Enos (2006) found that lead was likely to undergo anoxic corrosion, forming phases such as PbO and Pb_3O_4. Consequently, an increased amount of lead is likely to contribute to the maintenance of reducing conditions.

The presence of iron and lead in the repository is expected to have beneficial effects by contributing to the establishment and maintenance of reducing conditions. The additional iron and lead introduced by the shielded containers are not expected to have significant effects on redox conditions in the repository.

8.4 Carbon Dioxide Consumption

Additional CPR in the repository from the plastics and cellulosic materials used to emplace the shielded containers could result in the production of additional CO_2 by microbial degradation. The effects of CO_2 produced by microbial degradation of CPR are mitigated in the repository by the use of MgO backfill. The small increase in total CPR inventory will be addressed by the addition of sufficient MgO to maintain the required 1.2 Excess Factor, which is the moles of MgO in the repository divided by the moles of carbon in the CPR (Reyes 2008).

Iron and lead in the repository could react with CO_2, forming iron- and lead-carbonate phases (Dunagan et al. 2007):

$$Fe + H_2O + CO_2 \rightarrow FeCO_3 + H_2$$
$$Pb + H_2O + CO_2 \rightarrow PbCO_3 + H_2$$

However, iron sulfides and possibly lead sulfides are expected to be more stable than the carbonate phases under long-term repository conditions (Wall and Enos 2006). Consequently, DOE did not consider the consumption of CO_2 by iron or lead in the SCPA, which is appropriate given the uncertainties regarding the formation of iron- and lead-carbonate phases under repository conditions.

8.5 Complexation of Actinides by Organic Ligands

Dunagan et al. (2007) reviewed PABC-2004 calculations carried out to identify the likely effects of organic ligands on actinide solubilities and stated that these calculations showed that organic ligands will not form complexes with the +III and +IV actinides to a significant extent under expected WIPP conditions. Contrary to this statement, EPA (2006) previously reviewed the actinide solubility calculations cited by Dunagan et al. (2007) and concluded that the +III and +V actinide solubilities increased significantly with increased ligand concentrations because of complexation by EDTA and oxalate, respectively.

Competition of Fe^{2+} and Pb^{2+} with actinides for organic ligand binding sites may decrease the effects of organic ligands on actinide solubilities. However, increased inventories of iron and lead in the repository may not increase Fe^{2+} and Pb^{2+} concentrations in repository brines if the concentrations of these species are controlled by an equilibrium process. Regardless of the

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effects of metals inventories on dissolved metals concentrations, higher inventories of iron and lead resulting from the use of the shielded containers will not increase actinide solubilities.

8.6 Conclusions Regarding Repository Chemistry Effects of Shielded Containers

The principal effects of the shielded containers on WIPP repository chemistry would be expected to result from the relatively large increases in the inventories of iron and lead and relatively small increases in cellulosics and plastics from the emplacement materials. Processes such as gas generation from anoxic corrosion of metals and microbial degradation of CPR, establishment of reducing conditions by metals corrosion and CPR degradation, CO_2 consumption by reaction with iron and lead, and competition of aqueous iron and lead species for organic ligand binding sites with actinides were qualitatively evaluated. The results of this evaluation indicate that the increased iron, lead, and CPR inventories are not expected to have significant negative impacts on PA. In fact, previous PA calculations carried out to assess the effects of increased iron surface areas on repository releases indicate that higher iron surface areas would be expected to increase initial gas generation rates and brine consumption, thereby limiting total gas generation and repository releases because of lower brine saturation.

9.0 TEMPERATURE EFFECTS OF RH TRU IN SHIELDED CONTAINERS WASTE EMPLACEMENT

Elevated temperatures in the repository have been the focus of previous studies, because the of the potential for heat generation by the waste to impact repository closure rates. In the PABC-2004, temperature effects due to heat generation by the waste were screened out due to the low consequence demonstrated by these studies. Based on a steady-state heat transfer model, DOE demonstrated that when RH TRU waste was placed in boreholes in the disposal room walls, the temperature rise from a distance of about 30 m into the salt to the canister surface was 3°C, assuming that the canister was filled with RH TRU waste having a volumetric heat load of 71 W/m^3 (Sanchez and Trellue 1996, Table 12). Sanchez and Trellue (1996) used inverse shielding calculations to establish a conversion factor of 0.0037 W/Ci for RH TRU waste, based on the February 1995 WIPP Baseline Inventory Report. If these authors had used a volumetric heat load based on the volumetric activity limit of 23 Ci/L set by the WIPP LWA, the volumetric heat generation would have been 84 W/m^3 (23 Ci/L × 1000 L/m^3 × 0.0037 W/Ci) and the temperature rise would have been about one-half degree higher.

The results of Sanchez and Trellue (1996) were updated by Djordjevic (2003) to reflect inventory information available in TWBID Revision 2.1, Version 3.12 (LANL 2003a, 2003b). Based on the revised information, the conversion factor adjusted for radioactive decay to 2001 was 0.00315 W/Ci (Djordjevic 2003, Table 5). Thus, the temperature rise from the salt to a canister in the wall would be about 3°C, based on the maximum allowable curie density of 23 Ci/L.

These small temperature changes will decrease rapidly with time as the energetic gamma radiation associated with shorter-lived radionuclides decays. For example, the radioactivity associated with gamma rays in RH TRU waste was 1.306×10^6 Ci in 2001, and this would fall to 5.587×10^4 Ci by 100 years after repository closure (2133) (Djordjevic 2003, Table 3). Based

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on the inventory used for PABC-2009 contained in PAIR 2008, the value at 2133 would be 3.18 $\times 10^4$ Ci, indicating an even more rapid temperature decay than that based on earlier inventories. The major sources of energetic gammas at closure are Ba-137m, Cs-137, Pu-241, Sr-90 and Y-90 (Djordjevic 2003, Table 3). One hundred years after closure, the major sources are Ba-137m, Cs-137, Sr-90 and Y-90 (Djordjevic 2003, Table 3). The contribution of Pu-241 with a half-life of 14.4 years becomes minor after 100 years.

In its PCR, DOE did not specifically address the temperature situation when shielded containers are placed on the floors of disposal rooms, but instead drew analogies to the minimal temperature impact and low consequence of emplacing canisters in the wall. Since stakeholders have expressed a concern that the lead liner in a shielded container might become overheated, a bounding calculation has been made here to show that this is not likely. For this calculation, it is assumed that a shielded container is located on the floor of a disposal room, and that steady-state heat transfer occurs from a uniform volumetric heat source through the walls of the container into the surrounding air.

In Table 9-1, the RH TRU curie contents for selected radionuclides taken from the 2007 Annual Transuranic Waste Inventory Report (ATWIR) (DOE 2007c) were converted to watts using conversion factors developed by Djordjevic (2003). The last four columns of Table 9-1 compare various heat generation criteria. The limiting criterion (i.e., the criterion that results in the lowest volumetric heat generation rate) is highlighted for each nuclide. From this summary, it can be determined that the highest possible heat generation rate is 184 W/m^3 (for Am-241, Cm-244, etc.). This value is used to calculate the temperatures in shielded containers.

Since the surface dose rate is limited to 200 mrem/hr for CH TRU waste, this imposes a limitation on the energetic gamma radiation in the shielded container. Crawford and Taggart (2007) determined the maximum quantity of radioactivity for dominant gamma emitters in RH TRU waste that could be emplaced in a shielded container and not exceed the 200 mrem/hr dose rate (see column 4 of Table 9-1). However, this may not establish the maximum heat generation rate. In addition, the waste must meet the 23 Ci/L (2.3×10^4 Ci/m^3) statutory requirement (see column 5 of Table 9-1). Consider, for example, Cs-137. The allowable Cs-137 content in a shielded container that meets the statutory 200 mrem/hr surface dose rate limit is 2 Ci and, since the volume of a 30-gallon drum is 0.113 m^3, the curie density is 18 Ci/m^3. This is substantially below the limit of 2.3×10^4 Ci/m^3. The waste must also meet decay heat limitations. The CH-TRAMPAC sets 40 watts (W) as the maximum decay heat load (DOE 2005, Table 5.2-1). If CH TRU waste with this decay heat limit were placed in a 55-gallon container, the volumetric heat generation rate would be 184 W/m^3 (see column 9 of Table 9-1). Still another limitation is the fact that the total radioactivity associated with several of the selected energetic gammas may be less than what would provide a surface dose rate of 200 mrem/hr. Using a bounding assumption that all the radioactivity associated with each selected radionuclide is placed in a 30-gallon drum, it can be seen that the volumetric heat generation is miniscule for radionuclides such as Cm-247 and Pu-243 (see column 6 of Table 9-1).

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Table 9-1: Radioactivity and Heat Loading of Dominant Gamma Emitting Radionuclides in RH TRU Waste

Nuclide	RH TRU radioactivity (Ci)	Conversion factor (watts/Curie)	Max. activity for 200 mrem/hr (Ci)	30-gal drum curie density (Ci/m^3)	Heat gen. rate based on RH TRU Inventory (W/m^3)	Heat gen. rate based on 2.3E04 Ci/m^3 limit (W/m^3)	Heat gen. rate based on 200 mrem/hr (W/m^3)	Heat gen. rate based on decay heat limit of 40 watts (W/m^3)
Am-241	2.79E+04	0.0333	2.089E+05	1.8E+06	8220	766	61537	184
Cm-243	1.92E+02	0.0367	2.130E+02	1.9E+03	62	843	69	184
Cm-244	8.70E+03	0.0350	6.978E+05	6.2E+06	2696	806	216270	184
Cm-247	1.41E-07	0.0141	1.000E+01	8.8E+01	0.000000018	325	1	184
Co-60	1.09E+03	0.0153	1.200E-01	1.1E+00	148	353	0.02	184
Cs-134	9.33E+02	0.0102	6.400E-01	5.7E+00	84	234	0.1	184
Cs-137	3.39E+06	0.0011	2.000E+00	1.8E+01	33148	25	0.02	184
Eu-152	2.27E+04	0.0076	3.900E-01	3.5E+00	1520	174	0.03	184
Eu-154	5.30E+03	0.0090	2.900E-01	2.6E+00	420	206	0.02	184
Pu-238	2.25E+04	0.0332	2.855E+06	2.5E+07	6602	763	837858	184
Pu-239	3.18E+04	0.0308	1.512E+05	1.3E+06	8667	708	41222	184
Pu-240	2.12E+04	0.0311	9.365E+06	8.3E+07	5836	715	2578053	184
Pu-243	1.39E-07	0.0012	1.396E+03	1.2E+04	0.000000001	27	14	184
Th-229	2.73E+01	0.0306	4.435E+03	3.9E+04	7	704	1201	184

Data in column 2 are from ATWIR 2007 (DOE 2007c, Table 3-15, decayed through 2006). Data in column 3 are from Djordjevic 2003. Data in column 4 are from Crawford and Taggart 2007. Data in column 5 are obtained by dividing column 4 data by volume of 30-gallon drum (0.113 m^3). Data in column 6 are obtained by dividing the product of columns 2 and 3 by the volume of a 30-gallon drum. Data in column 7 are obtained by multiplying data in column 3 by 2.3×10^4 Ci/m^3. Data in column 8 are obtained by dividing the product of columns 3 and 4 by the volume of a 30-gallon drum. Data in column 9 are obtained by dividing decay heat limit of 40 watts by volume of 55-gallon drum (0.217 m^3). Limiting values for each radionuclide are highlighted.

As noted above, the shielded container concept involves placing a 30-gallon drum of RH TRU waste inside a shielded container consisting of a 3/16-in inner steel wall, a 1-in thick lead liner and a 1/8-in thick outer steel wall. The temperature change in the interior of the 30-gallon drum, assuming a uniform volumetric heat source, is given by the equation:

$$\Delta T = q/4\pi k_w$$

where k_w is the thermal conductivity of the waste and q is the linear power density; q is related to the volumetric heat generation rate, Q, by the equation $q = Q \times \pi r_w^2$, where r_w is the inner radius of the 30-gallon drum (0.231 m). A volumetric heat generation rate of 184 W/m^3 is equivalent to linear power density of 39 W/m.

The temperature drop associated with radial conductive heat transfer through each of several layers of the shielded container waste package can be expressed by the equation:

$$\Delta T = q/2\pi r_i \times (t_i/k_i)$$

where r_i is the inner radius of the *i*th container layer with thickness t_i and conductivity k_i.

There is an additional temperature drop that occurs from the outer surface of the shielded container to the bulk coolant in the disposal room (assumed here to be air[10]). The temperature drop associated with this surface film is given by the equation:

$$\Delta T = q/2\pi r_o h_s$$

where h_s is the surface heat transfer coefficient and r_o is the outer radius of the shielded container.

Using these equations and the parameters listed in Table 9-2, the temperature rise from the ambient repository temperature to the inner wall of the shielded container is about 2°C.

Table 9-2: Parameters Used to Calculate Temperature Rise in Shielded Containers

Parameter	Value	Units
Volumetric heat generation rate	184	W/m^3
Linear power density	39	W/m
30-gallon drum inner radius	0.231	m
30-gallon drum wall thickness	0.00121	m
Air space between 30-gallon drum and SC	0.0257	m
SC inner wall thickness	0.00474	m
SC lead liner thickness	0.0253	m
SC outer wall thickness	0.00317	m
SC outer radius	0.291	m
Thermal conductivity – iron	80	W/m-K @ 300K

[10] At some point in time after repository closure, the oxygen will have been consumed by anoxic corrosion leaving a nitrogen-rich atmosphere, but the thermal properties of nitrogen and air are essentially the same.

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Table 9-2: Parameters Used to Calculate Temperature Rise in Shielded Containers

Parameter	Value	Units
Thermal conductivity – lead	35	W/m-K @ 300K
Thermal conductivity – air	0.0262	W/m-K @ 300K
Heat transfer coefficient – air	10	W/m^2-K (natural convection)

The preceding analysis was based on bounding calculations determined by various statutory and/or regulatory limits. For additional perspective, the list of 43 RH TRU waste streams that are candidates for disposal in shielded containers was examined to determine the waste stream with the highest Am-241 content (Crawford and Taggart 2007, Table 10). Hanford waste stream RL-W663 (S5420 heterogeneous waste) contains 42.5 Ci/m^3 of Am-241, as well as 5 Ci/m^3 of Cs-137. As shown in Table 9-3, this waste stream has a volumetric heat generation rate of 1.7 W/m^3, a value well below that used for the bounding calculations.

Table 9-3: Heat Generation in RH TRU Waste Stream with Highest Am-241 Content Being Considered for Shielded Container Disposal

	Waste Stream RL-W663		
Radionuclide	(Ci/m^3)	Ci/drum	Watts/drum
Am-241	4.25E+01	4.80E+00	1.60E-01
Cs-137	5.04E+00	5.70E-01	6.29E-04
Pu-238	6.78E+00	7.66E-01	2.54E-02
Pu-239	3.80E-01	4.29E-02	1.32E-03
Pu-240	4.90E-01	5.54E-02	1.72E-03
Pu-241	2.13E-03	2.41E-04	7.43E-09
Pu-242	2.44E-04	2.76E-05	8.19E-07
S-90	3.07E+00	3.47E-01	4.05E-04
Y-90	3.07E+00	3.47E-01	1.92E-03
Ba-137m	5.04E+00	5.70E-01	2.23E-03
U-235	6.61E-06	7.47E-07	1.96E-08
Total (watts/drum)			1.94E-01
Total (w/m^3)			1.71E+00

Note: Cs-137/Ba-137m and Sr-90/Y-90 assumed to be in secular equilibrium

10.0 SURFACE DOSE OF LESS THAN 200 MREM/HR AND MEASUREMENT UNCERTAINTY

This section discusses measurement procedures and their attendant uncertainties in demonstrating compliance with the surface dose rate limit of not greater than 200 mrem/hr for CH TRU waste established by WIPP LWA (PL 102-579).

10.1 Terminology Clarification

The parameter that classifies TRU waste as RH or CH, as required in the LWA, is the surface dose rate expressed in units of mrem per hour. This criterion is found in the subsequent DOE documents that flow down from the LWA, such as the RH Waste Characterization Program Implementation Plan (WCPIP) (DOE 2003)[11] and the WIPP waste acceptance criteria (DOE 2007a).

While a technical discussion of the interactions of radiation and matter is beyond the scope of this report, there are three units related to ionizing radiation that bear defining:

- *Dose rate* is a measure of the energy deposited per unit mass of absorbing material per unit time, and can include contributions from all types of ionizing radiations; alpha, beta, gamma and neutron. Dose rate is measured in units of rads or the SI equivalent Grays (Gys) per unit time.

- An external *exposure rate* is a measure of the charge created by the ionizing radiation within a given volume or air. Exposure is defined only for x-ray or gamma rays, by definition, and exposure rate is expressed in Roentgens per unit time (R/hr) or the SI equivalent coulombs per kilogram (C/kg).

- A *dose equivalent rate* is a measure of the probable biological effects of a given radiation exposure and can include contributions from all types of ionizing radiations—alpha, beta, gamma and neutron—and includes consideration of the radiation's biological effects. It is derived by multiplying the dose rate by a quality factor (QF) to adjust for the differences in energy transfer among the types of ionizing radiation. Dose equivalent rate is expressed in units of rem per unit time (e.g., rem/hr) or the SI equivalent sievert (Sv) per unit time.

Assuming that a waste container's contents are TRU, the sole determinant of the container's status as CH or RH is its "surface dose rate," defined in Section 2.0 Definitions of the LWA as being not greater than 200 mrem/hr. Guidelines for radiation exposure limits to personnel are typically quoted in units of dose equivalent (rem) in order to place exposures to different types and energies of radiation on a common basis. It is common usage to express the surface dose rate criterion in mrem/hr, even though it is more precise to refer to this as a surface dose equivalent rate.

Practically speaking, the measurable radiation associated with the bulk of packaged TRU wastes encountered throughout the DOE complex consists predominantly of gamma emissions, although a few waste types have large neutron components.[12] DOE has stated that the shielded containers will not be used for "neutron emitting RH TRU waste" (Moody 2008), and that main gamma-

[11] DOE/WIPP-02-3122 initially used similar language as the LWA and the CH-TRAMPAC, but this was revised in 2002 and Revision 1 correctly uses the term *dose equivalent rate* expressed in Rem (DOE 2007a).

[12] Due to the nature of beta radiation, it is largely absorbed by the waste matrix itself, and the waste container does not contribute to measurements at a container's surface. DOE has stated (Moody 2008) that the 1-in thick lead shield will ensure there is no beta component to the container's surface dose rate.

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emitting radionuclide constituents of the wastes will be Cs-137 and minor amounts of Am-241 and Co-60. This is consistent with what EPA has observed during inspections of RH TRU generator sites to date. If a waste container exhibits only photon (gamma) radiation, it is appropriate to consider a measured exposure rate in mR/hr to be nearly the same as a dose equivalent rate in mrem/hr. The specific numerical adjustment is assigning a QF of 0.95 to convert the exposure in air (mR) to a tissue dose (equivalent) in mrem, as stated by DOE (Moody 2008).

Site Health Physics (HP) or radiation control (Rad Con) personnel routinely monitor waste containers during storage and movement using a variety of gamma and neutron-sensitive instruments. In practice, the units of exposure rate, dose equivalent rate, and dose rate are used interchangeably, a convention that is common throughout this industry. Due to the nature of the majority of TRU wastes, i.e., predominantly gamma-emitting materials, the terms do not differ significantly in magnitude.

10.2 Current Practices for TRU CH-RH Classification at DOE TRU Generator Sites

10.2.1 Surface Dose Rate Instrumentation

The instruments used to conduct surface dose rate surveys at CH and RH TRU generator sites are typical of the portable beta-, gamma-, and neutron-sensitive instruments in common use throughout the nuclear industry. They represent most manufacturers of radiation detection equipment (i.e., Ludlum, Eberline, ORTEC, Fluke), and both older analog and newer digital units are in widespread use.

Beta-gamma: Typical beta-gamma sensitive instruments are rate meters with Geiger-Mueller (GM) tubes or an equivalent probe that responds to beta particles above a specific energy and gamma radiation, and provide output in events per unit time, i.e., counts per minute (cpm), and/or mR/hr, depending on the calibration. As stated previously, beta particles are usually attenuated by the waste matrix/container and do not generally contribute to the waste container's surface dose rate. These meters are most often used for contamination control surveys.

Gamma: Typical gamma-sensitive instruments are rate meters with an interchangeable gamma-sensitive (sodium iodide [NaI]) probe, single-body units with an internal probe, and air ionization (ion) chambers. All of these units typically provide output in exposure (mR/hr), which is assumed to be equivalent to mrem/hr (for photons measured in air). These meters are best suited to measure the gamma contribution of a surface dose rate survey for TRU waste containers. The gamma instruments used for the Dose-to-Curie (DTC)[13] determination for RH TRU containers typically consist of a rate meter located outside of the shielded DTC enclosure or hot cell that is attached to a probe (ion chamber) held in a fixed geometry relative to the waste container being assayed within the DTC enclosure.

[13] Dose-to-Curie is a radiological characterization technique where the surface dose rate of a waste container is correlated to concentrations of specific gamma-emitting radionuclides. This technique is described in the procedure CCP-TP-504. DTC is currently used to characterize RH TRU wastes at INL, ANL and ORNL, BCLDP and GE VNC.

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Neutron: Typical neutron detection units, commonly called Rem Balls, consist of a rate meter body attached to a circular boron trifluoride (BF_3) detector filled with tissue-equivalent material that, when calibrated, provides a reading in Rem. These tend to be the largest portable instruments in common use. For the Idaho National Laboratory Central Characterization Project (INL-CCP)[14] RH waste characterization program, site HP personnel operated a Rem Ball and gamma survey meter alongside the INL-CCP ion chambers within the DTC enclosure. The Argonne National Laboratory (ANL-CCP) and Oak Ridge National Laboratory (ORNL-CCP) RH waste characterization programs used neutron-sensitive instruments whose detectors were located within the DTC hot cell or assay enclosure and were cabled to digital display units outside the enclosure, allowing operators to easily read their output. These units provided the neutron component of the surface dose rate for the ANL-CCP and ORNL-CCP RH waste containers. The WIPP site uses Rem Balls to make hand measurements of surface dose rates for waste payloads (for example, 14 drum payloads) to assure adequate worker health and safety.

These same types of instruments would be used to survey shielded containers.

10.2.2 Current Surface Dose Rate Survey Practices

Procedures that control the surface dose rate determinations vary by site, although all site measurement and test equipment (M&TE) programs must be compliant with the CBFO QAPD (DOE 2004b). The QAPD identifies broad requirements and cites documents such as American Society for Testing and Materials (ASTM) methods and American National Standards Institute (ANSI) as appropriate guidance. A standard of particular interest is ANSI N323A, which is cited in the CCP DTC procedure (CCP 2008a) and the procedure for calibrating the RH gamma survey instruments used by INL-CCP (see Section 10.2.4). ANSI N323A specifies a variety of M&TE requirements related to survey meter calibration, surface dose rate operation, and documentation.

Regarding EPA's concern that all shielded containers have surface dose rates less than 200 mrem/hr, DOE has stated that they will "employ a system of controls for packaging and measuring that ensures a very high degree of confidence that this requirement is met" (Moody 2008). Differences have been observed among the surface dose rate practices at CH TRU generators. This may be due in part to the assumption that the likelihood of a container exceeding a surface dose rate of 200 mrem/hr after having been handled, staged, characterized, and repeatedly surveyed, is small, as discussed in Section 10.2.5. However, a container's contents may shift during handling, and a single or small number of "hot" items within a drum can produce an enhanced measurable surface dose rate by virtue of a positional change. Consistency among the performance of surface dose rate surveys is desirable in general and of greater importance for the use of shielded containers.

[14] The Central Characterization Project (CCP) operates CH and RH TRU waste characterization programs at several TRU generator sites. CCP currently operates all RH TRU waste characterization facilities, and these are referred to by the generator site abbreviation followed by CCP, e.g., INL-CCP, ORNL-CCP, ANL-CCP and LANL-CCP.

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10.2.3 Modifications to Surface Dose Rate Survey Procedures

Apart from DOE's statement in Moody 2008 that they will "ensure that all shielded containers exhibit a surface dose rate less than 200 mrem/hr when packaged for disposal," the specific surface dose rate expectations of shielded containers are unclear. Since a single design has been proposed, it will not be possible to increase a container's shielding to reduce the surface dose rate. Prospective control of each shielded container's surface dose rate consists of limiting the amounts of Cs-137, Co-60, Am-241 or other gamma contributors that are packaged in each shielded container.

EPA believes that the waste packaging and surface dose rate procedures at all DOE sites that plan to use shielded containers should undergo evaluation and revision to ensure a high degree of standardization. Specifically, each generator site using shielded containers should address or incorporate in its procedures the following:

- A minimum number of survey points on each waste container and the specific measurement geometry should be specified, including the container's top and bottom, for all surface dose rate procedures at all generator sites. Documentation for each survey should include a diagram of all survey points.
- A reproducible geometry should be employed. Using a device that consistently positions the detector the same way relative to the waste container would be helpful, i.e., a stand or jig that holds the detector and waste container in the same configuration for each measurement, much like is done currently for RH wastes at INL, ANL, ORNL and VNC-CCP.
- An explicit requirement stating that the highest observed reading must be used for the container's measurement of record must be established.
- The radionuclide (Cs-137, Co-60, Am-241, or other large gamma contributor) content of each container should be planned or adjusted during container loading to ensure that surface dose rates are less than 200 mrem/hr, based on container-specific data derived from DTC, other radiological characterization of the 30-gallon drum prior to placement within the shielded container or Acceptable Knowledge (AK). This approach is implied, but not explicit, in DOE's statement that it would "employ a system of controls for packaging and measuring that ensure a very high degree of confidence" that all shielded containers exhibit surface dose rates less than 200 mrem/hr (Moody 2008).
- A determination regarding a container's lack of neutron-emitting TRU waste based on measurement of the 30-gallon drum prior to placement within the shielded container should be made and documented with an appropriately calibrated and controlled neutron-sensitive instrument. This information should be included as part of each container's Batch Data Report (BDR) and be available for EPA inspection during routine and unscheduled site inspections.
- Surface dose rate survey records should be included as part of each container's BDR and be available for EPA inspection.

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- The procedures should also address site calibration facilities and training of surface dose rate survey personnel specifically in handling of SCs.
- A formal CBFO procedure addressing these concerns should be initiated and implemented complex-wide as a replacement of, or supplement to, the current site-specific surface dose rate survey procedures.

10.2.4 CH TRU Wastes

The manner in which CH waste containers are stored and managed at DOE generator sites is based on historical information regarding their contents and/or generation processes (AK). Containers are stored, staged, assigned to waste streams, and ultimately assayed according to the available AK for those wastes. The management of CH containers involves survey measurements taken multiple times such as routine area or item monitoring; upon selection of containers for non-destructive assay (NDA), non destructive examination (NDE) or other characterization techniques; prior to any container movement and/or restacking; following movement to and/or staging at any characterization areas; routine monitoring of staged containers awaiting characterization; and post-characterization return to site storage for failed containers or promotion through characterization process for successful containers. Essentially, any time a CH drum is handled or moved, a site HP measurement is made and recorded. Any container that measures close to 200 mrem/hr would be easily identified and segregated as part of the site's routine as low as reasonably achievable (ALARA) practices.

EPA has observed the use of brightly colored markers in CH drum storage areas at LANL, Hanford, the Advanced Mixed Waste Treatment Project (AMWTP), INL and ORNL. A marker is placed on top of a drum to indicate a "hot spot," i.e., a surface dose rate above a site-specific administrative level, typically 50 mR/hr. This provides a clearly visual aid directing all personnel to avoid specific drums or areas, if possible, consistent with standard ALARA radiation protection practices. A measurement indicating a container with a surface dose rate above 200 mrem/hr would trigger at least one of several site HP controls, not to mention the problems it would pose for waste handling and measurement personnel at several points in the waste characterization process. It is difficult to imagine a realistic scenario in which such a container would go unnoticed at the TRU generator sites currently approved by EPA.

Consider all CH waste characterization sites operated by CCP.[15] According to the CCP Transuranic Waste Certification Plan (CCP 2007), the measurement of record by which the CH generator certifies that a container meets the CH Data Quality Objective (DQO) for a surface dose rate of less than 200 mrem/hr originates within each site's HP or Rad Con program. The CCP waste certification plan also stipulates that the "neutron contribution to the total dose equivalent rate" shall be reported (CCP 2007). Site HP personnel take the surface dose rate measurements when the payload is prepared for shipment and these values are recorded on the Payload Assembly Container Transportation Certification Document (PACTD), and are also reported separately using the WIPP Waste Data System (WDS).[16] These values are provided to the site's Waste Certification Official (WCO), who formally certifies that compliance with the

[15] This currently includes LANL, INL, ORNL, SRS, and Hanford, and in the past has included ANL, the Nevada Test Site (NTS) and Lawrence Livermore National Laboratory (LLNL).

[16] In 2009, the WDS replaced the WWIS.

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CH surface dose rate criterion has been met. This certification is done for each individual drum within the payload and for the shipment as a whole. EPA has observed this process during CH inspections at several generator sites in the course of evaluating the WIPP Waste Information System (WWIS). An equivalent process to what is described at CCP sites occurs for the AMWTF CH waste characterization program using different operating procedures, but the same WDS WCO certification. Minor differences exist with respect to specific instruments, forms, and frequency of surface dose rate surveys; however, all CH TRU generator sites provide the same WCO certification within the WDS.

RH containers receive a greater emphasis than CH with respect to their status determination by virtue of their external dose rate and their potential for personnel exposure. As stated above, the majority of CH and RH containers have surface dose rates that are far from their classification limit, significantly less than or greater than 200 mrem/hr, respectively. For these containers, it is easy to ignore consideration of the uncertainty associated with surface dose rate determination and still ensure regulatory compliance with the CH-RH criterion. However, shielded containers may require a greater level of scrutiny and specific modifications of the existing site procedures to ensure that the highest measured values for all shielded containers are below 200 mrem/hr.

10.3 Uncertainty for Surface Dose Rate Measurements

Regulatory compliance must be demonstrated for both CH and RH waste containers, and the current practice is to report a single, measured value without consideration of the value's uncertainty. This uncertainty becomes relevant when a waste container is sufficiently close to a regulatory limit that it introduces questions regarding the container's classification, as discussed below.

According to the RH WCPIP, the "surface dose rate minimum and maximum limits for RH TRU waste are not established with an associated error or uncertainty" (DOE 2003). This is in contrast to other DQOs, such as radionuclide composition, Fissile Gram Equivalent (FGE), and Decay Heat, all of which must be reported in conjunction with an estimate of the parameter's uncertainty or Total Measurement Uncertainty (TMU). Also, radionuclide data derived from NDA (CH TRU) and radiological characterization (RH TRU) are presented with their uncertainties expressed as TMU. While TMU must be reported, there are no limits attached to it. EPA has observed CH TRU data with TMU values greater than 100% and RH TRU values approaching 10%, which have been acceptable.

TMU has not been addressed for surface dose rate measurements for several reasons, mainly because, as stated above, it is not required. Surface dose rate measurements are not controlled to the same extent as radionuclide-specific determinations, which generally involve greater attention to details like reproducible source-to-detector distance, longer counting times, isotopic distributions, and item/measurement geometry. In a technical sense, TMU is not directly applicable to surface dose rate measurements. For example, radionuclide-specific measurements[17] record the total number of events (counts) per unit time which, when sufficiently large, is assumed to follow a known distribution that allows the derivation of meaningful statistical parameters; acquisition (counting) times can be adjusted to accommodate low signal

[17] This includes radionuclide-specific measurements that are used to derive FGE, PE Ci and TAAC.

(activity) containers. Surface dose rate measurements look to simply record the highest response rate of a given item relative to the CH-RH criterion (200 mrem/hr), provided the instrument has been appropriately exposed to the source; increasing the counting time does not matter.

Positional effects must be considered. Typical CH and RH waste matrices, such as debris, may contain a small number or even a single item that is heavily contaminated within a matrix of much less contaminated debris. The position of such an item within a waste container can cause the surface dose rate readings to vary considerably from one side or end of the container to the other. Proper survey techniques help to minimize this effect, and CBFO has stated that (Moody 2008):

> *The surface dose rate measurement protocols that DOE uses at the various sites involve multiple measurements around each waste container, with the single highest measured value employed as the "dose rate of record" that governs how the container is classified.*

The use of multiple measurements around a waste container when performing a surface dose rate survey is the main way of addressing positional effects. Site procedures typically include this and, if properly executed, multiple measurements and attention to detail should identify any hot spots close to one side or end of a waste container. This assumes that for shielded containers, the single highest measured value would be the "dose rate of record," as CBFO has stated (Moody 2008). Although this is understood to be a common practice, it is not clear that all surface dose rate survey procedures currently in use at CH and RH generator sites include this as an explicit requirement.

As discussed previously, the CBFO QAPD requires that each site's M&TE program meet the requirements of ANSI-N323. This entails many general and specific requirements for site M&TE programs, i.e., calibration frequency, maintenance of instruments and standards, use of check sources, operational characteristics and documentation. The specified acceptance range for accuracy of neutron dose equivalent instruments is ± 20%;[18] the gamma acceptance range for accuracy is ± 10% to ± 15%[19] (ANSI 1997). This tolerance is assumed to encompass contributions from all sources of uncertainty involved in the calibration process, i.e., calibration source(s), positional effects, curve fitting, and differences between calibration source and actual wastes.

For example, assume that the results of surveying a container RH waste yield a surface dose rate of 210 mrem/hr. If the allowable calibration uncertainty of the survey instrument is 10% and this represents the results of a single gamma measurement, a simple restatement of these results is that the container's surface dose rate is between 189 and 231 mrem/hr. If the container's surface dose rate results of 210 mrem/hr were the composite of a gamma and a neutron measurement, and each measurement complied with the ANSI standard, the uncertainty calculation becomes more complex. Assuming the gamma and neutron measurements are independent, the 10% gamma uncertainty and the 20% neutron uncertainty would be added in quadrature, i.e., by

[18] The specific requirement is ±30% for 0–10 mrem/hr and ±20% for above 10 mrem/hr.

[19] The specific requirement is that the instrument be tested near the end points of the range, i.e., 20% and 80% of full scale, and the acceptance ranges are ±15% for the low point and ±10% for the upper point.

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taking the square root of the sum of the squares for both measurements. This yields an uncertainty of 22%, allowing a restatement of the 210 mrem/hr value as between 163 and 256 mrem/hr. However, if the gamma and neutron measurements are not considered to be independent, their uncertainties would be additive (summed), increasing the uncertainty relative to the 210 mrem/hr measured value. The same approach is applicable to a hypothetical CH waste container with a measured surface dose rate of 190 mrem/hr, which could be stated as a surface dose rate between 171 and 209 mrem/hr based on a single gamma measurement, and between 148 and 231 mrem/hr based on two independent measurements, one gamma and one neutron. This hypothetical drum of PFP waste would be classified as CH TRU. Because there is no consideration for uncertainty or error, one could reasonably question the validity of the classifications for these containers as CH or RH.

10.4 Summary of Measurement Issues

DOE surface dose rate measurement procedures for photons and neutrons should specifically address uncertainties to ensure that the legal limit of 200 mrem/hr is not exceeded. In addition, DOE should develop site-wide procedures to ensure that surface dose rate measurements are conducted consistently at all TRU waste generator sites. EPA recognizes that these issues are not relevant to the SC design; rather they are implementation issues. However, they must be addressed as part of any waste disposal program utilizing shielded containers.

11.0 SUMMARY AND CONCLUSIONS

SC&A has reviewed the DOE PCR regarding the use of shielded containers for the disposal of selected RH TRU waste streams on the floor of the WIPP disposal rooms. In the review, particular attention was directed to *Analysis Report for Shielded Container Performance Assessment* (Dunagan et al. 2007) and *Analysis of RH TRU Wastes for Containment in Lead Shielded Containers* (Crawford and Taggart 2007), since these two documents summarize DOE's technical approach to PA. A number of relevant supporting documents were also reviewed. SC&A demonstrated that the maximum temperature increase in the wall of a shielded container from photon interactions was only a few degrees. SC&A examined the MicroShield quality assurance documentation and found it to be acceptable. SC&A ran the MicroShield code duplicating LANL results. SC&A evaluated the impact of additional radionuclides that are strong photon emitters, in addition to those selected by LANL.

The impact of the PCR on inventory changes was reviewed and the DOE approach was validated. Possible changes to the repository chemical conditions were examined and it was concluded that impacts from the PCR on repository performance were negligible.

DOE modeling showed that the shielded container approach resulted in barely perceptible changes in the PA mean CCDFs, even for the bounding case where all of the RH TRU waste was processed like CH TRU waste and placed in shielded containers on the floors of the disposal rooms. The calculational approach used in the SCPA was reviewed and found to be acceptable and properly implemented.

Based on its review of the shielded container safety analysis, SC&A found that the shielded container created no accident risks to the MOI or nearby worker that were greater than for CH

TRU in 55-gallon drums. In fact, due to the robust container design, the risks were lower for a variety of postulated accidents.

Important implementation questions must be addressed before disposal in shielded containers can be implemented. As described in Section 10, consideration should be given to adopting a DOE complex-wide procedure or requirements for characterizing the surface dose rate for shielded containers, and the procedure or requirements should account for measurement uncertainty to ensure that the 200 mrem/hr surface dose rate limit for CH TRU is not exceeded. This would include procedures to ensure that the radiation source does not shift within the container during handling and transportation.

12.0 REFERENCES

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APPENDIX A

RESOLUTION OF CORRECT THICKNESS FOR INNER AND OUTER STEEL SHELLS FOR SHIELDED CONTAINERS

EPA questioned DOE about the use of different thicknesses for the inner and outer shells of the shielded containers reported in various DOE documents. EPA's specific comment, DOE's response, and EPA's conclusion are presented in this Appendix.

EPA Comment

During our review of various DOE documents related to shielded containers, we have noted several inconsistencies regarding the thickness of the inner and outer steel shells of the container:

- Dunagan et al. 2007 (Section 2.2) lists the thicknesses of the outer and inner walls as 1/8 in (0.125) and 3/16 in (0.1875), respectively. Elsewhere (i.e., Section 3.1.6.2), the same authors list the combined thickness of the inner and outer steel shells as 0.3125 in.
- According to DOE 2010a, Enclosure 1, the inner and outer steel walls are 7 gauge (0.144 in) and 11 gauge (0.091 in), respectively.
- DOE states that the inner wall thickness is 0.1793 in (DOE 2009 Enclosure, Section 4.2.3).

DOE should indicate which dimensions are the correct ones and what effects, if any, the corrected dimensions have on the various analyses that DOE has performed.

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DOE Response

The correct dimensions for the thickness of outer shell of the shielded container is 0.120 in (+/- 0.008 in), 11 gauge (GA), and the inner shell is 0.179 in (+/- 0.008 in), 7 GA (Washington TRU Solutions 2007).

Concerning the Shielded Container Performance Assessment Document:

Since the analysis in Dunagan et al. (2007) was performed, the inner and outer thicknesses of the shielded container have changed to 0.120 ± 0.008 in (11 GA) for the outer wall and 0.179 ± 0.008 in (7 GA) for the inner wall. Though these values are less than the values in Dunagan et al. (2007), the conclusions formed based on the thickness of the walls remain unchanged. The small reduction of the wall thicknesses will have no impact on the results of the analysis performed in Dunagan et al. (2007).

Concerning the Safety Impact Analysis Document:

The dimensions stated in "Summary of the Safety Impact Analysis for the Lead Shielded Container" were incorrect. However, the Safety Impact Analysis was performed using the correct dimensions stated above and does not change the results and conclusions in the report, i.e., consequences to the public (i.e., the maximally exposed offsite-individual) and to the onsite (facility) worker will not increase with the use of the shielded containers.

The following paragraph, page 1 in "Summary of the Safety Impact Analysis for the Lead Shielded Container," should be replaced with the following paragraph.

> The shielded container has approximately the same exterior dimensions as a 55-gallon drum and holds a single 30-gallon drum that will contain the RH TRU waste (See Figure 1). The cylindrical sidewall of the shielded container has nominal 1-in thick lead shielding sandwiched within a double-walled steel shell. The external wall is 11 gauge (0.120 in ± 0.008 in) steel and the internal wall is 7 gauge (0.179 in ± 0.008 in) steel. The lid and the bottom of the container are made of carbon steel and are approximately 3 in thick. The 30-gallon inner container has a gross internal volume of 4.0 ft^3 (0.11 m^3) and a maximum loaded weight of 2,260 pounds. The empty weight of the shielded container is 1,726 lbs.

This will be noted as errata to the "Summary of the Safety Impact Analysis for the Lead Shielded Container" document.

Concerning the Shielded Container Type A Evaluation Report:

The analyses, tests, and evaluations performed on the shielded container to demonstrate compliance of the packaging design for use as a standalone DOT 7A Type A packaging were performed using the correct dimensions for the inner and outer shells as stated above. The results and conclusions in "Shielded Container Type A Evaluation Report" for use of the shielded container as a DOT 7A Type A packaging remain valid.

DOE Reference

Shielded Container Assembly, Drawing No. 165-F-026-W5, Rev. B, 2007, Washington TRU Solutions LLC, Carlsbad, New Mexico.

EPA Conclusion

Based on this information, the Agency has concluded that thickness of the inner and outer steel shells of the shielded containers has been properly addressed by DOE.

APPENDIX B

CONSEQUENCES OF FIRE DAMAGE TO SHIELDED CONTAINERS

To better understand why the consequences of a fire that damages a shielded container containing RH TRU waste are no greater than the consequences of a fire that damages a standard 55-gallon drum of CH TRU waste, a brief description of the Accident Analysis (AA) used in the WIPP Documented Safety Analysis (DSA) is provided here (WIPP 2010a).

In the AA, the total effective doses (TED) to both the maximally exposed offsite individual (MOI) and an onsite worker located 100 m from the accident are calculated. The source term (ST) for the calculation is the amount of Pu-239 equivalent curies (PE-Ci) released to the atmosphere from the fire accident. The source term is multiplied by a dose conversion factor (TED_i - rem/PE-Ci) to obtain the TED incurred by the *i*th receptor (D_i - rem):

$$D_i = ST \times TED_i$$

The source term for a given accident scenario is a function of five factors:

- MAR – material at risk (PE-Ci): the amount of material available to be acted upon by the accident (fire)
- DR – damage ratio: fraction of material actually involved in the accident
- ARF – airborne release fraction
- RF – respirable fraction
- LPF – leak path factor: fraction of radionuclides that get filtered out or deposited by natural processes within the facility

Accordingly, the equation for the source term is:

$$ST = MAR \times DR \times ARF \times RF \times LPF$$

For the shielded container AA, the material at risk is assumed to be the number of containers involved in the accident times the PE-Ci per container.

The concept of Pu-239 equivalent curies is designed to normalize risks from other TRU radionuclides to Pu-239 as described in Appendix B of the WIPP Waste Acceptance Criteria (DOE 2010). The Pu-239 equivalent activity for the *i*th radionuclide (AM_i) is defined as A_i/WF_i, where Ai is the activity of the *i*th radionuclide and WF_i is the PE-Ci weighting factor. WF_i is, in turn, defined as E_0/E_i, where E_0 is the 50-year whole-body committed dose for inhalation of Pu-239 particles with a 1 micron AMAD and a weekly lung clearance class. E_i is the 50-year committed whole-body dose for the *i*th radionuclide with a one micron AMAD and a lung clearance class that results in the highest value of E*i*. Values of the 50-year commited dose are obtained from DOE 1988. The dose conversion factor for Pu-239 is 5.1E+02 rem/μCi, while the comparable value for Cs-137 (a major source of RH TRU activity) is 3.2E-02 rem/μCi. Thus, any releases of Cs-137 from a SC would involve insignificant incremental inhalation exposures.

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DOE equates the SC to a pipe overpack container (POC) in terms of general physical characteristics, i.e., they both involve a container within a container (WIPP 2010b). Testing of POCs during fires is described in (DOE-STD-5506-2007):

> *Four POCs were subjected to Type B protocol thermal tests as summarized in Appendix C. The associated 150 MW fuel pool fire caused the one outer 55-gallon drum of a POC package with a metal filter to experience lid loss. This occurred within the first three minutes of the fire. Post-fire inspection showed the pipe component seal and filter gasket to be damaged. Associated leak rate testing of this POC showed a total leak rate of 24 cm^3/s at a differential pressure of 87 kPa.*

Based on this information, the product of ARF × RF was estimated to be 8.1E-08 (WIPP-2010b, Section 7.5). The comparable values for ARF × RF for 55-gallon drums ranged from 1E-04 to 1E-02 for confined burning and unconfined burning, respectively (WIPP 2010a, Table 3-1). On a per-container basis, the MAR is the same for both a standard 55-gallon drum and an SD, with the limit specified as ≤ 80 PE-Ci. Thus, the ST is smaller for the SC than for a 55-gallon drum. This result is based on the assumption that the inner liner of the SC assembly and the internal 30-gallon drum retain their integrity during the fire except for minimal leakage. This assumption is consistent with that made for POCs. It should also be noted that 55-gallon drums are typically shipped and emplaced as seven-packs, while SCs will be emplaced as three-packs. Thus, the total MAR for the SC waste is less than for CH TRU waste.

Appendix B References

DOE 1988. *Internal Dose Conversion Factors for Calculation of Dose to the Public*. DOE/EH-0071.

DOE 2007. *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. DOE-STD-5506-2007. April 2007.

DOE 2010. *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 6.5. DOE/WIPP-02-3112. June 30, 2010.

WIPP 2010a. *WIPP Accident Analysis Calculations for Events Involving Released from the Gamma Shielded Container*, WIPP-031.

WIPP 2010b. *Fire Analysis of the Shielded Container for the Waste Isolation Pilot Plant, Carlsbad, New Mexico*, WIPP-032.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 25 2011

OFFICE OF
AIR AND RADIATION

Mr. Edward Ziemianski
Acting Manager, Carlsbad Field Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88221

Dear Mr. Ziemianski:

This letter announces the U.S. Environmental Protection Agency's (EPA's) proposed decision to approve the Department of Energy's (DOE's) planned change request (PCR) to emplace a portion of the remote-handled (RH) transuranic (TRU) waste inventory in specially designed shielded containers at the Waste Isolation Pilot Plant (WIPP). With this request, DOE plans to place RH TRU waste in these containers on the floor of the disposal rooms, rather than emplacing it in boreholes in the facility walls. DOE submitted this request in order to enhance the efficiency of facility operations; once eligible waste is properly loaded into the shielded container assembly, it may be treated as contact-handled (CH) waste for the purposes of facility operations. DOE plans, however, to maintain the RH designation for the waste.

In its December 7, 2007 letter (Docket A-98-49, II-B3-106), EPA requested DOE to undergo a safety analysis, acquire approval from the Nuclear Regulatory Agency, and obtain certification from the Department of Transportation regarding shielded containers. At this time, the Agency finds that DOE has fulfilled all of these documentation requirements. Additionally, EPA finds that the results of performance assessment show that the use of shielded containers does not significantly affect facility compliance with 40 CFR 194. The results of the Agency's review are included in an attachment to this letter.

With this letter, EPA is opening an informal 60-day public comment period, which the Agency committed to provide to stakeholders in its December 11, 2008 letter (A-98-49, II-B3-115) to DOE. Following the receipt and resolution of public comments, EPA proposes to allow the emplacement of shielded container assemblies at WIPP, on the condition that, prior to shipping the shielded containers to WIPP, DOE implements a consistent complex-wide procedure to ensure that the shielded containers remain below the Land Withdrawal Act 200 millirem per hour dose limit for contact-handled waste. We understand that DOE will separately need a hazardous waste permit modification from the New Mexico Environment Department. This proposed approval is independent of that permit modification.

00081

If you have any questions, please contact Jonathan Walsh at 202-343-9238 or walsh.jonathan@epa.gov.

Sincerely,

for Jonathan Edwards, Director
Radiation Protection Division

cc: Electronic distribution

Frank Marcinowski, DOE HQ
Christine Gelles, DOE HQ
Alton Harris, DOE HQ
Russ Patterson, DOE CBFO
George Basabilvazo, DOE CBFO
Steve Zappe, NMED
Nick Stone, EPA Region 6

Attachment

Background

The WIPP Land Withdrawal Act (LWA) of 1992 (PL 102-579) defines remote-handled transuranic (RH TRU) waste as TRU waste with a surface dose rate of 200 millirem (mrem)/hr or greater, and contact-handled transuranic waste (CH TRU) waste as TRU waste with a surface dose rate not greater than 200 mrem/hr. RH waste is currently shipped to WIPP in an unshielded steel canister, which holds three 55-gallon drums of waste. The canister is handled and moved using specialized apparatus, and is emplaced in boreholes drilled horizontally into the walls of the waste disposal rooms; a concrete borehole plug shields facility workers from radiation from the canister after it is placed in the wall.

The shielded container has the approximate external dimensions of a 55-gallon drum. The sides of the container consist of an inch-thick layer of lead shielding between inner and outer layers of carbon steel, and the top and bottom of the container consist of three-inch thick carbon steel. The container holds a 30-gallon waste drum. Many RH waste streams, if loaded in shielded container assemblies, would have a container surface dose rate below 200 millirem per hour and could be handled using the same equipment and techniques as CH waste. DOE has stated that use of shielded containers will "increase the efficiency of utilization of the WIPP facility by easing the restrictions on waste handling needed during emplacement of RH waste canisters in the walls of the rooms" (Moody 2007). According to DOE, WIPP is currently limited to a maximum of six RH shipments per week due to logistical constraints, whereas CH waste handling processes allow four to five shipments to be received, unloaded and emplaced daily. In addition to minimizing the disruptions from in-the-wall emplacement of RH TRU waste canisters, the use of shielded containers would conserve borehole space for higher-activity waste streams by providing additional emplacement locations for some RH TRU waste.

Though some fraction of the RH TRU waste would be handled as though it were CH, DOE will still track the waste as remote-handled. DOE will continue to consider the shielded container waste in the calculation of the total amount of RH TRU waste disposed of at WIPP, which will remain below the 250,000 ft^3 (7,079 m^3) specified in the Agreement for Consultation and Cooperation between DOE and the State of New Mexico (Moody 2007, DOE 1981), and below the 5.1 million Curies specified by the WIPP LWA, regardless of how the waste is handled and emplaced.

Timeline

On November 15, 2007 (Docket A-98-49, II-B2-68), DOE submitted the shielded containers PCR to EPA for approval. Also in November, 2007, a stakeholder meeting was held in Albuquerque, NM, and a 60-day informal comment period was opened. In response to the PCR and public input, EPA advised DOE of three requirements that needed to be satisfied before the Agency would consider approval: 1) NRC would need to

approve the shipping container design, 2) the shipping container design would need to be approved by the Department of Transportation (DOT), and 3) DOE would conduct and submit a safety analysis for facility operations involving the shielded container. This initiated a series of technical correspondences. On June 10, 2009 (Docket A-98-49, II-B2-72), DOE received NRC approval to ship RH waste in the shielded container using the HalfPACT. In a November 10, 2010 submission (Docket A-98-49, II-B2-77), DOE provided the Agency with the final technical information needed to demonstrate that it had fully self-certified the shielded container assembly to DOT's Type-A shipping requirements. Finally, on December 3, 2010 (Docket A-98-49, Item II-B2-78), DOE provided the Agency with a revised White Paper, detailing the results of safety analyses. These materials satisfied the Agency's preconditions, and allowed a final technical review of the shielded container PCR.

Technical basis for approval

In order to determine the impacts of the shielded container assembly on repository performance, DOE conducted performance assessment (PA) calculations comparing several emplacement schemes with a known, compliant baseline (Dunagan et al. 2007). The baseline selected for comparison with the shielded container PA was the 2004 Performance Assessment Baseline Calculation (PABC-2004), which was the most recently EPA-approved PA at the time the PCR was submitted. In order to demonstrate compliance, DOE chose a bounding approach for the shielded container PA in which all of the RH TRU waste inventory would be emplaced on the floors of the disposal rooms. Three sets of complementary cumulative distribution functions (CCDFs) were calculated: one assuming that all RH TRU waste was combined into a single composite waste stream and emplaced in shielded containers; one in which RH waste was divided evenly between shielded containers and boreholes; and a third in which all 77 RH TRU waste streams were treated individually and placed on the repository floor. Comparisons were made based on mean total releases and mean releases from cuttings and cavings, direct brine releases, and spallings releases separately. DOE showed, and EPA agrees, that differences between the mean total releases for the various emplacement schemes were essentially indistinguishable. Direct brine releases were slightly reduced in scenarios in which all RH waste was placed on the floor of the repository in shielded containers. DOE's calculations were reviewed and found to be correct and appropriate.

The Agency's review finds that DOE has met EPA's stated requirements for approval of the shielded container assembly. The Department has successfully demonstrated that handling RH waste in shielded container assemblies does not pose greater operational hazards than those encountered in the handling of standard CH waste drums. PA results also show that even in the bounding case (in which all RH waste is emplaced in shielded containers) cumulative releases from the facility are unaffected over the 10,000 performance period. Full details of EPA's technical review are included in [SCA 2010].

Public Comment

EPA is soliciting informal public comment for 60 days. As done previously with other planned change requests, the Agency will advertise the proposed approval on its WIPP website and send out a notice on the WIPP-NEWS e-mail listserv. Interested parties will be directed to Ray Lee (202-343-9463, lee.raymond@epa.gov), and all comments will be considered before EPA issues its final approval on the shielded containers.

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87196 505-262-1862 FAX: 505-262-1864 www.sric.org

June 23, 2011

Ray Lee
U.S. Environmental Protection Agency
Washington, DC

VIA EMAIL

RE: WIPP Shielded Containers Planned Change Request

Dear Ray,

Southwest Research and Information Center (SRIC) provides the following comments on the planned change request for approval of the use of shielded containers for remote-handled (RH) waste at WIPP. SRIC appreciates that EPA provided a 90-day informal comment period on the request.

However, SRIC is disappointed that EPA and the Department of Energy (DOE) Carlsbad Field Office (CBFO) provided no interactive discussion of the request since the November 29, 2007 meeting in Albuquerque. There were various comments and questions at that meeting that deserved responses and further public discussion. While EPA's various requests for information resulted in additional documents being provided by CBFO, not all of the outstanding issues have been satisfactorily addressed.

SRIC's conclusion is that it is premature to approve the use of shielded containers because additional documentation and analysis is required. Instead of approving shielded containers, EPA should convene either a public meeting or conference call so that additional information is provided by CBFO and, thereafter, additional analysis is done of the impacts of the use of shielded containers, and additional public comment occurs.

1. The purpose of the planned change request has not been clearly explained by DOE, nor adequately discussed in EPA's proposed decision letter of March 25, 2011.

The proposed decision states: "DOE submitted this request in order to enhance the efficiency of facility operations." at 1. The proposed decision also states that CBFO maintains that shielded containers will "increase the efficiency of utilization of the WIPP facility by easing the restrictions on waste handling needed during emplacment of RH waste canisters in the walls of the rooms." Further, "WIPP is currently limited to a maximum of six RH shipments per week due to logistical constraints, whereas CH waste handling processes allow four to five shipments to be received, unloaded and emplaced daily. In addition to minimizing the disruptions from in-the-wall emplacement of RH TRU waste canisters, the use of shielded containers would conserve

borehole space for high-activity waste streams by providing additional emplacement locations for some RH TRU waste." Attachment at 1.

"Efficiency" is not specifically defined. Is "efficiency" related to saving money – or spending more? CBFO should describe in detail how using shielded containers will be more efficient. Or is efficiency related only to the amount of RH waste that can come to WIPP?

In any case, that discussion of the purpose is incomplete and misleading. Among other things, there is no discussion about the amount of contacted-handled (CH) and RH waste that needs to be accommodated. There is no discussion about what the historic efficiencies have been and whether the existing processes can handle the amounts of CH and RH waste in the WIPP inventory. There is no discussion about what inefficiencies and disruptions are introduced by a major change in operations and reduction in the amount of space available for CH waste, when space designated for CH waste is used for RH waste. There is no discussion of whether the real purpose of the request is to allow more RH waste to come to WIPP than would occur with current processes and practices. Those matters should be documented and analyzed before shielded containers are approved. Thus, additional information is required from CBFO and additional analysis is needed by EPA before use of shielded containers is approved.

The 2010 WIPP Inventory (DOE/TRU-10-3425) includes a total of 140,800 cubic meters of CH waste (Table 3-1) and 5,420 cubic meters of RH waste (Table 3-2) to be disposed at WIPP. However, neither the CBFO request nor the EPA proposed decision actually discusses the historic efficiencies and inefficiencies. According to statistics on the WIPP website (http://www.wipp.energy.gov/general/GenerateWippStatusReport.pdf), the amount of CH waste disposed in each panel has varied from a low of 10,496.65 cubic meters (Panel 1 - less than 59 percent of permitted capacity) to a high of 17,997.67 cubic meters (Panel 2 – 100 percent of permitted capacity). The WIPP Hazardous Waste Permit (Table 4.1.1) allows 18,000 cubic meters of CH waste (Panels 1 and 2) or 18,750 cubic meters of CH waste in subsequent panels. The increased permitted capacity was based on CBFO's request to improve efficiencies by not unduly limiting the amount of CH waste in Panel 3 and subsequent panels. Despite the capacity increases, Panel 3 was filled with 17,902.06 cubic meters of CH waste (91 percent of permitted capacity), Panel 4 was filled with 14,257.54 cubic meters of CH waste (76 percent of permitted capacity), and while Panel 5 is still receiving CH waste, it will not be completely filled to the 18,750 cubic meter permitted capacity.

For RH waste, Panel 4 permitted capacity is 400 canisters, and 198 canisters (49.5 percent) were emplaced. For Panel 5, the permitted capacity is 500 canisters, and 264 (52.8 percent) were emplaced.

Thus, CBFO has not historically used all of the available storage capacity for either CH or RH waste. CBFO has not actually shown how much RH waste can be accommodated in the remaining borehole locations in walls of the underground panels. CBFO has also not shown how much CH waste disposal space would be eliminated by shielded containers, nor whether additional changes would be needed in the future to accommodate CH waste planned for disposal. A piecemeal approach of changing RH waste configuration to allow more disposal and then later requesting to change CH disposal configuration to accommodate space lost to shielded containers is inappropriate and could be dangerous and disruptive.

Further, past changes in the Hazardous Waste Permit to allow for greater efficiencies have not had that result. Therefore, SRIC believes that CBFO must provide a more complete discussion of what amount of RH waste needs to be accommodated, what efficiencies are needed, and whether such changes can and will be implemented before the planned change is approved.

2. The effects of use of shielded containers has not been adequately described by CBFO, nor adequately analyzed in EPA's proposed decision.

EPA's proposed decision "finds that the results of the performance assessment show that the use of shielded containers does not significantly affect facility compliance with 40 CFR 194." at 1. However, SRIC has not found analysis by CBFO or EPA that specifically shows compliance with 40 CFR 191, Subpart A. Since the WIPP Land Withdrawal Act (Public Law 102-579, as amended), Section 9(a)(1)(A) requires compliance with 40 CFR 191, Subpart A, CBFO must demonstrate, and EPA must analyze and confirm, that shielded containers would result in compliance with those all of those standards.

If the 5,420 cubic meters of RH waste in the WIPP Inventory cannot be accommodated in boreholes in remaining unfilled panels, one effect of using shielded containers is to bring more RH waste to WIPP than would come without the change. Thus, more radioactivity would be handled at WIPP than if some of the RH waste in the inventory were not brought to WIPP. Such an increased amount of radioactivity could affect compliance with 40 CFR 191. At a minimum, the planned change request should document how much additional radioactivity would be brought if the planned change request is approved, as compared with the amount of radioactivity if lesser amounts of RH waste are emplaced. CBFO should also provide information, and EPA should independently analyze, whether that additional radioactivity could increase releases during the operational lifetime and affect compliance with 40 CFR 191, Subpart A.

3. Operational changes should be required if shielded containers are to be allowed.

In its proposed decision, EPA would impose one condition: "prior to shipping the shielded containers to WIPP, DOE implements a consistent complex-wide procedure to ensure that the shielded containers remain below the Land Withdrawal Act 200 millirem per hour dose limit for contact-handled waste." at 1. While such a condition is appropriate, it is not sufficient.

The EPA Technical Review by S. Cohen & Associates suggested the need for such consistent procedures and identified eight specific issues. at 53-54. SRIC also believes that the measured surface dose rate must be required in the Waste Data System (WDS) for each container. EPA should clarify that all of those requirements must be addressed in the new procedures. Such procedures must be subject to EPA inspections and to a 45-day public comment period, similar to what is done with baseline inspections, before shielded containers could be used at each site.

The general condition also must require new procedures at WIPP. The last sentence of the EPA Technical Review states: "This would include procedures to ensure that the radiation source does not shift within the container during handling and transportation." Upon arrival of shielded containers at WIPP, new procedures would be needed to examine each container to determine that its surface dose rate is below the 200 millirem per hour limit. Procedures should require that any shielded container above that limit must be returned to the shipping site and repackaged. Procedures should also require a suspension of all use of shielded containers and an investigation

of the cause(s) of the excessive surface dose rate and measures to ensure that the problem does not recur at any site.

Additional radioactivity coming to WIPP also could increase worker radiation exposure. Such exposures may already be a problem at WIPP. Under the Energy Employees Occupational Injury Compensation Program, four WIPP workers have been approved for compensation for work-related illnesses from radiation exposure.
http://www.dol.gov/owcp/energy/regs/compliance/statistics/WebPages/WASTE_ISO_PILOT.htm
SRIC has made further inquiries to the Department of Labor and has been informed that all four workers also have been employed at other DOE sites. Thus, while their illnesses are definitively from radiation exposure, how much of the exposure is WIPP-related has not been determined. Nevertheless, containers with surface dose rate at or above 200 millirem per hour pose higher risks to workers. Thus, the worker exposure issue and procedures necessary to avoid increased exposures is relevant to decisions about use of shielded containers.

The EPA Technical Review also stated:

> "Clearly, the radionuclide inventory of RH TRU waste is very uncertain (as evident from the large changes shown by Table 7-7 and Table 7-8), which leads to uncertainty in the amount of RH TRU waste that can ultimately be packaged in shielded containers. Thus, the amount of RH TRU estimated to be disposed of at WIPP should be re-examined for each annual inventory estimate." at 41.

EPA should require that each annual inventory provide detailed analysis of what waste streams and what RH waste containers are to use shielded containers. The inventory and reference documents should describe in detail any changes made during each year as to the status of specific RH waste streams or waste containers that are or are not using shielded containers.

In conclusion, EPA should not now approve the use of shielded containers because additional documentation and analysis is required. Instead of approving shielded containers, EPA should convene either a public meeting or conference call among interested parties so that additional information is provided by CBFO and, thereafter, additional analysis is done of the impacts of the use of shielded containers, and additional public comment occurs.

Citizens for Alternatives to Radioactive Dumping (CARD), Concerned Citizens for Nuclear Safety (CCNS), Loretto Community, and Nuclear Watch of New Mexico join in these comments.

Thank you very much for your careful consideration of, and your response to, these comments.

Sincerely,

Don Hancock

: 00089

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

SEP 2 9 2011

ENTERED
OCT 2011

Mr. John Kieling, Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Class 2 Permit Modification Request for the Waste Isolation Pilot Plant Hazardous Waste Facility Permit, Permit Number: NM4890139088-TSDF

Dear Mr. Kieling:

Enclosed is a Class 2 Permit Modification Request containing the following items:

- Item 1, Update Ventilation Language
- Item 2, Addition of a Shielded Container
- Item 3, Revise the WIPP Groundwater Detection Monitoring Program Plan

We certify under penalty of law that this document and the enclosure were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact George T. Basabilvazo at (575) 234-7488.

Sincerely,

Roger A Walker for Ed Ziemianski

Edward Ziemianski, Interim Manager
Carlsbad Field Office

M. F. Sharif, General Manager
Washington TRU Solutions LLC

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Item 1

Class 2 Permit Modification Request

Update Ventilation Language

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP Permit Number - NM4890139088-TSDF

September 2011

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: 00052

Acronyms/Abbreviations/Units

CFR	Code of Federal Regulations
CH	contact-handled
HWDU	Hazardous Waste Disposal Unit
MSHA	Mine Safety and Health Administration
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
Permit	Hazardous Waste Facility Permit
PMR	Permit Modification Request
RH	remote-handled
scfm	standard cubic feet per minute
SOP	standard operating procedure
TRU	transuranic
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant

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Overview of the Permit Modification Request

This document contains one Class 2 Permit Modification Request (**PMR**) for the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit (**Permit**) Number NM4890139088-TSDF.

This PMR is being submitted by the U.S. Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC, collectively referred to as the Permittees, in accordance with the WIPP Permit, Part 1, Condition 1.3.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40 Code of Federal Regulations (**CFR**) 270.42(b)). The modification provides for the following changes:

- Add definition of a filled room.
- Revise language to indicate when 35,000 standard cubic feet per minute (**scfm**) is required for worker entry into active rooms and when reporting is required.
- Change a related reporting requirement.

These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP Permit is provided in this PMR. The proposed modification to the text of the WIPP Permit has been identified using red text and a double underline and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP Permit requirement, Permit Part 1, Condition 1.3.1. for submission of this Class 2 PMR.

1. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(i)) requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the Permit.

The Permittees are proposing the following changes in this PMR:

1. Add definition for a "filled room" in Condition 1.5.19.
2. Add clarifying language in Conditions 4.5.3.2, Attachment A2, Section A2-2a(3), Attachment O, Section O-1, Section O-2, Section O-3, Section O-3c(1), Section O-3c(2), and Section O-5a to indicate that 35,000 scfm is required for worker entry into any active CH TRU mixed waste room that is adjacent to a filled room or in room 7 of any panel.
3. Modify when reporting to the New Mexico Environment Department (NMED) is necessary if the ventilation requirements are not met. Delete text in O-3b(2) since it is redundant with the reporting requirements in O-5a and condition 4.6.4.3.

The Table of Changes (Appendix A) and proposed text changes in redline strikeout (Appendix B) of this PMR describe each change that is being proposed. Appendix A provides a detailed list of changes by Permit section.

2. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

The Permittees are submitting this PMR as specified in Item A.4.b of Appendix I in 20.4.1.900 NMAC (incorporating 40 CFR 270.42) which states: "*Changes in the frequency of or procedures for monitoring, reporting, sampling or maintenance activities by the permittee: other changes.*" Therefore this modification request is a Class 2 under Item A.4.b.

3. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

The basis for this PMR is to improve the protection of operating personnel by reducing the time the workers must be present in the exhaust air of panels to adjust ventilation regulators. Permit Attachment A4, Section A4-4 states that *"[t]he exhaust drift in the waste disposal area will normally not be used for personnel access."* This restriction minimizes the chance for exposure to emissions from the waste. This PMR proposes to use the active remote-handled (**RH**) transuranic (**TRU**) mixed waste disposal room to gain access to the ventilation louvers without requiring workers to travel the longer distances down the exhaust drift even if the ventilation flow rate in the RH TRU mixed waste disposal room is less than 35,000 scfm. Currently workers have to enter and travel within the ventilation exhaust areas to adjust ventilation. This PMR proposes to ameliorate this circumstance by minimizing the amount of time a worker must spend down-wind from the waste. This is accomplished by changing the restriction regarding access to rooms that contain TRU mixed waste. Specifically, this modification makes it acceptable for a worker to enter an RH TRU mixed waste room with less than 35,000 scfm as long as that room is not adjacent to a filled contact-handled (**CH**) TRU mixed waste room and RH TRU waste handling is not under way in the room. Using the RH TRU mixed waste room to access the ventilation control louvers shortens the travel path for workers and minimizes the amount of time that must be spent in the exhaust drift. This modification also clarifies that workers are not allowed into a CH TRU mixed waste room that is adjacent to a filled CH TRU mixed waste room or in Room 7 of any panel when CH TRU mixed waste is being disposed without a minimum airflow of 35,000 scfm. This proposed change is consistent with the exposure modeling and the administrative history of the Permit as discussed below. This change does not waive any ventilation requirements imposed by the Mine Safety and Health Administration (**MSHA**).

There are times when it is necessary to enter an active disposal room in order to establish normal ventilation. In such cases and in order to protect workers, reentry is accomplished in accordance with a standard operating procedure (**SOP**). According to the SOP the ventilation mode is shifted to "Filtration Mode" for thirty minutes prior to reentry to the underground. Also prior to reentry into the underground, filters at radiological station A are checked for radiological contamination. Then workers are allowed underground to establish that adequate air quality exists as defined by MSHA (30 CFR 57.5015) and the SOP including volatile organic compounds (**VOCs**) as appropriate. Once air quality has been determined to be acceptable the reentry team proceeds to the active panel area to inspect for abnormal conditions (i.e., fire, roof fall, or dropped/breached containers). Once the condition has been determined to be adequate, normal ventilation and entry to the underground may be established. This process is a

systematic approach to prevent the inadvertent release of radioactive contamination and assures protection of human health and the environment.

Normally, the active panel inspection can be performed from the entry to the active room (i.e., from the intake drift at the room entrance). In order to assure such reentry activity can be performed after the Permit is modified, language is placed in Attachment O, Section O-3c(2) that specifically exempts entry for establishing normal ventilation (i.e., 35,000 scfm) from the requirement that ventilation be verified to be at 35,000 scfm prior to entering. The language requires that such entry be noted in the log book so that clear documentation of such events is kept in the Operating Record for the facility.

In addition, modification of the reporting requirements is proposed. Currently, there is a 7-day notification requirement whenever the ventilation requirements are not met. This is triggered after a monthly review of the ventilation records. The Permittees are proposing in place of the 7-day notification, which is usually reserved to situations which pose risk to human health or the environment, that instances where the ventilation requirements are not achieved be reported annually in the Mine Ventilation Rate Monitoring Annual Report. To this extent, the Permittees are proposing changes to the text in Permit Part 4, Condition 4.6.4.3 and Permit Attachment O, Sections O-3b(2) and O-5a. Currently required calculations, measurements and evaluations will remain the same. The changes will only be to the reporting mechanism, and frequency.

Source of the 35,000 scfm Ventilation Requirement in the Permit:

When the Permittees prepared their Permit Application in 1996, the NMED requested that several exposure scenarios be examined to evaluate the potential releases of VOCs and the effects on underground workers (WIPP RCRA Part B Permit Application, DOE/WIPP 91-005, Revision 6 Appendix D9, Attachment 1). These scenarios involved a roof fall in an open room (i.e., one being actively filled with CH TRU mixed waste) and a closed room (i.e., a CH TRU mixed waste room that was filled with drums of waste and had ventilation barriers in place). Two other scenarios evaluated "normal operations" to determine risk to workers actively placing waste in CH TRU mixed waste rooms when no roof fall occurs. In all four cases, the potentially exposed individual was an underground waste handler working in the active CH TRU mixed waste room. The four scenarios are shown in Figures 1 to 4 which are taken from the NMED's written testimony submitted during the original Permit hearings in 1999 (NMED Direct Testimony Regarding Regulatory Process and Imposed Conditions" (HRM 98-04(P))). In all four cases, the NMED determined that the combination of the environmental performance standards (established through room-based limits) and the minimum ventilation of 35,000 scfm were sufficient to protect these workers. Hence, the Permit was issued with the condition that 35,000 scfm be maintained whenever workers are present in an active room (Permit Attachment O, multiple locations).

Applicability to RH TRU Mixed Waste Rooms:

At the time the Permit was issued in 1999, RH TRU waste was prohibited and RH TRU waste emplacements were not included in the NMED's ventilation analysis. Rooms that are being filled with RH TRU waste represent one additional scenario as shown in Figure 5. As can be seen in Figure 5, the worker is unaffected by normal operations or a roof fall in the adjacent CH TRU mixed waste room and by any roof fall scenario in the adjacent filled room by virtue of the fact that the ventilation flow through the active CH TRU mixed waste room bypasses the active RH TRU mixed waste room. In other words, because RH TRU mixed waste rooms are upstream from CH TRU mixed waste rooms, the RH TRU mixed waste worker in an RH TRU

mixed waste room is never in the CH TRU mixed waste room ventilation stream, and therefore would not be subject to the consequences of the roof-fall scenario.

Volatile Organic Compound emissions from RH TRU waste itself are negligible due to the low volume of RH TRU waste being emplaced. The Permit Part 4.1.12 restricts the volume of RH waste that can be placed in each panel. Based on the current Panel 7 volume limit in Part 4.1.1.2 this restriction equates to less than 104 canisters per disposal room. Furthermore, RH is emplaced in boreholes with shield plugs and is not subject to active ventilation similar to drums of waste on the floor of an active room. Therefore, this emplacement configuration restricts VOC emissions from RH TRU mixed waste into the active disposal room.

Appropriateness of the Proposed Changes:

The changes proposed in the PMR are based on the NMED record that indicates the concern for maintaining adequate ventilation is to protect workers from exposure to harmful concentrations of VOCs in the active CH TRU mixed waste room adjacent to a filled CH TRU mixed waste room or in Room 7 of any panel during normal operations and in the event of a roof fall. These harmful concentrations cannot occur in the RH TRU mixed waste rooms during normal operations or as the result of the roof fall. Therefore, the change specifically limits the condition to maintain 35,000 scfm to any active room that is adjacent to a filled disposal room when workers are present. A "filled room" is also defined so there is no confusion regarding this terminology. The change normally would apply to the room in a panel that is receiving CH TRU mixed waste and not to an RH TRU mixed waste disposal room. However, there may be circumstances when a room is filled with CH TRU mixed waste and there is remaining RH TRU mixed waste to be emplaced in the next room. Another situation exists with Room 7 in each panel when CH TRU mixed waste is being disposed. Since this is the first room filled there is no adjacent filled room. In such cases, the requirement for 35,000 scfm would apply to the RH TRU mixed waste room (i.e., the room adjacent to a filled disposal room) and to Room 7 of any panel when CH TRU mixed waste is being disposed.

Figure 6 shows the current and proposed worker pathways to adjust the ventilation regulators. Clearly, the pathway allowed by this proposed modification is significantly shorter and thereby reduces the time that a worker must be downstream of the emplaced waste.

4. 20.4.1.900 NMAC (incorporating 40 CFR 270.42 (b)(1)(iv)), requires the applicant to provide the applicable information required by 40 CFR 270.13 through 270.21, 270.62 and 270.63.

Regulatory citations in this modification reference 20.4.1.900 NMAC (incorporating 40 CFR §§270.13-15) revised March, 2009. Title 40 CFR §§270.16 through 270.22, 270.62, 270.63 and 270.66 are not applicable at WIPP. Consequently, they are not included. Title 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR 270.11(d)(1) and 40 CFR 270.30(k)), requires that any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Part 1, Condition 1.9 of the Permit.

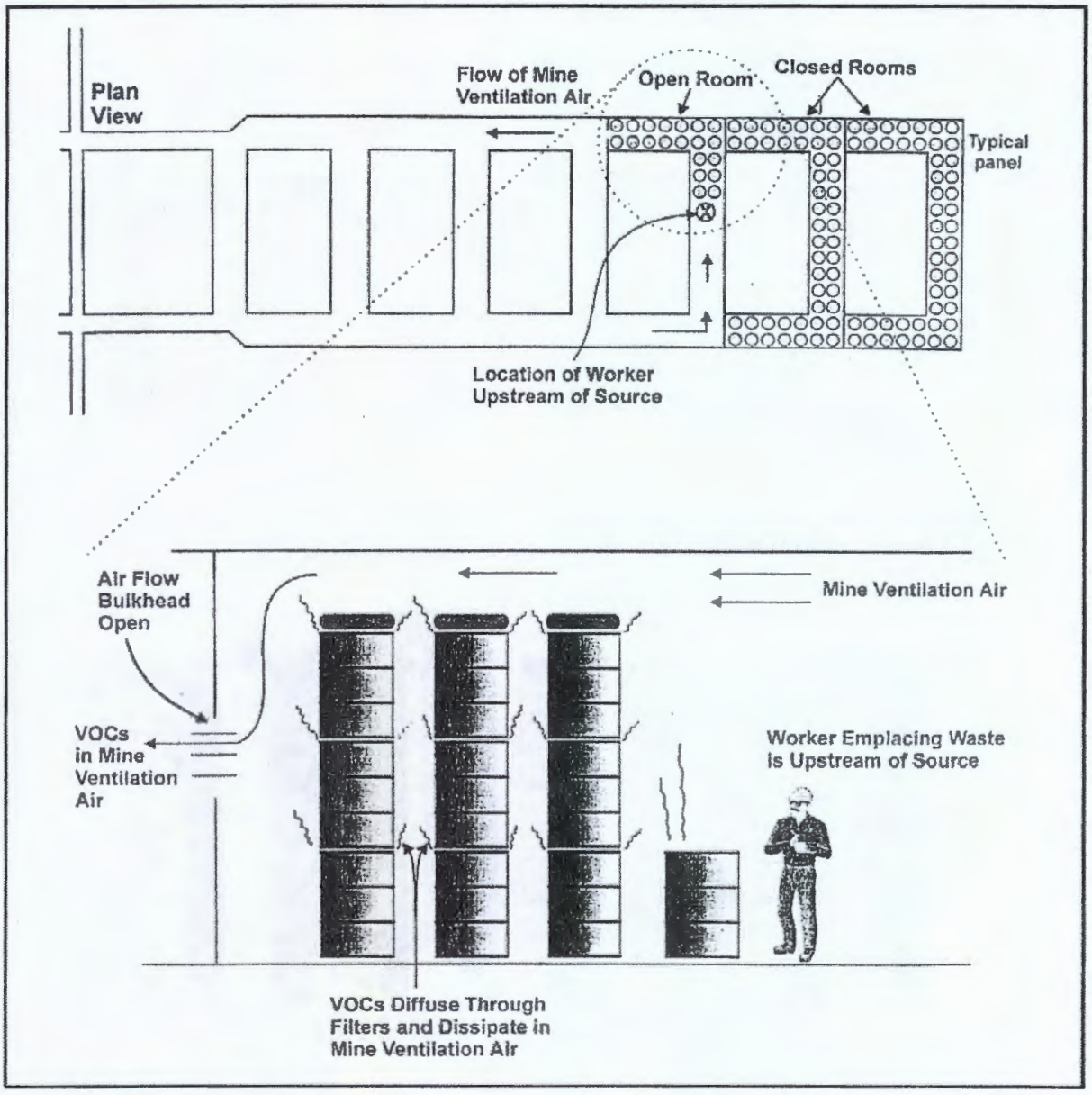


Figure 1
VOC Emissions from an Open Room, Open Panel under Normal Operation

: 00098

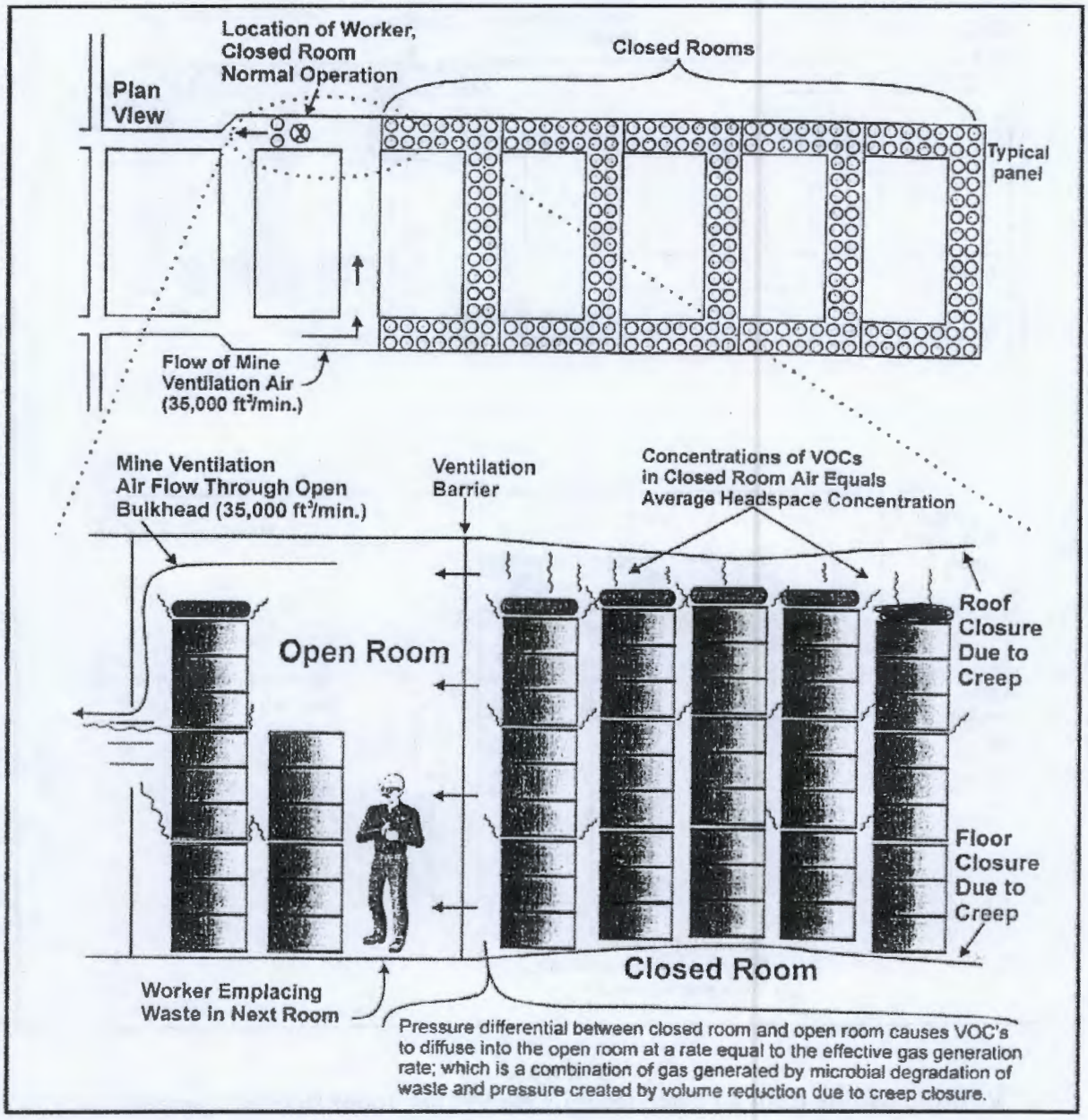


Figure 2
VOC Emissions from a Closed Room, Open Panel under Normal Operation

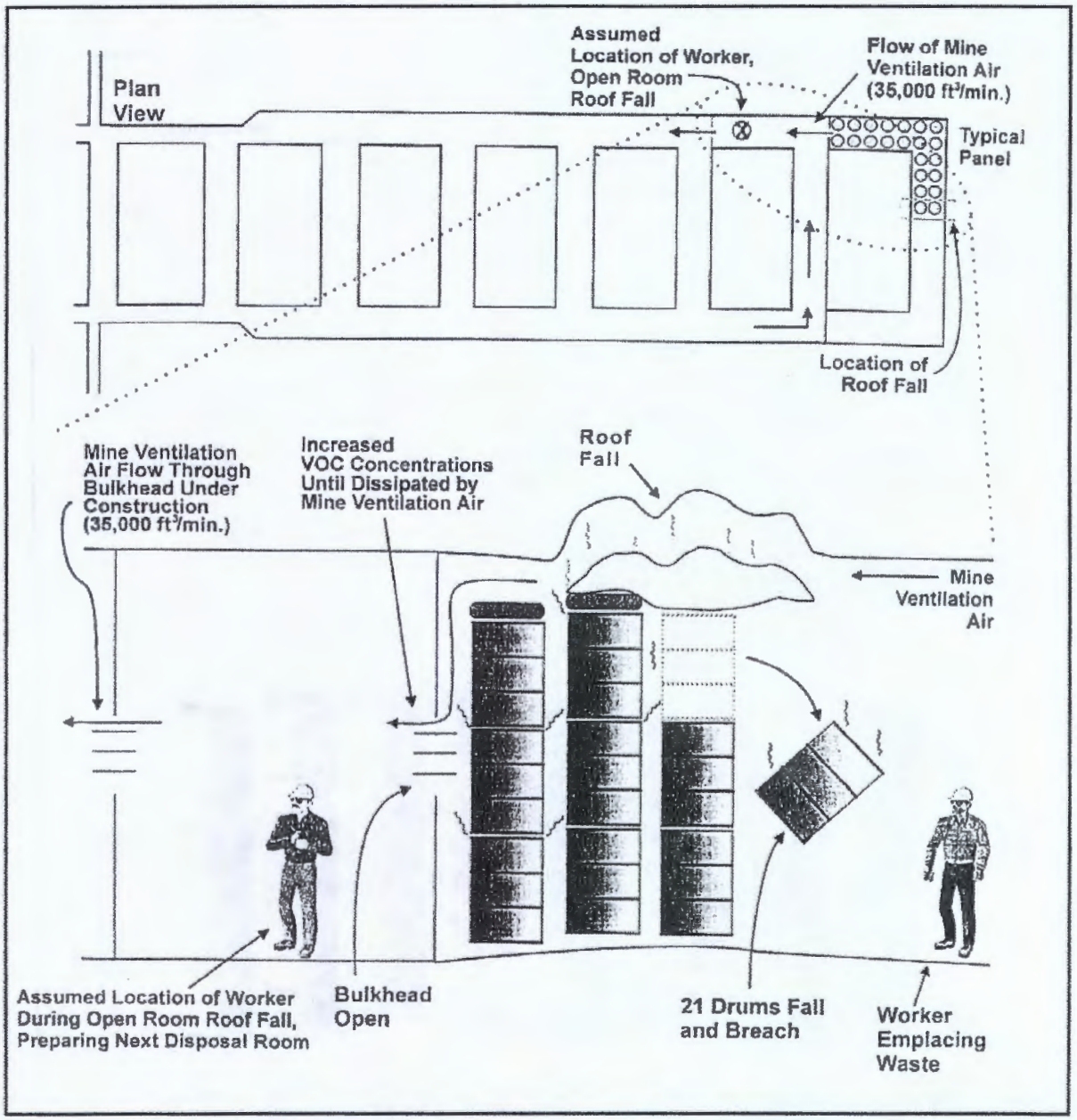
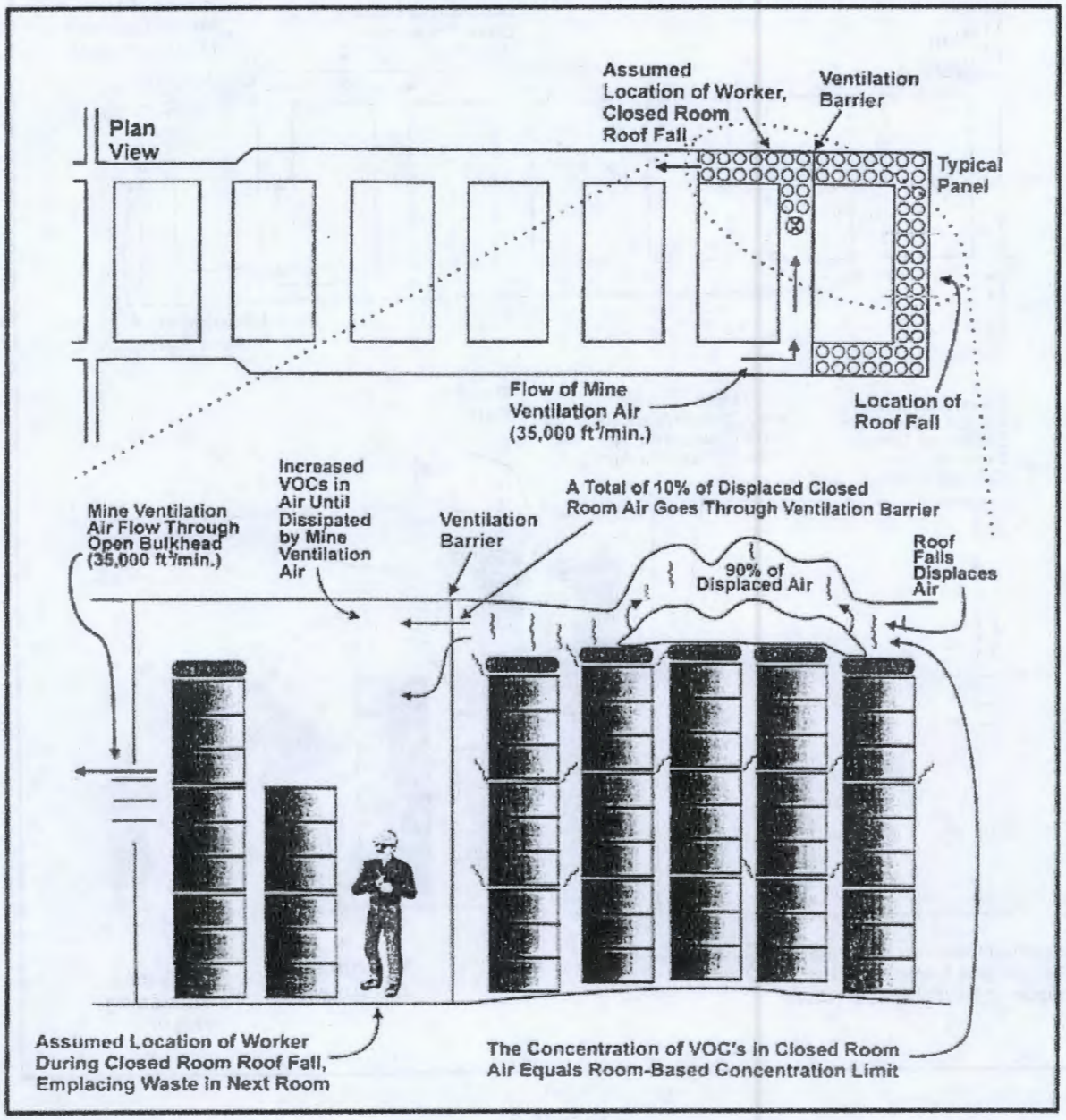


Figure 3
Roof Fall in an Open Room

: 00100



(X) = Assumed location of worker

Figure 4
Roof Fall in Closed Room

: 00101

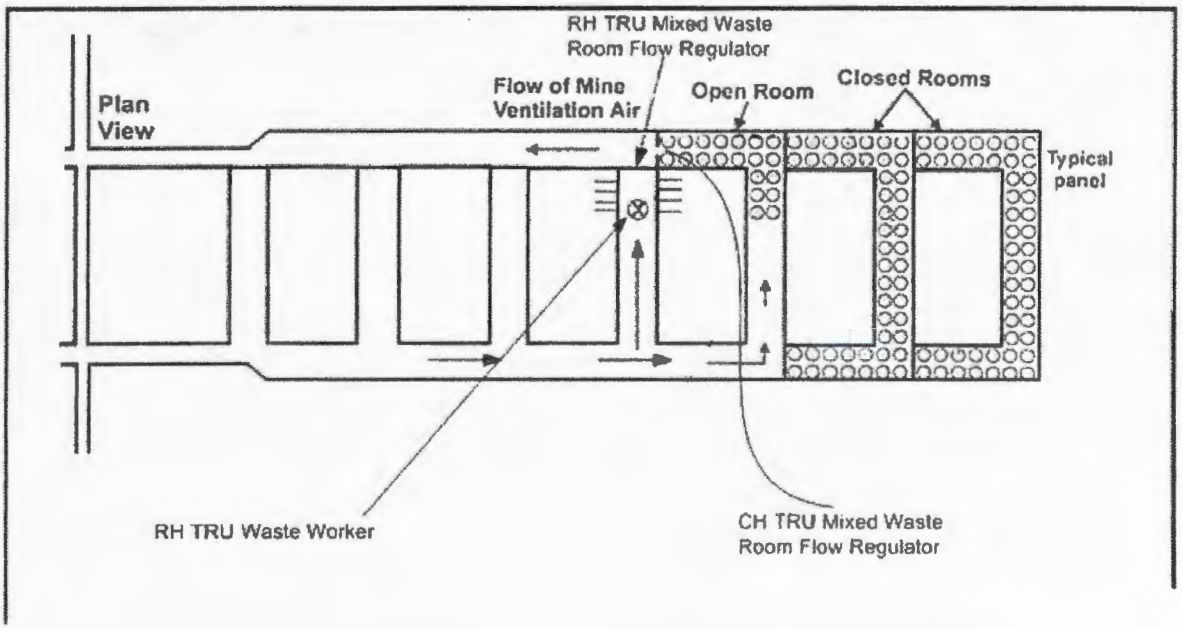


Figure 5
Location of Worker Emplacing RH-TRU Mixed Waste

: 09102

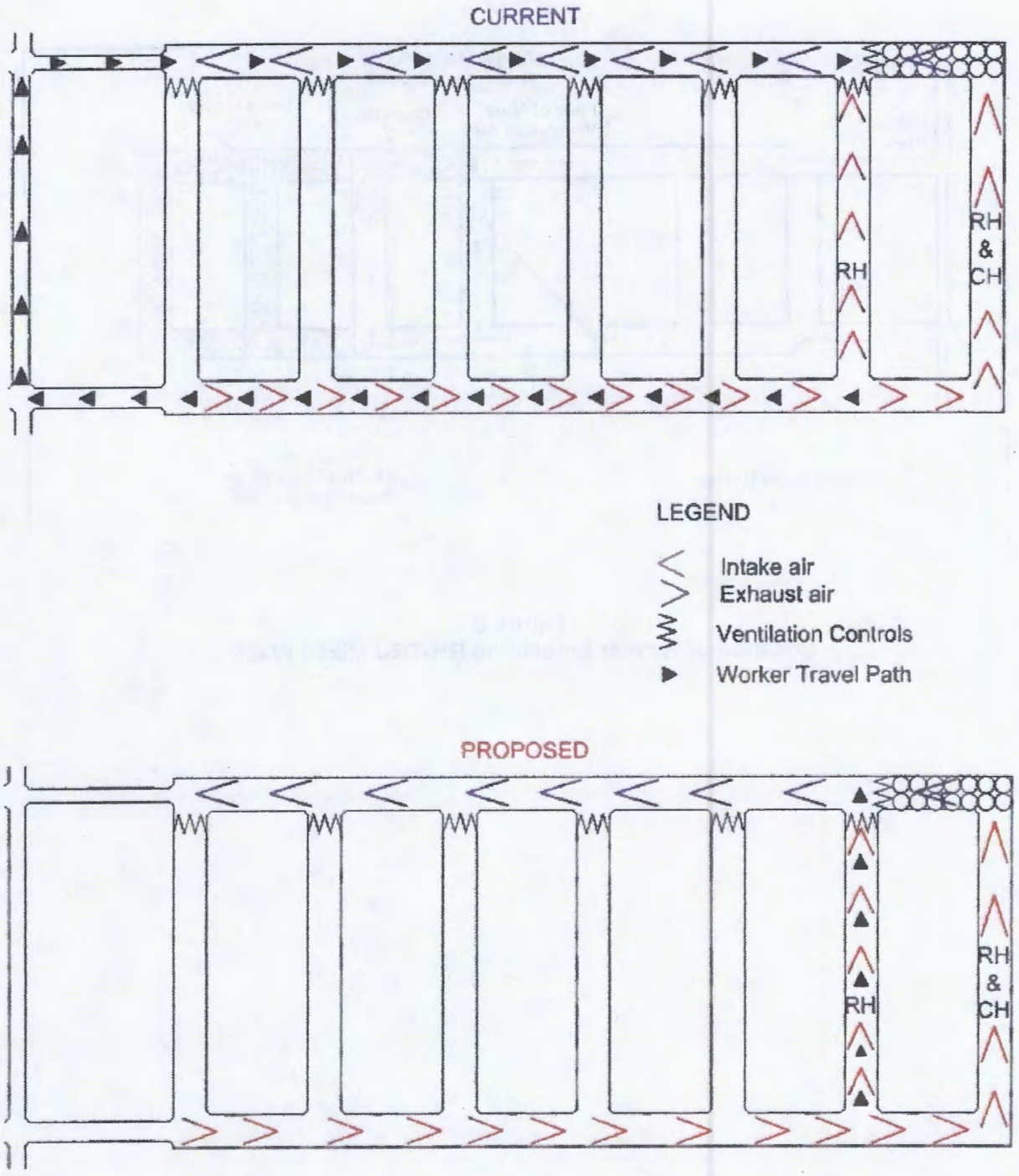


Figure 6
Current and Proposed Routes

00103

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.13		Contents of Part A permit application	Attachment B Part A		✓
§270.14(b)(1)		General facility description	Attachment A		✓
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Part 2.3.1 Attachment C		✓
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Part 2.3.1.1 Attachment C		✓
	§264.13(c)	Off-site waste analysis requirements	Part 2.2.1 Attachment C		✓
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Part 2.7 Attachment E-1a		✓
	§264.174	Container inspections	Attachment E-1b(1)		✓
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment E-1b Attachment E-1b(1)		✓
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		✓
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Part 2.12 Attachment D		✓
	§264.51	Contingency plan design and implementation	Part 2.12.1 Attachment D		✓
	§264.52 (a) & (c-f)	Contingency plan content	Attachment D		✓
	§264.53	Contingency plan copies	Part 2.12.2 Attachment D		✓
	§264.54	Contingency plan amendment	Part 2.12.3 Attachment D		✓
	§264.55	Emergency coordinator	Part 2.12.4 Attachment D-4a(1)		✓
	§264.56	Emergency procedures	Attachment D-4		✓
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment A Part 2.11		✓
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Part 2.11		✓
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment A1-1c(1) Part 2.11		✓
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Part 2.11		✓
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Part 2.11		✓
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Part 2.11		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Part 2.11 Part 4.4 Attachment D-4e Attachment G-1a		✓
	264 Subpart C	Preparedness and Prevention	Part 2.10		✓
	§264.31	Design and operation of facility	Part 2.1		✓
	§264.32	Required equipment	Part 2.10.1 Attachment D		✓
	§264.33	Testing and maintenance of equipment	Part 2.10.2 Attachment E-1a		✓
	§264.34	Access to communication/alarm system	Attachment E-1a Part 2.10.3		✓
	§264.35	Required aisle space	Part 2.10.4		✓
	§264.37	Arrangements with local authorities	Attachment D-4a(3)		✓
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Part 2.9		✓
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment A4		✓
§270.14(b) (11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Attachment G2-2.2 Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Attachment A1-1c(1) Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b) (12)	§264.16(a-e)	Personnel training program	Part 2.8 Attachment F		✓
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Part 6 & 7 Attachment G & H		✓
§270.14(b)(13)	§264.111	Closure performance standard	Attachment G-1a		✓
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment G-1		✓
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Part 6.3 Attachment G-1d(4)		✓
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment G-2a		✓
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment G-1e(2)		✓
§270.14(b)(13)	§264.113	Time allowed for closure	Part 6.5 Attachment G-1d		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.14(b)(13)	§264.114	Disposal/decontamination	Part 6.6 Attachment G-1e(2)		✓
§270.14(b)(13)	§264.115	Certification of closure	Part 6.7 Attachment G-2a		✓
§270.14(b)(13)	§264.116	Survey plat	Part 6.8 Attachment G-2b		✓
§270.14(b)(13)	§264.117	Post-closure care and use of property	Part 7.3 Attachment H-1a		✓
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Part 7.5 Attachment H-1a (1)		✓
§270.14(b)(13)	§264.178	Closure/containers	Part 6.9 Attachment A1-1h Attachment G-1		✓
§270.14(b)(13)	§264.601	Environmental performance standards-miscellaneous units	Attachment A-4 Attachment D-1 Attachment G-1a		✓
§270.14(b)(13)	§264.603	Post-closure care	Part 7.3 Attachment G-1a(3)		✓
§270.14(b)(14)	§264.119	Post-closure notices	Part 7.4 Attachment H-2		✓
§270.14(b)(15)	§264.142	Closure cost estimate	NA		✓
	§264.143	Financial assurance	NA		✓
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		✓
	§264.145	Post-closure care financial assurance	NA		✓
§270.14(b)(17)	§264.147	Liability insurance	NA		✓
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		✓
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(iii)		Surface waters	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.14(b)(19)(iv)		Surrounding land use	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(v)		Wind rose	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(xi)		Drainage on flood control barriers	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(xii)		Location of operational units	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Attachment B Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.15	§264 Subpart I	Containers	Part 3 Part 4.3 Attachment A1		✓
	§264.171	Condition of containers	Part 3.3 Attachment A1		✓
	§264.172	Compatibility of waste with containers	Part 3.4 Attachment A1		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
	§264.173	Management of containers	Part 3.5 Attachment A1		✓
	§264.174	Inspections	Part 3.7 Attachment E-1 Attachment A1-1e		✓
§270.15(a)	§264.175	Containment systems	Part 3.6 Attachment A1		✓
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment A1-1g Permit Part 2.1		✓
§270.15(d)	§264.177	Special requirements for incompatible wastes	Attachment A1-1g Permit Part 2.3.3.4		✓
	§264.178	Closure	Part 6 Attachment G		✓
§270.15(e)	§264.179	Air emission standards	Part 4.4.2 Attachment N		✓
§270.23	264 Subpart X	Miscellaneous units	Part 1.3.1 Attachment A2-1 Attachment G1.3.1		✓
§270.23(a)	§264.601	Detailed unit description	Part 4 Part 5 Attachment A2 Attachment L		✓
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Part 4 Part 5 Attachment A2 Attachment L		✓
§270.23(c)	§264.601	Potential exposure pathways	Part 4 Attachment A2 Attachment N	✓	
§270.23(d)		Demonstration of treatment effectiveness	Part 4 Attachment A2 Attachment N		✓
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Part 4 Part 5 Attachment A2 Attachment E-1 Attachment N Attachment L		✓
	§264.603	Post-closure care	Attachment H Attachment H1		✓
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Part 1 Permit Part 2.13 & 2.14 Permit Part 4 Attachment C		✓
§270.30(j)(2)	§264.73(b)	Ground-water records	Part 1		✓
	264 Subpart F	Releases from solid waste management units	Part 5 & 7 Attachment G2 & L		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
	§264.90	Applicability	Part 5 Attachment L		✓
	§264.91	Required programs	Attachment L		✓
	§264.92	Ground-water protection standard	Attachment L		✓
	§264.93	Hazardous constituents	Attachment L		✓
	§264.94	Concentration limits	Part 5 Attachment L		✓
	§264.95	Point of compliance	Part 5 Attachment L		✓
	§264.96	Compliance period	Attachment L		✓
	§264.97	General ground-water monitoring requirements	Part 5 Attachment L		✓
	§264.98	Detection monitoring program	Part 5 Attachment L		✓
	§264.99	Compliance monitoring program	Part 5 Attachment L		✓
	§264.100	Corrective action program	Part 5 Attachment L		✓
	§264.101	Corrective action for solid waste management units	Part 8 Attachment L		✓
	264 Appendix IX	Ground-water Monitoring List	Part 5 Attachment L		✓

Appendix A
Table of Changes

: 00110

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: 00111

Table of Changes

Affected Permit Section	Explanation of Change	Page Number
• Part 1, Condition 1.5.19.	• Added definition for Filled Room	B-2
• Part 4, Condition 4.5.3.2.	• Deleted "active" • Deleted "the" • Added "an active" • Added "adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed"	B-2 B-2 B-2 B-2
• Part 4, Condition 4.6.4.3.	• Deleted "Notification" • Added "Evaluation" • Deleted "Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved, the" • Added "The" • Deleted "notify" replaced with "report to" • Deleted "writing within seven calendar days" • Added "the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved"	B-2 B-2 B-2 B-2 B-2 B-2
• Attachment A2, Section A2-2a(3)	• Added "active" • Added "that is adjacent to a filled room" • Deleted "where waste disposal is taking place" • Added "or in Room 7 of any panel when CH TRU mixed waste is being disposed" • Deleted "The" • Added "Filled" • Deleted "that are filled with waste" • Deleted "the" • Added "adjacent active" • Deleted " that are actively being filled" • Add "or in Room 7 of any panel when CH TRU mixed waste is being disposed."	B-3 B-3
• Attachment O, Section O-1	• Added "that is adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed."	B-3
• Attachment O, Section O-2	• Added "that are adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed."	B-4
• Attachment O, Section O-3	• Added "that are adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed."	B-4
• Attachment O, Section O-3b(2)	• Deleted "The Permittees will notify NMED within seven calendar days if either the minimum running annual average mine ventilation exhaust rate of 260,000 scfm or a minimum active room ventilation rate of 35,000 scfm when workers are present in the room are not achieved."	B-4
• Attachment O, Section O-3c(1)	• Added "the Minimum Airflow for an" • Added "that is Adjacent to a Filled Room" • Deleted "Minimum Airflow" • Added "in an active room that is adjacent to a	B-4 B-4 B-4 B-4

Affected Permit Section	Explanation of Change	Page Number
	filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed." • Added "that" • Deleted "(s)"	B-4 B-4 B-4
• Attachment O, Section O-3c(2)	• Added "Entry to restricted access active disposal rooms for the purpose of establishing normal ventilation is allowed. Such entry shall also be documented on the log sheet including a reference to the SOP used for reentry."	B-4
• Attachment O, Section O-5a	• Deleted "active room" • Added "for an active room that is adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed." • Deleted "O-3b(2)" • Added "Permit Section 4.5.3.2" • Deleted "Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in O-3b(2) have not been achieved, the" • Added "The" • Deleted "notify" • Added "report to" • Deleted "writing within seven calendar days" • Added "the annual report specified in Permit Section 4.6.4.2. whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section have not been achieved"	B-5 B-5 B-5 B-5 B-5 B-5 B-5 B-5 B-5 B-5 B-5

: 00113

Appendix B
Proposed Revised Permit Text

: 0011

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: 00115

Proposed Revised Permit Text:

1.5.19. Filled Room

"Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as described in Permit Part 4 that will no longer receive mixed waste for emplacement.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum ~~active~~ room ventilation rate of 35,000 standard ft^3/min when workers are present in ~~the~~ an active room adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.601(c)).

4.6.4.3. ~~Notification~~ Evaluation Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved, the~~ The Permittees shall ~~notify~~ report to the Secretary in ~~writing within seven calendar days~~the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved.

A2-2a(3) Subsurface Structures

Underground Ventilation System Description

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room that is adjacent to a filled room ~~where waste disposal is taking place~~ when workers are present in the room or in

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Room 7 of any panel when CH TRU mixed waste is being disposed. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. Rubber or sheet metal attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. ~~The~~ Filled rooms ~~that are filled with waste~~ will be isolated from the ventilation system, while ~~the~~ adjacent active rooms ~~that are actively being filled~~or in Room 7 of any panel when CH TRU mixed waste is being disposed will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

O-1 Definitions

Restricted Access: If the required ventilation rate in an active disposal room that is adjacent to a filled room or Room 7 of any panel when CH TRU mixed waste is being disposed cannot be achieved or cannot be supported due to operational needs, access is restricted by the use of barriers, signs and postings, or individuals stationed at the entrance to the active disposal room when ventilation rates are below 35,000 scfm.

O-2 Objective

The objective of this plan is to describe how the ventilation requirements in the Permit will be met. This plan achieves this objective and documents the process by which the Permittees demonstrate compliance with the ventilation requirements by:

- Maintaining an annual running average of 260,000 scfm through the underground repository

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- Maintaining a minimum of 35,000 scfm of air through the active disposal rooms that are adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed when workers are present in the rooms

O-3 Design and Procedures

This section describes the four basic processes that make up the mine ventilation rate monitoring plan:

- Test and Balance, a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components
- Monitoring and calculation of the Running Annual Average of the Total Mine Airflow to verify achievement of the 260,000 scfm minimum requirement
- Monitoring of active disposal room(s) that are adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed to ensure a minimum flow of 35,000 scfm whenever workers are present in the room

O-3b(2) Calculation of the Running Annual Average of Total Mine Airflow

The use of an average value of 730 hours per month in the monthly average calculation is reasonable, given that all the numbers involved are very large and that the final use of the monthly average flow is in an annual calculation. ~~The Permittees will notify NMED within seven calendar days if either the minimum running annual average mine ventilation exhaust rate of 260,000 scfm or a minimum active room ventilation rate of 35,000 scfm when workers are present in the room are not achieved.~~

O-3c(1) Verification of the Minimum Airflow for an Active Disposal Room that is Adjacent to a Filled Room ~~Minimum Airflow~~

Whenever workers are present in an active room that is adjacent to a filled room or in Room 7 of any panel when CH TRU mixed waste is being disposed, the Permittees shall verify the minimum airflow through that active disposal room~~(s)~~ of 35,000 scfm at the start of each shift, any time there is an operational mode change, or if there is a change in the ventilation system configuration.

O-3c(2) Measurement and Calculation of the Active Waste Disposal Room Airflow

The operator shall compare the recorded acfm value with the minimum acfm value provided at the top of the log sheet. The airflow shall be re-checked and recorded whenever there is an operational mode change or a change in ventilation system configuration. Once the ventilation rate has been recorded and verified to be at least the required minimum, personnel access to the room is unrestricted in accordance with normal underground operating procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room shall be restricted. Those periods when active disposal room access is restricted shall be documented on the log sheet for that active disposal room. Entry to restricted access active disposal rooms for the purpose of establishing normal ventilation is allowed. Such entry shall be documented on the log sheet including a reference to the SOP used for reentry.

O-5a Reporting

The Permittees shall submit an annual report to NMED presenting the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In the years that the Test and Balance is performed, the Permittees will provide a summary of the results in the annual report.

The Permittees shall calculate the running annual average mine ventilation rate on a monthly basis and evaluate compliance with the minimum ~~active room~~ ventilation rate for an active room that is adjacent to a filled room or Room 7 of any panel when CH TRU mixed waste is being disposed specified in ~~O-3b(2)~~Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in O-3b(2) have not been achieved, the~~ The Permittees will ~~notify~~ report to the Secretary in ~~writing within seven calendar days~~ the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2. have not been achieved.

Item 2

Class 2 Permit Modification Request

Addition of a Shielded Container

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP Permit Number - NM4890139088-TSDF

September 2011

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Acronyms/Abbreviations/Units

AK	Acceptable Knowledge
CFR	Code of Federal Regulations
CH	contact handled
DAC	Drum Age Criteria
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ft	feet
gal	gallon
HWDU	Hazardous Waste Disposal Unit
L	Liter
lbs	pounds
m^3	cubic meters
mrem/h	millirem per hour
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
PMR	Permit Modification Request
RCRA	Resource Conservation and Recovery Act
RH	remote handled
TRU	transuranic
TSDF	Treatment, Storage and Disposal Facility
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WTS	Washington TRU Solutions LLC
WWIS	WIPP Waste Information System

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Overview of the Permit Modification Request

This document contains one Class 2 Permit Modification Request (**PMR**) for the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit (**Permit**) Number NM4890139088-TSDF.

This PMR is being submitted by the U.S. Department of Energy (**DOE**) Carlsbad Field Office and Washington TRU Solutions LLC (**WTS**), collectively referred to as the Permittees, in accordance with the WIPP Permit, Part 1, Condition 1.3.1. (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40 Code of Federal Regulations (**CFR**) §270.42(b)). The modification provides for the following changes:

- addition of a new gamma shielded container for managing remote-handled (**RH**) transuranic (**TRU**) mixed waste as contact handled (**CH**) TRU mixed waste since it meets the surface dose rate of CH TRU mixed waste,
- description of how the volume of RH TRU mixed waste which is disposed in gamma shielded containers will be tracked, and,
- related changes to waste handling descriptions.

The gamma shielded container will be used to package RH TRU mixed waste that is approved for shipment to the WIPP facility for disposal and meets the surface dose requirements, once packaged, of CH TRU mixed waste.

These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP Permit and related supporting documents are provided in this PMR. The proposed modification to the text of the WIPP Permit has been identified using red text and a double underline and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the WIPP Permit Part 1, Condition 1.3.1. for submission of this Class 2 PMR.

1. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(i)) requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the Permit.

The Permittees are proposing to package a portion of the RH TRU mixed waste inventory in gamma shielded containers for emplacement at the WIPP facility. The use of the shielded containers will enable the DOE to reduce the time and personnel necessary for the packaging and management of specific RH TRU mixed waste that will meet the surface dose rate limitations for CH TRU mixed waste.

The Nuclear Regulatory Commission (**NRC**) has authorized the use of the HalfPACT transportation package for the shipment of shielded containers. The shielded containers comply with the U.S. Department of Transportation (**DOT**) Type 7A specifications.

The RH TRU mixed waste that will be packaged in shielded containers is included in the current inventory for disposal at the WIPP facility. Candidate RH TRU mixed waste streams for

shipment and disposal in gamma shielded containers will be selected based on the requirement to keep the radiation surface dose rate at the external surface of the shielded container below 200 millirem per hour (**mrem/h**) in accordance with Permit Part 1, Condition 1.5.1. The characterization being performed on waste being shipped in shielded containers will be no different than the waste characterization that is now required for RH TRU mixed waste in the Permittees' Waste Analysis Plan.

RH TRU mixed waste emplaced at the WIPP facility in shielded containers will remain designated as RH TRU mixed waste in the WIPP Waste Information System (**WWIS**). The emplaced volume will be counted against the RH repository limit of 7,080 cubic meters ($\mathbf{m^3}$) and RH TRU mixed waste volume limits specified in the Permit. The shielded container allows the Permittees to manage the shipment in a manner consistent with management of a CH TRU mixed waste shipment.

The shielded container is designed to hold an inner 30-gallon container. The cylindrical sidewall of the shielded container has approximately a 1-inch-thick lead shield sandwiched between two carbon steel shells. The external wall is approximately 1/8-inch thick, and the internal wall has a thickness of approximately 3/16-inch. The lid and the bottom of the shielded container are made of carbon steel and are approximately 3 inches thick. The empty weight of the shielded container is approximately 1,726 pounds. The shielded container and the inner 30-gallon container will be vented. The shielded container is shown in Figure 1.

The shielded containers will be assembled in a 3-pack configuration on a triangular pallet surrounded by radial and axial dunnage components. They will be transported as a single 3-pack configuration within the HalfPACT packaging.

Upon arrival at the WIPP facility, the shielded containers will be processed as CH TRU mixed waste using CH TRU mixed waste handling equipment and operating procedures. After receipt at the WIPP facility, the HalfPACT transportation container will be opened using existing lifting fixtures and equipment in the CH Bay portion of the Waste Handling Building. Once accessible after the HalfPACT lids have been removed, the top axial dunnage will be removed prior to removing the 3-pack assembly from the HalfPACT (see Figure 2). Next, the 3-pack assembly, the radial dunnage, the bottom slipsheet and the triangular pallet will be lifted from the HalfPACT using the installed guide tubes and placed on a facility pallet. The facility pallet will then be placed in storage or moved to the repository in the same manner as other CH TRU mixed waste. The 3-pack assembly will be placed singly on the floor using the slipsheet. The triangular pallet will be removed and not emplaced. The 3-pack will be placed in the interstitial spaces among the CH TRU mixed waste (see Figure 3). No waste assemblies will be placed on top of a 3-pack assembly of shielded containers because the narrower cross section of the 3-pack assembly of shielded containers may make the stack unstable. Emplacement of the 3-pack assembly of shielded containers will be performed using existing waste handling equipment and fixtures.

The Permittees will track waste components, packaging, transportation and emplacement information using the same method as other waste that is transported and emplaced at the WIPP facility. The shielded container waste will be reported as RH TRU mixed waste as the volume of waste in the inner waste container. Quantities of RH TRU waste that arrives in canisters is currently counted based on the volume of inner containers. Therefore, shielded containers and canisters will have a common volume reporting basis in the WWIS.

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The Permittees have evaluated the Drum Age Criteria (**DAC**) for the shielded container packaging configuration (Drum Age Criteria Values for the Shielded Container, September 2011). A conservative packaging configuration was used in the evaluation (Appendix C). The evaluation indicates that existing 55-gallon DAC values bound the values for the shielded container.

The Permittees are proposing the following changes in this PMR:

1. Add a new container in Part 3, Condition, 3.3.18.; Part 4, Condition 4.3.1.8; Attachment A1, Section A1-1b(2); Section A1-1d(3); Section A1-1d(4); Table A1-2; Figure A1-37; Attachment A2, Section A2-2a(1); Section A2-2b, Table A2-1; Attachment A4, Section A4-3; Attachment C1, Section C1-1a, Section C1-1a(1), Table C1-8 and footnote; Attachment D, Section D-1d, Section D-1e(1); Attachment E, Section E-1b(1); Attachment G3, Section G3-4a; and Attachment H1, Introduction.

2. Revise Part 4, Table 4.1.1 to remove the container equivalent column since RH TRU mixed waste will be disposed of in both canisters and shielded containers making the calculation of container equivalents impossible. This is the same approach used for CH TRU mixed waste which can arrive in six different containers. Furthermore, this table is a volume based limitation and not a container limitation. Thus it is not necessary to have the number of equivalent containers since the volume is not being proposed for change.

3. Add a figure of the shielded container (Figure A1-37).

4. Add "Shielded Containers" to Attachment C1, Sections C1-1a and C1-1a (1) and revise Table C1-8 indicating that the 55-gallon drum DAC bounds the shielded container.

Appendix A, The Table of Changes, provides a detailed list of changes by Permit section. Proposed text changes are included in Appendix B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

- This PMR proposes to add a new container to the Permit. The Permittees have added other containers and shipping packages and these have been previously approved by the New Mexico Environment Department (**NMED**) as Class 2 modifications. These include the following:
- Direct loaded ten drum overpack (approved 11-25-2002)
- Direct loaded 85-gallon drums (approved 11-25-2002)
- Addition of 100-gallon drums (approved 11-25-2002)
- Addition of a standard large box 2 (**SLB2**) (approved 4-15-2011)
- Addition of a HalfPACT shipping package (approved 11-25-2002)
- Addition of a TRUPACT III shipping package (approved 4-15-2011)

Unlike the SLB2 and TRUPACT III, there is no need for specialized waste management equipment nor is there any increase in the proposed storage area in the Waste Handling Building for managing shielded containers. NMED processed and approved these containers and shipping packages as Class 2 PMRs. Therefore, this is a Class 2 as specified in 20.4.1.900 NMAC (incorporating 40 CFR, §270.42(b)), Appendix I, Item F.3.b which states: "*Storage of different wastes in containers,.... That do not require additional or different management practices from those authorized in the permit.*"

Although RH TRU mixed waste has been shipped to the WIPP facility previously, this waste has not been managed in the CH TRU waste management portion of the facility. Therefore, this classification is appropriate and will allow for public comment on this requested change.

3. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

This PMR is necessary to add a shielded container as an acceptable waste container at the WIPP facility.

Shielded containers have been developed as one method to expedite the packaging and shipment of RH TRU mixed waste. Consequently, the Permittees seek approval to manage these containers under the WIPP facility Permit. Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management of that waste at the WIPP facility. Only waste that meets the definitions of TRU mixed waste in Permit Part 1, Section 1.5.7 that can be packaged to meet the surface dose rate limitations for CH TRU mixed waste will be managed at the WIPP facility in shielded containers. The Permittees are proposing the use of shielded containers to reduce the time and personnel necessary for the packaging and management of specific RH TRU mixed waste that will meet the surface dose rate limitations for CH TRU mixed waste. The shielded container will be transported to the WIPP facility in the HalfPACT transportation package. The shielded containers will be managed and emplaced in the rooms of the repository as CH TRU mixed waste. The containers comply with DOT Type 7A specifications and they will have a surface dose rate of less than 200 mrem/h.

The RH TRU mixed waste that will be packaged in shielded containers is included in the inventory for the WIPP facility and will have undergone the required characterization as RH TRU mixed waste specified in the WIPP Waste Analysis Plan. No change in the permitted aboveground hazardous waste storage or underground disposal unit capacity is required. Candidate RH TRU mixed waste streams for shipment and disposal in shielded containers will be selected based on the requirement to keep the radiation surface dose rate at the external surface of the shielded containers below 200 mrem/h. The volume of waste emplaced in shielded containers will remain designated as RH TRU mixed waste in the WWIS and will be counted against the RH TRU mixed waste repository limit of 7,080 m^3.

Additional explanations of why the changes are needed is provided in Item 1 above.

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4. **20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)) requires the applicant to provide the applicable information required by 40 CFR §270.13 through §270.21, §270.62 and §270.63.**

The attached regulatory crosswalk describes those portions of the WIPP Permit that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised March 2009, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §270.16 through §270.22, §270.62, §270.63 and §270.66 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. **20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)) require that any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.**

The transmittal letter for this PMR contains the signed certification statement in accordance with Permit Part 1, Condition 1.9. of the WIPP Permit.

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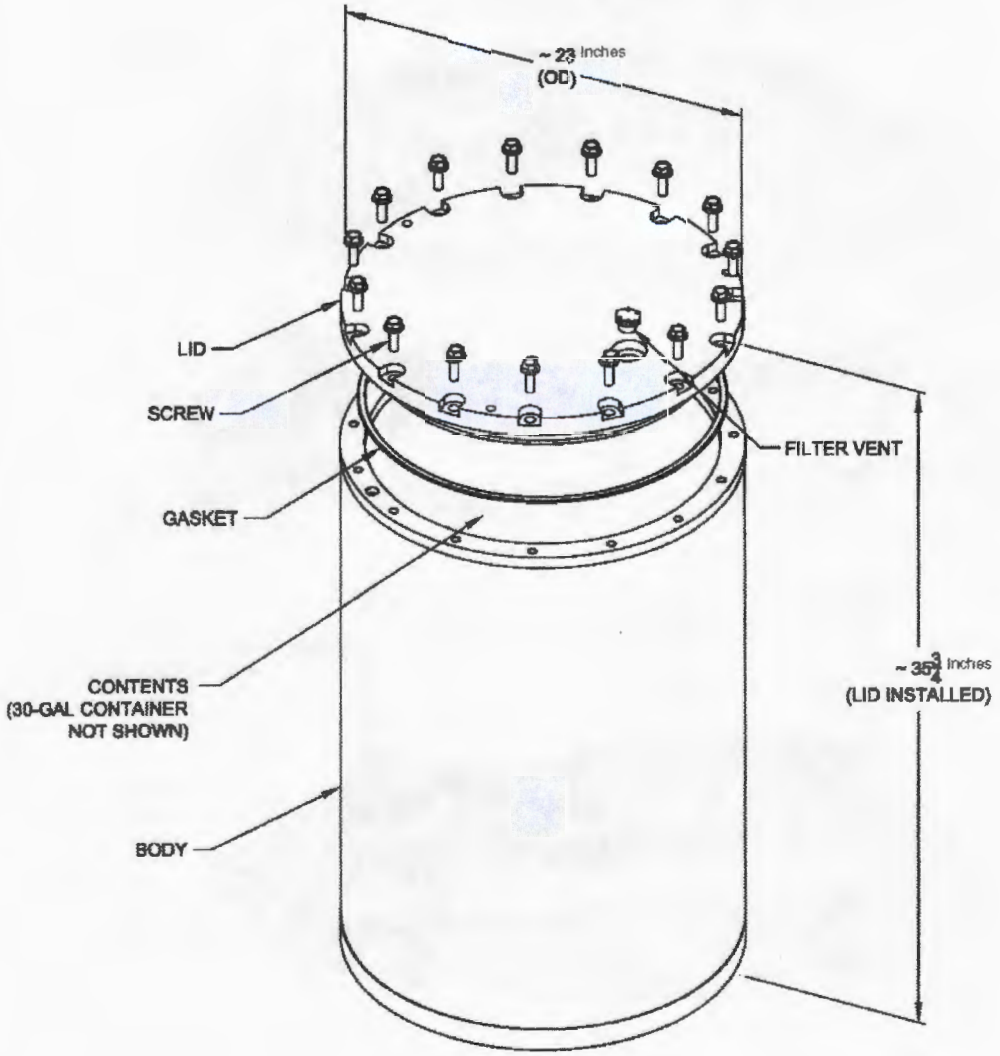

Figure 1
Shielded Container

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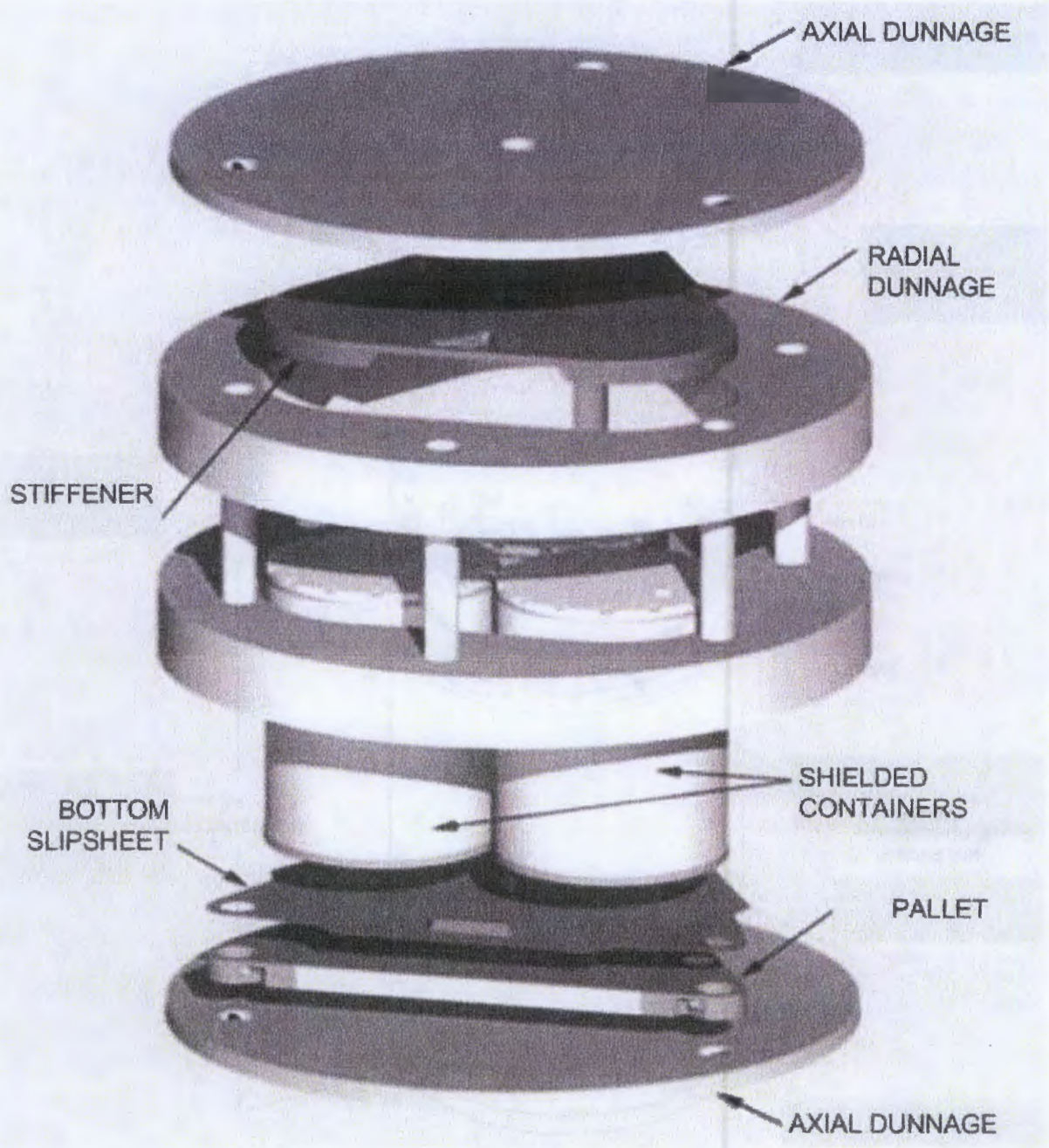

Figure 2
3-Pack Assembly of Shielded Containers with Axial and Radial Dunnage

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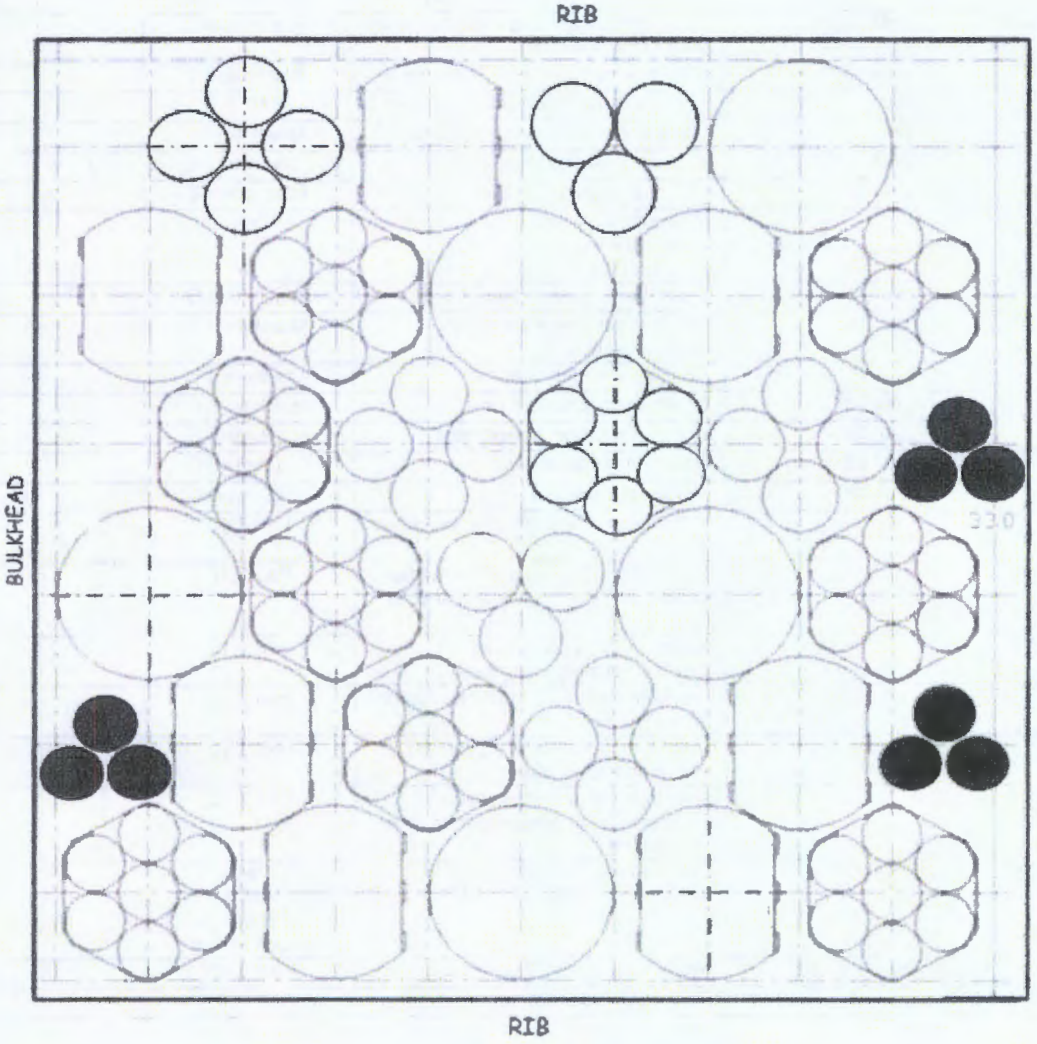

Figure 3
Shielded Containers – Randomly Placed in the Interstitial Spaces in Waste Rows

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Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (Incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.13		Contents of Part A permit application	Attachment B, Part A		✓
§270.14(b)(1)		General facility description	Attachment A		✓
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment C		✓
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment C		✓
	§264.13(c)	Off-site waste analysis requirements	Attachment C		✓
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Part 2.6		✓
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment E		✓
	§264.174	Container inspections	Attachment E	✓	
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment E		✓
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment D		✓
	§264.51	Contingency plan design and implementation	Attachment D		✓
	§264.52 (a) & (c-f)	Contingency plan content	Attachment D	✓	
	§264.53	Contingency plan copies	Attachment D		✓
	§264.54	Contingency plan amendment	Attachment D		✓
	§264.55	Emergency coordinator	Attachment D		✓
	§264.56	Emergency procedures	Attachment D		✓
§270.14(b)(8)		Description of procedures, structures or equipment for:	Part 2.10		✓
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Part 2.10		✓
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Part 2.10		✓
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Part 2.10		✓
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Part 2.10		✓
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Part 2.10		✓
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Part Part 4 Attachment A2 Attachment N		✓
	264 Subpart C	Preparedness and Prevention	Part 2.10		✓
	§264.31	Design and operation of facility	Part 2.10		✓
	§264.32	Required equipment	Part 2.10 Attachment D		✓
	§264.33	Testing and maintenance of equipment	Attachment E		✓
	§264.34	Access to communication/alarm system	Part 2.10		✓
	§264.35	Required aisle space	Part 2.10		✓
	§264.37	Arrangements with local authorities	Attachment D		✓
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Part 2.10		✓

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Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of tum lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment A4	✓	
§270.14(b)(11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		✓
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		✓
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		✓
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Part 2 Attachment F		✓
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Attachment G & H		✓
§270.14(b)(13)	§264.111	Closure performance standard	Attachment G		✓
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment G		✓
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment G		✓
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment G		✓
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment G		✓
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment G		✓
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment G		✓
§270.14(b)(13)	§264.115	Certification of closure	Attachment G		✓
§270.14(b)(13)	§264.116	Survey plat	Attachment G		✓
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment H		✓
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment H		✓
§270.14(b)(13)	§264.178	Closure/ containers	Attachment G		✓
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment G		✓
§270.14(b)(13)	§264.603	Post-closure care	Attachment G		✓
§270.14(b)(14)	§264.119	Post-closure notices	Attachment H		✓
§270.14(b)(15)	§264.142	Closure cost estimate	NA		✓
	§264.143	Financial assurance	NA		✓
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		✓
	§264.145	Post-closure care financial assurance	NA		✓
§270.14(b)(17)	§264.147	Liability insurance	NA		✓
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		✓
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment B Part A		✓

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Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment B Part A		✓
§270.14(b)(19)(iii)		Surface waters	Attachment B Part A		✓
§270.14(b)(19)(iv)		Surrounding Land use	Attachment B Part A		✓
§270.14(b)(19)(v)		Wind rose	Attachment B Part A		✓
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment B Part A		✓
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment B Part A		✓
§270.14(b)(19)(xi)		Drainage on flood control barriers	Attachment B Part A		✓
§270.14(b)(19)(xii)		Location of operational units	Attachment B Part A		✓
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Attachment B Part A		✓
§270.15	§264 Subpart I	Containers	Attachment A1	✓	
	§264.171	Condition of containers	Attachment A1		✓
	§264.172	Compatibility of waste with containers	Attachment A1		✓
	§264.173	Management of containers	Attachment A1	✓	
	§264.174	Inspections	Attachment E Attachment A1		✓
§270.15(a)	§264.175	Containment systems	Attachment A1		✓
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Part 2		✓
§270..15(d)	§264.177	Special requirements for incompatible wastes	Part 2		✓
	§264.178	Closure	Attachment G		✓
§270.15(e)	§264.179	Air emission standards	Part 4 Attachment N		✓
§270.23	264 Subpart X	Miscellaneous units	Attachment A2	✓	
§270.23(a)	§264.601	Detailed unit description	Attachment A2		✓
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Part 5 Attachment L		✓
§270.23(c)	§264.601	Potential exposure pathways	Part 4 Attachment A2 Attachment N		✓
§270.23(d)		Demonstration of treatment effectiveness	NA		✓
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Part 2 Part 4 Part 5		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
			Attachment A2 Attachment N		
	§264.603	Post-closure care	Attachment H Attachment H1	✓	
	264 Subpart E	Manifest system, record keeping, and reporting	Part 2 Attachment C		✓

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Appendix A
Table of Changes

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Table of Changes

Affected Permit Section	Explanation of Change	Page Number
Part 3, Condition 3.3.1.8.	Add "Section 3.3.1.8. Shielded Container" and "Each 30-gallon inner container has a gross internal volume of 4.0 ft^3 (0.11 m^3). This container will be used to emplace RH TRU mixed waste, but the shielding will allow it to be managed as CH TRU mixed waste. For the purpose of this Permit, shielded containers are managed and handled as CH TRU mixed waste containers, but will remain counted towards the volume of RH TRU mixed waste containers."	B-2
Part 4, Table 4.1.1.	Remove "container equivalent" column since the RH TRU mixed waste may now be disposed at the WIPP facility in containers other than canisters.	B-3
Part 4, Condition 4.3.1.8	Add Section "4.3.1.8 Shielded Container" and "Shielded containers are configured as a 3-pack."	B-4
Attachment A1, Section A1-1b(2)	Add "shielded containers which are received in HalfPACTs" Add "Shielded Container Remote-handled TRU mixed waste may be shipped to the WIPP facility in shielded containers arranged as 3-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37). Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed as CH TRU mixed waste."	B-5
Attachment A1, Section A1-1d(3)	Add "that is not in a shielded container" Add "RH TRU mixed waste received in shielded containers will be handled as CH TRU mixed waste"	B-5
Attachment A1, Section A1-1d(4)	Add "A1-1d(4) Handling Waste in Shielded Containers Remote-handled TRU mixed waste shipped to the WIPP facility in shielded containers will be handled and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit. An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is	B-5,B-6

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Affected Permit Section	Explanation of Change	Page Number
	removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2). A HalfPACT may hold one 3-pack assembly of shielded containers. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. Once the shielded container assembly is on the facility pallet, the radial dunnage will be removed for return to the generator along with axial dunnage. For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two 3-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2)."	
Attachment A1, Table A1-2	Revise Table A1-2 to add shielded containers.	B-7
Attachment A1, Figure A1-37	Add "Figure A1-37 Typical Shielded Container"	B-8
Attachment A2, Section A2-2a(1)	Add "two 3-packs of shielded containers" Delete "or"	B-9
Attachment A2, Section A2-2b	Add "and shielded containers" Delete "(e.g., TRUPACT IIs or HalfPACTs)," Add "one 3-pack of shielded containers" Add "or shielded containers"	B-9
Attachment A2, Table A2-1	Revise Table A2-1 to add shielded containers.	B-10
Attachment A4, Section A4-3	Add "one 3-pack of shielded containers," Add "two 3-packs of shielded containers,"	B-11
Attachment C1, Section C1-1a	Add "and shielded containers"	B-12
Attachment C1, Section C1-1a(1)	Add "and shielded containers" Delete "and" Add ",and shielded containers"	B-12,B-13

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Affected Permit Section	Explanation of Change	Page Number
Attachment C1, Table C1-8	Add "and shielded containers" Add "and shielded containers" to footnote [a]	B-14,B-15
Attachment D, Section D-1d	Add "RH TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as 3-packs." .	B-16
Attachment D, Section D-1e(1)	Add "or shielded containers"	B-16
Attachment E, Section E-1b(1)	Delete "CH TRU mixed" Add "that will be managed as CH TRU mixed waste" Add "," and delete "or" Add "or shielded containers as three (3) packs" Add "offsite waste that will be managed as" Add "Offsite waste that will be managed as"	B-17
Attachment G3, Section G3-4a	Add "TRU mixed waste including RH TRU mixed waste in shielded containers"	B-18
Attachment H1, Introduction	Add "Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1."	B-19

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Appendix B
Proposed Revised Permit Text

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: 001142

Proposed Revised Permit Text:

3.3.1. Acceptable Storage Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for storage of TRU mixed waste at WIPP. The Permittees are prohibited from storing TRU mixed waste in any container not specified in Permit Attachment A1, Section A1-1b, as set forth below:

3.3.1.8. Shielded Container

Each 30-gallon inner container has a gross internal volume of 4.0 ft^3 (0.11 m^3). This container will be used to emplace RH TRU mixed waste, but the shielding will allow it to be managed as CH TRU mixed waste. For the purpose of this Permit, shielded containers are managed and handled as CH TRU mixed waste containers, but will remain counted towards the volume of RH TRU mixed waste containers.

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Table 4.1.1.

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	~~Container Equivalent~~	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	~~400 RH TRU Canisters~~	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	15,720 ft^3 (445 m^3)	~~500 RH TRU Canisters~~	
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	~~600 RH TRU Canisters~~	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	**~~2960 RH TRU Canisters~~**	

[1] The area of each panel is approximately 124,150 ft^2 (11,533 m^2).

[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended).

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4.3. DISPOSAL CONTAINERS

4.3.1 Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.8. Shielded Container

Shielded containers are configured as a 3-pack.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers which are received in HalfPACTs and 55-gallon drums, which are received in a CNS 10-160B cask.

Shielded Container

Remote-handled TRU mixed waste may be shipped to the WIPP facility in shielded containers arranged as 3-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed as CH TRU mixed waste.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. RH TRU mixed waste received in shielded containers will be handled as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

A1-1d(4) Handling Waste in Shielded Containers

Remote-handled TRU mixed waste shipped to the WIPP facility in shielded containers will be handled and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

A HalfPACT may hold one 3-pack assembly of shielded containers. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the radial dunnage will be removed for return to the generator along with axial dunnage. For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two 3-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

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Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

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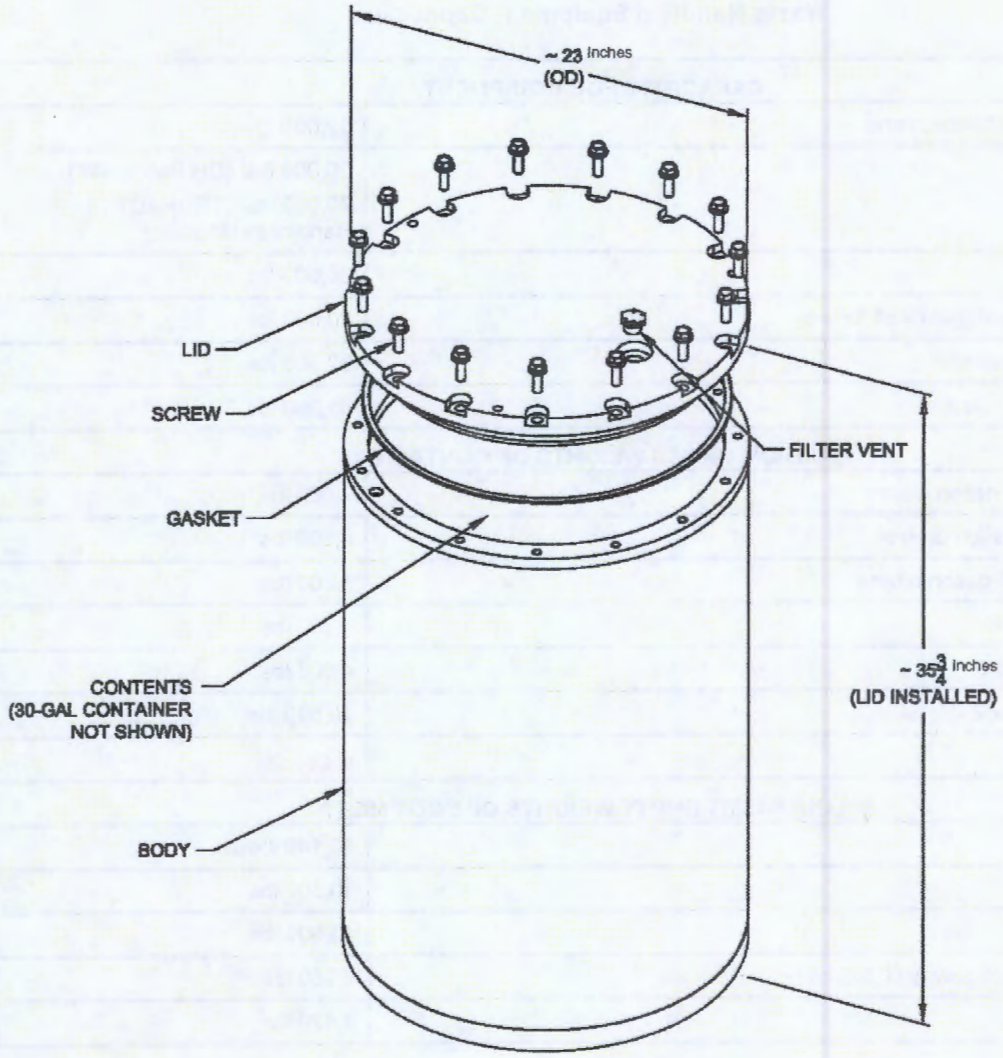

Figure A1-37
Typical Shielded Container

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A2-2a(1) CH TRU Mixed Waste Handling Equipment

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2 (**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, ~~or~~ four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

A2-2b Geologic Repository Process Description

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers ~~(e.g., TRUPACT IIs or HalfPACTs),~~ at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one 3-pack of shielded containers, or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

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A4-3 Waste Handling Building Traffic

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one 3-pack of shielded containers, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two 3-packs of shielded containers, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

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C1-1a Method Requirements

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, ~~and~~ SLB2s ,and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

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Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner

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Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

: 00156

D-1d Description of Containers

RH TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as 3-packs.

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers or shielded containers (7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, ~~or~~ one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

00157

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site ~~CH TRU mixed~~ waste that will be managed as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), ~~or~~ in standard large box 2s (**SLB2s**) or shielded containers as three (3) packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

As described in Permit Attachment A1, Section A1-1d(3), offsite waste that will be managed as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Offsite waste that will be managed as RH TRU mixed waste is handled and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

00159

ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

Introduction

Upon receipt of the necessary certifications and permits from the EPA and the New Mexico Environment Department, the Permittees will begin disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU and TRU mixed waste in the WIPP. This waste emplacement and disposal phase will continue until the regulated capacity of the repository of 6,200,000 cubic feet (175,588 cubic meters) of TRU and TRU mixed waste has been reached, and as long as the Permittees comply with the requirements of the Permit. For the purposes of this Permit Attachment, this time period is assumed to be 25 years. The waste will be shipped from DOE facilities across the country in specially designed transportation containers certified by the Nuclear Regulatory Commission. The transportation routes from these facilities to the WIPP have been predetermined. The CH TRU mixed waste will be packaged in 55-gallon (208-liter), 85-gallon (322-liter), 100-gallon (379-liter) steel drums, standard waste boxes (**SWBs**), ten drum overpacks (**TDOPs**), and/or standard large box 2s (**SLB2s**). An SWB is a steel container having a free volume of 66.3 cubic feet (1.88 cubic meters). Figure H1-2 shows the general arrangement of a seven-pack of drums and an SWB as received in a Contact-Handled Package. RH TRU mixed waste inside a Remote-Handled Package is contained in one or more of the allowable containers described in Permit Attachment A1. Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1.

Appendix C

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EVALUATION OF DRUM AGE CRITERIA FOR THE SHIELDED CONTAINER

September 2011
Revision 2

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Acronyms and Abbreviations

atm	atmosphere
DAC	drum age criterion
K	Kelvin
mol/s/mol fraction	mole/second/mole fraction
TRU	transuranic
VOC	volatile organic compound

1.0 Background and Purpose

Containers of transuranic (TRU) waste must meet a minimum age criterion before a volatile organic compound (VOC) gas sample collected from the waste container headspace is considered representative of the VOCs within the container. The drum age criterion (DAC) is the time required after container closure, or after container closure and container venting, before a headspace gas sample can be collected. The methodology described in "Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations" (BWXT, 2000) is the basis for the packaging-specific DAC values for debris waste (summary category S5000) currently approved in the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant ("Permit") (NMED, current version).

The shielded container is a new waste container that has been proposed for disposal at the Waste Isolation Pilot Plant. The shielded container is a vented carbon steel and lead cylindrical assembly with a removable lid. It is approved for the shipment of TRU waste in the HalfPACT package. Up to three (3) shielded containers can be shipped within a HalfPACT package.

The shielded container is designed to carry one 30-gallon payload drum. A partially exploded view of the shielded container, including its 30-gallon payload drum, is provided in Figure 1. In addition to the 30-gallon payload drum, the shielded container may optionally contain a plastic mesh drum handling bag to facilitate installation of the 30-gallon payload drum within the shielded container. If used, the optional drum handling bag is left open.

The shielded container and 30-gallon drum must each be installed with a filter vent. TRU waste is placed into a vented 30-gallon drum, which is then loaded into the shielded container.

Packaging-specific DAC values were previously determined for a number of packaging configurations (BWXT, 2000, Shaw 2003). The DAC for each packaging configuration was determined using the computer program VDRUM that solved a series of differential equations describing the VOC transport phenomena within the waste container (BWXT, 2000 and Connolly et al, 1998). Model input parameters include the physical properties of VOCs, the initial concentration profile in the waste container, physical dimensions of each confinement layer (thickness, surface area, void volume), and the hydrogen diffusion characteristics of filter vents installed on the waste containers (BWXT, 2000 and Connolly et al, 1998). Model parameters and assumptions used in determining the DAC values have also been documented (Shaw 2003, BWXT, 2000 and Connolly et al, 1998).

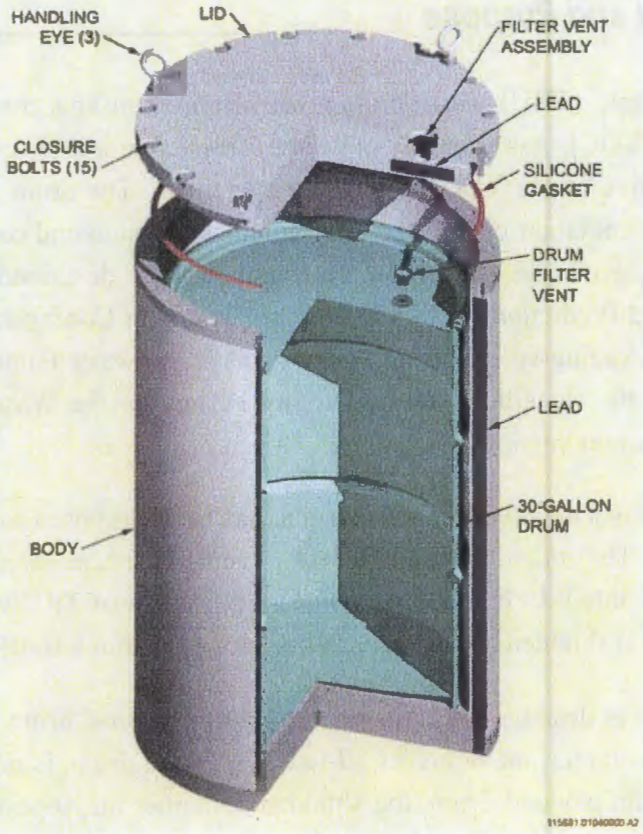


Figure 1
Shielded Container

The purpose of this report is to demonstrate that separate DAC values are not required for the shielded container or the 30-gallon drum (to allow for headspace sampling of stand-alone 30-gallon drum before being placed in the shielded container) because the existing 55-gallon drum default DAC values under Scenario 3, Packaging Configuration Group 3 (debris waste, summary category S5000) serve as reference upper bounds for the shielded container and 30-gallon drum packaging configurations, and therefore can be conservatively applied to the shielded container or 30-gallon drum. The inside volume of an empty shielded container is approximately 159 liters (Day, 2008) compared to 208 liters for an empty 55-gallon drum. As the waste will be loaded in a 30-gallon drum, a shielded container packaging configuration (and, by definition, the 30-gallon drum configuration) will hold less waste and has less available void volume than a typical 55-gallon drum loaded with debris waste. In addition, the shielded container packaging configurations will not use a rigid drum liner. Based on sensitivity studies (BWXT, 2000) these differences should result in lower DACs for the shielded container, and therefore the default 55-gallon drum DACs under Scenario 3, Packaging Configuration Group 3, should serve as conservative upper bounds. The next sections demonstrate that the DAC value

for the shielded container (and the stand-alone 30-gallon drum) is indeed bounded by the existing 55-gallon drum packaging configuration DAC.

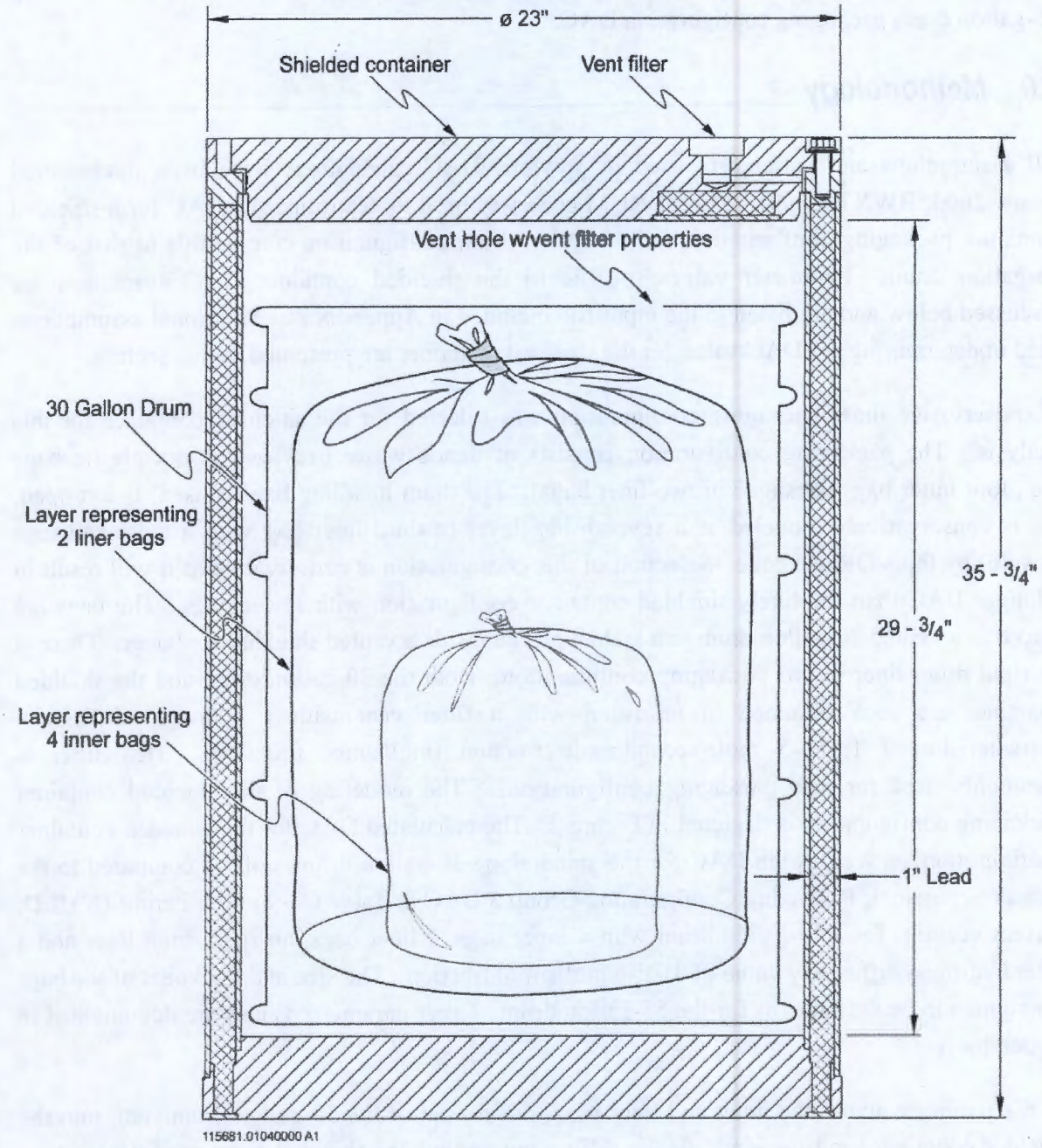
2.0 Methodology

All assumptions and parameters used in previous DAC calculations have been documented (Shaw 2003, BWXT, 2000). The VDRUM code was used to determine the DAC for a shielded container packaging configuration and 30-gallon drum configuration comparable to that of the 55-gallon drum. Parameter values specific to the shielded container DAC evaluation are discussed below and are listed in the input file included in Appendix A. Additional assumptions used in determining the DAC value for the shielded container are presented in this section.

A conservative inner packaging configuration was selected for the shielded container for this analysis. The packaging configuration consists of debris waste packaged in six plastic bags (i.e., four inner bags packaged in two liner bags). The drum handling bag (if used) is left open, but is conservatively modeled as a seventh bag layer (a third liner bag with a twist and tape closure) by the VDRUM code. Selection of this configuration is conservative as it will result in a longer DAC than the likely shielded container configuration with fewer bags. The bags are placed in a vented 30-gallon drum that is then placed inside a vented shielded container. There is no rigid drum liner in this packaging configuration. Both the 30-gallon drum and the shielded container are each assumed to be fitted with a filter vent with a hydrogen diffusivity characteristic of 1.85E-5 mole/second/mole fraction (mol/s/mol fraction). This filter is commonly used for new packaging configurations. The modeling of the shielded container packaging configuration is depicted in Figure 2. The calculated DAC for the shielded container configuration, as well as the DAC for the stand-alone 30-gallon drum, will be compared to the default Scenario 3, Packaging Configuration Group 3 DAC in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum with 4 inner bags, 2 liner bags, no rigid drum liner and a filter hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction. The size and thickness of the bags is assumed to be the same as for the 55-gallon drum. Other parameter values are documented in Appendix A.

VOCs permeate across the inner and liner bags, diffuse out of the 30-gallon drum vent, into the shielded container headspace, and finally diffuse out through the shielded container filter vent.

In this and all previous DAC calculations (Shaw 2003, BWXT, 2000 and Connolly et al, 1998), it is conservatively assumed that the VOC concentration within the innermost confinement layer is constant due to thermodynamic equilibrium of the gas phase surrounding the VOC-contaminated waste matrix.



Note: Optional drum handling bag not shown.

Figure 2
VDRUM Model of Shielded Container Packaging Configuration

To model this configuration using VDRUM, the hydrogen diffusion value of the 30-gallon drum filter vent is expressed as an equivalent surface area of the opening in the lid. If the transport rate of a VOC across a filter vent and an opening are set equal to each other (BWXT, 2000), then an equivalent opening surface area can be defined in terms of the VOC diffusivity across the filter vent:

$$D^*_{VOC}\Delta y = \frac{D_{VOC}A_d c}{x_d}\Delta y \qquad (1)$$

where

D^*_{VOC} = VOC diffusivity across filter vent, mole s^{-1}

D_{VOC} = VOC diffusivity in air, cm^2 s^{-1}

A_d = surface area of opening in confinement layer, cm^2

c = gas concentration, mole cm^{-3}

x_d = thickness of confinement layer at opening, cm

Δy = VOC mole fraction difference across confinement layer

Rearranging Equation (1) yields

$$A_d = \frac{D^*_{VOC}x_d}{D_{VOC}c} \qquad (2)$$

From Shaw, 2003 the ratio of VOC diffusivity across a filter vent to that across air is assumed equivalent to the ratio of hydrogen across a filter vent to that of hydrogen in air:

$$\frac{D^*_{VOC}}{D_{VOC}} = \frac{D^*_{H_2}}{D_{H_2}} \qquad (3)$$

where

D^*_{H2} = Hydrogen diffusivity across filter vent, mole s^{-1}

D_{H2} = Hydrogen diffusivity in air, cm^2 s^{-1}

Therefore, the equivalent surface area of an opening in a confinement layer can be expressed in terms of hydrogen diffusivity across the filter vent in the confinement layer

$$A_d = \frac{D^*_{H_2} x_d}{D_{H_2} c} \tag{4}$$

The ideal gas law estimates the gas concentration:

$$c = \frac{P_{atm}}{RT} \tag{5}$$

where

P_{atm} = pressure, atmosphere (atm)
T = temperature, Kelvin (K)
R = gas constant = 82.06 cm^3 atm/(g-mole) K

Hydrogen diffusivity is estimated using the Fuller, Schettler, and Giddings equation (Shaw, 2003):

$$D_{H_2} = \frac{0.00143T^{1.75}}{PM^{0.5}_{H_2,air}\left[(\Sigma_v)^{1/3}_{H_2} + (\Sigma_v)^{1/3}_{air}\right]^2} \tag{6}$$

where

T = gas temperature, K
P = pressure, bar
$M_{H2,air}$ = $2\,[1/M_{H2} + 1/M_{air}]^{-1}$
M_i = molecular weight of component i, gram (gram-mole)$^{-1}$
$(\Sigma_v)_i$ = atomic diffusion volume of component i

where

$M_{H2} = 2.016$ $(\Sigma_v)_i = 6.12$
$M_{air} = 28.97$ $(\Sigma_v)_i = 19.7$ (BWXT, 2000)

In the case of hydrogen-air system at T = 298.2 K and P = 1 atmosphere = 1.01325 bar, the diffusivity is:

$$D_{H2} = 0.758\ cm^2\ s^{-1}$$

Assuming an area thickness of 1.0 cm, the equivalent surface area for the 30-gallon drum filter vent of 1.85 x 10^{-5} mol/s/mol fraction diffusivity is the following:

$$A_d = \frac{1.85x10^{-5}(82.06)(298.2)}{0.758} = 0.597\ cm^2$$

3.0 Results

The DAC calculated using an established methodology (BWXT, 2000) for a representative shielded container packaging configuration (four inner bags packaged in two liner bags inside an optional drum handling bag inside a 30-gallon drum fitted with a 1.85E-5 mol/sec/mol fraction filter inside a shielded container fitted with a 1.85E-5 mol/sec/mol fraction filter) is documented in the output file included in Appendix A. The longest DAC is 16 days based on the VOC methyl isobutyl ketone. This DAC is equivalent to the Scenario 3, Packaging Configuration Group 3 DAC of 16 days in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum with 4 inner bags, 2 liner bags (bounding case), no rigid drum liner, and a filter hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction. Thus, the analysis has demonstrated that separate DAC values are not required for the representative shielded container packaging configuration because the existing default 55-gallon drum DACs under Packaging Configuration Group 3 serve as upper bounds and should be used.

The DAC for directly sampling the headspace of the 30-gallon drum, prior to placing in a shielded container, was also evaluated. This DAC, calculated as 10 days, is also bounded by the Packaging Configuration Group 3 DAC of 16 days in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum. The input and output files for the 30-gallon drum configuration are also presented in Appendix A.

4.0 References

BWXT, see Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly.

Connolly, M.J. et al., 1998, *Position for Determining Gas Phase Volatile Organic Concentrations in Transuranic Waste Containers*, INEEL-95/0109, Rev. 2, Idaho National Engineering Laboratory, Idaho Falls, ID (1998).

Day, B., 2008, *Calculation of Void Volume Inside a Shielded Container Loaded with a 30-gal Drum using a Polypropylene Drum Handling Bag*" Washington TRU Solutions LLC, Carlsbad, New Mexico.

Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly (BWXT), 2000, *Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations*, INEEL/EXT-2000-01207, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

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NMED, see New Mexico Environment Department

Shaw, see Shaw Environmental and Infrastructure, Inc.

Shaw Environmental and Infrastructure, Inc. (Shaw), 2003, Determination of Drum Age Criteria Values for Ten-Drum Overpacks, 85-Gallon Drums, and 100-Gallon Drums, Revision 1, Shaw Environmental and Infrastructure, Inc, Albuquerque, New Mexico.

Appendix A
Input and Output Files Associated with the Shielded Container and 30-Gallon Drum DAC Value Determination

This appendix includes the input and output files for the shielded container and the 30-gallon drum that document the calculation of DAC values using the methodology described in BWXT (2000).

The computer program VDRUM used for deriving DAC values in BWXT (2000) employs input files of required data and reports the time for volatile organic compounds (VOCs) to reach at least 90 percent of their steady state concentrations. The input file for each packaging configuration includes the same data structure beginning with the input and output file names and the number of VOCs evaluated. Each VOC included in the analysis has two lines of input data, the initial concentrations in the layers of confinement and the physical and chemical properties. The physical characteristics, such as thickness and surface area, of each type of confinement layer are entered.

To determine the drum age criteria, the greatest time in days is selected from the VOCs (shown in bold in the output data listing). The data structures for the input and output files are shown in the following sections.

Input File Format

Line 1: Input file name, output file name, number of VOCs evaluated

Line 2: Name of VOC #1, $[IB]_0$, $[LB]_0$, $[LHS]_0$, $[DHS]_0$

Where:

$[IB]_0$ – Initial VOC concentration (ppmv) in inner bags
$[LB]_0$ – Initial VOC concentration (ppmv) in liner bags
$[LHS]_0$ – Initial VOC concentration (ppmv) in drum liner headspace
$[DHS]_0$ – Initial VOC concentration (ppmv) in drum headspace

Line 3: MW, ρ, D, T_c, P_c, D*, H, k, G (see Reference 1 for VOC-specific values)

Where:

MW – VOC molecular weight (g/gmol)
ρ – VOC permeability in polyethylene @ 25°C, $cm^3(STP)\ cm^{-1}\ sec^{-1}\ (cmHg)^{-1}$
D – VOC diffusivity in air @ 25°C, $cm^2\ s^{-1}$
T_c – VOC critical temperature, K
P_c – VOC critical pressure, atm
D* – VOC diffusivity across filter vent, mol/s/mol fraction
H – VOC Henrys constant for polyethylene drum liner, $(cm^3$ polymer) atm/$(cm^3$ (STP) gas)
k – VOC mass transfer coefficient at drum liner surface, s^{-1}
G – VOC generate rate (always set to 0 (zero)).

Lines (2n, 2n+1): Information for n^{th} (last) VOC

Line (2n+2): $A_p(1)$, $A_d(1)$, $V(1)$, $x_p(1)$, $x_d(1)$

Line (2n+3): $A_p(2)$, $A_d(2)$, $V(2)$, $x_p(2)$, $x_d(2)$

Line (2n+4): $A_p(3)$, $A_d(3)$, $V(3)$, $x_p(3)$, $x_d(3)$

Line (2n+5): $A_p(4)$, $A_d(4)$, $V(4)$, $x_p(4)$, $x_d(4)$

Where:

A_p – permeable surface area, cm^2
A_d – diffusional cross-sectional area, cm^2
V – void volume inside layer of confinement, cm^3
x_p – layer thickness, cm
x_d – length of diffusional path length, cm
1 – inner bag
2 – drum liner bag
3 – drum liner headspace
4 – drum headspace

Line (2n+6): T, P, D_v*

Where:

T – gas temperature = 25°C
P – gas pressure = 76 cm Hg
D_v* – hydrogen diffusion characteristic across drum filter vent, mol/s/mol fraction

Output File Format

Line 1: Input file name

Lines 2, n+1: VOC, DAC, [DAC], [SS]

Where:

VOC – name of VOC
DAC – drum age criterion, days
[DAC] – VOC concentration at the time of the DAC value, ppmv
[SS] – VOC concentration at steady-state conditions, ppmv

Specific information about data input includes the following:

- The hydrogen release rate across the 30-gallon drum is defined by the hydrogen diffusivity of the filter vent. The DAC value was calculated for a diffusivity value of 1.85E-5 mol/s/mol fraction for the 30-gallon drum filter vent.

- T_c, P_c are required if D = 0 (i.e., when VOC diffusivity in air is not specified).
- T_c, P_c, D_v* are required if D* = 0 (i.e., when VOC diffusivity across filter vent is not specified) and the drum is vented.
- If D > 0 and D* > 0 (i.e., when diffusivities are specified), T_c and P_c can equal zero.
- No VOC gas generation is assumed; therefore, g equals zero.
- Only gas permeation across bags is considered, so $A_d = x_d = 0$ (for bags only).
- Although a rigid drum liner is not included in the packaging configuration, the VDRUM model includes a rigid drum liner layer in the input file and specification of A_p and x_p is required to estimate the volume of liner material. In order to nullify the effects of resistance to permeation of the non-existent rigid drum liner, x_p is set to a very small, non-zero value as shown in the input file, making the resistance to permeation of VOCs through this layer negligible.
- The shielded container packaging configuration parameter values are assumed to be the same as those for the corresponding 55-gallon drum (BWXT, 2000) values of bag thickness and surface area.
- The drum handling bag, though open at the top, is conservatively modeled as a third liner bag with twist and tape closure. The bag adds a thickness of 0.028 cm for 0.084 cm total. These values are shown in the corresponding input file.
- Assumptions for void volumes between the inner and liner bags and within the 30-gallon drum headspace are scaled by a factor of 30/55 from the corresponding 55-gallon drum void volumes previously used (BWXT, 2000). Thus, the void volume between inner and liner bags is 10,900 cm^3 (scaled from the 55-gallon drum value of 20,000 cm^3). The void volume in the 30-gallon drum headspace is 15,300 cm^3 (scaled from the 55-gallon drum value of 28,000 cm^3)
- The void volume between the 30-gallon drum and the shielded container is 37,284 cm^3 (Day, 2008).
- The release rate from the shielded container filter vent was set to a diffusivity of 1.85E-5 mol/s/mol fraction. Because VDRUM only allows entry of one filtered layer of confinement, the filter on the 30-gallon drum was accounted for by adjusting the parameter values for diffusion through the rigid drum liner layer hole to match the characteristics of the 30-gallon drum filter diffusion (the rigid drum liner layer is required in the VDRUM model). The modeled dimensions of the rigid drum liner hole are adjusted so the effective release rate equals the diffusivity value of 1.85E-5 mol/s/mol fraction 30-gallon drum filter vent. The 1.85E-5 mol/sec/mol fraction filter vent is modeled as a hole with an area of 0.597 cm^2 through a 1.0 cm thick layer.

Input File for Shielded Container DAC Evaluation

```
'shieldcontvdrum','shieldcontvdrum.out',12
'carbon tetrachloride',1000.,0.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',1000.,0.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',1000.,0.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',1000.,0.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',1000.,0.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',1000.,0.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',1000.,0.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',1000.,0.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',1000.,0.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',1000.,0.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',1000.,0.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',1000.,0.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
14000.,0.,0.,0.050,0.
14000.,0.,10900.,0.084,0.
12800.,0.597,15300.,0.00005,1.0
0.,0.,37284.,0.,0.
25.,76.,1.85e-5

c       shielded container, w/30-gal drum, each w/ filter vent, 4 inner bags, 2 liner bags
c         Drum handling bag modeled as a third twist and tape liner bag even though
c         bag is open at top. The bag adds a thickness of 0.028 cm for 0.084 cm total.
c       Value for volume within innermost bags not required.
c       Void volume between bags: 10,900 cm3 (scaled from 55-gal drum value of 20,000 cm3)
c       Bag thickness same as Scenario 3
c       Void volume in 30-gal drum headspace = 15,300 cm3 (scaled from 55-gal drum value of 28,000 cm3)
c       Void volume between 30-gal and shielded container: 37,284 cm3
c       No liner so no solubility for VOCs (thus, 30-gal drum as  "liner thickness" xp = 0.00005 cm)
c       Effective surface area across 30-gal drum  filter (assuming xd= 1.0 cm): Ad = 0.597 cm2
c       so effective H2 release rate equals 30-gal drum filter vent, D*(H2)=1.85e-5 mol/s/mol fraction
c       D*H2 = total H2 diff. char. across shielded container filter vent = 1.85e-5 mol/s/mol fr
c       VOC diff. char. estimated knowing D*H2, VOC Tc, VOC Pc
```

Output File for Shielded Container DAC Evaluation

shieldcontvdrum			
carbon tetrachloride	14	399.5111	438.5642
methanol	11	346.9043	379.4464
dichloromethane	11	403.0082	443.6181
toluene	12	436.2250	480.7493
trichloroethylene	12	436.7753	477.0292
butanol	12	412.6895	456.2111
chloroform	12	406.4105	448.6669
1,1-dichloroethene	15	359.0007	392.9815
methyl ethyl ketone	14	389.6570	425.0542
methyl isobutyl ketone	**16**	**380.5107**	**419.6800**
1,1,2,2-tetrachloroethane	11	444.8763	493.8665
chlorobenzene	12	431.7012	479.1213

Input File for 30-Gallon Drum DAC Evaluation

'30galdrum','30galdrum.out',12
'carbon tetrachloride',1000.,0.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',1000.,0.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',1000.,0.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',1000.,0.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',1000.,0.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',1000.,0.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',1000.,0.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',1000.,0.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',1000.,0.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',1000.,0.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',1000.,0.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',1000.,0.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
14000.,0.,0.,0.050,0.
14000.,0.,10900.,0.056,0.
12800.,150.,40000.,0.00005,1.4
0.,0.,15300.,0.,0.
25.,76.,185.e-7
c 30-gal drum w/ filter vent, 4 inner bags, 2 liner bags
c Value for volume within innermost bags not required.
c Void volume between bags: 10,900 cm3 (scaled from 55-gal drum value of 20,000 cm3)
c Bag thickness same as Scenario 3
c Void volume in 30-gal drum headspace = 15,300 cm3 (scaled from 55-gal drum value of 28,000 cm3)
c No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c 30-gal drum filter vent = 1.85e-5 mol/s/mol fr
c VOC diff. char. estimated knowing D*H2, VOC Tc, VOC Pc

Output File for 30-Gallon Drum DAC Evaluation

30galdrum			
carbon tetrachloride	7	756.5144	814.9987
methanol	8	612.8073	663.1251
dichloromethane	5	762.1498	828.8836
toluene	3	904.2119	935.8895
trichloroethylene	3	878.6143	924.7414
butanol	5	809.4791	864.1644
chloroform	5	769.9742	842.9145
1,1-dichloroethene	**10**	**639.2377**	**696.2681**
methyl ethyl ketone	7	704.3638	778.6090
methyl isobutyl ketone	9	696.7892	764.4190
1,1,2,2-tetrachloroethane	1	950.9211	976.5667
chlorobenzene	3	887.4651	930.9960

Item 3

Class 2 Permit Modification Request

Revise the WIPP Groundwater Detection Monitoring Program Plan

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP Permit Number - NM4890139088-TSDF

SEPTEMBER 2011

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Acronyms and Abbreviations

ASER	Annual Site Environmental Report
CBFO	Carlsbad Field Office
CFR	Code of Federal Regulations
DMP	Detection Monitoring Program
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
HWDU	Hazardous Waste Disposal Unit
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
Permit	Hazardous Waste Facility Permit
PMR	Permit Modification Request
QAO	quality assurance objective
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
TOX	total organic halogen
TRU	transuranic
V and V	verification and validation
WIPP	Waste Isolation Pilot Plant
WLMP	Water Level Monitoring Program
WTS	Washington TRU Solutions LLC

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Overview of the Permit Modification Request

This document contains one Class 2 permit modification request (**PMR**) to the Hazardous Waste Facility Permit (**Permit**) for the Waste Isolation Pilot Plant (**WIPP**) facility, Permit Number NM4890139088-TSDF.

This PMR is being submitted by the U.S. Department of Energy (**DOE**), Carlsbad Field Office (**CBFO**) and Washington TRU Solutions LLC (**WTS**), collectively referred to as the Permittees, in accordance with the Permit Part 1, Condition 1.3.1 (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40 Code of Federal Regulations (**CFR**) §270.42(d)).

These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the WIPP Permit and related supporting documents are provided in this PMR. The proposed modification to the text of the WIPP Permit has been identified using red text and a double underline and a ~~strikeout~~ font for deleted information. The following information specifically addresses how compliance has been achieved with the WIPP Permit Part 1, Condition 1.3.1. for submission of this Class 2 PMR.

1. **20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(i)), requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the Permit.**

This PMR proposes to make changes to the groundwater monitoring program as described in Permit Part 5 and Attachment L. The Table of Changes and redline/strikeout in Attachments A and B of this modification, respectively, and the discussion below describe the exact changes to be made to the Permit Conditions and supporting documents. These changes are being made in accordance with the Groundwater Permit Modification Work Plan approved by the NMED on August 5, 2011. The approved Groundwater Permit Modification Work Plan and the NMED approval letter are included in Attachment C to this PMR. The purpose of the Groundwater Permit Modification Work Plan is to address the content of the PMR and the process that the Permittees' will follow to prepare and submit the PMR. The Groundwater Permit Modification Work Plan tentative schedule includes discussing the Draft PMR with Stakeholders and the NMED. The Draft PMR was provided to Stakeholders and the NMED on August 15, 2011. The Draft PMR was then discussed with the Stakeholders and the NMED on August 30, 2011 at the Pre-submittal meeting in Albuquerque, NM.

The PMR includes, but is not limited to, the items in the Groundwater Permit Modifcation Work Plan described below. The elements of the Groundwater Permit Modification Work Plan are shown in **Bold** font below and the descriptions of the proposed changes are shown in *italized* text.

- **Revise sources of confusion and ambiguities.**

  *The Permit contains confusing references to the components of the groundwater monitoring plan and to the various elements of the program. The modification request proposes clarification by describing the program as the Groundwater Monitoring Program consisting of two components: the Detection Monitoring Program (**DMP**) and the Water Level Monitoring Program (**WLMP**). The DMP consists of six wells that are*

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sampled, analyzed, and reported annually. The WLMP consists of over 40 wells that are measured monthly and reported semi-annually.

- **Specifically identify which wells are used for density measurements.**

  A new table, Attachment L, Table L-4, was added to identify the Culebra wells used for obtaining density measurements.

  - **Specify frequency for density measurements and assessment.**

    Attachment L, Section L-4c(1) was revised to specify the frequency for density measurements as annually.

  - **Specify how density measurements are performed.**

    Attachment L, Section L-4c(1), last paragraph, now describes the means of how density measurements are performed.

- **Include a specific list of wells that must be monitored for water levels.**

  - **Exclude non-Culebra wells from those required for water level measurements.**

    A new table, Attachment L, Table L-4, lists the Culebra wells for water level monitoring. Non-Culebra wells have been excluded.

- **Remove all references to the non-Culebra sampling well identified as WQSP-6A.**

  This change was made when the Permit was renewed in 2010. Therefore, no change is being proposed.

- **Clarify the need for, and use of, written procedures for both field work and non-field work, including the procedure for developing a potentiometric surface map annually.**

  The sections listed below were revised to clarify the need for, and use of, written procedures (referred to as standard operating procedures or SOPs) for both field work and non-field work:

  Attachment L, Sections L-1, L-4c(1), L-4c(1)(i), L-4c(1)(ii), L-4c(2)(i), L-4c(2)(ii), L-4c(2)(iii), L-4c(2)(iv), L-4c(2)(v), L-4d(1), L-4d(2),L-7a(4),L-7c, L-7d, L-7e, L-7f, L-7g, L-7h, L-7i, and Table L-3.

  In addition, the SOP descriptions were removed from the text, updated, and included as the new Table L-3. The procedure for developing a potentiometric surface map was added to Attachment L, Section L-5c.

- **Clarify the data quality objectives section and explain data quality objectives and quality assurance objectives and the difference between the quality assurance objectives for field work and laboratory analysis.**

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*The data quality objectives (**DQOs**) and quality assurance objectives (**QAOs**) are clearly identified, revised, and separated into Attachment L, Sections L-7a(1), Data Quality Objectives, and new Section L-7a(2), Quality Assurance Objectives. These changes clearly define the DQOs for each Groundwater Monitoring Program component and clarify the associated QAOs.*

- **Remove specificity regarding departments and organizations and replace those terms with "the Permittees."**

  Attachment L, Section L-7, Project Organization and Responsibilities, has been deleted. References to departments, organizations, and titles referenced in Attachment L are eliminated or replaced with "Permittees."

  The sections that were revised are listed below:

  Attachment L, Sections L-4c(2)(i), L-4c(2)(ii), L-4c(2)(v), L-4c(3), L-5(a), L-5(b), and L-5(c).

  *Updated the organization that performs data verification and validation (**V and V**) in Attachment L, Section L-4c(3).*

- **Add background values from the "Waste Isolation Pilot Plant Resource Conservation and Recovery Act Background Groundwater Quality Baseline Report" and Addendum 1, IT Corporation, July 2000, to be used for making statistical determinations of contamination.**

  This change was made when the Permit was renewed in 2010. Therefore, no change is being proposed.

- **Separate parameters from constituents so that general chemistry parameters (e.g., pH, calcium) are separated from the hazardous constituents.**

  This change was made when the Permit was renewed in 2010.

- **Clarify serial sampling requirements including the following:**

  - **Remove several field parameters that are not indicators of stabilization, such as chloride, divalent cations, alkalinity, total iron, and Eh.**

    This change was made in Attachment L, Section L-4c(2)(ii).

  - **Remove the bubbler line requirements.**

    This change was made in Attachment L, Section L-4c(2)(i).

  - **Restrict serial sampling for stabilization to no more than three well bore volumes.**

    This change was made in Attachment L, Section L-4c(2)(i) and L-4c(2)(ii).

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- **Change the frequency of performing groundwater sampling and analysis to an annual basis rather than semi-annually.**

  - **Change the frequency of reporting to annually rather than semi-annually.**

    The modification includes clarification regarding when sampling data will be submitted. The Permittees are proposing annual sampling instead of semi-annual sampling based on 15 years of data that show little or no change in constituent concentrations. The Permittees are proposing a specific date that the report will be due to the NMED.

    A November 30 submittal will be in the form of an "Annual Culebra Groundwater Report" which includes the Annual Culebra Groundwater sampling results.

    See Part 5, Conditions 5.5.1, 5.10.2.1, 5.10.2.2, 5.10.2.3, Attachment L, Sections L-4a, L-4c(3), L-4e(4), L-5b, L-5c, Table L-2.

- **Change the frequency of reporting water level values to twice per year rather than monthly.**

  The details of the proposed changes with regard to WLMP reporting are as follows:

  - *Effective on the first reporting date after approval of the PMR, the Permittees will provide a groundwater level report to the NMED semi-annually according to the following schedule:*

    1. *By May 31 for groundwater level measurements taken between August 1 and January 31.*

    2. *By November 30 for groundwater level measurements taken between February 1 and July 31. The Permittees will combine the November water level data report with the November "Annual Culebra Groundwater Report."*

    3. *Each semi-annual report will include a hydrograph for each Culebra monitoring well. The hydrograph will show both uncorrected (as measured) and corrected (to equivalent freshwater) heads.*

    4. *Each semi-annual report will include a hydrograph for each Culebra monitoring well beginning with the 2005 sampling year and displaying at least five years of continuous measurement.*

    5. *In the November "Annual Culebra Groundwater Report," the Permittees will provide a Culebra Potentiometric Surface Map, corrected to equivalent freshwater heads.*

  See Part 5, Conditions 5.10.2.2, 5.10.2.3, Attachment L, Sections, L-4c(1), L-4c(1)(ii), L-5b,L-5c.

  - **Include enhanced interpretation in the form of annotated hydrographs.**

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Attachment L, Section L-4c(1)(ii) was revised to stipulate that the semi-annual groundwater reports will include annotated hydrographs and trend analysis.

- **Include flow rate and direction determination in the annual detection monitoring report.**

  The Permittees have clarified that flow rate and direction determinations will be included in the "Annual Culebra Groundwater Report" required by Attachment L, Section L-5c. Only the downgradient wells could trigger actions leading to compliance monitoring. Based on transport modeling, the only wells that would likely intercept a contaminant plume are downgradient wells WQSP 4 to 6 from the WIPP shaft area. These wells are located between the shafts and the facility boundary such that detection would occur long before any contamination would reach the boundary. The Culebra water surface mapping method, employed by the Permittees to demonstrate flow rate and direction, will provide a periodic demonstration that the flow paths continue to be in the direction of these downgradient wells.

  - **Remove the "Annual Site Environmental Report" (ASER) as a means of reporting flow rate and direction.**

    The PMR proposes to remove the ASER as a Permit deliverable and report the relevant groundwater flow rate and direction in the "Annual Culebra Groundwater Report."

    The PMR proposes to remove requirements to report radionuclide analytical results annually to the NMED. These are not measured under the Permit and were previously provided as part of the ASER.

    See Part 5, Condition 5.10.2.3, Attachment L, Sections, L-4e(4), L-5b, L-5c.

- **Revise the statistical process for data analysis to be consistent with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(h)).**

  The PMR clarifies how temporal and spatial analyses and statistical evaluations are performed.

  See Attachment L, Sections L-4e, L-4e(1), L-4e(2), L-4e(3).

- **Update figures, tables, and text with current information.**

  The PMR proposes to remove obsolete content throughout Part 5 and Attachment L. This includes conditions in the Permit that only applied to the initial baseline sampling and is no longer required. This language is proposed for deletion and past-tense statements are either completed or are made current. For example, in Section L-4e(4) added, "TRU mixed" to clarify the point in time when baseline measurements ceased.

- **Describe the methodology for generation of the Culebra Potentiometric Surface Map whereby the Permittees determine the groundwater flow rate and direction annually in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.98(e)).**

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In Attachment L, Section L-5c, Bullet #7 clarifies the methodology for groundwater surface elevations including how the potentiometric map is determined and drawn. The Permittees have proposed a procedure for generating the potentiometric map that is required by the Permit. This procedure is designed to reflect the most recent hydrological information regarding the Culebra and uses the most recent water level measurements and water densities. The Permittees propose that the potentiometric map be generated using the following steps:

- *Examine hydrographs to identify the month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.*
- *Convert water levels from the subject month to equivalent freshwater heads using fluid densities appropriate to the date.*
- *Fit the trend surface through freshwater heads.*
- *Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (PABCs) and define initial fixed-head boundary conditions based on the trend surface.*
- *Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.*
- *Run MODFLOW with optimal boundary conditions fit.*
- *Contour MODFLOW head results on WIPP site.*
- *Compute the particle path and travel time from the Waste Handling Shaft to the LWA Boundary.*
- *Data analysis that will accompany the potentiometric surface map will include:*
  - *Measured versus modeled scatter plot diagram*
  - *Frequency of modeled head residuals*
  - *Modeled residual freshwater head at each well*
  - *Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).*

Other Proposed Changes

The Groundwater Permit Modification Work Plan states, "The PMR will include, but will not necessarily be limited to the modifications..." Therefore, the Permittees propose these changes that are not specifically listed in the Groundwater Permit Modification Work Plan.

- Clarify the contents of the Operating Record versus what will be retained on file at the facility but not in the Operating Record.

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The Permittees are clarifying which records are required to be in the Operating Record (20.4.1.501 NMAC, incorporating 40 CFR 264.73) versus those that will be kept on file at the facility.

- The Permittees are deleting the reference to Teflon and replacing it with "inert material."

  See Attachment L, Sections in L-4c(2).

- The Permittees have added a clarification that the analytical laboratory may deviate from SW 846 and/or request sample containers, volumes, and holding times that are different than those listed in Table L-6 with prior approval by NMED.

  See Attachment L, Table L-6 Note

- The Permittees have combined the Request for Analysis and Chain of Custody example forms into one form.

  See Attachment L, Section L-4c(2)(iv), L-4c(2)(v) and Figure L-13.

- The Permittees are deleting the requirement for non-dedicated sample collection lines and referring the cleaning of other non-dedicated components to SOPs.

  See Attachment L, Section L-4c(2)(iii).

- The Permittees are proposing the removal of total organic halogen (TOX) as a parameter.

  See Part 5, Condition 5.4, Table 5.4.a, and Attachment L, Section L-4c(2)(iii), Table 6.

- The Permittees are proposing to change the baseline value for methylene chloride to five micrograms per liter (µg/L).

  See Part 5, Table 5.6.

- *The Permittees are making numerous editorial changes throughout Part 5 and Attachment L and deleting redundant text.*

The following are examples of Editorial changes that the Permittees are proposing to clarify Permit text and make the text consistent:

  - *Standardize the term "ground-water" and "ground water" to the term "groundwater."*

  - *Eliminate "branching from the main sample line..." in Attachment L, Section L-4c(2)(iii) because it is redundant to text in Attachment L, Section L-4c(2)(i)*

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- *Consolidated the terms "WIPP", "WIPP facility", "WIPP site", "WIPP area", "WIPP vicinity", and "WIPP region" in an attempt to make the useage consistent with the definition of the permitted facility in Permit Part 1, Section 1.5.3.*

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

This is a Class 2 modification for the reasons listed below:

- "Changes in ground-water sampling or analysis procedures or monitoring schedule, with prior approval of the director...[1]1" pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.42, Appendix I, C. Ground-water protection, Item 2). The NMED provided prior approval of the classification with the approval of the Groundwater Permit Modification Work Plan.

- "Changes in the indicator parameters, hazardous constituents, or concentration limits (including ACLs): b. as specified in the detection monitoring program...2" pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.42, Appendix I, C. Ground-water protection, Item 5.b).

3. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(iii)), requires the applicants to explain why the modification is needed.

This PMR is needed to comply with the Groundwater Permit Modification Work Plan, approved by the NMED on August 5, 2011. The following discussion provides a brief explanation of why the changes are required by the Groundwater Permit Modification Work Plan. The exact change that is being made is described in Item 1 above and the attached redline/strikeout text in Attachment B. The following discussion is formatted to follow the Groundwater Permit Modification Work Plan. The elements of the Work Plan are shown in **Bold** font below. Where applicable, the description of proposed changes is shown in *italized* text and the explanation of why the change is being made is shown in blue.

- **Revise sources of confusion and ambiguities.**

  *The Permit contains confusing references to the components of the groundwater monitoring plan and to the various elements of the program. The modification request proposes clarification by describing the program as the Groundwater Monitoring Program consisting of two components: the Detection Monitoring Program (**DMP**) and the Water Level Monitoring Program (**WLMP**). The DMP consists of six wells that are sampled, analyzed, and reported annually. The WLMP consists of over 40 wells that are measured monthly and reported semi-annually.*

  The first item in the Groundwater Permit Modification Work Plan deals with ambiguities and confusion in the Permit with regard to the implementation of groundwater monitoring at the WIPP facility. The Permittees identified several specific examples of these sources and listed them in the Groundwater Permit Modification Work Plan.

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The first item in the Groundwater Permit Modification Work Plan deals with ambiguities and confusion in the Permit with regard to the implementation of groundwater detection monitoring requirements at the WIPP facility. Eliminating the sources of confusion and ambiguity is required to facilitate compliance with Permit and with Item 10.a. of the NMED stipulated Final Order NO. HWB-09-47. The Permittees identified specific examples of these sources and listed them in the Groundwater Permit Modification Work Plan. Ambiguities and confusing text dealt with areas such as groundwater well designation, water level measurement, procedures, data quality objectives, quality assurance objectives, and organizational responsibilities. However, before dealing with these specific sources, it is necessary to clarify the WIPP groundwater DMP and its program components to eliminate confusion with regard to what program components are used for compliance with various requirements.

Clarifying the program as the Groundwater Monitoring Program consisting of two components, the DMP and the WLMP, which eliminates confusion with regard to what program components are used to satisfy various requirements. Language in the Permit refers to the overall program and all wells as being the DMP. However, in other places, the DMP wells are limited to only the wells that are sampled and analyzed. In order to correct this, the Permittees are proposing language that defines the overall program as the Groundwater Monitoring Program with two components, the DMP and the WLMP. Each component has its own set of measurement wells and measurement activities and associated DQOs. The DMP consists of six wells that are sampled and analyzed annually to determine if contamination has been released from the disposal units. The WLMP consists of over 40 wells that are measured monthly and reported semi-annually to determine if assumptions regarding groundwater flow and direction remain valid.

- **Specifically identify which wells are used for density measurements.**

A new table, Attachment L, Table L-4, was added to identify the Culebra wells used for obtaining density measurements.

Density measurements are only relevant to Culebra water level determinations. Previously, the number of wells used was defined generally as those available for measurement. These wells included some that are too distant to have a meaningful impact on the facility water level determination and some that were completed in horizons other than the Culebra and had no impact on the water level mapping. The Permittees have optimized (McKenna 2004) the number and location of wells for making water level determinations and are proposing to establish these wells as a list in the Permit that can only be changed via a permit modification. The list eliminates non-Culebra wells from the measurement schedule since these measurements are not used to determine compliance with groundwater monitoring requirements of the Permit.

In addition, language has been clarified to ensure that the water levels are measured monthly, that densities are measured annually, that acceptable methods are used for making measurements, and that new density data are used in correcting measured water levels to freshwater heads. This language ensures that semi-annual and annual data submittals are of acceptable quality and are presented in a consistent manner that makes comparison of results over time possible. The measurement methodology and the procedure for drawing the maps (discussed subsequently) also ensure consistency between the data reported to the NMED for Permit compliance and data reported to the Environmental Protection Agency (EPA).

This change is required to clarify specifically what wells are used to obtain density measurements.

- **Specify frequency for density measurements and assessment.**

  Attachment L, Section L-4c(1) was revised to specify the frequency for density measurements as annually.

  The language in the Permit does not reflect the original intent of the Groundwater Monitoring Program to evaluate density annually. The language has been clarified to require measurement and evaluation annually.

- **Specify how density measurements are performed.**

  Attachment L, Section L-4c(1), last paragraph, now describes the means of how density measurements are performed.

  This clarification is required to provide instructions on how density measurements can be consistently performed. Measurement will be made using a hydrometer for DMWs, mobile pressure transducer for redundant wells, and fixed transducers in other wells. Calculations are presented in Attachment L, Section L-4c(1).

- **Include a specific list of wells that must be monitored for water levels.**

  - **Exclude non-Culebra wells from those required for water level measurements.**

    A new table, Attachment L, Table L-4 lists all Culebra wells for water level monitoring, excluding non-Culebra wells.

    Some confusion exists in the Permit regarding which wells are to be sampled or measured. The Permittees have clarified this by providing a list of Culebra wells for both the DMP and the WLMP (new Attachment L, Table L-4). Non-Culebra wells have been excluded because they provide no data for detection monitoring.

- **Clarify the need for, and use of, written procedures for both field work and non-field work, including the procedure for developing a potentiometric surface map annually.**

  The sections listed below were revised to clarify the need for, and use of, written procedures for both field work and non-field work:

  Attachment L, Sections L-1, L-4c(1), L-4c(1)(i), L-4c(1)(ii), L-4c(2)(i), L-4c(2)(ii), L-4c(2)(iii), L-4c(2)(iv), L-4c(2)(v), L-4d(1), L-4d(2),L-7a(4),L-7c, L-7d, L-7e, L-7f, L-7g, L-7h, L-7i, and Table L-3.

  In addition, the procedure descriptions were removed from the text, updated, and included as new Table L-3. The procedure for developing a potentiometric surface map was added to Attachment L, Section L-5c.

  Another source of confusion in the Permit has to do with procedures needed to conduct the Groundwater Monitoring Plan. The Permit lists specific procedures needed for field

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activities but is silent with regard to non-field procedures used to analyze and map groundwater data. Language regarding procedures is ambiguous. In order to eliminate this ambiguity, the Permittees are proposing a list of field and non-field procedures and a description of the process (procedure) for producing the annual potentiometric surface map.

This approach accomplishes three objectives. First, it satisfies the Resource Conservation and Recovery Act (**RCRA**) regulations that specify that certain groundwater activities be performed in accordance with procedures and that personnel be trained to those procedures and use them during monitoring activities. This table lists the minimum RCRA requirements that are to be included in procedures. Second, it removes the details of the procedures from the Permit, thereby giving the Permittees the flexibility to change procedures to accommodate administrative changes or changes in sampling or analytical methods without having to seek a permit modification. Preparing, using, and controlling SOPs is mandated at the WIPP facility by the DOE quality assurance requirements. Standard operating procedures may change frequently as the DOE requirements change. By listing specific SOPs by number and title in the Permit, the Permittees find themselves in a position where implementing changes, even administrative ones, may be delayed because of the need to modify the Permit first. In order to overcome this, the Permittees are proposing to list the specific items that must be included in facility SOPs, and committing to have the current version of the SOP on file for the NMED to examine at any time. In this way, the Permit controls the essential content of the SOP while the Permittees control the administration for the SOP. Third, it enhances the enforceability of the program by removing any question regarding which SOPs are in place and are being followed by the Permittees with regard to the Groundwater Monitoring Program.

- **Clarify the data quality objectives section and explain data quality objectives and quality assurance objectives and the difference between quality assurance objectives for field work and for laboratory analysis.**

  The DQOs and QAOs are clearly identified, revised, and separated into Attachment L, Sections L-7a(1), Data Quality Objectives, and new Section L-7a(2), Quality Assurance Objectives. These changes clearly define the DQOs for each Groundwater Monitoring Program component and clarifies the QAOs.

  The Permit confuses DQOs and QAOs and fails to distinguish between QAOs applicable to field measurements and those applicable to laboratory analysis. In addition, the clarification of the Groundwater Monitoring Program, consisting of two separate components, leads to the need to state a DQO for each component. While the program has been operating under a consistent set of QAOs, specifying them in the Permit ensures consistency for future Groundwater Monitoring Program activities. Furthermore, clearly stated QAOs and DQOs aligns the program with EPA Guidance which encourages this.

- **Remove specificity regarding departments and organizations and replace those terms with "the Permittees."**

  Deleted entire section of former Permit, Attachment L, Section L-7, Project Organization and Responsibilities. Deleted all references to departments, organizations, and titles

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referenced in former Attachment L, Section L-7 throughout Attachment L and eliminated or replaced with Permittees.

The sections that were revised are listed below:

Attachment L, Sections L-4c(2)(i), L-4c(2)(ii), L-4c(2)(v), L-4c(3), L-5(a), L-5(b), and L-5(c).

Changed organizational titles to the more generic "Permittees" where applicable in Attachment L.

When the Groundwater Program was initially placed in the Permit, it was based on an internal WIPP facility implementation plan which included specific organization and position names. As a result, there are numerous places in the Permit where unnecessary detail regarding position titles and organizations is provided. While this is important at the facility level as part of an implementation plan, it is not needed in the Permit, and creates an administrative burden to the extent that if the organizational names or functions change at the facility, a Permit modification is necessary. Therefore, in an effort to focus the Permit on the requirements and to leave the details for implementation to the Permittees internal programs and processes, changes such as this are being proposed.

Updated the organization that performs data V and V.

This change is necessary because previously the Permittees contracted data V & V to a subcontractor, the text reflected this activity. The Permittees now perform V & V in house and much of the language that applies to managing subcontractors does not apply. Instead, an SOP for V&V is listed in Attachment L, Table L-3 to ensure the proper V&V.

- **Clarify serial sampling requirements including the following:**

  - **Remove several field parameters that are not indicators of stabilization, such as chloride, divalent cations, alkalinity, total iron, and Eh.**

    See Attachment L, Section L-4c(2)(ii).

    Another area addressed by the Groundwater Permit Modification Work Plan regards serial sampling. The Permit requires the measurement of chloride divalent cations, alkalinity, total iron, Eh, pH, specific conductance, temperature, and specific gravity as parameters that may be used to determine field stabilization of Culebra groundwater prior to final sampling. After over 15 years of sampling experience, the Permittees have determined that certain changes are appropriate to facilitate sampling and to remove unneeded sampling activity. Specifically, the Permittees are proposing to change how field stabilization is determined prior to taking a final sample for analysis. Based on field experience with the DMP, the Permittees have identified that pH, specific conductance, temperature, and specific gravity are the most diagnostic indicators of groundwater condition and are easily measured in the field. Other parameters are significantly more difficult to measure and, in the case of iron, have little meaning with regard to the current well configuration because they are not iron cased wells. Furthermore, specific conductance does not require the sample be filtered.

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- **Remove the bubbler line requirements.**

  See Attachment L, Section L-4c(2)(i).

  The bubbler line requirements are redundant to the water level probe. Bubbler technology is now obsolete.

- **Restrict serial sampling for stabilization to no more than three well bore volumes.**

  See Attachment L, Sections L-4c(2)(i) and L-4c(2ii).

  The Permittees are proposing to restrict the volume of water to be pumped from a well prior to sampling, to no more than three well bore volumes or when field parameters meet the stablility requirements in the Permit, whichever occurs first in order to be consistent with the EPA RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (EPA/530/SW-86/055, September 1986) and to avoid unnecessary pumping of groundwater.

- **Change the frequency of performing groundwater sampling and analysis to an annual basis rather than semi-annually.**

  As part of the Groundwater Permit Modification Work Plan, the Permittees have evaluated the frequency for groundwater sampling and reporting. The cumulative results, which can be found in the most recent data report, indicates that there has been no significant change in the nature of the Culebra groundwater and no indication of contamination leading to the conclusion that annual sampling will be adequate. Furthermore, there is no mechanism to transfer volatile organic compounds such as carbon tetrachloride from the air being exhausted from the repository to the Culebra groundwater. Therefore, increased levels of carbon tetrachloride in the WIPP underground will not impact the Culebra Groundwater. Reporting is proposed to be reduced to annually as well.

  - **Change the frequency of reporting to annually rather than semi-annually.**

    These changes are being made because the data shows limited variability in sampling events and no indication of contamination resulting from TRU waste management. Furthermore, many of the parameters are non-detects. Therefore, semi-annual reporting is not necessary.

- **Change the frequency of reporting water level values to twice per year rather than monthly.**

  Water level data shows minimal variability therefore, monthly reporting is not necessary and semi-annual reporting is adequate.

  - **Include enhanced interpretation in the form of annotated hydrographs.**

    Attachment L, Section L-4c(1)(ii) was revised to stipulate that the semi-annual groundwater reports will include annotated hydrographs and trend analysis.

The NMED has reported that the current format, while compliant with the Permit, is not as useful as a semi-annual report with hydrographs.

- **Include flow rate and direction determination in the annual detection monitoring report.**

  Because the Permittees are proposing to remove the ASER as described below as the vehicle for reporting flow rate and direction, the "Annual Culebra Groundwater Report" will now include this information. In addition, the Permittees are only reporting on downgradient wells because they are the only ones that can trigger actions leading to compliance monitoring. Based on transport modeling, the wells that would likely intercept a contaminant plume are WQSP 4 to 6. These wells are located between the shafts and the facility boundary such that detection would occur before any contamination would reach the boundary. The conceptual models now employed by the Permittees to demonstrate flow rate and direction will provide a periodic demonstration that the flow paths continue to be in the direction of these downgradient wells.

  The other wells are upgradient from the release point and could not be contaminated by releases from the repository, therefore using them to trigger compliance monitoring is not appropriate.

  - **Remove the "Annual Site Environmental Report " (ASER) as a means of reporting flow rate and direction.**

    Removed the ASER and replaced with the "Annual Culebra Groundwater Report."

    The requirement to submit the ASER is deleted since the ASER was previously the vehicle for submitting the water level sampling contour map. Now separate water level reports are proposed for submittal. Although the ASER is proposed for deletion from the Permit, it is still readily available to the NMED and interested Stakeholders. Copies may be obtained by calling the WIPP Information Center at (800) 336-9477 or by contacting the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

    Removed requirements to report radionuclide analytical results annually to the NMED as a consequence of deleting the requirement to submit the ASER. The requirement to report radionuclide data is also deleted.

    This information is not collected under the Permit and was available because it was contained in the ASER. With the deletion of the ASER as a deliverable, these data are proposed for deletion from the Permit.

- **Revise the statistical process for data analysis to be consistent with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(h)).**

  Clarified how temporal and spatial analysis and statistical evaluations are performed.

  See Attachment L, Sections L-4e, L-4e(1), L-4e(2), L-4e(3).

  Another area addressed by the Groundwater Permit Modification Work Plan has to do with the removal of obsolete requirements from the Permit. Much of the statistical

analysis portion of the permit is aimed at establishing the baseline statistics for ongoing comparisons to determine if a release has occurred. This information is no longer needed since the baseline has been established and has been incorporated into the Permit. The Permit was written with the assumption that there would be detectable constituents and that they can be represented as distributions making statistical analysis possible. In reality, no organic constituents have been detected so that the values are set at the minimum detection level for the analysis. This limits use of predictive statistics for comparisons. To compensate, the Permittees do comparisons to the baseline value to determine if the analytical result is "over or under" the baseline. Using this approach, most of the statistical discussion is not needed. Furthermore, by specifying that for constituents with distributions (such as metals), a statistical method will be used; the Permit accomplishes the goal of forcing a statistical analysis without the extensive detail in the text.

- **Update figures, tables and text with current information.**

  Removed obsolete content throughout Part 5 and Attachment L including conditions in the Permit that only applied to the initial baseline sampling and are no longer required. This language is proposed for deletion and past-tense statements are either completed or are made current.

  In addition, figures and tables are being revised to reflect current information and proposed Permit text is described in detail in Table 1.

Table 1

Description of Figure Changes in Attachment L and Explanation of why the Respective Changes were Made	
Figure L-1	No Change
Figure L-2	Deleted "Figure L-2" and replaced with a "New Figure L-2" which is more representative of facility boundries and the sixteen square mile Land Withdrawal Boundry.
Figure L-3	Revised L-3 due to the deletion of the "Unnamed Member" in the Rustler formation to 'Los Medaños". Also added a "~" to "Los Medaños" and "Gatuña".
Figure L-4	Revised L-4 to show the scale changed from metric to feet for consistency and a cleaner version. Also added a "~" to "Gatuña".
Figure L-5	Deleted "Figure L-5 Schematic North-South Cross Section Through the North Delaware Basin' and replaced with a new figure which represents the current presentation of the Potentiometric map generation methodology output and replaces Figures L-6 and L-9.
Figure L-6	Deleted "Figure-6 Culebra Freshwater Head Contour Surface" and replaced with new "Figure L-6 Detection Monitoring Well Locations" The new Figure shows the current DMP wells.
Figure L-7	Deleted "Figure L-7 Total Dissolved Solids Distribution in the Culebra" because it does not match the current Geochemical conceptual model. Replaced with "Figure L-7 As-Built Configuration of Well WQSP-1"
Figure L-8	Deleted "Figure L-8 WQSP Monitor Well Locations 'and replaced with a new "Figure L-8 As Built Configuration of Well WQSP-2" due to the depths not being correct in the original Permit.
Figure L-9	Deleted "Figure L-9 WIPP DMP Monitor Well Locations and Potentiometric Surface of the Culebra Near the WIPP Site as of 12/96 (adjusted to equivalent freshwater head)" and replaced with a new "Figure L-9 As-Built Configuration of Well WQSP-3" due to the depths not being correct in the original Permit.
Figure L-10	Deleted "Figure L-10 As-Built Configuration of Well WQSP-1" and replaced with a new "Figure L-10 As-Built Configuration of Well WQSP-4" due to the depths not being correct in the original Permit.
Figure L-11	Deleted "Figure L-11 As Built Configuration of Well WQSP-2" and replaced with a new "Figure L-11 As-Built Configuration of Well WQSP-5" due to the depths not being correct in the original Permit.
Figure L-12	Deleted "Figure L-12 As Built Configuration of Well WQSP-3" and replaced with a new "Figure L-12 As-Built Configuration of Well WQSP-6" due to the depths not being correct in the original Permit.
Figure L-13	Deleted "Figure L-13 As Built Configuration of Well WQSP-4" and replaced with a new "Figure L-13 Example Chain-of Custody/Request for Analysis Form" due to combining the COC and the RFA into one form.
Figure L-14	Deleted "Figure L-14 As Built Configuration of Well WQSP-5" and replaced with a new "Figure L-14 Groundwater Level Surveillance Wells (inset represents the groundwater surveillance wells in the WIPP Land Withdrawal Area). The new Figure L-14 is an update of L-18 which has been deleted.
Figure L-15	Deleted "Figure L-15 As Built Configuration of Well WQSP-6" and replaced with a new "Figure L-12 As-Built Configuration of Well WQSP-6" due to the depths not being correct in the original Permit.
Figure L-16	Deleted Figure L-16 Reserved due to it being blank and no Figure is attached.
Figure L-17a	Deleted, combined L-17a and L-17b to create Figure L-13.
Figure L-17b	Deleted, combined L-17a and L-17b to create Figure L-13.
Figure L-18	Deleted, the Figure has been updated and replaced in Figure L-14

- **Describe the methodology for generation of the Culebra Potentiometric Surface Map whereby the Permittees determine the groundwater flow rate and direction annually in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.98(e)).**

  This methodology is being proposed to ensure development of consistent potentiometric surface maps.

Other Proposed Changes

The Groundwater Permit Modification Work Plan recognizes that the Permittees may need to make other changes to the Groundwater Monitoring Plan in addition to those specifically identified in the Groundwater Permit Modification Work Plan. These "Other Changes" include the following:

- *The Permittees are moving records which are not required to be maintained in the Operating Record (20.4.1.501 NMAC, incorporating 40 CFR 264.73) to facility files.*

  This change is needed to ensure that the appropriate records are being maintained in the Operating Record.

- *The Permittees are proposing to change the sampling line from Teflon® to an inert material.*

  This change is being proposed because sampling line materials other than Teflon® are inert, less costly, and functionally equivalent.

- *The Permittees are clarifying that the analytical laboratory may request sample containers, volumes, and holding times that are different than those listed in Attachment L, Table L-6.*

  This change is required so that the samples are submitted in a manner that is compatible with the requirements of the analytical laboratory.

- *The Permittees are proposing to combine the Request for Analysis and Chain of Custody example forms into one form.*

  This change is being proposed to the form to minimize the administrative burden without loss of any required information. Using this form combines identifying the laboratory analytical request and chain of custody into one form.

- *The Permittees are deleting the requirement for non-dedicated sample collection lines and referring the cleaning of other non-dedicated components to SOPs.*

  This change is being proposed because the Permittees do not use non-dedicated sample collection lines and the cleaning process is specified in SOPs.

- *The Permittees are proposing the removal of TOX as an indicator parameter.*

The analytical results for TOX have resulted in low and variable concentrations in the DMP. The analysis is extremely difficult to perform on WIPP groundwater due to high chloride content. Deletion will reduce this analytical burden without reducing the effectiveness of the DMP. Halogenated organic compounds are analyzed using GC/MS and have not been detected.

- *The Permittees are proposing to change the baseline value for methylene chloride to five micrograms per liter (µg/L).*

  The value in the Permit of three micrograms per liter is not supported by the data collected as part of the baseline sampling program and appears to be in error. The proposed value is consistent with NMED screening levels for water and the minimum detection limit for this compound.

- *The Permittees are making numerous editorial changes throughout Part 5 and Attachment L and deleting redundant text.*

The following are examples of Editorial changes that the Permittees are proposing to clarify Permit text and make the text consistent:

- Standardize the term "ground-water" and "ground water" to the term "groundwater."
- Eliminate "branching from the main sample line..." in Attachment L, Section L-4c(2)(iii) because it is redundant to text in Attachment L, Section L-4c(2)(i)
- Consolidated the terms "WIPP", "WIPP facility", "WIPP site", "WIPP area", "WIPP vicinity", and "WIPP region" in an attempt to make the useage consistent with the definition of the permitted facility in Permit Part 1, Section 1.5.3.

Such editorial changes are being made to make the Permit text consistent.

4. **20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)), requires the applicant to provide the applicable information required by 40 CFR §§270.13 through 270.21, 270.62 and 270.63.**

The attached regulatory crosswalk describes those portions of the Permit that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised March 1, 2009, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §§270.16 through 270.22, 270.62, 270.63 and 270.66 are not applicable at the WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. **20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)), requires any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.**

The transmittal letter for this PMR contains the signed certification statement in accordance with Part 1, Condition 1.9 of the Permit.

Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.13		Contents of Part A permit application	Attachment B Part A		✓
§270.14(b)(1)		General facility description	Attachment A		✓
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Part 2.3.1 Attachment C		✓
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Part 2.3.1.1 Attachment C		✓
	§264.13(c)	Off-site waste analysis requirements	Part 2.2.1 Attachment C		✓
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Part 2.7 Attachment E-1a		✓
	§264.174	Container inspections	Attachment E-1b(1)		✓
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment E-1b Attachment E-1b(1)		✓
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		✓
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Part 2.12 Attachment D		✓
	§264.51	Contingency plan design and implementation	Part 2.12.1 Attachment D		✓
	§264.52 (a) & (c-f)	Contingency plan content	Attachment D		✓
	§264.53	Contingency plan copies	Part 2.12.2 Attachment D		✓
	§264.54	Contingency plan amendment	Part 2.12.3 Attachment D		✓
	§264.55	Emergency coordinator	Part 2.12.4 Attachment D-4a(1)		✓
	§264.56	Emergency procedures	Attachment D-4		✓
§270.14(b)(8)		Description of procedures, structures or equipment for:	Attachment A Part 2.11		✓
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Part 2.11		✓
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Attachment A1-1c(1) Part 2.11		✓
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Part 2.11		✓
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Part 2.11		✓
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Part 2.11		✓
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Part 2.11 Part 4.4 Attachment D-4e Attachment G-1a		✓
	264 Subpart C	Preparedness and Prevention	Part 2.10		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
	§264.31	Design and operation of facility	Part 2.1		✓
	§264.32	Required equipment	Part 2.10.1 Attachment D		✓
	§264.33	Testing and maintenance of equipment	Part 2.10.2 Attachment E-1a		✓
	§264.34	Access to communication/alarm system	Attachment E-1a Part 2.10.3		✓
	§264.35	Required aisle space	Part 2.10.4		✓
	§264.37	Arrangements with local authorities	Attachment D-4a(3)		✓
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Part 2.9		✓
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment A4		✓
§270.14(b) (11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Attachment G2-2.2 Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Attachment A1-1c(1) Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Part 2.8 Attachment F		✓
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Part 6 & 7 Attachment G & H		✓
§270.14(b)(13)	§264.111	Closure performance standard	Attachment G-1a		✓
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment G-1		✓
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Part 6.3 Attachment G-1d(4)		✓
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment G-2a		✓
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment G-1e(2)		✓
§270.14(b)(13)	§264.113	Time allowed for closure	Part 6.5 Attachment G-1d		✓
§270.14(b)(13)	§264.114	Disposal/decontamination	Part 6.6 Attachment G-1e(2)		✓
§270.14(b)(13)	§264.115	Certification of closure	Part 6.7 Attachment G-2a		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.14(b)(13)	§264.116	Survey plat	Part 6.8 Attachment G-2b		✓
§270.14(b)(13)	§264.117	Post-closure care and use of property	Part 7.3 Attachment H-1a		✓
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Part 7.5 Attachment H-1a (1)		✓
§270.14(b)(13)	§264.178	Closure/containers	Part 6.9 Attachment A1-1h Attachment G-1		✓
§270.14(b)(13)	§264.601	Environmental performance standards-miscellaneous units	Attachment A-4 Attachment D-1 Attachment G-1a		✓
§270.14(b)(13)	§264.603	Post-closure care	Part 7.3 Attachment G-1a(3)		✓
§270.14(b)(14)	§264.119	Post-closure notices	Part 7.4 Attachment H-2		✓
§270.14(b)(15)	§264.142	Closure cost estimate	NA		✓
	§264.143	Financial assurance	NA		✓
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		✓
	§264.145	Post-closure care financial assurance	NA		✓
§270.14(b)(17)	§264.147	Liability insurance	NA		✓
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		✓
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(iii)		Surface waters	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(iv)		Surrounding land use	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.14(b)(19)(v)		Wind rose	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(xi)		Drainage on flood control barriers	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(19)(xii)		Location of operational units	Attachment B2 Part A Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Attachment B Renewal App. Sep. 2009, 270.14 Contents of Part B: General Requirements		✓
§270.15	§264 Subpart I	Containers	Part 3 Part 4.3 Attachment A1		✓
	§264.171	Condition of containers	Part 3.3 Attachment A1		✓
	§264.172	Compatibility of waste with containers	Part 3.4 Attachment A1		✓
	§264.173	Management of containers	Part 3.5 Attachment A1		✓
	§264.174	Inspections	Part 3.7 Attachment E-1 Attachment A1-1s		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
§270.15(a)	§264.175	Containment systems	Part 3.6 Attachment A1		✓
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Attachment A1-1g Permit Part 2.1		✓
§270.15(d)	§264.177	Special requirements for incompatible wastes	Attachment A1-1g Permit Part 2.3.3.4		✓
	§264.178	Closure	Part 6 Attachment G		✓
§270.15(e)	§264.179	Air emission standards	Part 4.4.2 Attachment N		✓
§270.23	264 Subpart X	Miscellaneous units	Part 1.3.1 Attachment A2-1 Attachment G1.3.1		✓
§270.23(a)	§264.601	Detailed unit description	Part 4 Part 5 Attachment A2 Attachment L	✓	
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Part 4 Part 5 Attachment A2 Attachment L	✓	
§270.23(c)	§264.601	Potential exposure pathways	Part 4 Part 5 Attachment A2 Attachment N Attachment L	✓	
§270.23(d)		Demonstration of treatment effectiveness	Part 4 Attachment A2 Attachment N		✓
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Part 4 Part 5 Attachment A2 Attachment E-1 Attachment N Attachment L	✓	
	§264.603	Post-closure care	Attachment H Attachment H1		✓
	264 Subpart E	Manifest system, record keeping, and reporting	Permit Part 1 Permit Part 2.13 & 2.14 Permit Part 4 Attachment C		✓
§270.30(j)(2)	§264.73(b)	Ground-water records	Part 1		✓
	264 Subpart F	Releases from solid waste management units	Part 5 & 7 Attachment G2 & L		✓
	§264.90	Applicability	Part 5 Attachment L		✓
	§264.91	Required programs	Attachment L		✓
	§264.92	Ground-water protection standard	Attachment L		✓
	§264.93	Hazardous constituents	Attachment L		✓

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the WIPP Permit Application	Yes	No
	§264.94	Concentration limits	Part 5 Attachment L		✓
	§264.95	Point of compliance	Part 5 Attachment L		✓
	§264.96	Compliance period	Attachment L		✓
	§264.97	General ground-water monitoring requirements	Part 5 Attachment L	✓	
	§264.98	Detection monitoring program	Part 5 Attachment L	✓	
	§264.99	Compliance monitoring program	Part 5 Attachment L		✓
	§264.100	Corrective action program	Part 5 Attachment L		✓
	§264.101	Corrective action for solid waste management units	Part 8 Attachment L		✓
	264 Appendix IX	Ground-water Monitoring List	Part 5 Attachment L		✓

Attachment A
Table of Changes

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Table of Changes

Affected Permit Section	Explanation of Change
Global	Changed "ground-water" and "ground water" to "groundwater"
Part 5, Section 5.3.1.	Revised Figure L-8 to L-6
Part 5, Section 5.3.2.	Deleted "10" from "Figure L-10" and replace with "7" to read "Figure L-7"
Part 5, Section 5.3.2.	Deleted "16" from "Figure L-16" and replace with "12" to read "Figure L-12"
Part 5, Section 5.4., Table 5.4.a	Deleted "Total organic halogen (**TOH**)"
Part 5, Section 5.4., Table 5.4.a	Replaced "Density" with "Specific Gravity"
Part 5, Section 5.4., Table 5.4.a	Deleted "Iron (Total Fe)"
Part 5, Section 5.5.	Deleted ", including background ground-water quality samples, "
Part 5, Section 5.5.1.	Deleted "semi" from "semiannually"
Part 5, Table 5.6	Replaced "3.00" with "5.00" for the Methylene chloride for WQSP wells 1 through 6
Part 5, Section 5.10.2.1.	Replaced "in compliance with the schedule on Table 5.10.2.1 below, and" with "in the Annual Groundwater Report by November 30 of each year"
Part 5, Section 5.10.2.1., Table 5.10.2.1	Deleted table
Part 5, Section 5.10.2.2.	Replaced "submitted within 30 calendar days after data are collected" with "reported semiannually by May 31 and November 30"
Part 5, Section 5.10.2.2.	Added "The November water level data report shall be combined with the Annual Groundwater Report specified in Permit Part 5.10.2.3."
Part 5, Section 5.10.2.3.	Deleted "and Radionuclide Sampling" from heading
Part 5, Section 5.10.2.3.	Added "(to include annotated hydrographs)"
Part 5, Section 5.10.2.3.	Deleted "and the results of radionuclide specific analysis of groundwaters sampled from the DMWs"
Part 5, Section 5.10.2.3.	Replaced "Site Environmental" with "Culebra Groundwater"
Part 5, Section 5.10.2.3.	Replaced "by October 1" with "by November 30"
Attachment L, Global	Added "Amended Renewal Application" before Addendum L
Attachment L, Global	Deleted ", Amended Renewal Application" after section numbers
Attachment L, List of Abbreviations/Acronyms	Added "/UNITS" to title
Attachment L, List of Abbreviations/Acronyms	Deleted "ASER Annual Site Environmental Report"
Attachment L, List of Abbreviations/Acronyms	Deleted "AR/VR Approval/Variation Request"
Attachment L, List of Abbreviations/Acronyms	Replaced "CofC Chain of Custody" with "CofC/RFA chain of custody/request for analysis"
Attachment L, List of Abbreviations/Acronyms	Added "Dewey Lake Dewey Lake Redbeds Formation"
Attachment L, List of Abbreviations/Acronyms	Added "DMW Detection Monitoring Wells"
Attachment L, List of	Deleted "EM Environmental Monitoring"

Affected Permit Section	Explanation of Change
Abbreviations/Acronyms	
Attachment L, List of Abbreviations/Acronyms	Deleted "ES&H Environmental, Safety, and Health Department"
Attachment L, List of Abbreviations/Acronyms	Deleted "FEIS Final Environmental Impact Statement"
Attachment L, List of Abbreviations/Acronyms	Added "(s)" to "gram"
Attachment L, List of Abbreviations/Acronyms	Deleted "GWSP Groundwater Surveillance Program"
Attachment L, List of Abbreviations/Acronyms	Added "LCSD lab control sample duplicate"
Attachment L, List of Abbreviations/Acronyms	Deleted "LD limit of detection"
Attachment L, List of Abbreviations/Acronyms	Added "Los Medaños Los Medaños Member of the Rustler Formation"
Attachment L, List of Abbreviations/Acronyms	Added "Magenta Magenta Member of the Rustler"
Attachment L, List of Abbreviations/Acronyms	Added "molal moles per kilogram"
Attachment L, List of Abbreviations/Acronyms	Deleted "PRS Project Records Services"
Attachment L, List of Abbreviations/Acronyms	Added "QAO Quality Assurance Objective"
Attachment L, List of Abbreviations/Acronyms	Added "PABC Performance Assessment Baseline Calculation(s)"
Attachment L, List of Abbreviations/Acronyms	Deleted "RFA request for analysis"
Attachment L, List of Abbreviations/Acronyms	Deleted "RIDS Records Inventory and Disposition Schedule"
Attachment L, List of Abbreviations/Acronyms	Added "SAP Sampling and Analysis Plan"
Attachment L, List of Abbreviations/Acronyms	Deleted "STLB sample tracking book"
Attachment L, List of Abbreviations/Acronyms	Deleted "TOX total organic halogens"
Attachment L, List of Abbreviations/Acronyms	Deleted "TSS total suspended solids"
Attachment L, List of Abbreviations/Acronyms	Added "UTLV upper tolerance limit value"
Attachment L, List of Abbreviations/Acronyms	Deleted "WQSP Water Quality Sampling Program"
Attachment L, Section L-1	Replaced "is a geologic repository for the disposal of transuranic (**TRU**) waste" with "facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units

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Affected Permit Section	Explanation of Change
	(**HWDUs**) in the underground, will be met"
Attachment L, Section L-1	Deleted "The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (hereinafter referred to as the Salado). At WIPP, water-bearing units occur both above and below the disposal horizon. Ground-water monitoring of the uppermost aquifer below the facility is not proposed at WIPP because that water-bearing unit (the Bell Canyon Formation) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon Formation are separated by over 2000 ft (610 m) of very low-permeability evaporite sediments (Addendum L1, Amended Renewal Application (DOE, 2009)). No natural credible pathway has been established for contaminant transport to aquifers below the repository horizon, as there is no hydrologic communication between the repository and underlying aquifer. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on their review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for ground-water monitoring through the Salado and the Castile Formation (hereinafter referred to as the Castile) into the Bell Canyon aquifer would compromise the isolation properties of the repository medium."
Attachment L, Section L-1	Added "The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses."
Attachment L, Section L-1	Deleted "Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met."
Attachment L, Section L-1	Added "The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet. The WIPP is a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**)

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Affected Permit Section	Explanation of Change
	into the Bell Canyon would compromise the isolation properties of the repository medium."
Attachment L, Section L-1	Added "the"
Attachment L, Section L-1	Replaced "in the past has focused" with "facility focuses"
Attachment L, Section L-1	Replaced "member" with "Member (Culebra)"
Attachment L, Section L-1	Replaced "(hereinafter referred to as the Culebra)" with "(Rustler)"
Attachment L, Section L-1	Replaced "Modeling of ground-water movement in the Culebra, based on the concept of a ground-water basin" with "Groundwater movement in the Culebra, using results from the basin-scale groundwater model"
Attachment L, Section L-1	Deleted "The WIPP site is located in Eddy County in southeastern New Mexico (Figure L-1) within the Pecos Valley section of the southern Great Plains physiographic province (Powers et al., 1978). The site is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses. The WIPP site (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet."
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Added "and rate determination"
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Replaced "analytical" with "indicator"
Attachment L, Section L-1	Added "and hazardous constituents"
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Deleted ", and establishes personnel responsibilities"
Attachment L, Section L-1	Replaced "sampling and analysis plan" with "DMP"
Attachment L, Section L-1	Replaced "field operating procedures, referenced throughout this plan." with "the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d))."
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Added "Culebra" before "groundwater"
Attachment L, Section L-1	Added "and rate determination"
Attachment L, Section L-1	Deleted "These procedures prescribe proper field sampling techniques."
Attachment L, Section L-1	Replaced "Samples" with "Data required by this plan"
Attachment L, Section L-1	Replaced "trained" with "qualified"

Affected Permit Section	Explanation of Change
Attachment L, Section L-1	Replaced "under the supervision and direction of qualified engineers, scientists, or other technical personnel." with "in accordance with SOPs (Table L-3)."
Attachment L, Section L-1a(1)	Replaced "site" with "facility"
Attachment L, Section L-1a(1)	Added "bounded to the north and east by the Capitan Reef"
Attachment L, Section L-1a(1)	Deleted "During the Permian period, which came to a close about 245 million years ago, ancient seas covered the basin. Their later evaporation resulted in the deposition of a thick sequence of evaporites. Addendum L1, Section L1-1 of the Amended Renewal Application (DOE, 2009) presents a detailed discussion of the regional geologic history."
Attachment L, Section L-1a(1)	Added "and Amended Renewal Application Addendum L1, Section L1-1 (DOE 2009) for more detail"
Attachment L, Section L-1a(1)	Deleted ", which formed through evaporation of the Permian Sea,"
Attachment L, Section L-1a(1)	Deleted "(hereinafter referred to as the Rustler)"
Attathment L, Section L-1a(1)	Changed "Rustler's" to "Rustler"
Attachment L, Section L-1a(1)	Added "Redbeds Formation (Dewey Lake)"
Attachment L, Section L-1a(1)	Deleted "[1]" footnote indicator
Attachment L, Section L-1a(1)	Deleted "Formation (hereinafter referred to as the Bell Canyon)— "
Attachment L, Section L-1a(1)	Added "is"
Attachment L, Section L-1a(1)	Deleted footnote 1 " While there may be some uncertainty over the amount of vertical recharge occurring within the Rustler, the issue is only of significance to long-term performance calculations in which releases from the repository occur through the creation of a migration pathway resulting from drilling (inadvertently) in the WIPP area. The consequences of vertical recharge are bounded in the modeling by assuming that under future climate conditions (which are assumed to be cooler and wetter), the ground-water surface elevation (water table) raises near ground surface, at which time the water table tends to mimic topography."
Attachment L, Section L-1a(1)	Deleted "—"
Attachment L, Section L-1a(1)	Added "and"
Attachment L, Section L-1a(1)	Added "above"
Attachment L, Section L-1a(1)	Replaced "sequences" with "deposits"
Attachment L, Section L-1a(1)	Deleted "above"
Attachment L, Section L-1a(1)	Added "lithostatic"
Attachment L, Section L-1a(1)	Replaced "more than 2,000" with "approximately 2,200"
Attachment L, Section L-1a(1)	Replaced "13.8" with "14.9"
Attachment L, Section L-1a(1)	Replaced "moves" with "deforms"
Attachment L, Section L-1a(1)	Replaced "for millions of years" with "since deposition"
Attachment L, Section L-1a(1	Replaced "L-5" with L-4"
Attachment L, Section L-1a(2)(i)	Replaced "found" with "determined" Added "facility"
Attachment L, Section L-1a(2)(ii)	Added "naturally"
Attachment L, Section L-1a(2)(ii)	Deleted "As a comparison, the permeability of the Salado is roughly a thousand times less than that of a lower clay liner required of surface impoundments and

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Affected Permit Section	Explanation of Change
	landfills, assuming similar thicknesses."
Attachment L, Section L-1a(2)(iii)	Deleted "(specifically, the Culebra Member, hereafter referred to as the Culebra)"
Attachment L, Section L-1a(2)(iii)	Replaced "6" with "5" to read "L-5"
Attachment L, Section L-1a(2)(iii)	Deleted "The Culebra is hydrologically confined."
Attachment L, Section L-1a(2)(iii)	Deleted "(Additional short-term pumping tests have been conducted in the Water Quality Sampling Program (**WQSP**) wells (see Addendum L1, Section L1-2a(3)(a)(ii) of the Amended Renewal Application (DOE, 2009))."
Attachment L, Section L-1a(2)(iii)	Deleted "recently"
Attachment L, Section L-1a(2)(iii)	Replaced "The hydraulic tests are designed to yield pressure data for estimation of hydrologic characteristics" with "Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics"
Attachment L, Section L-1a(2)(iii)	Replaced "for input to flow modeling" with "in calibration of flow models"
Attachment L, Section L-1a(2)(iii)	Replaced "six" with "ten"
Attachment L, Section L-1a(2)(iii)	Deleted "Over the site, Culebra transmissivity varies over three to four orders of magnitude. Figure D6-30 shows variation in transmissivity in the Culebra in the WIPP region."
Attachment L, Section L-1a(2)(iii)	Replaced "3" with "7"
Attachment L, Section L-1a(2)(iii)	Replaced "9" with "13"
Attachment L, Section L-1a(2)(iii)	Replaced "P-18" with "SNL-15"
Attachment L, Section L-1a(2)(iii)	Added "(Roberts, 2007)"
Attachment L, Section L-1a(2)(iii)	Deleted "Qualitative correlations have been noted between transmissivity and several geologic features possibly related to open-fracture density, including (1) the distribution of overburden above the Culebra, (2) the distribution of halite in other members of the Rustler, (3) the dissolution of halite in the upper portion of the Salado, and (4) the distribution of gypsum fillings in fractures in the Culebra. Measured matrix porosities of the Culebra vary from 0.03 to 0.30. Fracture porosity values have not been measured directly, but interpreted values from tracer tests at the H-3, H-6, and H-11 hydropads vary from 5×10^{-4} to 3×10^{-3}. Data are insufficient to determine whether the average porosity of the matrix and fractures varies significantly on a regional scale."
Attachment L, Section L-1a(2)(iii)	Deleted "Previous conceptual models of the Culebra (see Addendum L1 of the Amended Renewal Application (DOE, 2009)) have not been able to consistently relate the hydrogeochemical facies, radiogenic ages, and flow constraints (that is, transmissivity, boundary conditions, etc.) in the Culebra." after "flow."
Attachment L, Section L-1a(2)(iii)	Deleted "However"
Attachment L, Section L-1a(2)(iii)	Changed "the" to "The"
Attachment L, Section L-1a(2)(iii)	Deleted "new"
Attachment L, Section L-1a(2)(iii)	Deleted "could"
Attachment L, Section L-1a(2)(iii)	Added "s" to explain
Attachment L, Section L-1a(2)(iii)	Deleted "new"
Attachment L, Section L-1a(2)(iii)	Added "basin-scale"
Attachment L, Section L-1a(2)(iii)	Deleted "basin"
Attachment L, Section L-1a(2)(iii)	Deleted "This differs from previous interpretations, wherein no-flow was assumed between Rustler units."

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Affected Permit Section	Explanation of Change
Attachment L, Section L-1a(2)(iii)	Added "in the vicinity of the WIPP facility"
Attachment L, Section L-1a(2)(iii)	Added "toward Nash Draw"
Attachment L, Section L-1a(2)(iii)	Added "currently"
Attachment L, Section L-1a(2)(iii)	Replaced "to a more southerly direction." with "in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south."
Attachment L, Section L-1a(2)(iii)	Deleted "Four hydrogeochemical facies within the Culebra in the WIPP area (DOE, 1997) have been identified: • Zone A - saline (2-3 molal) NaCl brines, Mg/Ca ratio of 1.2 to 2; • Zone B - dilute (<0.1 molal) CaSO4 - rich ground water; • Zone C - variable composition (0.3-1.6 molal); Mg/Ca ratio 0.3 to 1.2; and • Zone D - high salinities (3-7 molal); K/Na weight ratios (0.2). Facies A ground-water flow is slow, has not changed over the last 14,000 years, and probably recharged more than 600,000 years ago. Vertical leakage occurs to Facies A, and both lateral and vertical ground-water flow rates are extremely low. Facies B occurs in an area with greater vertical fracturing in the Culebra, and therefore exhibits more vertical infiltration and more rapid lateral flow in the Culebra. Flow in Facies B is currently to the south (it may mix with Facies C water to the southeast) but was more toward the west during wetter climates; vertical infiltration from the Dewey Lake to the Culebra Facies B is assumed by the Permittees to have occurred during wetter climates in an area south of the WIPP site. Facies C water was not diluted to create Facies B water. Facies C occurs "in between" Facies A and B, and ground-water flow entered the Culebra prior to the climate change (to drier conditions) 14,000 years ago. Facies C ground-water flow is to the south at WIPP, where the Permittees theorized that it joins with a small amount of Facies A solute being transported from the east. Ground-water flow rate in Facies C is faster than in A but slower than in B, and the proposed recharge area from the Dewey Lake to the Culebra was to the northeast of the WIPP site. Facies C ground water infiltrated into the Dewey Lake and then interacted with anhydrite and halite along its path to the Culebra, wherein it mixed with smaller amounts of Facies A water. the Permittees concluded that the presence of anhydrite within Rustler units does not preclude slow downward infiltration (DOE, 1997)."
Attachment L, Section L-1a(2)(iii)	Added "Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines. • Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area. Mg/Ca molar ratio 0.32 to 0.52. • Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6. • Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1. • Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2. • Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4. • Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2. • Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6. The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down

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Affected Permit Section	Explanation of Change
	the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (TDS) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra. The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6–5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two, from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4-8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata."
Attachment L, Section L-1a(2)(iii)	Changed "Facies" to "facies"
Attachment L, Section L-1a(2)(iii)	Added "basin-scale"
Attachment L, Section L-1a(2)(iii)	Deleted "basin"
Attachment L, Section L-1a(2)(iii)	Replaced "Ground-water levels in the Culebra in the WIPP region have been measured for several decades. Water-level rises have been observed in the WIPP region and are possibly related to recovery from impacts caused by shaft installation, response to potash effluent discharge, or are unexplained, as discussed below. The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the potential cause of the water-level rise appears to be a primary factor. In the vicinity of the WIPP site, water-level rises are believed to be caused by recovery from drainage into the shafts. Drainage into shafts has been reduced by a number of grouting programs over the years, most recently in 1993 around the Air Intake Shaft. Northwest of the site, in and near Nash Draw, water levels appear to fluctuate in response to effluent discharge from potash mines. Correlation of water-level fluctuation with potash mine discharge, however, cannot be proven definitively because sufficient data on the timing and volumes of discharge are not available. Water-level rises in the vicinity of the H-9 hydropad, about 6.5 miles south of the site, are thought to be caused by neither WIPP activities nor potash mining discharge. They remain unexplained. The Permittees continue to monitor ground-water levels throughout the region." with "Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed in the WIPP region and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor. Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring

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	wells would be of greatest value and to identify wells that could be removed from the network with little loss of information. As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away."
Attachment L, Section L-1a(2)(iii)	Replaced "unnamed lower member" with "Los Medaños Member"
Attachment L, Section L-1a(2)(iii)	Added "(**Los Medaños**)"
Attachment L, Section L-1a(2)(iii)	Changed "member" to "Member"
Attachment L, Section L-1a(2)(iii)	Added "(**Magenta**)"
Attachment L, Section L-1a(2)(iii)	Added"across" Deleted "over"
Attachment L, Section L-1a(2)(iii)	Added "basin-scale"
Attachment L, Section L-1a(2)(iii)	Deleted "basin"
Attachment L, Section L-1a(2)(iii)	Deleted "Recent simulations to enhance the conceptual understanding of the geohydrology of the Rustler can be found in Corbet and Knupp, 1996."
Attachment L, Section L-1a(2)(iii)	Added "facility" in two places
Attachment L, Section L-1a(2)(iii)	Deleted "(shown, for example, as Well H-8 in Figure L-7). However, the Permittees identified the Culebra as potential aquifer in the Compliance Certification Application (DOE, 1996). Because of this, the Culebra will be the focus of future ground-water monitoring at WIPP as it is also the most transmissive continuous water-bearing zone at WIPP and is the most likely pathway for contaminant migration"
Attachment L, Section L-2	Added "The requirements of"
Attachment L, Section L-2	Replaced "applies" with "apply"
Attachment L, Section L-2	Added "the" and "facility"
Attachment L, Section L-3	Deleted "Ground-water" from section heading
Attachment L, Section L-3a	Deleted "The Permittees have established a RCRA "Ground-water Detection Monitoring Program (DMP) Plan" to define and protect ground-water resources at WIPP. One of the objectives of the WIPP DMP is to establish, by means of ground-water sampling and analysis, an accurate and representative ground-water database that is scientifically defensible and demonstrates regulatory compliance. In addition, the DMP will be used to determine background or existing conditions of ground-water quality and quantity, including ground-water surface elevation and direction of flow, around the WIPP facility area."
Attachment L, Section L-3a	Added "DMP"
Attachment L, Section L-3a	Deleted "all"
Attachment L, Section L-3a	Added "applicable"
Attachment L, Section L-3a	Replaced "§§ 264.90 through 264.101" with "264 Subpart F"
Attachment L, Section L-3a	Deleted "all"
Attachment L, Section L-3a	Deleted "The ground-water quality data generated by monitoring activities will provide a comprehensive background database against which future"

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Attachment L, Section L-3a	Changed "analytical" to "Analytical"
Attachment L, Section L-3a	Replaced "can be compared" with "collected"
Attachment L, Section L-3a	Added "are compared to the baseline established in this Permit to determine whether or not a release has occurred"
Attachment L, Section L-3a	Deleted "Ground-water monitoring at WIPP has been historically conducted by several programs including the WIPP Site Characterization Program, the WIPP WQSP, and recently the WIPP Ground-water Surveillance Program (**GWSP**). Ground-water quality and ground-water surface elevation data have been collected by these programs for over 12 years at WIPP. Data from the WQSP wells (which are widely distributed across the area, see Figure L-8) will be used to continually define changes in the area's potentiometric surface and ground-water flow directions. New monitoring wells included in the WIPP GWSP (WQSP wells 1-6a) were constructed to the specifications provided in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (EPA, 1986) and constitute the RCRA ground-water monitoring network specified in this DMP as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). These wells are being used to establish background ground-water quality, ground-water surface elevations and flow directions in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(f) and (g) and 264.98(e)). Justification for the locations of these wells (3 upgradient and 4 downgradient) is presented below."
Attachment L, Section L-3a	Added "There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells."
Attachment L, Section L-3b	Deleted "The WQSP wells 1 through 6 constitute the RCRA DMP for WIPP (Figure L-9 and Permit Attachment B, Figure B2-3) during detection monitoring as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). This monitoring plan is a continuation of the current WIPP GWSP, and these wells will serve as the monitoring locations during background water-quality characterization and the RCRA DMP (Figure L-9 and Permit Attachment B, Figure B2-3)."
Attachment L, Section L-3b	Replaced "were" with "are"
Attachment L, Section L-3b	Added "(north)"
Attachment L, Section L-3b	Deleted "The locations of the three upgradient wells were selected to be representative of the flow vectors of ground water moving downgradient onto the WIPP site. Figure 34 of Davies, 1989, shows the simulation of direction and magnitude of ground-water flow. The upgradient wells were located based on the flow vectors resulting from this model simulation. The original WQSP observation wells, as well as those in the RCRA DMP, have been and will continue to be used as piezometer wells to support collection of ground-water surface elevation and ground-water flow modeling data to demonstrate regulatory compliance. Well location surveys for each of the seven wells were performed by the Permittees' survey personnel using the State Plane Coordinates-North American Datum Model 27 method. Results of the surveys are on file with the New Mexico State Engineers Department along with the

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	associated extraction permits for each well."
Attachment L, Section L-3b	Replace "were" with "are"
Attachment L, Section L-3b	Added "(south)"
Attachment L, Section L-3b	Deleted "in concert with the flow vectors shown by this model simulation" after "area"
Attachment L, Section L-3b	Added "to be located generally in the path of contaminants that might be released from the shaft area in the Culebra."
Attachment L, Section L-3b	Deleted "based on the greatest velocity magnitude of ground-water flow leaving the shaft area as shown on Figure 34 of Davies, 1989, and upgradient of the WIPP LWA boundary"
Attachment L, Section L-3b	Added "Well"
Attachment L, Section L-3b	Deleted "around wells DOE-1 and H-11"
Attachment L, Section L-3b	Deleted "The Culebra has been selected for the focus of the DMP due to it being regionally extensive and exhibiting the most significant transmissivity of the water-bearing units at WIPP. The Culebra has been extensively studied during all past hydrologic characterization programs and found to be the most likely hydrologic pathway to the accessible environment or compliance point for any potential contamination."
Attachment L, Section L-3b	Replaced "The RCRA ground-water monitoring network was not installed immediately downgradient of this plane. However, because the Underground HWDUs at WIPP are Subpart X units, and due to the relatively unique containment and transport aspects of the site, monitoring at the proposed locations will allow for detection of releases prior to release of these contaminants to the general public at the LWA boundary." with "Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur."
Attachment L, Section L-3b	Deleted "The DMP wells were located to intercept flow vectors downgradient away from the WIPP shafts area based on current density corrected potentiometric surfaces (Figure L-9). Based on natural contours of the potentiometric surface (Figure L-9) the selected well placement locations are downgradient of the general flow direction from the shaft area."
Attachment L, Section L-3b	Added "suggests"
Attachment L, Section L-3b	Deleted "of contaminant migration throughout the Culebra to the Land Withdrawal Act boundary suggests"
Attachment L, Section L-3b	Added "from the Waste Handling Shaft to the LWA boundary"
Attachment L, Section L-3b	Added "." After "years"
Attachment L, Section L-3b	Deleted "if, under worst case conditions,"
Attachment L, Section L-3b	Added "This assumes conditions where"
Attachment L, Section L-3b	Deleted "could"
Attachment L, Section L-3b	Added "(post closure) to the Culebra via the sealed shafts"
Attachment L, Section L-3b	Deleted "If contaminants were to migrate from the disposal facility, they would be detected by the DMP wells located midway between the shafts and LWA such that samples from wells could detect these contaminants long before they could reach the LWA boundary."
Attachment L, Section L-3b	Added "for the Culebra"
Attachment L, Section L-3b	Deleted "s" on "suggests"

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Attachment L, Section L-3b	Deleted "Recent (December 1996)"
Attachment L, Section L-3b	Changed "potentiometric" to "Potentiometric"
Attachment L, Section L-3b	Added ". The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4."
Attachment L, Section L-3b	Deleted "(Figure L-9). WQSP-4, WQSP-5, and WQSP-6 have been located downgradient of the waste emplacement areas according to present-day adjusted potentiometric surfaces. Potentiometric surfaces that have not been corrected for density differences and that contain transient relics of previous pumping-drawdown events do not reflect accurate natural ground-water flow directions and should not be used to assess the adequacy of ground-water monitoring locations. Previous potentiometric surface maps showing a potentiometric low and hydrologic gradient toward the area between WQSP-3 and WQSP-4 had not been adjusted to freshwater head equivalents, and had also been influenced by the long-term pumping at well H-19. Hence, some historic maps may not represent natural Culebra flow directions or gradients, and appropriateness of the RCRA monitoring network cannot be definitively evaluated using these data."
Attachment L, Section L-3b(1)	Changed section heading from "DMP Well Construction Specification" to "Detection Monitoring Well Construction Specification"
Attachment L, Section L-3b(1)(i)	Deleted section heading
Attachment L, Section L-3b(1)(i)	Added "Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995."
Attachment L, Section L-3b(1)(i)	Replaced "Well WQSP-1 was" with "The six WQSP Culebra wells were"
Attachment L, Section L-3b(1)(i)	Replaced "16" with "October 26"
Attachment L, Section L-3b(1)(i)	Replaced ", to a" with ". The"
Attachment L, Section L-3b(1)(i)	Replaced "737 ft (225 m) bgs" with "each well is shown in Table L-5"
Attachment L, Section L-3b(1)(i)	Replaced "borehole was" with "wells were"
Attachment L, Section L-3b(1)(i)	Deleted "extends 15 ft (5 m)"
Attachment L, Section L-3b(1)(i)	Replaced "unnamed lower member of the Rustler" with "Los Medaños as shown in Table L-5"
Attachment L, Section L-3b(1)(i)	Replaced "well was" with "wells were"
Attachment L, Section L-3b(1)(i)	Replaced "a depth of 693 ft (211 m) bgs using" with "the top of the Culebra using"
Attachment L, Section L-3b(1)(i)	Deleted ". The interval from 693 to 737 ft (225 to 211 m) bgs (the total depth) was drilled using air mist with a foaming agent as the drilling fluid. WQSP-1 was drilled to 695.6 ft (212 m) bgs using"
Attachment L, Section L-3b(1)(i)	Added "and"
Attachment L, Section L-3b(1)(i)	Replaced "and was" with ". The wells were then"
Attachment L, Section L-3b(1)(i)	Deleted "from 695.6 to 737 ft (212 to 225 m) bgs"
Attachment L, Section L-3b(1)(i)	Deleted "-" after 'in."
Attachment L, Section L-3b(1)(i)	Added "to total depth"
Attachment L, Section L-3b(1)(i)	Added "See Table L-5 for the drilling and coring intervals for each well."
Attachment L, Section L-3b(1)(i)	Replaced "WQSP-1 was" with "WQSP wells were"

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Attachment L, Section L-3b(1)(i)	Replaced space with "-"
Attachment L, Section L-3b(1)(i)	Replaced "WQSP-1 was" with "After reaming, wells were
Attachment L, Section L-3b(1)(i)	Replaced "737 ft (224.6 m) bgs" with "total depth"
Attachment L, Section L-3b(1)(i)	Replaced "from 702 to 727 ft (214 to 222 m) bgs" with "as shown in Table L-5"
Attachment L, Section L-3b(1)(i)	Deleted "from 640 to 651 ft (195 to 198 m) bgs"
Attachment L, Section L-3b(1)(i)	Replaced "from 651 to 737 ft (198 to 225 m) bgs." with "as indicated in Table L-5."
Attachment L, Section L-3b(1)(i)	Deleted "Based on core log results, the Culebra is located from 699 to 722 ft (213 to 220 m) bgs (see Figure L-10)."
Attachment L, Section L-3b(1)(ii)	Deleted section
Attachment L, Section L-3b(1)(iii)	Deleted section
Attachment L, Section L-3b(1)(iv)	Deleted section
Attachment L, Section L-3b(1)(v)	Deleted section
Attachment L, Section L-3b(1)(vi)	Deleted section
Attachment L, Section L-4a	Deleted "The seven RCRA monitoring wells have been sampled on a semiannual basis since their installation in 1995 to establish background ground-water quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98). This has included at least two full rounds of 20.4.1.500 NMAC (Incorporating 40 CFR §264) Appendix IX analysis for samples from each of the proposed RCRA detection monitoring wells. In addition, ground-water samples were collected from the DMP wells (from March 1997 until waste emplacement) at a frequency of four sample replicates collected semiannually from each well for the indicator parameters of pH, specific conductance (**SC**), total organic carbon (**TOC**), and total organic halogen (**TOX**) to further establish background ground-water quality until detection monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98) becomes applicable. A total of four rounds of Appendix IX analysis will be conducted for samples from each well for use in background ground-water quality determinations. Detection monitoring will start when the Permittees emplace waste and continue through the post-closure phase as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90[c]). During detection monitoring, one sample and one sample duplicate will be collected semiannually from each well in the RCRA detection monitoring network. As shown in Table L-2, the DMP will continue to collect ground-water quality samples for all seven wells on a semiannual basis during the life of the DMP. 20.4.1.500 NMAC (incorporating 40 CFR §264.97[g][2]) provides that an alternate sampling frequency to that provided in 20.4.1.500 NMAC (incorporating 40 CFR §264.98) may be proposed by the Permittees. Given the nature and rate of ground-water flow in the area surrounding WIPP, collecting and analyzing one sample semiannually will be protective of human health and the environment because any hazardous constituent leaving the underground disposal facility will not have the potential to migrate beyond the ground-water monitoring network in a one-year time frame. Ground-water flow characteristics are presented in detail in Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009)."
Attachment L, Section L-4a	Replaced "seven DMP wells" with "six DMWs"
Attachment L, Section L-4a	Replaced "DMP well" with "DMW"
Attachment L, Section L-4a	Added "annual"
Attachment L, Section L-4a	Replaced "other existing WQSP well sites" with "WLMP wells"

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Attachment L, Section L-4a	Replaced "to supplement the area water-level database and to help define regional changes in ground-water flow directions and gradients" with "when accessible"
Attachment L, Section L-4a	Replaced "RCRA DMP" with "DMW"
Attachment L, Section L-4a	Added "sampling"
Attachment L, Section L-4a	Deleted "If any change occurs which could affect the ability of the DMP to fulfill the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F), the Permittees shall promptly notify NMED in writing and apply for a permit modification, if appropriate."
Attachment L, Section L-4b	Added "and Hazardous Constituents" to section heading
Attachment L, Section L-4b	Replaced "analytes of interest" with "parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b are"
Attachment L, Section L-4b	Replaced "to establish" with "as part of the DMP."
Attachment L, Section L-4b	Deleted "background ground-water quality prior to emplacement of waste include all indicator parameters and all other parameters listed in 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX. Field measurements of pH, SC, temperature, chloride, Eh, total iron, and alkalinity are also measured during background sampling ." "The DMP was initiated upon waste emplacement, at which time the semiannual samples will be analyzed for the parameters listed in Table L-3. Parameters to be analyzed by the contract laboratory such as specific conductance, total dissolved solids, total suspended solids, density, pH, total organic carbon, and total organic halogens were included as indicator parameters because of their universal commonality to ground water. Parameters such as chloride, alkalinity, calcium, magnesium, and potassium were included as matrix-specific general indicator parameters. Calcium, magnesium, potassium, chloride, and iron may be deleted during detection monitoring, with prior approval of NMED. Organic and inorganic compounds on the right hand side of Table L-3 were chosen because they will occur in the waste to be disposed at the WIPP facility."
Attachment L, Section L-4b	Replaced "parameters" with "hazardous constituents"
Attachment L, Section L-4b	Replaced "the tentatively identified compound (**TIC**) process specified in the Waste Analysis Plan, Permit Attachment C" with "changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility."
Attachment L, Section L-4b	Replaced "compounds" with "hazardous constituents"
Attachment L, Section L-4b	Replaced "DMP list" with "Part 5, Table 5.4.b"
Attachment L, Section L-4b	Added "(e.g., hazardous constituent not in 40 CFR §264 Appendix IX)"
Attachment L, Section L-4c	Replaced "well" with "DMW"
Attachment L, Section L-4c	Replaced "DMP analytical suite" with "parameters and hazardous constituents in Part 5, Tables 5.4.a and 5.4.b"
Attachment L, Section L-4c(1)	Replaced "is a subprogram of the DMP. The quality assurance activities of the WLMP are in strict accordance with WP 13-1, and the quality assurance implementing procedure specific to ground-water surface elevation monitoring is WIPP Procedure WP 02-EM1014[2]. Current versions of both WP 13-1 and WP 02-EM1014 are maintained in the WIPP Operating Record. with "activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3. "
Attachment L, Section L-4c(1)	Deleted footnote 2 "[2]WP 02-EM1014 "Groundwater Level Measurements" is a technical procedure that specifies the steps followed by Environmental Monitoring (**EM**) personnel

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	for making manual ground-water level measurements in ground-water wells in the vicinity of the WIPP facility. The procedure provides general instructions including prerequisites, safety precautions, performance frequency, quality assurance, and records. Specific instructions are included for using the water level measurement electrical conductance probe and data management."
Attachment L, Section L-4c(1)	Deleted "Ground-water surface elevation monitoring is in progress now and will continue through the post-closure care period specified in Permit Part 7. This section of the plan addresses the activities of the WLMP during the preoperational and operational phases of WIPP. Collection of ground-water surface elevation data is required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). These data also provide: Data collection as required by the Environmental Monitoring Plan. A means to fulfill commitments made in the Final Environmental Impact Statement (**FEIS**). A means to comply with future ground-water inventory and monitoring regulations. Input for making land use decisions, (i.e., designing long-term active and passive institutional controls for the site). Assistance in understanding any changes to readings from the water-pressure transducers installed in each of the shafts to monitor water conditions behind the liners. An understanding of whether or not the horizontal and vertical gradients of flow are changing over time. The objective of the WLMP is to extend the documented record of ground-water surface elevation fluctuations in the Culebra and Magenta members of the Rustler in the vicinity of the WIPP facility and to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). Ground-water surface elevation data will be collected from each well of the RCRA DMP. Ground-water surface elevation data will also be collected from other Culebra wells, as well as monitoring wells completed in other water-bearing zones overlying and underlying the WIPP repository horizon (see Figure L-18) when access to those zones is possible. This includes, but is not limited to, the Bell Canyon, the Forty-niner, the contact zone between the Rustler and Salado, and the Dewey Lake."
Attachment L, Section L-4c(1)	Added "Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally,"
Attachment L, Section L-4c(1)	Changed "G" to "g" in "Groundwater"
Attachment L, Section L-4c(1)	Replaced "at least one accessible completed interval at each available well pad" with "the other Culebra wells as listed in Table L-4,"
Attachment L, Section L-4c(1)	Added "when accessible"
Attachment L, Section L-4c(1)	Deleted "At well pads with two or more wells completed in the same interval, quarterly measurements will be taken in the redundant wells ("
Attachment L, Section L-4c(1)	Changed "well to "Well"
Attachment L, Section L-4c(1)	Replaced "18" with "14" to read "L-14"
Attachment L, Section L-4c(1)	Deleted ")"
Attachment L, Section L-4c(1)	Deleted "Ground-water surface elevation measurements will be taken monthly at each of the seven DMP wells, as well as prior to each sampling event."
Attachment L, Section L-4c(1)	Replaced "report" with "Annual Culebra Groundwater Report"
Attachment L, Section L-4c(1)	Replaced "may" with "will be evaluated to determine if they"
Attachment L, Section L-4c(1)	Replaced "DMP well" with "DMW"

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Attachment L, Section L-4c(1)	Added "c" to end of "Section L-5"
Attachment L, Section L-4c(1)	Added "the"
Attachment L, Section L-4c(1)	Added "facility"
Attachment L, Section L-4c(1)	Deleted "both vertically in well bores and areally from well to well"
Attachment L, Section L-4c(1)	Deleted "at WIPP"
Attachment L, Section L-4c(1)	Added "Culebra groundwater"
Attachment L, Section L-4c(1)	Replaced "bores" with "s listed in Table L-4"
Attachment L, Section L-4c(1)	Added "d" to "measure"
Attachment L, Section L-4c(1)	Deleted "When both of these parameters are known, equivalent freshwater heads will be calculated. The concept of freshwater head is discussed in Lusczynski (1961). A discussion explaining the calculation of freshwater heads from mid-formation depth at WIPP can be found in Haug, et al. (1987). Freshwater heads are useful in identifying hydraulic gradients in aquifers of variable density such as those existing at the WIPP site. Freshwater head at a given point is defined as the height of a column of freshwater that will balance the existing pressure at that point (Lusczynski, 1961)."
Attachment L, Section L-4c(1)	Replaced "ground-" with "Culebra"
Attachment L, Section L-4c(1)	Replaced "g" with "γ"
Attachment L, Section L-4c(1)	Replaced "pressure" with "length of freshwater head"
Attachment L, Section L-4c(1)	Replaced "ρ" with "γ"
Attachment L, Section L-4c(1)	Added "ratio of borehole fluid density to density of fresh water"
Attachment L, Section L-4c(1)	Replaced "g" with "ρ"
Attachment L, Section L-4c(1)	Replaced "density (expressed as specific gravity)." With "specific gravity."
Attachment L, Section L-4c(1)	Added "Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.
Attachment L, Section L-4c(1)(i)	Replaced "When using an electrical conductance probe, the depth to water will be determined by reading the appropriate measurement markings on the embossed measuring tape when the alarm is activated at the surface. WIPP Procedure WP 02-EM1014 specifies" with "An SOP will be used when making water-level measurements for this program. The SOP will specify"
Attachment L, Section L-4c(1)(i)	Added ", and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records"
Attachment L, Section L-4c(1)(i)	Deleted "A current revision of this procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(1)(ii)	Deleted "All"
Attachment L, Section L-4c(1)(ii)	Changed "incoming" to "Incoming"
Attachment L, Section L-4c(1)(ii)	Deleted "timely"
Attachment L, Section L-4c(1)(ii)	Replaced "to" with "that"
Attachment L, Section L-4c(1)(ii)	Replaced "assure" with "ensures"

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Attachment L, Section L-4c(1)(ii)	Replaced "i.e." with "e.g."
Attachment L, Section L-4c(1)(ii)	Replaced "guidelines outlined in WIPP Procedures WP 02-EM3001[3] and WP 02-EM1014[4]" with "applicable SOPs (see Table L-3)""
Attachment L, Section L-4c(1)(ii)	Deleted footnotes 3 and 4 "[3]WP 02-EM3001 "Administrative Processes for Environmental Monitoring Programs" is a management control procedure to provide the administrative guidance to be used by Environmental Monitoring (EM) personnel to maintain quality control (QC) associated with EM sampling activities and to assure that data acquired under the WIPP Environmental Monitoring Program are valid. The precautions and limitations portion of this procedure assure that only qualified personnel acquire samples under the EM program, that cross contamination of sampling equipment is prevented, and that sample hold times are not exceeded. The Performance portion of the procedure provides step-by-step instructions for Quality Assurance/Quality Control (QA/QC) implementation, the use of data sheets and sample tracking logbooks, sample tacking from collection to submittal, and actions to take if sample results indicate the potential for exceeding a regulatory limit. [4]WP 02-EM1014 "Groundwater Level Measurement", is a technical procedure which lists the equipment required and the operational checks necessary to perform groundwater level measurements. This procedure as well as WP 02-EM3001 also provides information on performing validation and verification of laboratory data."
Attachment L, Section L-4c(1)(ii)	Deleted "Current copies of these procedures are maintained within the WIPP Operating Record."
Attachment L, Section L-4c(1)(ii)	Replaced "will" with "program"
Attachment L, Section L-4c(1)(ii)	Added "s" to "calculate"
Attachment L, Section L-4c(1)(ii)	Replaced "will also adjust" with "program adjusts"
Attachment L, Section L-4c(1)(ii)	Deleted "The data contained on the computerized work sheet will be translated into a database file. A printout will be made of the database file. The data each month will then be compiled into report format and transmitted to the appropriate agencies as requested by the Permittees."
Attachment L, Section L-4c(1)(ii)	Replaced "all" with "the"
Attachment L, Section L-4c(1)(ii)	Added "in Table L-4"
Attachment L, Section L-4c(1)(ii)	Replaced "one month after data are collected" with "by May 31 and November 30"
Attachment L, Section L-4c(1)(ii)	Added "Semi-annual groundwater reports will also include annotated hydrographs and trend analysis."
Attachment L, Section L-4c(1)(ii)	Deleted "A computerized database file will be maintained for all ground-water surface elevation data. Monthly and quarterly data will be appended into a yearly file. Upon verification that the yearly database is free of errors, it will be appended into the project database file. A printed copy of the current project database (through December of the preceding year) will be kept in the Environment, Safety and Health Department (**ES&H**) EM fire-resistant storage area."
Attachment L, Section L-4c(2)(i)	Deleted "The water-bearing units at WIPP are highly variable in their ability to yield water to monitoring wells. The Culebra, the most transmissive hydrologic unit in the WIPP area, exhibits transmissivities that range many orders of magnitude across the site area and is the primary focus of the DMP."
Attachment L, Section L-4c(2)(i)	Replaced "seven new DMP wells" with "six DMWs"
Attachment L, Section L-4c(2)(i)	Deleted "The wells used for ground-water quality sampling vary in yield, depth,

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	and pumping lift. These factors affect the duration of pumping as well as the equipment required at each well."
Attachment L, Section L-4c(2)(i)	Replaced "DMP wells will be" with "DMWs are"
Attachment L, Section L-4c(2)(i)	Replaced "down hole" and "down-hole"
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "are"
Attachment L, Section L-4c(2)(i)	Deleted "The electronic flow controller allows personnel collecting samples to control the rate of discharge during well purging to minimize the potential for loss of volatiles from the sample."
Attachment L, Section L-4c(2)(i)	Replaced "a minimum of" with "no more than"
Attachment L, Section L-4c(2)(i)	Added "or until field parameters have stabilized, whichever occurs first."
Attachment L, Section L-4c(2)(i)	Deleted "at a rate that will minimize the agitation of recharge water. This will be accomplished by monitoring formation pressure and matching the rate of discharge from the well as nearly as possible to the rate of recharge to the well. WIPP Procedure WP 02-EM1002[5] specifies the methods used for controlling flow rates and monitoring formation pressure. A current version of this document will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(2)(i)	Deleted footnote 5 "[5] WP 02-EM1002 "Electric Submersible Pump Monitoring System Installation and Operation" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples using electric submersible pumps (ESPs). The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure the correct installation and operation. The procedure details how to install the various subsystems such as the surface discharge and pressure monitoring system and the pressure monitoring bubbler and how to start up and shut down the ESP."
Attachment L, Section L-4c(2)(i)	Replaced "requirements will be used" with "will be performed in accordance with an SOP"
Attachment L, Section L-4c(2)(i)	Replaced "DMP wells will be" with "DMWs are"
Attachment L, Section L-4c(2)(i)	Deleted "Details of well construction are presented in Section L-3b(1)."
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"
Attachment L, Section L-4c(2)(i)	Deleted "will"
Attachment L, Section L-4c(2)(i)	Added "s" to "take"
Attachment L, Section L-4c(2)(i)	Deleted "Teflon®"
Attachment L, Section L-4c(2)(i)	Replaced "will also be" with "is"
Attachment L, Section L-4c(2)(i)	Added "The sampling line is manufactured from a chemically inert material."
Attachment L, Section L-4c(2)(i)	Deleted "Flow through the pipe will be regulated on the surface by a flow control valve and/or variable speed drive controller."
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"
Attachment L, Section L-4c(2)(i)	Deleted "Teflon®"
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"
Attachment L, Section L-4c(2)(i)	Deleted "Teflon®"
Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"

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Attachment L, Section L-4c(2)(i)	Replaced "will be" with "is"
Attachment L, Section L-4c(2)(i)	Deleted section on Pressure Monitoring Systems
Attachment L, Section L-4c(2)(i)	Deleted section on Sampling Overview
Attachment L, Section L-4c(2)(ii)	Added "' SOP for serial sampling will provide criteria for determining when a final sample should be taken."
Attachment L, Section L-4c(2)(ii)	Deleted "will consider a serial sample representative of undisturbed ground water when the majority of field indicator parameter measurements have stabilized within ±5 percent of the average of analytical results for the field indicator parameter from the background ground-water quality for each DMP well. Nonstabilization of one or two field indicator parameters attributable to matrix interferences, instrument drift, or other unforeseen reasons will not preclude the collection of final samples, provided the volume of purged water exceeds three well bore volumes."
Attachment L, Section L-4c(2)(ii)	Added "Each DMW will be purged to no more than three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed parameters are within $\pm$ 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile field laboratory for field indicator parameters."
Attachment L, Section L-4c(2)(ii)	Deleted "report, in the operating record, any final samples collected when field indicator parameters were not stabilized, and will"
Attachment L, Section L-4c(2)(ii)	Added "and place that explanation in the WIPP Operating Record"
Attachment L, Section L-4c(2)(ii)	Replaced "Team Leader (see Section L-7)" with "Permittees"
Attachment L, Section L-4c(2)(ii)	Deleted "chloride, divalent cations (hardness), alkalinity, total iron,"
Attachment L, Section L-4c(2)(ii)	Deleted "Eh"
Attachment L, Section L-4c(2)(ii)	Deleted "Protocols for collection of serial samples are specified in WIPP Procedure WP 02-EM1006[6]. Analysis of serial samples are specified in WIPP Procedure WP 02-EM1005[7]. Current versions of these procedures will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(2)(ii)	Replaced "Eh" with "specific conductance"
Attachment L, Section L-4c(2)(ii)	Deleted footnotes 6 and 7 "[6]WP 02-EM1006 "Final Sample and Serial Sample Collection" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples from the WQSP wells and from privately-owned wells in the vicinity of WIPP. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, and prerequisite actions which assure the data quality. The procedure addresses collection of samples from private wells, collection of serial ground-water samples, the collection of final samples for submittal to the laboratory, and data review by the monitoring task leader." "[7]WP 02-EM1005 "Groundwater Serial Sample Analysis" is a technical procedure that provides step-by-step instructions for on site analysis of ground water to determine ground-water stability prior to the collection of final samples for analysis. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure data quality. The procedure addresses the field measurement of Eh, pH, temperature, specific gravity, specific conductance, alkalinity, chloride, divalent cation, and total iron as indicators of ground-water stability."
Attachment L, Section L-4c(2)(ii)	Deleted "Teflon®"

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Attachment L, Section L-4c(2)(ii)	Deleted "The iron, divalent cation, chloride, alkalinity"
Attachment L, Section L-4c(2)(ii)	Changed "specific" to "Specific"
Attachment L, Section L-4c(2)(ii)	Deleted "Teflon®,"
Attachment L, Section L-4c(2)(ii)	Added ", that are certified clean by the laboratory,"
Attachment L, Section L-4c(2)(ii)	Deleted "Teflon®,"
Attachment L, Section L-4c(2)(ii)	Deleted "Serial sampling water collected for solute and specific conductance determinations will be filtered through a 0.45 micrometers (µm) membrane filter using a stainless steel, in-line filter holder."
Attachment L, Section L-4c(2)(ii)	Replaced "Filtered water will be used to rinse the sample bottle prior to serial sample collection." with "Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection."
Attachment L, Section L-4c(2)(ii)	Replaced "Eh" with "specific conductance"
Attachment L, Section L-4c(2)(ii)	Replaced "The filtered sample collected for solute analyses will be immediately analyzed for iron and alkalinity because these two solution parameters are extremely sensitive to changes in the ambient water-sample pressure and temperature. A sample and duplicate of filtered water will be collected and analyzed for solute parameters (alkalinity, chloride, divalent cations, and iron)." with "Samples collected will immediately be analyzed for pH and specific conductance (**SC**) as these parameters are most sensitive to changes in ambient temperature."
Attachment L, Section L-4c(2)(ii)	Replaced "Eh" with "specific conductance"
Attachment L, Section L-4c(2)(ii)	Deleted "Samples to be analyzed for chloride and divalent cations (after preservation with nitric acid and stored at 4°C) may be stored for one week prior to analysis with confidence that the analytical results will not be altered."
Attachment L, Section L-4c(2)(ii)	Replaced "WIPP Procedure WP 02-EM1006" with "Standard Operating Procedures (see Table L-3)"
Attachment L, Section L-4c(2)(ii)	Added "and analysis"
Attachment L, Section L-4c(2)(ii)	Deleted "WIPP Procedure WP 02-EM1005 defines the protocols for serial sample analysis. Current versions of these procedures will be maintained in the WIPP Operating Record. During the first two years of DMP well serial sampling, the first sample will be analyzed as soon as possible after the pump is turned on and daily thereafter for a period of four days or until the field indicator parameters (chloride, divalent cations, alkalinity, and iron) stabilize. pH and SC will be continually monitored by using a flow cell with ion-specific electrodes and a real-time readout. When detection monitoring begins, the serial sampling process may be modified and the decision to collect final samples would then be based on the number of well bore volumes purged and results of the analysis of chloride, temperature, specific gravity, pH, and SC. Removal of serial sampling from the DMP will be accomplished through a permit modification and a modification to this plan."
Attachment L, Section L-4c(2)(iii)	Replaced "4" with "6" to read "L-6"
Attachment L, Section L-4c(2)(iii)	Deleted "Non-dedicated sample collection lines from the well head to the sample collection area will be discarded after each use."
Attachment L, Section L-4c(2)(iii)	Added "in accordance with SOPs"
Attachment L, Section L-4c(2)(iii)	Deleted "with two gallons of fresh water, then rinsed with five gallons of 5 percent nitric acid solution and rinsed with five gallons of DI water"
Attachment L, Section L-4c(2)(iii)	Moved "blank" after "rinsate"
Attachment L, Section L-4c(2)(iii)	Replaced "decontamination" with "cleanliness"

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Attachment L, Section L-4c(2)(iii)	Deleted "Teflon®"
Attachment L, Section L-4c(2)(iii)	Deleted "branching from the main sample line"
Attachment L, Section L-4c(2)(iii)	Replaced "procedures, assure that" with "SOPs (see Table L-3) define how"
Attachment L, Section L-4c(2)(iii)	Deleted ". WIPP Procedure WP 02-EM1006 defines the requirements for collection of final samples"
Attachment L, Section L-4c(2)(iii)	Deleted "A current version of this procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(2)(iii)	Replaced "4" with "6" to read "L-6"
Attachment L, Section L-4c(2)(iii)	Deleted "Standard Operating Procedures [" and "]"
Attachment L, Section L-4c(2)(iii)	Replaced "procedures" with "SOPs"
Attachment L, Section L-4c(2)(iii)	Deleted "contract"
Attachment L, Section L-4c(2)(iii)	Deleted "Before the final sample is taken, all plastic and glass containers will be rinsed with the pumped ground water, either filtered or unfiltered, dependent upon analysis protocol. When the rinsing procedure is completed the final sample will be collected."
Attachment L, Section L-4c(2)(iii)	Replaced "contract" with "the analytical"
Attachment L, Section L-4c(2)(iii)	Replaced "general chemistry, radionuclides, metals, and selected VOCs that are specific to the waste anticipated to arrive at WIPP." with "parameters and hazardous constituents specified in Part 5, Tables 5.4.a and 5.4.b."
Attachment L, Section L-4c(2)(iii)	Deleted "Table L-3 presents the specific analytes for the DMP."
Attachment L, Section L-4c(2)(iii)	Added "Project"
Attachment L, Section L-4c(2)(iii)	Replaced "as" with "when"
Attachment L, Section L-4c(2)(iii)	Deleted "by the Permittees or NMED"
Attachment L, Section L-4c(2)(iii)	Deleted "Resulting "
Attachment L, Section L-4c(2)(iii)	Changed "wastes" to "Wastes"
Attachment L, Section L-4c(2)(iii)	Added "resulting from the sampling and field analysis of groundwater"
Attachment L, Section L-4c(2)(iii)	Replaced "Procedure WP 02-RC.01[8]." with "SOPs (see Table L-3)."
Attachment L, Section L-4c(2)(iii)	Deleted "A current version of this procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(2)(iii)	Deleted footnote 8 "[8]WP 02-RC.01 "Site-Generated, Non-Radioactive Hazardous Waste Management Plan" is a step-by-step procedure that defines site-generate non-radioactive hazardous waste (SGNRHW) and lists responsibilities of waste management organizations including the generator, waste handlers, sampling personnel, safety personnel, and compliance personnel. In addition, the procedure defines training requirements, container marking requirements, spill response, and list prohibitions. A Section of the procedure is focused on waste management practices including the management in satellite accumulation areas, the hazardous waste staging area for materials awaiting analysis, the establishment of accumulation times, and hazardous waste disposal."
Attachment L, Section L-4c(2)(iv)	Deleted "with either high purity hydrochloric acid, nitric acid, or sulfuric acid (ULTREX or equivalent), depending upon the standard method of treatment required for the particular parameter suite or"
Attachment L, Section L-4c(2)(iv)	Replaced "contract" with "the analytical"

Affected Permit Section	Explanation of Change
Attachment L, Section L-4c(2)(iv)	Deleted "SOPs (see Table L-4)"
Attachment L, Section L-4c(2)(iv)	Replaced "contract" with "analytical"
Attachment L, Section L-4c(2)(iv)	Deleted "use procedures that"
Attachment L, Section L-4c(2)(iv)	Deleted "and"
Attachment L, Section L-4c(2)(iv)	Added ", and the shipping requirements"
Attachment L, Section L-4c(2)(iv)	Replaced "if" with "when"
Attachment L, Section L-4c(2)(iv)	Added "WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping."
Attachment L, Section L-4c(2)(iv)	Added "the"
Attachment L, Section L-4c(2)(iv)	Replaced "will use" with "facility uses"
Attachment L, Section L-4c(2)(iv)	Replaced "(CofC) Forms and" with "/"
Attachment L, Section L-4c(2)(iv)	Replaced "(RFA) Forms" with "(**CofC/RFA**) forms"
Attachment L, Section L-4c(2)(iv)	Replaced "parameters" with "analytes"
Attachment L, Section L-4c(2)(iv)	Replaced "Procedure WP 02-EM3001" with "SOPs (see Table L-3)"
Attachment L, Section L-4c(2)(iv)	Deleted "s" from "provides"
Attachment L, Section L-4c(2)(iv)	Deleted "A current revision of this procedure will be maintained within the WIPP Operating Record. Insulated shipping containers packaged with crushed ice or reusable ice packs will be used to keep the samples cool during transport to the contract laboratory. Holding times for specific analytical parameters require samples to be shipped by express air freight. The coolers will be packaged to meet Department of Transportation and International Air Transportation Association commercial carrier regulations."
Attachment L, Section L-4c(2)(v)	Deleted "EM"
Attachment L, Section L-4c(2)(v)	Replaced "Procedure WP 02-EM3001" with "facility SOPs see (Table L-3)"
Attachment L, Section L-4c(2)(v)	Deleted "These procedures will be strictly followed throughout the course of each sample collection and analysis event. A current revision of this procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-4c(2)(v)	Deleted "will"
Attachment L, Section L-4c(2)(v)	Replaced "log books" with "data"
Attachment L, Section L-4c(2)(v)	Replaced "request for analysis/chain of custody (RFA and CofC" and ")" with "CofC/RFA"
Attachment L, Section L-4c(2)(v)	Replaced "The forms are briefly defined in the following subsections. with "An example form is shown in Figure L-13."
Attachment L, Section L-4c(2)(v)	All sample documentation will be completed for each sample and reviewed by the Team Leader or his/her designee for completeness and accuracy."
Attachment L, Section L-4c(2)(v)	Deleted "The Team Leader (see Section L-7) will assign the numbers prior to sample collection."
Attachment L, Section L-4c(2)(v)	Deleted "permanent,"
Attachment L, Section L-4c(2)(v)	Replaced "The" with "For example,"
Attachment L, Section L-4c(2)(v)	Replaced "will be" with "that are"
Attachment L, Section L-4c(2)(v)	Deleted "that"

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Attachment L, Section L-4c(2)(v)	Changed subeading from "Sample Tracking Logbook" to "Sample Identification and Tracking"
Attachment L, Section L-4c(2)(v)	Deleted "A"
Attachment L, Section L-4c(2)(v)	Changed "sample" to "Sample"
Attachment L, Section L-4c(2)(v)	Replaced "logbook (STLB) form will be completed for each sample collected." with "information will be completed for each sample collected."
Attachment L, Section L-4c(2)(v)	Replaced "STLB will" with "sample tracking information"
Attachment L, Section L-4c(2)(v)	Added "s" to "include"
Attachment L, Section L-4c(2)(v)	Replaced "C of C" with "CofC/RFA form"
Attachment L, Section L-4c(2)(v)	Deleted "RFA No.;"
Attachment L, Section L-4c(2)(v)	Replaced "STLB" with "Sample tracking"
Attachment L, Section L-4c(2)(v)	Deleted "and checked by the Team Leader. When samples are shipped, the STLB will remain in the custody of the EM Section for sample tracking purposes."
Attachment L, Section L-4c(2)(v)	Added "Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document."
Attachment L, Section L-4c(2)(v)	Changed subeading from "Request for Analysis and Chain of Custody" to "Chain of Custody and Request for Analysis"
Attachment L, Section L-4c(2)(v)	Deleted "n" from "An"
Attachment L, Section L-4c(2)(v)	Replaced "RFA and CofC" with "CofC/RFA"
Attachment L, Section L-4c(2)(v)	Deleted "An example of the RFA and CofC form is presented in Figures L-17a and L-17b."
Attachment L, Section L-4c(2)(v)	Replaced "RFA and CofC" with "CofC/RFA"
Attachment L, Section L-4c(2)(v)	Added "analytical"
Attachment L, Section L-4c(2)(v)	Replaced "RFA and CofC" with "CofC/RFA form"
Attachment L, Section L-4c(2)(v)	Replaced "RFA and CofC" with "CofC/RFA form"
Attachment L, Section L-4c(2)(v)	Replaced "Team Leader" with "Permittees"
Attachment L, Section L-4c(2)(v)	Replaced "RFA and CofC" with "CofC/RFA"
Attachment L, Section L-4c(2)(v)	Added "analytical"
Attachment L, Section L-4c(3)	Replaced "by a commercial laboratory." with "using"
Attachment L, Section L-4c(3)	Changed "Methods" to "methods"
Attachment L, Section L-4c(3)	Deleted "will be specified in procurement documents and will be"
Attachment L, Section L-4c(3)	Added "In Part 5,"
Attachment L, Section L-4c(3)	Replaced "L-3" with "s 5.4.a and 5.4.b"
Attachment L, Section L-4c(3)	Added "and hazardous constituents"
Attachment L, Section L-4c(3)	Added "unless alternate methods or protocols are approved by the NMED"
Attachment L, Section L-4c(3)	Replaced "selected" with "analytical"

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Attachment L, Section L-4c(3)	Added "protocols such as"
Attachment L, Section L-4c(3)	Added "unless alternate methods or protocols are approved by the NMED"
Attachment L, Section L-4c(3)	Added "analytical"
Attachment L, Section L-4c(3)	Added "WIPP"
Attachment L, Section L-4c(3)	Changed "operating record" to Operating Record."
Attachment L, Section L-4c(3)	Added "." After "Record"
Attachment L, Section L-4c(3)	Deleted "and will be available for review upon request by NMED."
Attachment L, Section L-4c(3)	Replaced "WIPP repository" with "Culebra groundwater"
Attachment L, Section L-4c(3)	Replaced "Once the initial qualification criteria, as specified above, have been met, the Permittees will select a laboratory based upon competitive bid. The selected laboratory will perform analytical work for the Permittees for a predetermined period of time, as specified in the contract between the Permittees and the selected laboratory. As this period of performance comes to an end, a new laboratory selection/competitive bid process will be initiated by the Permittees. The same or a different laboratory may be selected for the new contract period." with "The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (QC) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above."
Attachment L, Section L-4c(3)	Replaced "The" with "A copy of the laboratory"
Attachment L, Section L-4c(3)	Deleted "for the laboratory currently under contract"
Attachment L, Section L-4c(3)	Deleted "in a file"
Attachment L, Section L-4c(3)	Replaced "the operating record by the Permittees." with "WIPP facility files."
Attachment L, Section L-4c(3)	Added "by January 31"
Attachment L, Section L-4c(3)	Replaced "on behalf of the Permittees by the Management and Operating Contractor (**MOC**) Environmental Monitoring (**EM**). Data validation results are documented on an Approval/Variation Request (**AR/VR**) form (Procedure WP 15-PC3041). If no discrepancies are found in the data, the AR/VR form will be signed and the approved box will be checked. If however, discrepancies are found, the AR/VR form will be signed and the disapproved or approved-on-condition box will be checked and the form will be returned to the team leader accompanied by an attached report discussing the data validation results, any anomalies, and resolutions. Copies of the data validation report will be distributed to the EM Manager, QA Manager, the Team Leader, and the Contract Administrator. Copies of the data validation report will be kept on file in the EM records section for review upon request by NMED." with "and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record."
Attachment L, Section L-4d(1)	Changed section heading "Sampling Equipment Calibration Requirements" to "Sampling and Groundwater Elevation Monitoring Equipment Calibration"
Attachment L, Section L-4d(1)	Deleted "the WQSP and"

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Affected Permit Section	Explanation of Change
Attachment L, Section L-4d(1)	Replaced "maintenance administrative procedures specified below" with "SOPs"
Attachment L, Section L-4d(1)	Replaced "EM Section" with "Permittees"
Attachment L, Section L-4d(1)	Replaced ", in accordance with written procedures. The EM Section will also be responsible" with "and"
Attachment L, Section L-4d(2)	Replaced "Procedure WP 10-AD3029[9] A current revision of this procedure will be maintained in the WIPP Operating Record." with "facility SOPs (see Table L-3)."
Attachment L, Section L-4d(2)	Deleted footnote 9 "[9]WP 10-AD3029 "Calibration and Control of Monitoring and Data Collection Equipment" provides the step-by-step protocols for the establishment and maintenance of a master database of monitoring and data collection (**M&DC**) equipment, the recall process for equipment needing calibration, the performance of calibrations, the management of calibration results to determine the adequacy of recall frequencies, functional testing of M&DC equipment, and reporting including out-of-tolerance reporting and expired calibration reporting. In addition, the procedure provides step-by-step process for the storage of calibrated M&DC equipment and the use of rental equipment."
Attachment L, Section L-4d(2)	Replaced "EM Section" with "Permittees"
Attachment L, Section L-4d(2)	Replaced "calibrating the needed" with "ensuring"
Attachment L, Section L-4d(2)	Added "is calibrated"
Attachment L, Section L-4d(2)	Replaced "written procedures" with "SOPs"
Attachment L, Section L-4d(2)	Replaced "EM Section" with "Permittees"
Attachment L, Section L-4d(2)	Re[;aced "current" with "copies of records of the most recent"
Attachment L, Section L-4d(2)	Deleted "records"
Attachment L, Section L-4e	Added "Analytical" to section heading
Attachment L, Section L-4e	Deleted "As required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98), data collected to establish background ground-water quality and" Added "Analytical data collected"
Attachment L, Section L-4e	Replaced "DMP." with "Permittees"
Attachment L, Section L-4e	Deleted "Statistical analysis of DMP data will conform to EPA guidance "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (EPA, 1989)""
Attachment L, Section L-4e	Deleted "and "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992)."
Attachment L, Section L-4e(1),	Deleted "Environmental parameters vary with space and time. The effect of one or both of these two factors on the expected value of a point measurement will be statistically evaluated through spatial analysis and time series analysis. These methods often require extensive sampling efforts that may exceed the practical limits of the DMP sampling procedures. Spatial analysis may have limited use DMP during the operational period, although the effect of spatial auto-correlation on the interpretation of the data will be considered for each parameter. Spatial variability will be accounted for by the use of predetermined key sampling locations. Data analysis will be performed on a location-specific basis, or data from different locations will be combined only when the data are statistically homogeneous. Statistical homogeneity will be determined by evaluating mean values and variances from the residuals from the individual well data.

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	Time series analysis plays a more important role in data analysis for the DMP. Parameters will be reported as time series, either in tabular form or as time plots. For key time series parameters, these plots will be in the form of control charts on which control levels will be identified based on preoperational database, fixed standards, control location databases, or other standards for comparison. Where significant seasonal changes in the expected value of the parameter are identified in the preoperational database or in the control locations, corrections in the control levels which reflect the seasonal change will be made and documented."
Attachment L, Section L-4e(1)	Added "Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required. The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6."
Attachment L, Section L-4e(2)	Deleted "For data sets which include more than ten data points that are homogeneous in space and time (including seasonal homogeneity) and have less than ten percent missing data, a test for conformance to the normal distribution will be performed. The test for normality of the data will be performed in accordance with the methodologies presented in "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992). If normality is not met, the data will be log-transformed (or transformed using a suitable mathematical transformation, e.g., square root) and retested for normality. If the transformed data fit a normal distribution, the original data will be accepted as having lognormal or an otherwise mathematically-transformed normal distribution. If normality is still not found, two courses may be taken. One will be to continue to test the fit to standard families of distributions, such as the gamma, beta, and Weibull, with proper modifications to subsequent analyses based on these results. The other course will be to use nonparametric methods of data analysis. For data sets smaller than ten, but homogeneous and complete, the lognormal distribution will be assumed. Data sets with more than ten percent missing data will be analyzed using nonparametric methods. Nonhomogeneous data sets will be subdivided into homogeneous sets and each of these analyzed individually. Descriptive statistics will be calculated for each homogeneous data set. At a minimum, these include a central value and a range of variation. The central value is the arithmetic mean of the untransformed data if the data are not censored at either end. If the data are censored, either a trimmed mean or the median will be used as the central value (which may be within the censored range). If the data set is greater than ten and is uncensored, the standard deviation will be calculated and used as a basis for the reported range in variation. If these criteria are not met, the range between the 0.25 and 0.75 cartelist will be used."
Attachment L, Section L-4e(2)	Added "Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (UTLV) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be

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	calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value."
Attachment L, Section L-4e(3)	Changed section heading from "Data Anomalies" to "Action Levels"
Attachment L, Section L-4e(3)	Deleted "Data anomalies include data points reported as being below the limit of detection (**LD**) or otherwise censored over a specific range of values, missing data points occurring randomly in the data set, and outliers that cannot be ascribed to a known source of variation. Whenever possible, sample values which are reported below detection limits will be incorporated into the database as sample values measured at one-half the detection limit for statistical analysis. When values are not available, alternative methods of analysis, as specified in previous sections, will be used. In particular, the use of nonparametric statistics will be required. Missing data points comprising less than 10 percent of the data set do not significantly affect data analyses. Results based on data in which more than 10 percent is missing will be identified as such at the time of reporting. Consideration of the potential effect of missing data shall be made when the majority of the data are missing from a discrete time span."
Attachment L, Section L-4e(3) Attachment L, Section L-4e(3)	Replaced "Formal testing for outliers will only be done in accordance with EPA guidance. The" with "Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the"
Attachment L, Section L-4e(3)	Deleted "Section 8.2 of the"
Attachment L, Section L-4e(3)	Replaced "1989" with "2009"
Attachment L, Section L-4e(3)	Deleted "will be used to check for outliers"
Attachment L, Section L-4e(3)	Deleted "If an outside source of variation is not identified to account for outliers in a data set, it will be included in the data set and all subsequent analyses. If the inclusion of such outliers is found to affect the final results of the analyses significantly, both results (with and without outliers) will be reported."
Attachment L, Section L-4e(4)	Added "TRU mixed"
Attachment L, Section L-4e(4)	Added "hazardous"
Attachment L, Section L-4e(4)	Added "Part 5,"
Attachment L, Section L-4e(4)	Replaced "L-3" with "5.4.b"
Attachment L, Section L-4e(4)	Replaced "DMP ground-water" with "detection"
Attachment L, Section L-4e(4)	Added "during each of the ten background sampling events (with the exceptions of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed waste disposal began)"
Attachment L, Section L-4e(4)	Deleted "If any background ground-water quality parameter or constituent has not been measured prior to waste receipt, measurements will be made for those parameters or constituents in hydraulically upgradient DMP ground-water monitoring wells for a sequence of four sampling events. Following completion of the four sampling events, the arithmetic mean and variance shall then be calculated by the field supervisor or designee for each well."
Attachment L, Section L-4e(4)	Deleted "will then"
Attachment L, Section L-4e(4)	Replaced "background value against which statistical values" with "statistical baseline (Part 5, Table 5.6) that is used"

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Attachment L, Section L-4e(4)	Added "evaluating the significance of the results of"
Attachment L, Section L-4e(4)	Deleted "will be compared"
Attachment L, Section L-4e(4)	Added ". Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation"
Attachment L, Section L-4e(4)	Replaced "Statistical analysis and comparison will be accomplished using one of the five statistical tests specified in" with "The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with"
Attachment L, Section L-4e(4)	Replaced "98" with "97"
Attachment L, Section L-4e(4)	Added "(4)"
Attachment L, Section L-4e(4)	Deleted ", which may include Cochran's Approximation to the Behrens-Fisher students' t-test at the 0.01 level of significance (described in Appendix IV to 20.4.1.500 NMAC (incorporating 40 CFR §264)"
Attachment L, Section L-4e(4)	Replaced "a significant increase" with "that a constituent statistically exceeds the baseline"
Attachment L, Section L-4e(4)	Replaced "monitoring site" with "of the DMWs"
Attachment L, Section L-4e(4)	Added ")" after "CFR §264.98(f)"
Attachment L, Section L-4e(4)	Replaced "2" with "3"
Attachment L, Section L-4e(4)	Replaced "in" with "to"
Attachment L, Section L-4e(4)	Added "NMED in the"
Attachment L, Section L-4e(4)	Replaced "Site Environmental" with "Culebra Groundwater"
Attachment L, Section L-4e(4)	Deleted "(**ASER**)"
Attachment L, Section L-4e(4)	Replaced "and will be reported to NMED" with "by November 30"
Attachment L, Section L-4e(4)	Deleted "in October"
Attachment L, Section L-5a	Deleted ". Laboratory data reports will be forwarded to the Team Leader (see Section L-7) and NMED"
Attachment L, Section L-5a	Replaced "Analytical parameter" with "Parameter and hazardous constituent"
Attachment L, Section L-5a	Added "s" to result"
Attachment L, Section L-5a	Added "as specified in the Permit Part 5"
Attachment L, Section L-5b	Added "for hazardous constituents"
Attachment L, Section L-5b	Deleted "semi-"
Attachment L, Section L-5b	Replaced "Team Leader" with "Permitees"
Attachment L, Section L-5b	Replaced "Team Leader" with "Permitees"
Attachment L, Section L-5b	Replaced "ASER" with "Annual Culebra Groundwater Report"
Attachment L, Section L-5c	Changed section heading to "Semi-Annual Groundwater Surface Elevation Report "Annual Culebra Groundwater Report"
Attachment L, Section L-5c	Replaced ", and to the EM Manager and NMED in the ASER" with "in the Annual Culebra Groundwater Report"
Attachment L, Section L-5c	Replaced "ASER" with "report"
Attachment L, Section L-5c	Added "DMW and WLMP"
Attachment L, Section L-5c	Changed "Well" to "well"

Affected Permit Section	Explanation of Change
Attachment L, Section L-5c	Deleted "Any"
Attachment L, Section L-5c	Changed "pumping" to "Pumping"
Attachment L, Section L-5c	Added "related to"
Attachment L, Section L-5c	Deleted "activities"
Attachment L, Section L-5c	Added "that may have taken place since the last annual groundwater report"
Attachment L, Section L-5c	Added " • A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)). • The results of the annual measurements of densities. • Annotated hydrographs. • Groundwater flow rate and direction. – Potentiometric surface map generated using the following steps: – Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events. – Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date. – Fit trend surface through freshwater heads. – Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (PABC) and define initial fixed-head boundary conditions based on the trend surface. – Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW. – Run MODFLOW with optimal boundary conditions fit. – Contour MODFLOW head results on WIPP site. – Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary. – Data analysis that will accompany the potentiometric surface map will include: • Measured versus modeled scatter plot diagram • Frequency of modeled head residuals • Modeled residual freshwater head at each well • Explanations for modeled misfit residuals greater than 16.4 feet (5 meters). • Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2."
Attachment L, Section L-5c	Deleted "• Radionuclide specific data collected during the previous year."
Attachment L, Section L-5c	Replaced "ASER" with "Annual Culebra Groundwater Report"
Attachment L, Section L-5c	Added "facility"

Affected Permit Section	Explanation of Change
Attachment L, Section L-5c	Changed "operating record" to "Operating Record"
Attachment L, Section L-6	Replaced "ground-water surface elevation" with "water level"
Attachment L, Section L-6	Deleted "events"
Attachment L, Section L-6	Replaced "the form" with "either"
Attachment L, Section L-6	Replaced "in the EM section" with "at the Permittees facility or the Operating Record"
Attachment L, Section L-6	Replaced "records" with "files"
Attachment L, Section L-6	Added "'S" to "SAP"
Attachment L, Section L-6	Added "• Field Data Entry Sheets"
Attachment L, Section L-6	Deleted "• STLBs"
Attachment L, Section L-6	Added "CofC/"
Attachment L, Section L-6	Deleted "and CofC"
Attachment L, Section L-6	Deleted "s" on "forms"
Attachment L, Section L-6	Deleted "Contract"
Attachment L, Section L-6	Replaced "These and all raw analytical records generated in conjunction with ground-water sampling" with "Detection Monitoring Program monitoring, testing, and analytical data"
Attachment L, Section L-6	Replaced "ground-water surface elevation monitoring" with "WLMP data"
Attachment L, Section L-6	Replaced "stored in fire resistant cabinets" with "maintained in the WIPP facility Operating Record."
Attachment L, Section L-6	Deleted "in the EM section according to the Records Inventory and Disposition Schedule (**RIDS**) and will be made available for inspection upon request. The following records will be transmitted to the Permittees' Project Records Services (**PRS**) for long-term storage in accordance with the RIDS: • Instrument maintenance and calibration records • QC sample data • Control charts and calculation • Sample tracking and control documentation • Raw analytical results."
Attachment L, Section L-7	Deleted section
Attachment L, Section L-7a	Deleted section
Attachment L, Section L-7b	Deleted section
Attachment L, Section L-7c	Deleted section
Attachment L, Section L-7d	Deleted section
Attachment L, Section L-7e	Deleted section
Attachment L, Section L-7f	Deleted section
Attachment L, Section L-8	Renumbered section from "L-8" to "L-7"
Attachment L, Section L-8	Deleted "Specific"
Attachment L, Section L-8	Deleted "requirements for WIPP are defined in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record."

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Attachment L, Section L-8	Changed "Requirements" to "requirements"
Attachment L, Section L-8a	Renumbered section from "L-8a" to "L-7a"
Attachment L, Section L-8a	Replaced "QA Program—Overview" with "Data Quality Objectives and Quality Assurance Objectives" in section heading
Attachment L, Section L-8a	Deleted "The QA program was developed to assure that integrity and quality will be maintained for all samples collected and that equipment and records will be maintained in accordance with EPA guidance. The QA Program identifies data quality objectives (**DQO**), processes for assuring sample quality, and processes for generating and maintaining quality records."
Attachment L, Section L-8b	Renumbered section from "L-8b" to "L-7a(1)"
Attachment L, Section L-8b	Changed "DQOs" to "Data Quality Objectives" in section heading
Attachment L, Section L-8b	Added "Data Quality Objectives"
Attachment L, Section L-8b	Added parentheses around "DQOs"
Attachment L, Section L-8b	Replaced "will be" with "have been"
Attachment L, Section L-8b	Added "s" to "DQO"
Attachment L, Section L-8b	Added "DMP are shown in the following sections."
Attachment L, Section L-8b	Deleted "project will be to collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the ground water underlying the WIPP area. The data generated thus far by the DMP has been used to establish background ground-water quality. For the purpose of this DMP, DQOs for measurement data will be specified in terms of accuracy, precision, completeness, representativeness, and comparability. Measurements of data quality in terms of accuracy and precision will be derived from the analysis of QC samples generated in the field and laboratory. Appropriate QC procedures will be used so that known and acceptable levels of accuracy and precision will be maintained for each data set. This section defines the acceptance criteria for each QC analysis performed. The following subsections define each DQO."
Attachment L, Section L-8b	Added new sections "L-7a(1)(i) Detection Monitoring Program Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the ground water underlying the WIPP facility. L-7a(1)(ii) Water Level Monitoring Program Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility. L-7a(2) Quality Assurance Objectives Quality Assurance Objectives (QAOs) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability."
Attachment L, Section L-8b(1)	Renumbered section from "L-8a(1)" to "L-7a(2)(i)"
Attachment L, Section L-8b(1)	Replaced "samples" with "recoveries"
Attachment L, Section L-8b(1)(i)	Renumbered section from "L-8b(1)(i)" to "L-7a(2)(i)(A)"
Attachment L, Section L-8b(1)(i)	Added "specific conductance and" Added parentheses around "SC"
Attachment L, Section L-8b(1)(i)	Replaced "Eh" with "specific conductance"

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Affected Permit Section	Explanation of Change
Attachment L, Section L-8b(1)(i)	Added "specific gravity"
Attachment L, Section L-8b(1)(i)	Deleted "check"
Attachment L, Section L-8b(1)(i)	Replaced "assure" with "ensure"
Attachment L, Section L-8b(1)(i)	Replaced "Procedure WP 10-AD3029" with "facility SOPs"
Attachment L, Section L-8b(1)(i)	Delete "s"
Attachment L, Section L-8b(1)(i)	Deleted "A current revision of this document or procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-8b(1)(ii)	Renumbered section from "L-8b(1)(ii)" to "L-7a(2)(i)(B)"
Attachment L, Section L-8b(1)(ii)	Replaced "samples" with "recoveries"
Attachment L, Section L-8b(2)	Renumbered section from "L-8b(2)" to "L-7a(2)(ii)"
Attachment L, Section L-8b(2)(i)	Renumbered section from "L-8b(2)(i)" to "L-7a(2)(ii)(A)"
Attachment L, Section L-8b(2)(i)	Deleted "Precision of field measurements of water-quality parameters will meet or exceed required reporting levels."
Attachment L, Section L-8b(2)(i)	Added "Specific conductance"
Attachment L, Section L-8b(2)(i)	Deleted "SC"
Attachment L, Section L-8b(2)(i)	Deleted "optionally Eh"
Attachment L, Section L-8b(2)(i)	Added "," after "10%"
Attachment L, Section L-8b(2)(i)	Replaced "and" with "specific gravity to 0.01 by hydrometer,"
Attachment L, Section L-8b(2)(i)	Added "and SC"
Attachment L, Section L-8b(2)(i)	Added "Water-level measurement will be precise to ±0.01 ft. The precision of water density measurements, when measured in the field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than ±2 ft of error in the derived fresh-water head."
Attachment L, Section L-8b(2)(ii)	Renumbered section from "L-8b(2)(ii)" to "L-7a(2)(ii)(B)"
Attachment L, Section L-8b(2)(ii)	Replaced "Precision of laboratory analyses will be assessed by performing the same analyses twice on LCSs with each analytical batch assessed at a minimum frequency of 1 in 20 ground-water samples for nonradiological parameters and 1 in 10 for radiological parameters. The laboratory will determine analytical precision control limits by performing replicate analyses of control samples. Precision measurements will be expressed as RPD." with "Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (LCSD) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results."
Attachment L, Section L-8b(3)	Renumbered section from "L-8b(3)" to "L-7a(2)(iii)"
Attachment L, Section L-8b(3)	Replaced "1991" with "1999"
Attachment L, Section L-8b(3)	Added "National"
Attachment L, Section L-8b(3)	Replaced "1988" with "2004"
Attachment L, Section L-8b(3)	Added "method"
Attachment L, Section L-8b(3)	Added "method"
Attachment L, Section L-8b(4)	Renumbered section from "L-8b(4)" to "L-7a(2)(iv)"
Attachment L, Section L-8b(4)	Added "during sample shipment or"

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Attachment L, Section L-8b(4)	Replaced "noncritical measurements (i.e., field measurements)" with "analysis of Part 5, Table 5.4.a parameters"
Attachment L, Section L-8b(4)	Replaced "for critical measurements (i.e., compliance data)" with "analysis of Part 5, Table 5.4.b hazardous constituents"
Attachment L, Section L-8b(4)	Added "for Part 5, Table 5.4.b hazardous constituents"
Attachment L, Section L-8b(4)	Replaced "WIPP EM Manager" with "Permittees"
Attachment L, Section L-8b(4)	Deleted "on behalf of the Permittees"
Attachment L, Section L-8b(5)	Renumbered section from "L-8b(5)" to "L-7a(2)(v)"
Attachment L, Section L-8b(5)	Added "For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions."
Attachment L, Section L-8b(6)	Renumbered section from "L-8b(6)" to "L-7a(2)(vi)"
Attachment L, Section L-8b(6)	Added "and semivolatile organic compounds (**SVOC**s)"
Attachment L, Section L-8b(6)	Added "Culebra"
Attachment L, Section L-8b(6)	Changed "Ground-water" to "groundwater"
Attachment L, Section L-8c	Renumbered section from "L-8c" to "L-7b"
Attachment L, Section L-8c	Replaced "ground-water monitoring system was" with "approved"
Attachment L, Section L-8c	Deleted "ed" from "designed"
Attachment L, Section L-8c	Replaced "and will be maintained to meet specifications established in" with "for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with"
Attachment L, Section L-8c	Replaced "500" with "900"
Attachment L, Section L-8c	Deleted "§"
Attachment L, Section L-8c	Replaced "264 Subpart F and 264.601 through 264.603"with "270.42"
Attachment L, Section L-8d	Renumbered section from "L-8d" to "L-7c"
Attachment L, Section L-8d	Deleted "Provisions and responsibilities for"
Attachment L, Section L-8d	Change "the" to "The"
Attachment L, Section L-8d	Added "the"
Attachment L, Section L-8d	Added "facility"
Attachment L, Section L-8d	Added "(see Table L-3)"
Attachment L, Section L-8d	Deleted "Any"
Attachment L, Section L-8d	Changed "activities" to "Activities"
Attachment L, Section L-8d	Replaced "ground-water monitoring" with "the DMP"
Attachment L, Section L-8d	Added "data quality"
Attachment L, Section L-8d	Deleted "documented and"
Attachment L, Section L-8d	Deleted "and the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) Technical procedures, as specified elsewhere in this DMP, have been developed for each quality-affecting function performed for ground-water monitoring. The technical procedures unique to the DMP will be controlled by

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	the ES&H at WIPP. The procedures are sufficiently detailed and include, when applicable, quantitative or qualitative acceptance criteria. Procedures were prepared in accordance with requirements in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record."
Attachment L, Section L-8e	Renumbered section from "L-8e" to "L-7d"
Attachment L, Section L-8e	Replaced "Document controls" with "Permittees"
Attachment L, Section L-8e	Replaced "procedures" with "WIPP facility SOPs"
Attachment L, Section L-8e	Added "adequately identified or"
Attachment L, Section L-8f	Deleted section
Attachment L, Section L-8g	Renumbered section from "L-8g" to "L-7e"
Attachment L, Section L-8g	Added "(see Table L-3)"
Attachment L, Section L-8g	Replaced "QA Department" with "Permittees"
Attachment L, Section L-8g	Added "WIPP facility SOPs."
Attachment L, Section L-8g	Deleted "inspections and surveillance on the scope of work. EM section personnel will be responsible for performance checks as defined in applicable procedures and determined for the Permittees by MOC metrology laboratory personnel. Performance checks for the DMP will determine the acceptability of purchased items and assess degradation that occurs during use. A current revision of this document will be maintained in the WIPP Operating Record."
Attachment L, Section L-8h	Renumbered section from "L-8h" to "L-7f"
Attachment L, Section L-8h	Added "(see Table L-3)"
Attachment L, Section L-8h	Added "equipment"
Attachment L, Section L-8h	Replaced "Procedure WP 10-AD3029" with "facility SOPs (see Table L-3)"
Attachment L, Section L-8h	Deleted "A current revision of this document or procedure will be maintained in the WIPP Operating Record."
Attachment L, Section L-8i	Renumbered section from "L-8i" to "L-7g"
Attachment L, Section L-8i	Replaced "WIPP document" with "In accordance with"
Attachment L, Section L-8i	Deleted "specifies the system used at WIPP for ensuring that appropriate measures are established to control nonconforming conditions. Nonconforming conditions connected to the DMP will be identified in and controlled by documented procedures." with "(see Table L-3),
Attachment L, Section L-8i	Changed "Equipment" to "equipment"
Attachment L, Section L-8i	Deleted "A current revision of this document will be maintained in the WIPP Operating Record."
Attachment L, Section L-8j	Renumbered section from "L-8j" to "L-7h"
Attachment L, Section L-8j	Added "the" Added "facility"
Attachment L, Section L-8j	Added "(see Table L-3)"
Attachment L, Section L-8j	Added "the" Added "facility"
Attachment L, Section L-8j	Deleted "A current revision of this document will be maintained in the WIPP Operating Record."

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Attachment L, Section L-8k	Renumbered section from "L-8k" to "L-7i"
Attachment L, Section L-8k	Added "(see Table L-3)"
Attachment L, Section L-8k	Deleted "A current revision of this document will be maintained in the WIPP Operating Record."
Attachment L, Section L-8k	Added "record"
Attachment L, Section L-8k	Replaced "EM RIDS" with "Environmental Monitoring Records Inventory and Disposition Schedule"
Attachment L, Section L-8k	Deleted "QA records will document the results of the DMP implementing procedures and will be sufficient to demonstrate that all quality-related aspects are valid. The records will be identifiable, legible, and retrievable."
Attachment L, Section L-9	Renumbered section from "L-9" to "L-8"
Attachment L, Section L-9	Added "Crawley, M. and M. Nagy, 1998. "WIPP RCRA Background Groundwater Quality Baseline Report," DOE/WIPP-98-2285."
Attachment L, Section L-9	Added "Domski, P.S., and R.L. Beauheim. 2008. Evaluation of Culebra Brine Chemistry. AP-125. ERMS 549336. Carlsbad, NM: Sandia National Laboratories.(In development)
Attachment L, Section L-9	Deleted "Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York. Haug, A., V.A. Kelly, A.M. LaVenue, and J.F. Pickens, 1987. "Modeling of Ground-Water Flow in the Culebra Dolomite at the Waste Isolation Pilot Plant (WIPP) Site: Interim Report," SAND86-7167, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico."
Attachment L, Section L-9	Added "IT Corporation, "2000 Addendum 1 Waste Isolation Pilot Plant RCRA Background Groundwater Quality Baseline Update Report." Albuquerque, New Mexico."
Attachment L, Section L-9	Added "Kuhlman, K.L. 2010. Analysis Report, AP-111 Revision 1, Culebra Water Level Monitoring Network Design. ERMS 554054. Carlsbad, NM: Sandia National Laboratories"
Attachment L, Section L-9	Deleted "Lusczynski, N.J., 1961. "Head and Flow of Ground Water of Variable Density," Journal of Geophysical Research, Vol. 66, No. 12, pp. 4247–4256."
Attachment L, Section L-9	Added "McKenna, S. A. 2004. Analysis Report: Culebra Water Level Monitoring Network Design. AP-111. ERMS 540477. Carlsbad, NM: Sandia National Laboratories."
Attachment L, Section L-9	Deleted "Powers, D.W., S.J. Lambert, S.E. Shaffer, L.R. Hill, and W.D. Weart, eds., 1978. "Geologic Characterization Report for the Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico," SAND78-1596, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico."
Attachment L, Section L-9	Added "Powers, D. W. 2006. Analysis Report: Task 1B of AP-114; Identify Possible Area of Recharge to the Culebra West and South of WIPP (April 1). ERMS 543094. Carlsbad, NM: Sandia National Laboratories. Roberts, R. M. 2007. Analysis of Culebra Hydraulic Tests Performed Between June 2006 and September 2007. ERMS 547418. Carlsbad, NM: Sandia National Laboratories. Siegel, M.D., K. L. Robinson, and J. Myers. 1991. "Solute Relationships in Groundwaters from the Culebra Dolomite and Related Rocks in the Waste Isolation Pilot Plant Area, Southeastern New Mexico," SAND88-0196. U.S. Department of Energy (DOE), 1995. "Basic Data Report for WQSP-1 through WQSP-6A," DOE/WIPP-95-2154."
Attachment L, Section L-9	Deleted "U.S. Department of Energy (DOE), 1996. "United States Department

Affected Permit Section	Explanation of Change
	of Energy Waste Isolation Pilot Plant Compliance Certification Application," DOE/CAO-1996–2184, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico. U.S. Department of Energy (DOE), 1997. Responses to EPA's Request in EPA's March 19, 1997 Letter on the WIPP CCA. May 14, 1997."
Attachment L, Section L-9	Replaced "1992" with "2009"
Attachment L, Section L-9	Replaced "Addendum to Interim Final Guidance" with "Unified Guidance"
Attachment L, Section L-9	Replaced "1991" with "1999"
Attachment L, Section L-9	Deleted "U.S. Environmental Protection Agency (EPA), 1989. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities," U.S. Environmental Protection Agency, Washington, D.C."
Attachment L, Section L-9	Replaced "1988" with "2004"
Attachment L, Table L-1	Changed "Above" to "above"
Attachment L, Table L-1	Deleted "Coefficient"
Attachment L, Table L-1	Deleted "Specific capacity 0.029 to 0.04 ℓ/s/m"
Attachment L, Table L-1	Deleted Transmissivity and Permeability columns
Attachment L, Table L-1	Replaced "Unnamed lower member" with "Los Medaños"
Attachment L, Table L-1	Delete footnotes "3 and 4"
Attachment L, Table L-2	Changed "DMP monitoring wells" to "DMWs"
Attachment L, Table L-2	Changed "Semiannually" to "Annually"
Attachment L, Table L-2	Deleted "All other WIPP surveillance wells"
Attachment L, Table L-2	Deleted "On special request only"
Attachment L, Table L-2	Changed "DMP monitoring wells" to "DMWs"
Attachment L, Table L-2	Replaced "All other WIPP surveillance well sites" with "WLMP Wells (see Table L-4)"
Attachment L, Table L-2	Deleted "Redundant wells at all other WIPP surveillance well sites"
Attachment L, Table L-2	Deleted "Quarterly"
Attachment L, Table L-3	Deleted table
Attachment L, Tables	Inserted new Table L-3
Attachment L, Tables	Inserted new Table L-4
Attachment L, Tables	Inserted new Table L-5
Attachment L, Table L-4	Renumbered from "Table L-4" to "Table L-6"
Attachment L, Table L-4	Added "Note: Deviations from this table are allowed with prior approval by the NMED" to table
Attachment L, Table L-4	Deleted "TOX 3 250 ml Glass yes No H_2SO_4, pH<2 7 days[2]" in row 1 of the table data
Attachment L, Table L-4	Added ")" after "(Total" in row 10 of the table data
Attachment L, Figure L-2	Updated figure
Attachment L, Figure L-3	Updated figure
Attachment L, Figure L-4	Updated figure

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Affected Permit Section	Explanation of Change
Attachment L, Figure L-5	Deleted figure
Attachment L, Figures	Inserted new Figure L-5
Attachment L, Figure L-6	Deleted figure
Attachment L, Figure L-7	Deleted figure
Attachment L, Figure L-8	Renumbered figure from "L-8" to "L-6" and updated figure
Attachment L, Figure L-8	Replaced "WQSP" with "Detection"
Attachment L, Figure L-8	Added "ing" to "Monitor" in figure caption
Attachment L, Figure L-9	Deleted figure
Attachment L, Figure L-10	Renumbered figure from "L-10" to "L-7" and updated figure
Attachment L, Figure L-11	Renumbered figure from "L-11" to "L-8" and updated figure
Attachment L, Figure L-12	Renumbered figure from "L-12" to "L-9" and updated figure
Attachment L, Figure L-13	Renumbered figure from "L-13" to "L-10" and updated figure
Attachment L, Figure L-14	Renumbered figure from "L-14" to "L-11" and updated figure
Attachment L, Figure L-15	Renumbered figure from "L-15" to "L-12" and updated figure
Attachment L, Figure L-16	Deleted figure
Attachment L, Figure L-17a	Renumbered figure from "L-17a" to "L-13" and updated figure
Attachment L, Figure L-17a	Replaced "Record" with "Request for Analysis Form" in figure caption
Attachment L, Figure L-17b	Deleted figure
Attachment L, Figure L-18	Deleted figure
Attachment L, Figures	Inserted new Figure L-14

Attachment B
Proposed Revised Permit Text

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5.1. DETECTION MONITORING PROGRAM

This Part specifies the requirements of the Detection Monitoring Program (**DMP**). The DMP shall establish background ~~ground water~~ groundwater quality and monitor indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the ~~ground water~~groundwater, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98).

The DMP consists of six Detection Monitoring Wells (**DMWs**) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground Hazardous Waste Disposal Units (**Underground HWDUs**). The DMWs are screened in the Culebra Member of the Rustler Formation.

A DMP is necessary to demonstrate compliance with the environmental performance standard for the Underground HWDUs, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)). This environmental performance standard requires prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the ~~ground water~~ groundwater or subsurface environment.

5.3.1. Well Locations

The Permittees shall maintain the DMWs at the locations specified on the map in Figure L-~~8~~6 of Permit Attachment L (WIPP ~~Ground water~~Groundwater Detection Monitoring Program Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(a) and §264.98(b)), and as specified in Table 5.3.1 below:

5.3.2. Well Maintenance

The Permittees shall maintain the DMWs specified in Table 5.3.1 and in Permit Attachment L, Section L-3b and Figures L-~~10~~7 through L-~~16~~12, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(c) and §264.98(b)).

5.3.3 Well Plugging and Abandoning

The Permittees may propose to plug and abandon a DMW by submitting a permit modification request to the Secretary in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The Permittees shall plug and abandon any DMW in a manner which eliminates physical hazards, prevents ~~ground water~~ groundwater contamination, conserves hydrostatic head, and prevents intermixing of subsurface water. The Permittees shall submit a report to the Secretary which summarizes and certifies DMW plugging and abandoning methods within 90 calendar days from the date a DMW is removed from the DMP.

5.4. DETECTION MONITORING PROGRAM PARAMETERS AND CONSTITUENTS

The Permittees shall conduct the DMP at the DMWs as specified in Table 5.3.1 for the indicator parameters listed in Table 5.4.a and the hazardous constituents listed in Table 5.4.b below and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(a)):

Table 5.4.a – Indicator Parameters

pH	Specific conductance
Total organic carbon (**TOC**)	~~Total organic halogen (TOH)~~
Total dissolved solids (**TDS**)	Total suspended solids (**TSS**)
~~Density~~ Specific Gravity	Calcium
Magnesium	Potassium
Chloride	~~Iron (Total Fe)~~

5.5. SAMPLING AND ANALYSIS PROCEDURES

Except as provided in Permit Section 5.6, the Permittees shall use the following techniques and procedures to obtain and analyze DMP samples ~~including background ground water quality samples~~, from the DMWs specified in Table 5.3.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(d) and (e)):

5.5.1. Sample Collection Procedures

The Permittees shall collect one DMP sample and one DMP sample duplicate ~~semi~~annually from each DMW using the procedures specified in Permit Attachment L, Section L-4c, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g)(2), 264.98(d), and 264.601(a)).

5.6 BACKGROUND ~~GROUND WATER~~ GROUNDWATER QUALITY

For those hazardous constituents listed in Table 5.4.b, and for all substances listed in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), the background ~~ground water~~ groundwater quality values specified in Table 5.6 are established as specified in 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g) and 264.98(d)).

Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
Chloroform	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,2-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Carbon tetrachloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Chlorobenzene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Methylene chloride	~~3.00~~5.00 µg/L	5.00~~3.00~~ µg/L	5.00~~3.00~~ µg/L	5.00~~3.00~~ µg/L	5.00~~3.00~~ µg/L	5.00~~3.00~~ µg/L
1,1,2,2-tetrachloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Toluene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,1-trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Cresols	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,4-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,2-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
trans-1,2-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
2,4-dinitrophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
2,4-dinitrotoluene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachloroethane	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Isobutanol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Methyl ethyl ketone	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pentachlorophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pyridine	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Tetrachloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,2-Trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichlorofluoromethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Xylenes	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Nitrobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Vinyl chloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L

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Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
Arsenic	0.10 mg/L	0.06 mg/L	0.21 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L
Barium	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L
Cadmium	0.20 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.50 mg/L	0.50 mg/L	2.00 mg/L	2.00 mg/L	0.50 mg/L	0.50 mg/L
Lead	0.11 mg/L	0.17 mg/L	0.80 mg/L	0.53 mg/L	0.05 mg/L	0.15 mg/L
Mercury	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L
Selenium	0.15 mg/L	0.15 mg/L	2.00 mg/L	2.00 mg/L	0.10 mg/L	0.10 mg/L
Silver	0.50 mg/L	0.50 mg/L	0.31 mg/L	0.52 mg/L	0.50 mg/L	0.50 mg/L
Antimony	0.33 mg/L	0.50 mg/L	1.00 mg/L	0.80 mg/L	0.07 mg/L	0.14 mg/L
Beryllium	0.02 mg/L	1.00 mg/L	0.10 mg/L	0.25 mg/L	0.02 mg/L	0.02 mg/L
Nickel	0.50 mg/L	0.50 mg/L	5.00 mg/L	5.00 mg/L	0.10 mg/L	0.50 mg/L
Thallium	1.00 mg/L	1.00 mg/L	5.80 mg/L	1.00 mg/L	0.21 mg/L	0.56 mg/L
Vanadium	0.10 mg/L	0.10 mg/L	5.00 mg/L	5.00 mg/L	2.70 mg/L	0.10 mg/L

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5.7. ~~GROUND-WATER~~ GROUNDWATER SURFACE ELEVATION DETERMINATION

5.7.1 DMP ~~Ground-Water~~ Groundwater Surface Elevation Determination

The Permittees shall determine the ~~ground-water~~ groundwater surface elevation at each DMW specified in Table 5.3.1 each time the ~~ground-water~~ groundwater is sampled in compliance with Permit Sections 5.5.1 and 5.9.2, using the methods specified in Permit Attachment L, Section L-4c(1), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)).

5.7.2 Regional ~~Ground-Water~~ Groundwater Surface Elevation Determination

The Permittees shall determine the ground-water surface elevation on a monthly basis for each well completed in the Culebra Member of the Rustler Formation in the WIPP ~~Ground-Water~~ Groundwater Level Monitoring Program, as specified in Permit Attachment L, Section L-4c(1).

5.8 ~~GROUND-WATER~~ GROUNDWATER FLOW DETERMINATION

The Permittees shall determine the ground-water flow rate and direction in the Culebra Member of the Rustler Formation at least annually, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(e)). The Permittees shall use ~~ground-water~~ groundwater surface elevation data specified in Permit Section 5.7 to determine ~~ground-water~~ groundwater flow.

5.9.3 Data Evaluation

The Permittees shall determine whether there is statistically significant evidence of contamination for any hazardous constituent identified in Table 5.4.b each time the DMWs are sampled as specified in Permit Section 5.9.2. In determining whether statistically significant evidence of contamination exists, the Permittees shall compare the ~~ground-water~~ groundwater quality at each DMW specified in Table 5.3.1 to the background ~~ground-water~~ groundwater quality determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5.1 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, in the Annual Culebra Groundwater Report by November 30 of each year ~~in compliance with the schedule on Table 5.10.2.1 below, and~~ as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)):

Table 5.10.2.1 - Analytical Results Submittal Schedule	
Samples to be collected during the preceding months of:	Results due to the NMED Secretary by:
March - May	120calendar days after final sample is collected
September - November	120 calendar days after final sample is collected

5.10.2.2. Ground-Water Groundwater Surface Elevation Results

The Permittees shall submit to the Secretary ground-water groundwater surface elevation data specified in Permit Section 5.7. This submittal shall include both ground-watergroundwater surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be submitted reported semiannually by May 31 and November 30within 30 calendar days after data are collected. The November water level data report shall be combined with the Annual Culebra Groundwater Report specified in Permit Part 5.10.2.3.

5.10.2.3. Ground-Water Groundwater Flow and Radionuclide Sampling Results

The Permittees shall submit to the Secretary an evaluation of the ground-watergroundwater flow data (to include annotated hydrographs) specified in Permit Section 5.8 and the results of radionuclide-specific analysis of groundwaters sampled from the DMWs in the Annual Culebra Groundwater Site Environmental Report by October 1 by November 30 of each calendar year.

5.10.3.2 Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the ground-water groundwater in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

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ATTACHMENT L

WIPP ~~GROUND-WATER~~GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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ATTACHMENT L

WIPP ~~GROUND-WATER~~GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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LIST OF ABBREVIATIONS/ACRONYMS/UNITS

~~ASER~~	~~Annual Site Environmental Report~~
~~AR/VR~~	~~Approval/Variation Request~~
Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	~~Chain of Custody~~chain of custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
~~EM~~	~~Environmental Monitoring~~
EPA	U.S. Environmental Protection Agency
~~ES&H~~	~~Environment, Safety, and Health Department~~
~~FEIS~~	~~Final Environmental Impact Statement~~
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
~~GWSP~~	~~Groundwater Surveillance Program~~
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory control samples
LCSD	lab control sample duplicate
~~LD~~	~~limit of detection~~
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler
mg/L	milligram(s) per liter
mi	mile(s)

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mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
~~PRS~~	~~Project Records Services~~
QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
~~RFA~~	~~request for analysis~~
~~RIDS~~	~~Records Inventory and Disposition Schedule~~
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
~~STLB~~	~~sample tracking logbook~~
TDS	total dissolved solids
TOC	total organic carbon
~~TOX~~	~~total organic halogens~~
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
~~TSS~~	~~total suspended solids~~
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
~~WQSP~~	~~Water Quality Sampling Program~~
µg/L	microgram(s) per liter
µm	micrometers

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ATTACHMENT L

WIPP ~~GROUND-WATER~~GROUNDWATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) ~~is a geologic repository for the disposal of transuranic (TRU) waste~~ facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met. ~~The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (hereinafter referred to as the Salado). At WIPP, water bearing units occur both above and below the disposal horizon. Ground-water monitoring of the uppermost aquifer below the facility is not proposed at WIPP because that water-bearing unit (the Bell Canyon Formation) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon Formation are separated by over 2000 ft (610 m) of very low-permeability evaporite sediments (Addendum L1, Amended Renewal Application (DOE, 2009)). No natural credible pathway has been established for contaminant transport to aquifers below the repository horizon, as there is no hydrologic communication between the repository and underlying aquifer. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on their review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for ground-water monitoring through the Salado and the Castile Formation (hereinafter referred to as the Castile) into the Bell Canyon aquifer would compromise the isolation properties of the repository medium.~~

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses. ~~Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (HWDUs) in the underground, will be met.~~

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in

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the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

~~Ground-water~~Groundwater monitoring at the WIPP facility ~~in the past has focused~~ focuses on the Culebra ~~member~~ Member (**Culebra**) of the Rustler Formation (**Rustler**) ~~(hereinafter referred to as the Culebra)~~ because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. ~~Modeling of ground-water movement in the Culebra, based on the concept of a ground-water basin~~Groundwater movement in the Culebra, using results from the basin-scale groundwater model, is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, ~~Amended Renewal Application~~ (DOE, 2009).

~~The WIPP site is located in Eddy County in southeastern New Mexico (Figure L-1) within the Pecos Valley section of the southern Great Plains physiographic province (Powers et al., 1978). The site is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.~~

~~The WIPP site (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16-section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.~~

This monitoring plan addresses requirements for sample collection, Culebra ~~ground-water~~groundwater surface elevation monitoring, Culebra ~~ground-water~~groundwater flow direction and rate determination, data management, and reporting of Culebra ~~ground-water~~groundwater monitoring data. It also identifies indicator ~~analytical~~ parameters and hazardous constituents selected to assess Culebra ~~ground-water~~groundwater quality~~, and establishes personnel responsibilities~~ for the WIPP ~~ground-water~~groundwater detection monitoring program (**DMP**). Because quality assurance is an integral component of the ~~ground-water~~groundwater sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this DMP ~~sampling and analysis plan~~ are provided in the WIPP Standard Operating Procedures (**SOPs**)

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(see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d)). ~~field operating procedures, referenced throughout this plan.~~ Procedures are required for each aspect of the Culebra ~~ground-water~~groundwater sampling process, including Culebra ~~ground-water~~groundwater surface elevation measurement, Culebra ~~ground-water~~groundwater flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection. ~~These procedures prescribe proper field sampling techniques.~~ Data required by this plan ~~Samples~~ will be collected by ~~trained~~ qualified personnel in accordance with SOPs (Table L-3). ~~under the supervision and direction of qualified engineers, scientists, or other technical personnel.~~

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP ~~site~~ facility is situated within the Delaware Basin bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. ~~During the Permian period, which came to a close about 245 million years ago, ancient seas covered the basin. Their later evaporation resulted in the deposition of a thick sequence of evaporites. Addendum L1, Section L1-1 of the Amended Renewal Application (DOE, 2009) presents a detailed discussion of the regional geologic history.~~ Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile~~, which formed through evaporation of the Permian Sea,~~ consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation ~~(hereinafter referred to as the Rustler)~~ was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler~~'s~~ upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP ~~site~~facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) ~~of the Amended Renewal Application~~ (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the downward percolation of water into the evaporite units below.[4] The Bell Canyon ~~Formation~~

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[4] ~~While there may be some uncertainty over the amount of vertical recharge occurring within the Rustler, the issue is only of significance to long-term performance calculations in which releases from the repository occur through the creation of a migration pathway resulting from drilling (inadvertently) in the WIPP area. The consequences of vertical recharge are bounded in the modeling~~

~~(hereinafter referred to as the Bell Canyon)~~ is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) ~~of the Amended Renewal Application~~ (DOE, 2009)) and is confined above by the thick evaporite ~~sequences~~ deposits of the Castile ~~above~~. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is approximately 2,200 ~~more than 2,000~~ pounds per square inch [lb/in.^{2}] or ~~13.8~~14.9 megapascals [MPa]) and eventually ~~moves~~ deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place ~~for millions of years~~since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-~~4~~5), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) ~~of the Amended Renewal Application~~ (DOE, 2009)).

L-1a(2) ~~Ground-water~~Groundwater Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional ~~ground-water~~groundwater aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility ~~found~~ determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in

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~~by assuming that under future climate conditions (which are assumed to be cooler and wetter), the ground-water surface elevation (water table) raises near ground surface, at which time the water table tends to mimic topography.~~

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the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy. ~~As a comparison, the permeability of the Salado is roughly a thousand times less than that of a lower clay liner required of surface impoundments and landfills, assuming similar thicknesses.~~

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado ~~(specifically, the Culebra Member, hereafter referred to as the Culebra)~~. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-~~6~~5). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day. ~~The Culebra is hydrologically confined.~~

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). ~~(Additional short-term pumping tests have been conducted in the Water Quality Sampling Program (WQSP) wells (see Addendum L1, Section L1-2a(3)(a)(ii) of the Amended Renewal Application (DOE, 2009)).~~ Detailed cross-hole hydraulic testing has ~~recently~~ been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

~~The hydraulic tests are designed to yield pressure data for estimation of hydrologic characteristics~~ Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used ~~for~~

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~~input to flow modeling~~in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ~~six~~ ten orders of magnitude from east to west in the vicinity of WIPP. ~~Over the site, Culebra transmissivity varies over three to four orders of magnitude. Figure D6-30 shows variation in transmissivity in the Culebra in the WIPP region.~~ Transmissivities have been calculated at 1×10^{-3}~~7~~ square feet per day (1×10^{-9}~~13~~ square meters per second) at well ~~P-18~~SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts, 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east. ~~Qualitative correlations have been noted between transmissivity and several geologic features possibly related to open-fracture density, including (1) the distribution of overburden above the Culebra, (2) the distribution of halite in other members of the Rustler, (3) the dissolution of halite in the upper portion of the Salado, and (4) the distribution of gypsum fillings in fractures in the Culebra.~~

~~Measured matrix porosities of the Culebra vary from 0.03 to 0.30. Fracture porosity values have not been measured directly, but interpreted values from tracer tests at the H-3, H-6, and H-11 hydropads vary from 5×10^{-4} to 3×10^{-3}. Data are insufficient to determine whether the average porosity of the matrix and fractures varies significantly on a regional scale.~~

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in ~~ground-water~~groundwater geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the ~~ground-water~~groundwater in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

The radiogenic ages of the Culebra ~~ground-water~~groundwater and the geochemical differences provide information potentially relevant to the ~~ground-water~~groundwater flow directions and ~~ground-water~~groundwater interaction with other units and are important constraints on conceptual models of ~~ground-water~~groundwater flow. ~~Previous conceptual models of the Culebra (see Addendum L1 of the Amended Renewal Application (DOE, 2009)) have not been~~

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~~able to consistently relate the hydrogeochemical facies, radiogenic ages, and flow constraints (that is, transmissivity, boundary conditions, etc.) in the Culebra.~~

~~However, t~~The Permittees have proposed a ~~new~~ conceptualization of ~~ground-water~~groundwater flow that ~~could~~ explains observed geochemical facies and ~~ground-water~~groundwater flow patterns. The ~~new~~ conceptualization, referred to as the basin-scale ~~ground-water~~groundwater ~~basin~~ model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. ~~This differs from previous interpretations, wherein no flow was assumed between Rustler units.~~ The model assumes that the ~~ground-water~~groundwater system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on ~~ground-water~~groundwater flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south. ~~to a more southerly direction.~~

~~Four hydrogeochemical facies within the Culebra in the WIPP area (DOE, 1997) have been identified:~~

- ~~Zone A - saline (2-3 molal) NaCl brines, Mg/Ca ratio of 1.2 to 2;~~
- ~~Zone B - dilute (<0.1 molal) CaSO4 - rich ground water;~~
- ~~Zone C - variable composition (0.3-1.6 molal); Mg/Ca ratio 0.3 to 1.2; and~~
- ~~Zone D - high salinities (3-7 molal); K/Na weight ratios (0.2).~~

~~Facies A ground water flow is slow, has not changed over the last 14,000 years, and probably recharged more than 600,000 years ago. Vertical leakage occurs to Facies A, and both lateral and vertical ground water flow rates are extremely low. Facies B occurs in an area with greater vertical fracturing in the Culebra, and therefore exhibits more vertical infiltration and more rapid lateral flow in the Culebra. Flow in Facies B is currently to the south (it may mix with Facies C water to the southeast) but was more toward the west during wetter climates; vertical infiltration from the Dewey Lake to the Culebra Facies B is assumed by the Permittees to have occurred during wetter climates in an area south of the WIPP site. Facies C water was not diluted to create Facies B water. Facies C occurs "in between" Facies A and B, and ground water flow entered the Culebra prior to the climate change (to drier conditions) 14,000 years ago. Facies C ground water flow is to the south at WIPP, where the Permittees theorized that it joins with a small amount of Facies A solute being transported from the east. Ground water flow rate in Facies C is faster than in A but slower than in B, and the proposed recharge area from the Dewey Lake to the Culebra was to the northeast of the WIPP site. Facies C ground water infiltrated into the Dewey Lake and then interacted with anhydrite and halite along its path to the Culebra, wherein it mixed with smaller amounts of Facies A water. the Permittees concluded that the presence of anhydrite within Rustler units does not preclude slow downward infiltration (DOE, 1997).~~

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim

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(2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area, Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (**TDS**) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6-5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4-8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra ~~ground water~~groundwater was inconsistent with flow directions. This was based on the premise that ~~F~~facies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

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Head distribution in the Culebra (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)) is consistent with basin-scale ~~ground-water~~groundwater ~~basin-~~modeling results indicating that the generalized ~~ground-water~~groundwater flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

~~Ground-water levels in the Culebra in the WIPP region have been measured for several decades. Water-level rises have been observed in the WIPP region and are possibly related to recovery from impacts caused by shaft installation, response to potash effluent discharge, or are unexplained, as discussed below. The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the potential cause of the water-level rise appears to be a primary factor.~~

~~In the vicinity of the WIPP site, water-level rises are believed to be caused by recovery from drainage into the shafts. Drainage into shafts has been reduced by a number of grouting programs over the years, most recently in 1993 around the Air Intake Shaft. Northwest of the site, in and near Nash Draw, water levels appear to fluctuate in response to effluent discharge from potash mines. Correlation of water-level fluctuation with potash mine discharge, however, cannot be proven definitively because sufficient data on the timing and volumes of discharge are not available. Water-level rises in the vicinity of the H-9 hydropad, about 6.5 miles south of the site, are thought to be caused by neither WIPP activities nor potash mining discharge. They remain unexplained. The Permittees continue to monitor ground-water levels throughout the region.~~

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying Los Medaños~~unnamed lower member~~ Member (**Los Medaños**) of the Rustler and the overlying Magenta ~~member~~ Member (**Magenta**) of the Rustler (**Magenta**) ~~over~~ across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale ~~ground-water~~groundwater ~~basin-~~modeling. ~~Recent simulations to~~

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~~enhance the conceptual understanding of the geohydrology of the Rustler can be found in Corbet and Knupp, 1996.~~

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP ~~site~~ facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering ~~(shown, for example, as Well H-8 in Figure L-7). However, the Permittees identified the Culebra as potential aquifer in the Compliance Certification Application (DOE, 1996). Because of this, the Culebra will be the focus of future ground-water monitoring at WIPP as it is also the most transmissive continuous water-bearing zone at WIPP and is the most likely pathway for contaminant migration~~.

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the ~~ground-water~~groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) ~~applies~~ apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if ~~ground-water~~groundwater monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that ~~ground-water~~groundwater monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP ~~Ground-water~~ Detection Monitoring Program (DMP)—Overview

L-3a Scope

~~The Permittees have established a RCRA "Ground-water Detection Monitoring Program (DMP) Plan" to define and protect ground-water resources at WIPP. One of the objectives of the WIPP DMP is to establish, by means of ground-water sampling and analysis, an accurate and representative ground-water database that is scientifically defensible and demonstrates regulatory compliance. In addition, the DMP will be used to determine background or existing conditions of ground-water quality and quantity, including ground-water surface elevation and direction of flow, around the WIPP facility area.~~

This DMP plan governs ~~all ground-water~~groundwater sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264~~§§~~ Subpart F ~~264.90 through 264.101~~), and ensures that ~~all~~ such data are gathered in accordance with these and other applicable requirements. ~~The ground-water quality data generated by monitoring activities will provide a comprehensive background database against which future a~~Analytical results collected ~~can be compared~~ during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

~~Ground-water monitoring at WIPP has been historically conducted by several programs including the WIPP Site Characterization Program, the WIPP WQSP, and recently the WIPP Ground-water Surveillance Program (GWSP). Ground-water quality and ground-water surface~~

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~~elevation data have been collected by these programs for over 12 years at WIPP. Data from the WQSP wells (which are widely distributed across the area, see Figure L-8) will be used to continually define changes in the area's potentiometric surface and ground-water flow directions. New monitoring wells included in the WIPP GWSP (WQSP wells 1-6a) were constructed to the specifications provided in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (EPA, 1986) and constitute the RCRA ground-water monitoring network specified in this DMP as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). These wells are being used to establish background ground-water quality, ground-water surface elevations and flow directions in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(f) and (g) and 264.98(e)). Justification for the locations of these wells (3 upgradient and 4 downgradient) is presented below.~~

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

~~The WQSP wells 1 through 6 constitute the RCRA DMP for WIPP (Figure L-9 and Permit Attachment B, Figure B2-3) during detection monitoring as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). This monitoring plan is a continuation of the current WIPP GWSP, and these wells will serve as the monitoring locations during background water quality characterization and the RCRA DMP (Figure L-9 and Permit Attachment B, Figure B2-3).~~

Wells WQSP-1, WQSP-2, and WQSP-3 ~~were~~ are located directly upgradient (north) of the WIPP shaft area. ~~The locations of the three upgradient wells were selected to be representative of the flow vectors of ground water moving downgradient onto the WIPP site. Figure 34 of Davies, 1989, shows the simulation of direction and magnitude of ground-water flow. The upgradient wells were located based on the flow vectors resulting from this model simulation. The original WQSP observation wells, as well as those in the RCRA DMP, have been and will continue to be used as piezometer wells to support collection of ground-water surface elevation and ground-water flow modeling data to demonstrate regulatory compliance. Well location surveys for each of the seven wells were performed by the Permittees' survey personnel using the State Plane Coordinates North American Datum Model 27 method. Results of the surveys are on file with the New Mexico State Engineers Department along with the associated extraction permits for each well.~~

WQSP-4, WQSP-5, and WQSP-6 ~~were~~ are located downgradient (south) of the WIPP shaft area ~~in concert with the flow vectors shown by this model simulation~~. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra ~~based on the greatest velocity magnitude of ground-water flow leaving the shaft area as shown on Figure 34 of~~

~~Davies, 1989, and upgradient of the WIPP LWA boundary.~~ Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity ~~around wells DOE-1 and H-11~~, which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

~~The Culebra has been selected for the focus of the DMP due to it being regionally extensive and exhibiting the most significant transmissivity of the water-bearing units at WIPP. The Culebra has been extensively studied during all past hydrologic characterization programs and found to be the most likely hydrologic pathway to the accessible environment or compliance point for any potential contamination.~~

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." ~~The RCRA ground-water monitoring network was not installed immediately downgradient of this plane. However, because the Underground HWDUs at WIPP are Subpart X units, and due to the relatively unique containment and transport aspects of the site, monitoring at the proposed locations will allow for detection of releases prior to release of these contaminants to the general public at the LWA boundary.~~ Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

~~The DMP wells were located to intercept flow vectors downgradient away from the WIPP shafts area based on current density corrected potentiometric surfaces (Figure L-9). Based on natural contours of the potentiometric surface (Figure L-9) the selected well placement locations are downgradient of the general flow direction from the shaft area.~~ Transport modeling suggests ~~of contaminant migration throughout the Culebra to the Land Withdrawal Act boundary suggests~~ that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years, ~~if, under worst-case conditions,~~ This assumes conditions where hazardous constituents ~~could~~ migrate from the sealed repository (post closure) to the Culebra via the sealed shafts. ~~If contaminants were to migrate from the disposal facility, they would be detected by the DMP wells located midway between the shafts and LWA such that samples from wells could detect these contaminants long before they could reach the LWA boundary.~~

Potentiometric surfaces and ~~ground-water~~groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). ~~Recent (December 1996) p~~Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4. ~~(Figure L-9). WQSP-4, WQSP-5, and WQSP-6 have been located downgradient of the waste emplacement areas according to present-day adjusted potentiometric surfaces.~~

~~Potentiometric surfaces that have not been corrected for density differences and that contain transient relics of previous pumping drawdown events do not reflect accurate natural ground-water flow directions and should not be used to assess the adequacy of ground-water monitoring locations. Previous potentiometric surface maps showing a potentiometric low and hydrologic gradient toward the area between WQSP-3 and WQSP-4 had not been adjusted to~~

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freshwater head equivalents, and had also been influenced by the long-term pumping at well H-19. Hence, some historic maps may not represent natural Culebra flow directions or gradients, and appropriateness of the RCRA monitoring network cannot be definitively evaluated using these data.

L-3b(1) Detection Monitoring P-Well Construction Specification

L-3b(1)(i) WQSP-1

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

The six WQSP Culebra wells Well WQSP-1 was were drilled between September 13 and 16October 26, 1994, to a. The total depth of 737 ft (225 m) bgseach well is shown in Table L-5. The borehole waswells were drilled through the Culebra and extends 15 ft (5 m) into the unnamed lower member of the RustlerLos Medaños as shown in Table L-5. The wells was were drilled to a depth of 693 ft (211 m) bgs usingthe top of the Culebra using compressed air as the drilling fluid. The interval from 693 to 737 ft (225 to 211 m) bgs (the total depth) was drilled using air mist with a foaming agent as the drilling fluid. WQSP-1 was drilled to 695.6 ft (212 m) bgs using and a 9⅞-in. drill bit. The wells were then and was cored from 695.6 to 737 ft (212 to 225 m) bgs using a 5¼-in. core bit to cut 4-in.- (0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, WQSP-1 WQSP wells were was reamed to 9⅞-in. (0.3 m) in diameter to total depth. WQSP-1 wasAfter reaming, wells were cased from the surface to 737 ft (224.6 m) bgstotal depth with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 702 to 727 ft (214 to 222 m) bgsas shown in Table L-5. The annulus between the borehole wall and the casing/screen is packed with sand from 640 to 651 ft (195 to 198 m) bgs and with 8/16 Brady gravel from 651 to 737 ft (198 to 225 m) bgs. as indicated in Table L-5. Based on core log results, the Culebra is located from 699 to 722 ft (213 to 220 m) bgs (see Figure L-10).

L-3b(1)(ii) WQSP-2

Well WQSP-2 was drilled between September 6 and 12, 1994, to a total depth of 846 ft (257.9 m) bgs. The borehole was drilled through the Culebra and extends 12.3 ft (3.7 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 800 ft (244 m) bgs with a 9⅞ in. drill bit using compressed air as the drilling fluid. The interval from 800 to 846 ft (244 to 258 m) bgs (the total depth) was drilled with a 5¼ in. core bit to cut 4-in.- (0.1-m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-2 was reamed to 9⅞ in. (0.3 m) in diameter to total depth. WQSP-2 was cased from the surface to 846 ft (258 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 811 to 836 ft (247 to 255 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 790 to 793 ft (241 to 242 m) bgs and with 8/16 Brady gravel from 793 to 846 ft (242 to 258 m) bgs. Based on core log results, the Culebra is located from 810.1 to 833.7 ft (247 to 254 m) bgs (see Figure L-11).

L-3b(1)(iii) WQSP-3

Well WQSP-3 was drilled between October 21 and 26, 1994, to a total depth of 880 ft (268 m) bgs. The borehole was drilled through the Culebra and extends 10 ft (3.1 m) into the unnamed

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lower member of the Rustler. The well was drilled to a depth of 880 ft (268 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-3 was drilled to 833 ft (254 m) bgs using a 9⅞ in. drill bit and was cored from 833 to 879 ft (254 to 268 m) bgs using a 5¼ in. core bit to cut 4 in. (0.1 m) diameter core. After coring, WQSP-3 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 880 ft (268 m) bgs. WQSP-3 was cased from the surface to 880 ft (268 m) bgs with 5 in. (0.1 m) (0.28 in. [0.7 cm] wall) blank fiberglass casing with in line 5 in. (0.1 m) diameter fiberglass 0.02 in. (0.1 cm) slotted screen across the Culebra interval from 844 to 869 ft (257 to 265 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 827 to 830 ft (252 to 253 m) bgs and with 8/16 Brady gravel from 830 to 880 ft (253 to 268 m) bgs. Based on core log results, the Culebra is located from 844 to 870 ft (257 to 265 m) bgs (see Figure L-12).

L-3b(1)(iv) WQSP-4

Well WQSP-4 was drilled between October 5 and 10, 1994, to a total depth of 800 ft (244 m) bgs. The borehole was drilled through the Culebra and extends 9.2 ft (2.8 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 740 ft (226 m) bgs with a 9⅞ in. drill bit using compressed air as the drilling fluid. The interval from 740.5 to 798 ft (225.7 to 243 m) bgs was cored with a 5¼ in. (0.13-m) core bit to cut 4 in. (0.1 m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-4 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 800 ft (244 m) bgs. WQSP-4 was cased from the surface to 800 ft (244 m) bgs with 5 in. (0.1 m) (0.28 in. [0.7 cm] wall) blank fiberglass casing with in line 5 in. (0.1 m) diameter fiberglass 0.02 in. (0.1 cm) slotted screen across the Culebra interval from 764 to 789 ft (233 to 241 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 752 to 755 ft (229 to 230 m) bgs and with 8/16 Brady gravel from 755 to 800 ft (230 to 244 m) bgs. Based on core log results, the Culebra is located from 766 to 790.8 ft (233 to 241 m) bgs (see Figure L-13).

L-3b(1)(v) WQSP-5

Well WQSP-5 was drilled between October 12 and 19, 1994, to a total depth of 681 ft (208 m) bgs. The borehole was drilled through the Culebra and extends into the unnamed lower member of the Rustler. The well was drilled to a depth of 676 ft (206 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-5 was drilled to 648 ft (198 m) bgs using a 9⅞ in. drill bit and was cored from 648 to 676 ft (198 to 206 m) bgs using a 5¼ in. core bit to cut 4 in. (0.1 m) diameter core. After coring, WQSP-5 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 681 ft (208 m) bgs. WQSP-5 was cased from the surface to 681 ft (208 m) bgs with 5 in. (0.1 m) (0.28 in. [0.7 cm] wall) blank fiberglass casing with in line 5 in. (0.1 m) diameter fiberglass 0.02 in. (0.1 cm) slotted screen across the Culebra interval from 646 to 671 ft (197 to 205 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 623 to 626 ft (190 to 191 m) bgs and with 8/16 Brady gravel from 626 to 681 ft (191 to 208 m) bgs. Based on core log results, the Culebra is located from 648 to 674.4 ft (198 to 205.6 m) bgs (see Figure L-14).

L-3b(1)(vi) WQSP-6

Well WQSP-6 was drilled between September 26 and October 3, 1994, to a total depth of 616.6 ft (187.9 m) bgs. The borehole was drilled through the Culebra and extends 9.7 ft (3 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 367 ft (112 m) bgs using compressed air as the drilling fluid. The interval from 367 to 616 ft (112 to 188 m) bgs (the total depth) was drilled using brine as the drilling fluid. WQSP-6 was drilled to 568 ft (173 m) 4-

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~~in. (0.1 m) ft bgs using a 9⅞ in. drill bit and was cored from 568 to 616 ft (173 to 188 m) bgs using a 5¼ in. core bit to cut 4 in. (0.1 m) diameter core. After coring, WQSP-6 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 616.6 ft (188 m) bgs. WQSP-6 was cased from the surface to 616.6 ft (188 m) bgs with 5 in. (0.1 m) (0.28 in. [0.7 cm] wall) blank fiberglass casing with in-line 5 in. (0.1 m) diameter fiberglass 0.02 in. (0.1 cm) slotted screen across the Culebra interval from 581 to 606 ft (177 to 185 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 567 to 570 ft (173 to 173.7 m) bgs and with 8/16 Brady gravel from 570 to 616.6 ft (174 to 188 m) bgs. Based on core log results, the Culebra is located from 582 to 606.9 ft (177 to 185 m) bgs (see Figure L-15).~~

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the ~~ground-water~~groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

~~The seven RCRA monitoring wells have been sampled on a semiannual basis since their installation in 1995 to establish background ground-water quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98). This has included at least two full rounds of 20.4.1.500 NMAC (Incorporating 40 CFR §264) Appendix IX analysis for samples from each of the proposed RCRA detection monitoring wells. In addition, ground-water samples were collected from the DMP wells (from March 1997 until waste emplacement) at a frequency of four sample replicates collected semiannually from each well for the indicator parameters of pH, specific conductance (**SC**), total organic carbon (**TOC**), and total organic halogen (**TOX**) to further establish background ground water quality until detection monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98) becomes applicable. A total of four rounds of Appendix IX analysis will be conducted for samples from each well for use in background ground-water quality determinations.~~

~~Detection monitoring will start when the Permittees emplace waste and continue through the post-closure phase as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90[c]). During detection monitoring, one sample and one sample duplicate will be collected semiannually from each well in the RCRA detection monitoring network. As shown in Table L-2, the DMP will continue to collect ground-water quality samples for all seven wells on a semiannual basis during the life of the DMP. 20.4.1.500 NMAC (incorporating 40 CFR §264.97[g][2]) provides that an alternate sampling frequency to that provided in 20.4.1.500 NMAC (incorporating 40 CFR §264.98) may be proposed by the Permittees. Given the nature and rate of ground-water flow in the area surrounding WIPP, collecting and analyzing one sample semiannually will be protective of human health and the environment because any hazardous constituent leaving the underground disposal facility will not have the potential to migrate beyond the ground-water monitoring network in a one-year time frame. Ground-water flow characteristics are presented in detail in Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009).~~

~~Ground-water~~Groundwater surface elevations will be monitored in each of the ~~seven~~ six ~~DMP~~ DMWs ~~wells~~ on a monthly basis. The ~~ground-water~~groundwater surface elevation in each ~~DMP~~ DMW ~~well~~ will also be measured prior to each annual sampling event. ~~Ground-water~~Groundwater surface elevation measurements in the ~~other~~ WLMP wells ~~existing WQSP well sites~~ will also be monitored on a monthly basis when accessible ~~to supplement the area water-level database and to help define regional changes in ground-water flow directions and~~

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~~gradients~~. The characteristics of the ~~RCRA DMP~~DMW (sampling frequency, location) will be evaluated if significant changes are observed in the ~~ground-water~~groundwater flow direction or gradient. ~~If any change occurs which could affect the ability of the DMP to fulfill the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F), the Permittees shall promptly notify NMED in writing and apply for a permit modification, if appropriate.~~

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b ~~analytes of interest~~ are measured ~~to establish~~ as part of the DMP. ~~background ground-water quality prior to emplacement of waste include all indicator parameters and all other parameters listed in 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX. Field measurements of pH, SC, temperature, chloride, Eh, total iron, and alkalinity are also measured during background sampling .~~

~~The DMP was initiated upon waste emplacement, at which time the semiannual samples will be analyzed for the parameters listed in Table L-3. Parameters to be analyzed by the contract laboratory such as specific conductance, total dissolved solids, total suspended solids, density, pH, total organic carbon, and total organic halogens were included as indicator parameters because of their universal commonality to ground water. Parameters such as chloride, alkalinity, calcium, magnesium, and potassium were included as matrix-specific general indicator parameters. Calcium, magnesium, potassium, chloride, and iron may be deleted during detection monitoring, with prior approval of NMED. Organic and inorganic compounds on the right hand side of Table L-3 were chosen because they will occur in the waste to be disposed at the WIPP facility.~~ Additional ~~parameters~~ hazardous constituents may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility. ~~the tentatively identified compound (TIC) process specified in the Waste Analysis Plan, Permit Attachment C.~~ If ~~compounds~~ hazardous constituents are identified, these will be added to ~~the DMP list~~Part 5, Table 5.4.b, unless the Permittees provide justification for their omission (e.g., hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

L-4c ~~Ground-water~~Groundwater Surface Elevation Measurement, Sample Collection and Laboratory Analysis

~~Ground-water~~Groundwater surface elevations will be measured in each ~~well~~DMW prior to ~~ground-water~~groundwater sample collection. ~~Ground-water~~Groundwater will be extracted using serial and final sampling methods. Serial samples will be collected until ~~ground-water~~groundwater field indicator parameters stabilize, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the ~~DMP analytical suite~~ parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.

L-4c(1) ~~Ground-water~~Groundwater Surface Elevation Monitoring Methodology

The WIPP ~~ground-water~~groundwater level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3. ~~is a subprogram of the DMP. The quality assurance activities of the WLMP are in strict accordance with WP 13-1, and the quality assurance implementing procedure specific to ground-water surface elevation monitoring is~~

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~~WIPP Procedure WP 02-EM1014[2]. Current versions of both WP 13-1 and WP 02-EM1014 are maintained in the WIPP Operating Record.~~

~~Ground-water surface elevation monitoring is in progress now and will continue through the post-closure care period specified in Permit Part 7. This section of the plan addresses the activities of the WLMP during the preoperational and operational phases of WIPP.~~

~~Collection of ground-water surface elevation data is required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). These data also provide:~~

- ~~Data collection as required by the Environmental Monitoring Plan.~~
- ~~A means to fulfill commitments made in the Final Environmental Impact Statement (FEIS).~~
- ~~A means to comply with future ground-water inventory and monitoring regulations.~~
- ~~Input for making land use decisions, (i.e., designing long-term active and passive institutional controls for the site).~~
- ~~Assistance in understanding any changes to readings from the water-pressure transducers installed in each of the shafts to monitor water conditions behind the liners.~~
- ~~An understanding of whether or not the horizontal and vertical gradients of flow are changing over time.~~

~~The objective of the WLMP is to extend the documented record of ground-water surface elevation fluctuations in the Culebra and Magenta members of the Rustler in the vicinity of the WIPP facility and to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). Ground-water surface elevation data will be collected from each well of the RCRA DMP. Ground-water surface elevation data will also be collected from other Culebra wells, as well as monitoring wells completed in other water-bearing zones overlying and underlying the WIPP repository horizon (see Figure L-18) when access to those zones is possible. This includes, but is not limited to, the Bell Canyon, the Forty-niner, the contact zone between the Rustler and Salado, and the Dewey Lake.~~

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, ~~Ground-water~~groundwater surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, ~~at least one accessible completed interval at each available well pad~~when accessible. ~~At well pads with two or more wells completed in the same interval, quarterly measurements will be taken in the redundant wells (w~~Well locations are shown in Figure L-1814~~). Ground-water surface elevation measurements will be taken monthly at each of the seven DMP wells, as well as prior to each sampling event.~~ If a cumulative ~~ground-water~~groundwater surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not

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~~[2] WP 02-EM1014 "Groundwater Level Measurements" is a technical procedure that specifies the steps followed by Environmental Monitoring (EM) personnel for making manual ground-water level measurements in ground-water wells in the vicinity of the WIPP facility. The procedure provides general instructions including prerequisites, safety precautions, performance frequency, quality assurance, and records. Specific instructions are included for using the water level measurement electrical conductance probe and data management.~~

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attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the ~~report~~ Annual Culebra Groundwater Report specified in Permit Part 5. Abnormal, unexplained changes in ~~ground-water~~groundwater surface elevation ~~may~~ will be evaluated to determine if they indicate changes in site recharge/discharge which could affect the assumptions regarding ~~DMP~~ DMW ~~well~~ placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

~~Ground-water~~Groundwater surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual ~~ground-water~~groundwater surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of ~~ground-water~~groundwater surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density ~~both vertically in well bores and areally from well to well~~. To monitor the hydraulic gradients of the hydrologic flow systems ~~at WIPP~~ accurately, actual ~~ground-water~~groundwater surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 ~~bores~~ will be measured annually. ~~When both of these parameters are known, equivalent freshwater heads will be calculated. The concept of freshwater head is discussed in Lusczynski (1961).~~

~~A discussion explaining the calculation of freshwater heads from mid-formation depth at WIPP can be found in Haug, et al. (1987). Freshwater heads are useful in identifying hydraulic gradients in aquifers of variable density such as those existing at the WIPP site. Freshwater head at a given point is defined as the height of a column of freshwater that will balance the existing pressure at that point (Lusczynski, 1961).~~

Measured Culebra ~~ground~~-water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho_g \gamma_\rho h$$

where

p = freshwater head (~~pressure~~length of freshwater head)

γ_ρ = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)

ρ_g = freshwater density (mass/volume)

h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity. ~~density (expressed as specific gravity).~~

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Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate ~~ground-water~~groundwater surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. ~~When using an electrical conductance probe, the depth to water will be determined by reading the appropriate measurement markings on the embossed measuring tape when the alarm is activated at the surface. WIPP Procedure WP 02-EM1014~~ An SOP will be used when making water-level measurements for this program. The SOP will specify ~~specifies~~ the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records. ~~A current revision of this procedure will be maintained in the WIPP Operating Record.~~

L-4c(1)(ii) ~~Ground-water~~Groundwater Surface Elevation Records and Document Control

~~All i~~Incoming data will be processed in a ~~timely~~ manner ~~to~~ that ~~assure~~ensures data integrity. The data management process for ~~ground-water~~groundwater surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not possible (~~i.e.~~e.g., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to ~~guidelines outlined in~~ applicable SOPs ~~WIPP Procedures WP 02-EM3001[3] and WP 02-EM1014[4]~~ (see Table L-3). ~~Current copies of these procedures are maintained within the WIPP Operating Record.~~ These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program ~~will~~ calculates ~~ground-water~~groundwater surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet ~~will also adjust~~program adjusts ~~ground-water~~groundwater surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent

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~~[3] WP 02-EM3001 "Administrative Processes for Environmental Monitoring Programs" is a management control procedure to provide the administrative guidance to be used by Environmental Monitoring (EM) personnel to maintain quality control (QC) associated with EM sampling activities and to assure that data acquired under the WIPP Environmental Monitoring Program are valid. The precautions and limitations portion of this procedure assure that only qualified personnel acquire samples under the EM program, that cross contamination of sampling equipment is prevented, and that sample hold times are not exceeded. The Performance portion of the procedure provides step-by-step instructions for Quality Assurance/Quality Control (QA/QC) implementation, the use of data sheets and sample tracking logbooks, sample tacking from collection to submittal, and actions to take if sample results indicate the potential for exceeding a regulatory limit.~~

~~[4] WP 02-EM1014 "Groundwater Level Measurement", is a technical procedure which lists the equipment required and the operational checks necessary to perform groundwater level measurements. This procedure as well as WP 02-EM3001 also provides information on performing validation and verification of laboratory data.~~

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of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. ~~The data contained on the computerized work sheet will be translated into a database file. A printout will be made of the database file. The data each month will then be compiled into report format and transmitted to the appropriate agencies as requested by the Permittees. Ground-water~~Groundwater surface elevation data and equivalent freshwater heads for ~~all~~ the Culebra wells in Table L-4 will be transmitted to NMED ~~one month~~ by May 31 and November 30 ~~after data are collected~~. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

~~A computerized database file will be maintained for all ground water surface elevation data. Monthly and quarterly data will be appended into a yearly file. Upon verification that the yearly database is free of errors, it will be appended into the project database file. A printed copy of the current project database (through December of the preceding year) will be kept in the Environment, Safety and Health Department (ES&H) EM fire resistant storage area.~~

L-4c(2) ~~Ground-water~~Groundwater Sampling

L-4c(2)(i) ~~Ground-water~~Groundwater Pumping and Sampling Systems

~~The water-bearing units at WIPP are highly variable in their ability to yield water to monitoring wells. The Culebra, the most transmissive hydrologic unit in the WIPP area, exhibits transmissivities that range many orders of magnitude across the site area and is the primary focus of the DMP.~~

The ~~ground-water~~groundwater pumping and sampling systems used to collect a ~~ground-water~~groundwater sample from the ~~seven~~ six ~~new DMP~~ DMWs ~~wells~~ will provide continuous and adequate production of water so that a representative ~~ground-water~~groundwater sample can be obtained. ~~The wells used for ground-water quality sampling vary in yield, depth, and pumping lift. These factors affect the duration of pumping as well as the equipment required at each well.~~

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The ~~DMP wells~~DMWs are ~~will be~~ individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down-hole submersible pumps are ~~will be~~ controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

~~The electronic flow controller allows personnel collecting samples to control the rate of discharge during well purging to minimize the potential for loss of volatiles from the sample.~~ As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged ~~a minimum of~~no more than three well bore volumes or until field parameters have stabilized, whichever occurs first, ~~at a rate that will minimize the agitation of recharge water. This will be accomplished by monitoring formation pressure and matching the rate of discharge from the well as nearly as possible to the rate of recharge to the well. WIPP Procedure WP 02-EM1002[5] specifies the methods used for~~

~~[5] WP 02-EM1002 "Electric Submersible Pump Monitoring System Installation and Operation" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples using electric submersible pumps (ESPs). The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment,~~

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~~controlling flow rates and monitoring formation pressure. A current version of this document will be maintained in the WIPP Operating Record.~~ Well purging will be performed in accordance with an SOP ~~requirements will be used~~ in conjunction with serial sampling to determine when the ~~ground water~~groundwater chemistry stabilizes and is therefore representative of undisturbed ~~ground water~~groundwater.

The ~~DMP wells~~DMWs are ~~will be~~ cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). ~~Details of well construction are presented in Section L-3b(1).~~ An electric, submersible pump installation without the use of a packer is ~~will be~~ used in this instance. The largest amount of discharge from the submersible pump ~~will~~ takes place from a discharge pipe. In addition to this main discharge pipe a dedicated ~~Teflon®~~-sample line, running parallel to the discharge pipe, is ~~will also be~~ used. The sampling line is manufactured from a chemically inert material. ~~Flow through the pipe will be regulated on the surface by a flow control valve and/or variable speed drive controller.~~ Cumulative flow ~~will be~~is measured using a totalizing flow meter. Flow from the discharge pipe ~~will be~~is routed to a discharge tank for disposal.

The dedicated ~~Teflon®~~-sampling line ~~will be~~is used to collect the water sample that will undergo analysis. By using a dedicated ~~Teflon®~~-sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow through the sample collection line ~~will be~~is regulated by a flow-control valve. The sample line ~~will be~~is insulated at the surface to minimize temperature fluctuations.

~~Pressure Monitoring Systems~~

~~The DMP wells do not require the installation of a packer because sample biases due to well construction deficiencies are not present. However, pressures will be monitored using down hole automatic air line bubblers in the formation to maintain the water level above the pump intake. Pressure transducers may be used in line with bubblers to provide continual electronic monitoring through data acquisition systems. WIPP Procedure WP 02-EM1002 provides instructions for monitoring formation pressure using automatic airline bubblers in conjunction with pressure transducers and data acquisition systems. A current version of this document will be maintained in the WIPP Operating Record.~~

~~The mobile field laboratory provides a work place for conducting field sampling and analyses. The laboratory will be positioned near the wellhead, will be climate controlled, and will contain the necessary equipment, reagents, glassware, and deionized water for conducting the various field analyses.~~

~~Sampling Overview~~

~~Two types of water samples will be collected: serial samples and final samples. Serial samples will be taken at regular intervals and analyzed in the mobile field laboratory for various physical and chemical parameters (called field indicator parameters). The serial sample data will be used~~

~~prerequisite actions which assure the correct installation and operation. The procedure details how to install the various subsystems such as the surface discharge and pressure monitoring system and the pressure monitoring bubbler and how to start up and shut down the ESP.~~

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~~to determine whether the sample is representative of undisturbed ground water as a direct function of the stabilization of field indicator parameters and the volume of the water being pumped from the well. Interpretation of the serial sampling data will enable the Team Leader (see Section L-7) to determine when conditions representative of undisturbed ground water are attained in the pumped ground water.~~

~~Final samples will be collected when the serially sampled field indicator parameters have stabilized and are therefore representative of undisturbed ground water.~~

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the ~~ground water~~groundwater chemistry stabilizes and is therefore representative of undisturbed ~~ground water~~groundwater. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. ~~will consider a serial sample representative of undisturbed ground water when the majority of field indicator parameter measurements have stabilized within ±5 percent of the average of analytical results for the field indicator parameter from the background ground water quality for each DMP well. Nonstabilization of one or two field indicator parameters attributable to matrix interferences, instrument drift, or other unforeseen reasons will not preclude the collection of final samples, provided the volume of purged water exceeds three well bore volumes.~~ Each DMW will be purged to no more than three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed parameters are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile field laboratory for field indicator parameters. The Permittees will ~~report, in the operating record, any final samples collected when field indicator parameters were not stabilized, and will~~ provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the ~~ground water~~groundwater as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the ~~Team Leader (see Section L-7)~~Permittees, but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: ~~chloride, divalent cations (hardness), alkalinity, total iron,~~ pH, ~~Eh,~~ temperature, specific conductance, and specific gravity.

~~Protocols for collection of serial samples are specified in WIPP Procedure WP 02-EM1006[6]. Analysis of serial samples are specified in WIPP Procedure WP 02-EM1005[7]. Current versions of these procedures will be maintained in the WIPP Operating Record.~~

~~[6] WP 02-EM1006 "Final Sample and Serial Sample Collection" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples from the WQSP wells and from privately-owned wells in the vicinity of WIPP. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, and prerequisite actions which assure the data quality. The procedure addresses collection of samples from private wells, collection of serial ground-water samples, the collection of final samples for submittal to the laboratory, and data review by the monitoring task leader.~~

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The three field indicator parameters of temperature, ~~Eh~~specific conductance, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a ~~Teflon®~~sample line at atmospheric pressure. ~~The iron, divalent cation, chloride, alkalinity, s~~Specific conductance~~,~~ and specific gravity samples will be collected from the ~~Teflon®~~-sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the ~~Teflon®~~-sample line. ~~Serial sampling water collected for solute and specific conductance determinations will be filtered through a 0.45 micrometers (µm) membrane filter using a stainless steel, in-line filter holder.~~

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. ~~Filtered water will be used to rinse the sample bottle prior to serial sample collection.~~ Unfiltered ~~ground water~~groundwater will be used when determining temperature, pH, ~~Eh~~specific conductance, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. ~~The filtered sample collected for solute analyses will be immediately analyzed for iron and alkalinity because these two solution parameters are extremely sensitive to changes in the ambient water sample pressure and temperature. A sample and duplicate of filtered water will be collected and analyzed for solute parameters (alkalinity, chloride, divalent cations, and iron).~~ Temperature, pH, and ~~Eh~~specific conductance, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

~~Samples to be analyzed for chloride and divalent cations (after preservation with nitric acid and stored at 4°C) may be stored for one week prior to analysis with confidence that the analytical results will not be altered.~~

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. ~~WIPP Procedure WP 02-EM1006~~Standard Operating Procedures (see Table L-3) defines the protocols for the collection of final and serial samples and analysis. ~~WIPP Procedure WP 02-EM1005 defines the protocols for serial sample analysis. Current versions of these procedures will be maintained in the WIPP Operating Record.~~

~~During the first two years of DMP well serial sampling, the first sample will be analyzed as soon as possible after the pump is turned on and daily thereafter for a period of four days or until the~~

~~[7] WP 02-EM1005 "Groundwater Serial Sample Analysis" is a technical procedure that provides step-by-step instructions for on-site analysis of ground-water to determine ground-water stability prior tot he collection of final samples for analysis. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure data quality. The procedure addresses the field measurement of Eh, pH, temperature, specific gravity, specific conductance, alkalinity, chloride, divalent cation, and total iron as indicators of ground-water stability.~~

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~~field indicator parameters (chloride, divalent cations, alkalinity, and iron) stabilize. Eh, pH, and SC will be continually monitored by using a flow cell with ion-specific electrodes and a real-time readout. When detection monitoring begins, the serial sampling process may be modified and the decision to collect final samples would then be based on the number of well bore volumes purged and results of the analysis of chloride, temperature, specific gravity, pH, Eh, and SC. Removal of serial sampling from the DMP will be accomplished through a permit modification and a modification to this plan.~~

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-46 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head. ~~Non-dedicated sample collection lines from the well head to the sample collection area will be discarded after each use.~~

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (DI) water and rinsed in DI water. Sample containers will be new, certified clean containers that will be discarded after one use. ~~Ground-water~~Groundwater surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed in accordance with SOPs ~~with two gallons of fresh water, then rinsed with five gallons of 5 percent nitric acid solution and rinsed with five gallons of DI water~~ after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a ~~blank~~ rinsate blank sample will be collected to verify ~~decontamination~~cleanliness.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered ~~Teflon®~~-sampling lines ~~branching from the main sample line~~. Detailed protocols, in the form of ~~procedures~~SOPs (see Table L-3) define how~~, assure that~~ final samples will be collected in a consistent and repeatable fashion~~. WIPP Procedure WP 02-EM1006 defines the requirements for collection of final samples~~ for analyses~~. A current version of this procedure will be maintained in the WIPP Operating Record.~~

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-46). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory ~~Standard Operating Procedures~~ [SOPs]). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the

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applicable ~~procedures~~ SOPs generated, approved, and maintained by the ~~contract~~ analytical laboratory.

~~Before the final sample is taken, all plastic and glass containers will be rinsed with the pumped ground water, either filtered or unfiltered, dependent upon analysis protocol. When the rinsing procedure is completed the final sample will be collected.~~

Final samples will be sent to the analytical ~~contract~~ laboratories and analyzed for parameters and hazardous constituents specified in Part 5, Tables 5.4.a and 5.4.b. ~~general chemistry, radionuclides, metals, and selected VOCs that are specific to the waste anticipated to arrive at WIPP. Table L-3 presents the specific analytes for the DMP.~~

Duplicates of the final sample will be provided to WIPP Project oversight agencies ~~as~~ when requested ~~by the Permittees or NMED~~.

~~Resulting w~~Wastes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3). ~~Procedure WP 02-RC.01[8]. A current version of this procedure will be maintained in the WIPP Operating Record.~~

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated ~~with either high purity hydrochloric acid, nitric acid, or sulfuric acid (ULTREX or equivalent), depending upon the standard method of treatment required for the particular parameter suite or~~ as requested by the ~~contract~~ analytical laboratory ~~SOPs (see Table L-4)~~.

The ~~contract~~ analytical laboratory receiving the samples will ~~use procedures that~~ prescribe the type and amount of preservative, the container material type, ~~and~~ the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), ~~if~~ when laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility ~~will use~~uses uniquely numbered chain of custody ~~(CofC) Forms and~~ / request for analysis ~~(RFA) Forms~~ (CofC/RFA) forms. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes ~~parameters~~ of interest. WIPP ~~Procedure WP 02-EM3001~~SOPs (see Table L-3) provide~~s~~ instructions to ensure proper sample tracking protocol. ~~A current revision of this procedure will be maintained within the WIPP Operating Record.~~

~~Insulated shipping containers packaged with crushed ice or reusable ice packs will be used to keep the samples cool during transport to the contract laboratory. Holding times for specific~~

~~[8] WP 02-RC.01 "Site-Generated, Non-Radioactive Hazardous Waste Management Plan" is a step-by-step procedure that defines site-generate non-radioactive hazardous waste (SGNRHW) and lists responsibilities of waste management organizations including the generator, waste handlers, sampling personnel, safety personnel, and compliance personnel. In addition, the procedure defines training requirements, container marking requirements, spill response, and list prohibitions. A Section of the procedure is focused on waste management practices including the management in satellite accumulation areas, the hazardous waste staging area for materials awaiting analysis, the establishment of accumulation times, and hazardous waste disposal.~~

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~~analytical parameters require samples to be shipped by express air freight. The coolers will be packaged to meet Department of Transportation and International Air Transportation Association commercial carrier regulations.~~

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for ~~EM~~ sampling and analysis activities are detailed in WIPP facility ~~Procedure WP 02-EM3001~~SOPs (see Table L-3). ~~These procedures will be strictly followed throughout the course of each sample collection and analysis event. A current revision of this procedure will be maintained in the WIPP Operating Record.~~

Standardized forms used to document samples ~~will~~ include sample identification numbers, sample labels, custody tape, the sample tracking ~~log books~~data, and the ~~request for analysis/chain of custody (RFA and CofC~~CofC/RFA~~)~~ form. An example form is shown in Figure L-13. ~~The forms are briefly defined in the following subsections.~~

~~All sample documentation will be completed for each sample and reviewed by the Team Leader or his/her designee for completeness and accuracy.~~

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. ~~The Team Leader (see Section L-7) will assign the numbers prior to sample collection.~~ The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in ~~permanent,~~ indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. ~~The~~ For example, custody seals ~~will be~~that are adhesive-backed strips ~~that~~ are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking ~~Logbook~~

~~A s~~Sample tracking ~~logbook (STLB)~~ information will be completed for each sample collected. ~~form will be completed for each sample collected.~~ The sample tracking information ~~STLB will~~ includes the following information: ~~C of C~~ CofC/RFA form number; ~~RFA No.;~~ date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

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WQ6[1]C[2]R2[3]N1[4]

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. ~~STLB~~ Sample tracking information will be completed in the field by the sampling team. ~~and checked by the Team Leader. When samples are shipped, the STLB will remain in the custody of the EM Section for sample tracking purposes.~~

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document.

~~Request for Analysis and~~ Chain of Custody and Request for Analysis

~~An RFA and CofC~~CofC/RFA form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. ~~An example of the RFA and CofC form is presented in Figures L-17a and L-17b.~~ The ~~RFA and CofC~~CofC/RFA form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the ~~RFA and CofC~~CofC/RFA form. The completed original (top page) of the ~~RFA and CofC~~CofC/RFA form will be returned to the ~~Team Leader~~Permittees with the laboratory analytical report and becomes part of the permanent record of the sampling event. The ~~RFA and CofC~~CofC/RFA form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed ~~by~~ using ~~a commercial laboratory. M~~methods ~~will be specified in procurement documents and will be~~ selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b ~~L-3~~ presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical ~~selected~~ laboratory shall demonstrate, through laboratory SOPs, that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. ~~,~~ The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility ~~e~~Operating ~~r~~Record. ~~and will be~~

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~~available for review upon request by NMED.~~ Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in ~~ground water~~groundwater and the complexity of brines associated with the ~~WIPP repository~~Culebra groundwater.

~~Once the initial qualification criteria, as specified above, have been met, the Permittees will select a laboratory based upon competitive bid. The selected laboratory will perform analytical work for the Permittees for a predetermined period of time, as specified in the contract between the Permittees and the selected laboratory. As this period of performance comes to an end, a new laboratory selection/competitive bid process will be initiated by the Permittees. The same or a different laboratory may be selected for the new contract period.~~ The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (**QC**) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. ~~The~~ A copy of the laboratory SOPs ~~for the laboratory currently under contract~~ will be maintained ~~in a file~~ in WIPP facility files~~, the operating record by the Permittees.~~ The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed ~~on behalf of the Permittees by the Management and Operating Contractor (**MOC**) Environmental Monitoring (**EM**). Data validation results are~~ and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record. ~~documented on an Approval/Variation Request (**AR/VR**) form (Procedure WP 15-PC3041). If no discrepancies are found in the data, the AR/VR form will be signed and the approved box will be checked. If however, discrepancies are found, the AR/VR form will be signed and the disapproved or approved on condition box will be checked and the form will be returned to the team leader accompanied by an attached report discussing the data validation results, any anomalies, and resolutions. Copies of the data validation report will be distributed to the EM Manager, QA Manager, the Team Leader, and the Contract Administrator. Copies of the data validation report will be kept on file in the EM records section for review upon request by NMED.~~

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration ~~Requirements~~

The equipment used to collect data for ~~the WQSP and~~ this DMP will be calibrated in accordance with SOPs~~maintenance administrative procedures specified below~~. The Permittees ~~EM Section~~ will be responsible for calibrating needed equipment on schedule~~, in accordance with written procedures. The EM Section will also be responsible~~ and for maintaining current calibration records for each piece of equipment.

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L-4d(2) ~~Ground-water~~Groundwater Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking ~~ground-water~~groundwater surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). ~~Procedure WP 10-AD3029[9] A current revision of this procedure will be maintained in the WIPP Operating Record.~~ The ~~EM Section~~Permittees will be responsible for ensuring ~~calibrating the needed~~ equipment is calibrated on schedule in accordance with ~~written procedures~~SOPs. The ~~EM Section~~Permittees will also be responsible for maintaining copies of records of the most recent ~~current~~ calibration ~~records~~ for each piece of equipment.

L-4e Statistical Analysis of Laboratory Analytical Data

~~As required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98), data collected to establish background ground-water quality and~~Analytical data collected as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees~~DMP. Statistical analysis of DMP data will conform to EPA guidance "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (EPA, 1989) and "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

L-4e(1) Temporal and Spatial Analysis

~~Environmental parameters vary with space and time. The effect of one or both of these two factors on the expected value of a point measurement will be statistically evaluated through spatial analysis and time series analysis. These methods often require extensive sampling efforts that may exceed the practical limits of the DMP sampling procedures.~~

~~Spatial analysis may have limited use DMP during the operational period, although the effect of spatial auto-correlation on the interpretation of the data will be considered for each parameter. Spatial variability will be accounted for by the use of predetermined key sampling locations. Data analysis will be performed on a location-specific basis, or data from different locations will be combined only when the data are statistically homogeneous. Statistical homogeneity will be determined by evaluating mean values and variances from the residuals from the individual well data.~~

~~Time series analysis plays a more important role in data analysis for the DMP. Parameters will be reported as time series, either in tabular form or as time plots. For key time series parameters, these plots will be in the form of control charts on which control levels will be identified based on preoperational database, fixed standards, control location databases, or other standards for comparison. Where significant seasonal changes in the expected value of the parameter are identified in the preoperational database or in the control locations, corrections in the control levels which reflect the seasonal change will be made and documented.~~

~~[9] WP 10-AD3029 "Calibration and Control of Monitoring and Data Collection Equipment" provides the step-by-step protocols for the establishment and maintenance of a master database of monitoring and data collection (M&DC) equipment, the recall process for equipment needing calibration, the performance of calibrations, the management of calibration results to determine the adequacy of recall frequencies, functional testing of M&DC equipment, and reporting including out-of-tolerance reporting and expired calibration reporting. In addition, the procedure provides step-by-step process for the storage of calibrated M&DC equipment and the use of rental equipment.~~

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Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

L-4e(2) Distributions and Descriptive Statistics

~~For data sets which include more than ten data points that are homogeneous in space and time (including seasonal homogeneity) and have less than ten percent missing data, a test for conformance to the normal distribution will be performed. The test for normality of the data will be performed in accordance with the methodologies presented in "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

~~If normality is not met, the data will be log-transformed (or transformed using a suitable mathematical transformation, e.g., square root) and retested for normality. If the transformed data fit a normal distribution, the original data will be accepted as having lognormal or an otherwise mathematically transformed normal distribution. If normality is still not found, two courses may be taken. One will be to continue to test the fit to standard families of distributions, such as the gamma, beta, and Weibull, with proper modifications to subsequent analyses based on these results. The other course will be to use nonparametric methods of data analysis.~~

~~For data sets smaller than ten, but homogeneous and complete, the lognormal distribution will be assumed. Data sets with more than ten percent missing data will be analyzed using nonparametric methods. Nonhomogeneous data sets will be subdivided into homogeneous sets and each of these analyzed individually.~~

~~Descriptive statistics will be calculated for each homogeneous data set. At a minimum, these include a central value and a range of variation. The central value is the arithmetic mean of the untransformed data if the data are not censored at either end. If the data are censored, either a trimmed mean or the median will be used as the central value (which may be within the censored range). If the data set is greater than ten and is uncensored, the standard deviation will be calculated and used as a basis for the reported range in variation. If these criteria are not met, the range between the 0.25 and 0.75 cartelist will be used.~~

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (**UTLV**) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

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L-4e(3) Action Levels~~Data Anomalies~~

~~Data anomalies include data points reported as being below the limit of detection (LD) or otherwise censored over a specific range of values, missing data points occurring randomly in the data set, and outliers that cannot be ascribed to a known source of variation.~~

~~Whenever possible, sample values which are reported below detection limits will be incorporated into the database as sample values measured at one-half the detection limit for statistical analysis. When values are not available, alternative methods of analysis, as specified in previous sections, will be used. In particular, the use of nonparametric statistics will be required.~~

~~Missing data points comprising less than 10 percent of the data set do not significantly affect data analyses. Results based on data in which more than 10 percent is missing will be identified as such at the time of reporting. Consideration of the potential effect of missing data shall be made when the majority of the data are missing from a discrete time span.~~

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the ~~Formal testing for outliers will only be done in accordance with EPA guidance. The~~ methodologies specified in ~~Section 8.2 of the~~ "Statistical Analysis of Ground-~~W~~water Monitoring Data at RCRA Facilities" (EPA, ~~1989~~2009) ~~will be used to check for outliers~~.

~~If an outside source of variation is not identified to account for outliers in a data set, it will be included in the data set and all subsequent analyses. If the inclusion of such outliers is found to affect the final results of the analyses significantly, both results (with and without outliers) will be reported.~~

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background ~~ground-water~~groundwater quality hazardous constituent specified in Part 5, Table ~~L-3~~5.4.b at every ~~DMP ground water~~detection monitoring well during each of the ten background sampling events (with the exceptions of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed waste disposal began). ~~If any background ground-water quality parameter or constituent has not been measured prior to waste receipt, measurements will be made for those parameters or constituents in hydraulically upgradient DMP ground water monitoring wells for a sequence of four sampling events. Following completion of the four sampling events, the arithmetic mean and variance shall then be calculated by the field supervisor or designee for each well.~~ These measurements ~~will then~~ serve as a ~~background value~~ statistical baseline (Part 5, Table 5.6) ~~against which~~ that is ~~statistical values~~ used for evaluating the significance of the results of subsequent sampling events during detection monitoring ~~will be compared~~. Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. ~~Statistical analysis and comparison will be accomplished using one of the five statistical tests specified in~~ The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.~~98~~97(h)(4)~~, which may include Cochran's Approximation to the Behrens-Fisher students' t-test at the 0.01 level of significance (described in Appendix IV to 20.4.1.500 NMAC (incorporating 40 CFR §264)~~. If the

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comparisons show that a constituent statistically exceeds the baseline ~~a significant increase~~ at any ~~monitoring site~~of the DMWs (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f))), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(~~2~~3)). The results of the statistical comparison will be reported annually to ~~in~~ the NMED in the Annual Culebra ~~Site Environmental~~ Groundwater Report ~~(ASER)~~ by November 30, ~~and will be reported to NMED~~ as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)) ~~in October~~.

L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees. ~~Laboratory data reports will be forwarded to the Team Leader (see Section L-7) and NMED~~ and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.

- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.

- Parameter and hazardous constituent~~Analytical parameter~~, analytical results, reporting units, reporting limit, analytical method used.

- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specified in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from ~~semi-~~annual ~~ground-water~~groundwater sampling activities will be compared and interpreted by the ~~Team Leader~~Permittees through generation of statistical analyses as specified in Section L-~~4~~e. The ~~Team Leader~~Permittees will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report ~~ASER~~ in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra ~~Site Environmental~~Groundwater Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report~~, and to the EM Manager and NMED in the ASER~~. The ~~ASER~~ report will include all applicable information that may affect the comparison of background ~~ground-water~~groundwater quality and ~~ground-water~~groundwater surface elevation data through time. This information will include but is not limited to:

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- DMW and WLMP ~~W~~well configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).

- ~~Any p~~Pumping activities that may have taken place since publication of the last annual report (i.e., related to ~~ground water~~groundwater quality sampling, hydraulic testing, and shaft installation or grouting~~ activities~~) that may have taken place since the last annual groundwater report.

- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

- The results of the annual measurements of densities.

- Annotated hydrographs.

- Groundwater flow rate and direction.

- Potentiometric surface map generated using the following steps:

  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.

  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.

  - Fit trend surface through freshwater heads.

  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (**PABCs**) and define initial fixed-head boundary conditions based on the trend surface.

  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.

  - Run MODFLOW with optimal boundary conditions fit.

  - Contour MODFLOW head results on WIPP site.

  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.

  - Data analysis that will accompany the potentiometric surface map will include:

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- Measured versus modeled scatter plot diagram
- Frequency of modeled head residuals
- Modeled residual freshwater head at each well
- Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).

- Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2.

- ~~Radionuclide-specific data collected during the previous year.~~

The DMP data used in generating the ~~ASER~~ Annual Culebra Groundwater Report will be maintained as part of the WIPP facility ~~o~~Operating ~~r~~Record and will be provided to NMED for review as specified in the permit.

L-6 Records Management

Records generated during ~~ground-water~~groundwater sampling and water level ~~ground-water surface-elevation~~ monitoring ~~events~~ will be maintained in either ~~the form~~ project files ~~in the EM section~~at the Permitees facility or the Operating Record. Project ~~records~~ files will include, but are not limited to:

- Sampling and Analysis Plans (SAPs)
- SOPs
- Field Data Entry Sheets
- ~~STLBs~~
- CofC/RFA ~~and CofC~~ forms
- ~~Contract~~ Analytical Laboratory Data Reports
- Variance Logs and Nonconformance Reports
- Corrective Action Reports.

~~These and all raw analytical records~~ Detection Monitoring Program monitoring, testing, and analytical data ~~generated in conjunction with ground-water sampling~~ and ~~ground-water surface elevation~~ WLMP data~~monitoring~~ will be ~~stored in fire-resistant cabinets~~maintained in the WIPP facility Operating Record. ~~in the EM section according to the Records Inventory and Disposition Schedule (RIDS) and will be made available for inspection upon request. The following records will be transmitted to the Permittees' Project Records Services (PRS) for long-term storage in accordance with the RIDS:~~

- ~~Instrument maintenance and calibration records~~
- ~~QC sample data~~
- ~~Control charts and calculation~~
- ~~Sample tracking and control documentation~~
- ~~Raw analytical results.~~

~~L-7 Project Organization and Responsibilities~~

~~L-7a Environmental Monitoring Manager~~

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~~The EM Manager will be responsible for the overall design and implementation of the DMP. The EM Manager will develop and approve specific procedures all DMP activities, and will review and approve programmatic reports. The EM Manager will provide oversight of appropriate levels of cooperation and consultation between the EM Section and the State of New Mexico regarding environmental monitoring and will revise the QA section of the DMP, if necessary, and submit revisions as permit modifications as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42).~~

~~The EM Manager and staff will be responsible for achieving and maintaining quality in the DMP. All DMP data will be reviewed and approved by the EM Manager, or designee, prior to release.~~

~~The EM Manager will establish minimum qualification criteria and training requirements for all DMP personnel. The EM Manager will assure that position descriptions for assigned DMP personnel are adequately prepared. The EM Manager and/or Team Leader will assure that training is performed on an individual basis to maintain an acceptable level of proficiency by all new or temporary DMP staff and by all permanent GWSP staff. The EM Manager will assure that documents detailing all staff training are current and properly filed. Copies of training records will be on file for the Permittees in the MOC Technical Training Section.~~

~~The EM Manager will appoint a DMP Team Leader and Field Team, and assign the following responsibilities specified below.~~

~~L-7b – Team Leader~~

~~The Team Leader will coordinate and oversee field sampling activities, ensuring that sampling and associated procedures will be followed and that QA/QC and safety guidelines will be met. The Team Leader will direct the DMP per written approved procedures, and initiate the review of programmatic plans and procedures. The Team Leader will review and evaluate sample data, prepare and review programmatic reports, and assure that appropriate samples will be collected and analyzed. The Team Leader will assure that adequate technical support is provided to the Quality Assurance (**QA**) Department, when required during audits of vendor facilities. Any nonconformances or project changes will be immediately communicated to the Team Leader.~~

~~L-7c – Field Team~~

~~The field team members will consist of one or more scientists, engineers, or technicians, who will be responsible for sample collection, handling, shipping, and preparation and maintenance of appropriate data sheets, and completion of sample tracking documentation under the direction of the Team Leader, in accordance with this DMP and associated field procedures. The field team will inspect, maintain, and ensure proper calibration of equipment prior to use at each site, while ensuring that site health and safety requirements will be met at all times. The field team will communicate any nonconformances, malfunctions, or project changes to the Team Leader immediately.~~

~~L-7d – Safety Manager~~

~~The Safety Manager will be responsible for ensuring that the necessary requirements for the health and safety of personnel associated with sampling and analysis activities are met. The cognizant manager will be responsible for ensuring that field team members operate in a safe manner and personnel have appropriate training. The Safety Manager will ensure that periodic~~

~~health and safety assessments are conducted and that the cognizant manager will initiate corrective actions where deficiencies are identified.~~

~~L-7e Analytical Laboratory Management~~

~~Sample collection containers supplied by the laboratory will be certified as clean by either the laboratory or their supplier. The Permittees will supply containers for radiological samples. The analytical laboratory will be responsible for performing analyses in accordance with this DMP Plan and regulatory requirements. The laboratory will maintain documentation of sample handling and custody, analytical results, and internal QC data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside laboratory acceptance limits will trigger an investigation and, if appropriate, corrective action, as directed by the EM Manager. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above.~~

~~L-7f Quality Assurance (QA) Manager~~

~~The QA Manager will provide independent oversight of the DMP, via the assigned cognizant QA engineer, to verify that quality objectives are defined and achieved. The QA Manager will ensure objective, independent assessments of the DMP quality performance and the quality performance of the contract analytical laboratory. The QA Manager has been delegated authority on behalf of the Permittees by the MOC General Manager and will have access to work areas, identify quality problems, initiate or recommend corrective actions, verify implementation of corrective actions, and ensure that work will be controlled or stopped until adequate disposition of an unsatisfactory condition has been implemented.~~

L-~~7~~8 Quality Assurance Requirements

~~Specific~~ Quality Assurance (**QA**) ~~requirements for WIPP are defined in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record.~~ ~~R~~requirements specific to the DMP are presented in this section.

L-~~8a~~7a ~~QA Program Overview~~ Data Quality Objectives and Quality Assurance Objectives

~~The QA program was developed to assure that integrity and quality will be maintained for all samples collected and that equipment and records will be maintained in accordance with EPA guidance. The QA Program identifies data quality objectives (DQO), processes for assuring sample quality, and processes for generating and maintaining quality records.~~

L-~~8b~~7a(1) Data Quality Objectives

Data Quality Objectives (**DQOs**) are qualitative and quantitative statements that specify the quality of data required to support project decisions. DQOs have been ~~will be~~ established to ensure that the data collected will be of a sufficient and known quality for their intended uses. The overall DQOs for this DMP are shown in the following sections. ~~project will be to collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the ground water underlying the WIPP area. The data generated thus far by the DMP has been used to establish background ground-water quality. For the purpose of this~~

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~~DMP, DQOs for measurement data will be specified in terms of accuracy, precision, completeness, representativeness, and comparability. Measurements of data quality in terms of accuracy and precision will be derived from the analysis of QC samples generated in the field and laboratory. Appropriate QC procedures will be used so that known and acceptable levels of accuracy and precision will be maintained for each data set. This section defines the acceptance criteria for each QC analysis performed. The following subsections define each DQO.~~

L-7a(1)(i) Detection Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the groundwater underlying the WIPP facility.

L-7a(1)(ii) Water Level Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility.

L-7a(2) Quality Assurance Objectives

Quality Assurance Objectives (**QAOs**) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability.

L-~~8b~~7a(~~1~~2)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries~~samples~~. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-~~8b~~7a(~~1~~2)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (**SC**), temperature, ~~Eh~~, specific gravity and static ~~ground-water~~groundwater surface elevation. Field measurement accuracy will be determined using calibration ~~check~~ standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ~~assure~~ensure accuracy. Accuracy of ~~ground-water~~groundwater surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs ~~Procedure WP 10-AD3029~~ contains instructions that outline protocols for maintaining current calibration of ~~ground-water~~groundwater surface elevation measurement instrumentation. ~~A current revision of this document or procedure will be maintained in the WIPP Operating Record.~~

L-~~8b~~7a(~~1~~2)(~~ii~~)(B) Accuracy Objectives for Laboratory Measurements

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Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries ~~samples~~. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-~~8b~~7a(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)|}{average\ of\ measured\ samples\ 1+2} \times 100$$

L-~~8b~~7a(2)(ii)(A) Precision Objectives for Field Measurements

~~Precision of field measurements of water quality parameters will meet or exceed required reporting levels.~~ Specific conductance ~~SC~~, pH, temperature, and ~~optionally Eh~~ will be measured during well purging and after sampling. SC measurements will be precise to ±10%, pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer, ~~and~~ temperature to 0.10 degrees Celsius (°C), and SC~~Eh~~ to 10 millivolts (mV). Water-level measurement will be precise to ±0.01 ft. The precision of water density measurements, when measured in the field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than ±2 ft of error in the derived fresh-water head.

L-~~8b~~7a(2)(ii)(B) Precision Objectives for Laboratory Measurements

~~Precision of laboratory analyses will be assessed by performing the same analyses twice on LCSs with each analytical batch assessed at a minimum frequency of 1 in 20 ground-water samples for nonradiological parameters and 1 in 10 for radiological parameters. The laboratory will determine analytical precision control limits by performing replicate analyses of control samples. Precision measurements will be expressed as RPD.~~ Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (**LCSD**) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results. Laboratory analytical precision is also parameter dependent and will be prescribed in laboratory SOPs.

L-~~8b~~7a(~~3~~2)(iii) Contamination

In addition to measurements of precision and bias, QC checks for contamination will be performed. QC samples including trip blanks, field blanks, and method blanks will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents and glassware. Trip blanks will be used to assess volatile organic compound (**VOC**) sample contamination during shipment and handling and will be collected and analyzed at a frequency of 1 sample per sample shipment. Field blanks will be used to assess field sample collection methods and will be collected and analyzed at a minimum frequency of one sample per 20 samples (five percent of the samples collected).

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Method blanks will be used to assess contamination resulting from the analytical process and will be analyzed at a minimum frequency of one sample per 20 samples, or five percent of the samples collected. Evaluation of sample blanks will be performed following U.S. EPA "National Functional Guidelines for Organic Data Review" (EPA, ~~1991~~1999) and "National Functional Guidelines for Evaluating Inorganics Analyses" (EPA, ~~1988~~2004). Only method blanks will be analyzed via wet chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed method reporting limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in method blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

L-~~8b~~7a(~~4~~2)(iv) Completeness

Completeness is a measure of the amount of usable valid data resulting from a data collection activity, given the sample design and analysis. Completeness may be affected by unexpected conditions that may occur during the data collection process.

Occurrences that reduce the amount of data collected include sample container breakage during sample shipment or in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for analysis of Part 5, Table 5.4.a parameters ~~noncritical measurements (i.e., field measurements)~~ will be 90 percent and 100 percent analysis of Part 5, Table 5.4.b hazardous constituents~~for critical measurements (i.e., compliance data)~~. If the completeness objective for Part 5, Table 5.4.b hazardous constituents is not met, the ~~WIPP EM Manager~~Permittees will determine ~~on behalf of the Permittees~~ the need for resampling on a case-by-case basis. Numerical expression of the completeness (**%C**) of data is as follows:

$$\%C = \frac{number\ of\ accepted\ samples}{total\ number\ of\ samples\ collected} \times 100$$

L-~~8b~~7a(~~5~~2)(v) Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this DMP will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures will be designed to minimize factors affecting the integrity of the samples. ~~Ground water~~Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected will be those that will most accurately and precisely represent the true concentration of analytes of interest.

For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions.

L-~~8b~~7a(~~6~~2)(vi) Comparability

Comparability is the extent to which one data set can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measures dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (µg/L) for VOCs and semivolatile organic compounds (SVOCs).

Culebra ~~Ground-water~~groundwater surface elevation measurements will be expressed as equivalent freshwater elevation in feet above mean sea level.

L-~~8c~~7b Design Control

The approved ~~ground-water monitoring system was~~ designed for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with ~~and will be maintained to meet specifications established in~~ 20.4.1.~~500~~ 900 NMAC (incorporating 40 CFR ~~§§264 Subpart F~~270.42 ~~and 264.601 through 264.603~~).

L-~~8d~~7c Instructions, Procedures, and Drawings

~~Provisions and responsibilities for t~~The preparation and use of instructions and procedures at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). ~~Any a~~Activities performed for the DMP ~~ground-water monitoring~~ that may affect ~~ground-water~~groundwater data quality will be performed in accordance with ~~documented and~~ approved procedures which comply with the Permit ~~and the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F)~~.

~~Technical procedures, as specified elsewhere in this DMP, have been developed for each quality-affecting function performed for ground-water monitoring. The technical procedures unique to the DMP will be controlled by the ES&H at WIPP. The procedures are sufficiently detailed and include, when applicable, quantitative or qualitative acceptance criteria.~~

~~Procedures were prepared in accordance with requirements in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record.~~

L-~~8e~~7d Document Control

Permittees ~~Document controls~~ will ensure that the latest approved versions of ~~procedures~~ WIPP facility SOPs will be used in performing ~~ground-water~~groundwater monitoring functions and that obsolete materials will be adequately identified or removed from work areas.

~~L-8f Control of Work Processes~~

~~Process control requirements, defined in WIPP document WP 13-1 are met, and will continue to be met, for this DMP. A current revision of this document will be maintained in the WIPP Operating Record.~~

L-~~8g~~7e Inspection and Surveillance

Inspection and surveillance activities will be conducted as outlined in WIPP document WP 13-1 (see Table L-3). The ~~QA Department~~Permittees will be responsible for performing the applicable WIPP facility SOPs. ~~inspections and surveillance on the scope of work. EM section personnel will be responsible for performance checks as defined in applicable procedures and determined for the Permittees by MOC metrology laboratory personnel. Performance checks for the DMP will determine the acceptability of purchased items and assess degradation that occurs during use. A current revision of this document will be maintained in the WIPP Operating Record.~~

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L-~~8h~~7f Control of Monitoring and Data Collection Equipment

WIPP document WP 13-1 (see Table L-3) outlines the basic requirements for control and calibrating monitoring and data collection (**M&DC**) equipment. M&DC equipment shall be properly controlled, calibrated, and maintained according to WIPP facility SOPs (see Table L-3) ~~Procedure WP 10-AD3029~~ to ensure continued accuracy of ~~ground-water~~groundwater monitoring data. Results of calibrations, maintenance, and repair will be documented. Calibration records will identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records will be maintained to track uses of M&DC equipment. If M&DC equipment is found to be out of tolerance, the equipment will be tagged and it will not be used until corrections are made. ~~A current revision of this document or procedure will be maintained in the WIPP Operating Record.~~

L-~~8i~~7g Control of Nonconforming Conditions

In accordance with ~~WIPP document~~ WP 13-1 (see Table L-3), ~~specifies the system used at WIPP for ensuring that appropriate measures are established to control nonconforming conditions. Nonconforming conditions connected to the DMP will be identified in and controlled by documented procedures. E~~equipment that does not conform to specified requirements will be controlled to prevent use. The disposition of defective items will be documented on records traceable to the affected items. Prior to final disposition, faulty items will be tagged and segregated. Repaired equipment will be subject to the original acceptance inspections and tests prior to use. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

L-~~8j~~7h Corrective Action

Requirements for the development and implementation of a system to determine, document, and initiate appropriate corrective actions after encountering conditions adverse to quality at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). Conditions adverse to acceptable quality will be documented and reported in accordance with corrective action procedures and corrected as soon as practical. Immediate action will be taken to control work performed under conditions adverse to acceptable quality and its results to prevent quality degradation. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

L-~~8k~~7i Quality Assurance Records

WIPP document WP 13-1 (see Table L-3) outlines the policy that will be used at the WIPP facility regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

Records to be generated in the DMP will be specified by procedure. QA and RCRA operating records will be identified. This will be the basis for the labeling of records as "QA" or "RCRA operating record" on the Environmental Monitoring Records Inventory and Disposition Schedule~~EM RIDS~~.

~~QA records will document the results of the DMP implementing procedures and will be sufficient to demonstrate that all quality-related aspects are valid. The records will be identifiable, legible, and retrievable.~~

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TABLES

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Table L-1
Hydrological Parameters for Rock Units aAbove the Salado at WIPP

Unit		Hydraulic Conductivity	Storage ~~Coefficient~~	~~Transmissivity~~	~~Permeability~~	Thickness	Hydraulic Gradient
Santa Rosa		2×10^{-8} to 2×10^{-6} m/s (1) (2)	~~Specific capacity 0.029 to 0.041 ℓ/s/m~~	~~6×10^{-7} to 6×10^{-6} m^2/s (3)~~	~~10^{-10} m^2~~	0 to 91 m	0.001 (5)
Dewey Lake		10^{-8} m/s	Specific storage 1×10^{-5} (1/m) (2)	~~2.8×10^{-6} to 2.8×10^{-4} m^2/s (4)~~	~~5.01×10^{-17} m^2~~	152 m	0.001 (5)
Rustler	Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	~~8×10^{-8} to 8×10^{-9} m^2/s~~	~~0 m^2~~	13 to 23 m	NA (6)
	Magenta	$1 \times 10^{-8.5}$ to $1 \times 10^{-6.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	~~4×10^{-4} to 1×10^{-9} m^2/s~~	~~6.31×10^{-14} m^2~~	7 to 8.5 m	3 to 6
	Tamarisk	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	~~$< 2.7 \times 10^{-11}$ m^2/s~~	~~0 m^2~~	26 to 56 m	NA (6)
	Culebra	$1 \times 10^{-7.5}$ to $1 \times 10^{-5.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	~~1×10^{-3} to 1×10^{-12} m^2/s~~	~~2.1×10^{-14} m^2~~	4 to 11.6 m	0.003 to 0.007 (5)
	~~Unnamed lower member~~ Los Medaños	6×10^{-15} to 1×10^{-13} m/s 1.5×10^{-11} to 1.2×10^{-11} m/s (basal interval)	Specific storage 1×10^{-5} (1/m) (2)	~~2.9×10^{-10} to 2.2×10^{-13} m^2/s 2.9×10^{-10} to 2.4×10^{-10} m^2/s (basal interval)~~	~~0 m^2~~	29 to 38 m	NA (6)

Matrix characteristics relevant to fluid flow include values used in this table such as permeability, hydraulic conductivity, gradient, etc.)

Table Notes:

(1) The Santa Rosa Formation is not present in the western portion of the WIPP site. It was combined with the Dewey Lake Red Beds in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996), and the range of values entered here are those used in that study for the Dewey Lake/Triassic hydrostratigraphic unit.

(2) Values or ranges of values given for these entries are the values used in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996). Values are estimated based on literature values for similar rock types, adjusted to be consistent with site-specific data where available. Ranges of values include spatial variation over the WIPP site and differences in values used in different simulations to test model sensitivity to the parameter.

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~~(3) The range of values given here for transmissivity of the Santa Rosa is estimated for the center of the site. Transmissivity is the product of the thickness of the productive interval times its hydraulic conductivity. Thickness of the Santa Rosa is estimated to be 30 meters at the center of the WIPP site, and the range of derived transmissivities are based on the range of hydraulic conductivity values used by Corbet and Knupp (1996) for the combined Dewey Lake/Triassic unit.~~

~~(4) The range of values given here by transmissivity of the Dewey Lake is estimated for the center of the site. Transmissivity is the product of the thickness of the productive interval times its hydraulic conductivity. Thickness of the Dewey Lake is estimated to be 140 meters at the center of the WIPP site, and the range of derived transmissivities are based on the range of hydraulic conductivity values used by Corbet and Knupp (1996) for the combined Dewey Lake/Triassic unit.~~

(5) Hydraulic gradient is a dimensionless term describing change in the elevation of hydraulic head divided by change in horizontal distance. Values given in these entries are determined from potentiometric surfaces. The range of values given for the Culebra reflects the highest and lowest gradients observed within the WIPP site boundary. Values for the Dewey Lake and Santa Rosa are assumed to be the same as the gradient determined from the water table. Note that the Santa Rosa Formation is absent or above the water table in most of the controlled area, and that the concept of a horizontal hydraulic gradient is not meaningful for these regions.

(6) Flow in units of very low hydraulic conductivity is slow, and primarily vertical. The concept of a horizontal hydraulic gradient is not applicable.

Sources: Beauheim, 1986; Domenico and Schwartz, 1990; Domski, Upton, and Beauheim, 1996; Earlough, 1977.

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Table L-2
WIPP ~~Ground-water~~Groundwater Detection Monitoring Program Sample Collection and ~~Ground-water~~Groundwater Surface Elevation Measurement Frequency

Installation	Frequency
~~Ground-water~~Groundwater Quality Sampling	
~~DMP monitoring wells~~DMWs	~~Semia~~Annually
~~All other WIPP surveillance wells~~	~~On special request only~~
~~Ground-water~~Groundwater Surface Elevation Monitoring	
~~DMP monitoring wells~~DMWs	Monthly and prior to sampling events
WLMP Wells (see Table L-4) ~~All other WIPP surveillance well sites~~	Monthly
~~Redundant wells at all other WIPP surveillance well sites~~	~~Quarterly~~

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Table L-3
Analytical Parameter List for the WIPP Detection Monitoring Program

Background Ground-water Quality	Operational Detection Monitoring Ground-water Quality
Indicator Parameters	**Indicator Parameters**
pH, SC, TOC, TOH, TDS, TSS, density	pH, SC, TOC, TOH, TDS, TSS, density
Parameters Listed in	**Hazardous Constituents**
20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX, Calcium, Magnesium, Potassium	**Organic**
Field Analyses	Chloroform 1,2-dichloroethane Carbon tetrachloride Chlorobenzene 1,1-dichloroethylene 1,1-dichloroethane Methylene chloride 1,1,2,2-tetrachloroethane Toluene 1,1,1-trichloroethane Cresols — 1,4-dichlorobenzene 1,2-dichlorobenzene — trans-1,2-dichloroethylene 2,4-dinitrophenol — 2,4-dinitrotoluene Hexachloroethane — Hexachlorobenzene Isobutanol — Methyl ethyl ketone Pentachlorophenol Pyridine — Tetrachloroethylene 1,1,2 Trichloroethane — Trichloroethylene Trichlorofluoromethane — Xylenes Nitrobenzene — Vinyl Chloride
pH, SC, temperature, chloride, Eh, alkalinity, total Fe, specific gravity	**Metals** Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver Antimony — Calcium Beryllium — Magnesium Nickel — Potassium Thallium Vanadium
	Field Analyses
	pH, SC, temperature, chloride, Eh, alkalinity, total Fe, specific gravity

Note: Because of the lack of sophisticated weights and measures equipment available for field density assessment, field density evaluations are expressed in terms of specific gravity, which is a unitless measure.

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Table L-3
Standard Operating Procedures Applicable to the DMP

Number	Title/Description
WP 02-EM1005	Groundwater Serial Sample Analysis: This procedure provides general instructions necessary to perform field analyses of serial samples in support of the DMP. Serial samples are collected and analyzed at the field laboratory for field indicators. Serial sample results help determine if pumped groundwater is representative of undisturbed groundwater within the formation.
WP 02-EM1006	Final and Serial Sample Collection: This procedure describes the steps for collecting groundwater samples from the DMWs near the WIPP facility. Serial samples are collected and analyzed at the Field Laboratory until stabilization of the field parameters occurs. Final samples for Resource Conservation and Recovery Act (RCRA) analyses are collected and analyzed by a contract laboratory.
WP 02-EM1014	Groundwater Level Measurement: This document describes the method used for groundwater level measurements in support of groundwater monitoring at the WIPP facility using a portable electronic water-level probe.
WP 02-EM1021	Pressure Density Survey: This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at non-detection monitoring wells. Because most pressure densities are obtained by Sandia National Laboratories via pressure transducers installed in wells, this procedure is used to obtain pressure densities at wells not equipped with fixed transducers.
WP 02-EM1026	Water Level Data Handling and Reporting: This procedure provides instructions on handling water level data. Data are collected and recorded on field forms in accordance with WP 02-EM1014. This procedure is initiated when wells in the water surveillance program have been measured for a given month.
WP 02-EM3001	Administrative Processes for Environmental Monitoring and Hydrology Programs: This procedure provides the administrative guidance environmental monitoring personnel use to maintain quality control associated with environmental monitoring sampling and reporting activities. This administrative procedure does not pertain to volatile organic compound (VOC) monitoring, with the exception of Section 5.0 which pertains to the regulatory reporting review process.
WP 02-EM3003	Data Validation and Verification of RCRA Constituents. This procedure provides instructions on performing verification and validation of laboratory data containing the analytical results of groundwater monitoring samples. This procedure is applied only to the non-radiological analyses results for compliance data associated with the detection monitoring samples. The data reviewed for this procedure includes general chemistry parameters and RCRA constituents.
WP-02-RC.01	Hazardous and Universal Waste Management Plan. This plan describes the responsibilities and handling requirements for hazardous and universal wastes generated at the WIPP facility. It is meant to ensure that these wastes are properly handled, accumulated, and transported to an approved Treatment, Storage, Disposal Facility (TSDF) in accordance with applicable state and federal regulations, U.S. Department of Energy (DOE) Orders, and Washington TRU Solutions LLC (WTS) policies and procedures. This plan implements applicable sections of 20.4.1.100-1102 New Mexico Administrative Code (NMAC), *Hazardous Waste Management* (incorporating 40 *Code of Federal Regulations* [CFR] Parts 260-268 and 273).
WP 10-AD3029	Calibration and Control of Monitoring and Data Collection Equipment: This procedure provides direction for the control and calibration of Monitoring and Data Collection (M&DC) equipment at the WIPP facility, and ensures traceability to NIST (National Institute of Standards and Technology) standards, international standards, or intrinsic standards. This procedure also establishes requirements and responsibilities for identifying recall equipment, and for obtaining calibration services for WIPP facility M&DC equipment.
WP 13-1	Washington TRU Solutions LLC Quality Assurance Program Description. This document establishes the minimum quality requirements for Management and Operating Contractor (MOC) personnel and guidance for the development and implementation of QA programs by MOC organizations.

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Table L-4
January 2011 Culebra WLMP

WELL ID	WELL ID	WELL ID
AEC-7	H-17	SNL-15
C-2737	H-19 pad*	SNL-16
ERDA-9	I-461	SNL-17
H-02b2	SNL-01	SNL-18
H-03b2	SNL-02	SNL-19
H-04bR	SNL-03	WQSP-1
H-05b	SNL-05	WQSP-2
H-06bR	SNL-06	WQSP-3
H-07b1	SNL-08	WQSP-4
H-9bR	SNL-09	WQSP-5
H-10c	SNL-10	WQSP-6
H-11b4	SNL-12	WIPP-11
H-12	SNL-13	WIPP-13
H-15R	SNL-14	WIPP-19
H-16		

*H-19b0 monthly

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Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 and 16, 1994	737 (225)	15 (5)	693 (211)	695.6 to 737 (211 to 224.6)	737 (224.6)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 224.6)	699 to 722 (213 to 221)
WQSP-2 Figure L-8	September 6 and 12, 1994	846 (257.9)	12.3 (3.7)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.1 to 833.7 (247 to 254)
WQSP-3 Figure L-9	October 21 and 26, 1994	880 (268)	10 (3.1)	880 (268)	833 to 879 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 and 10, 1994.	800 (244)	9.2 (2.8)	740 (226)	740.5 to 798 (225.7 to 243)	800 (244)	764 to 789 (233 to 241)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 and 19, 1994.	681 (208)	2.0(0.61)	676 (206)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205.6)
WQSP-6 Figure L-12	September 26 and October 3, 1994	616.6 (187.9)	9.7 (3)	367 (112)	367 to 616 (112 to 188)	616.6 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 173.7)	570 to 616.6 (174 to 188)	582 to 606.9 (177 to 185)

Table L-46
Analytical Parameter and Sample Requirements

(10) PARAMETERS	(12) NO. OF BOTTLES	(13) VOLUME	(14) TYPE	(15) ACID WASH	(16) SAMPLE FILTER	(17) PRESERVATIVE	(18) HOLDING TIME
Indicator[1] Parameters: • pH • SC • ~~TOC~~ • ~~TOX~~	 - - 4 ~~3~~	 25 ml[2] 100 ml[2] 15 ml[2] ~~250 ml~~	 Glass Glass Glass ~~Glass~~	 Field determined Field determined yes ~~yes~~	 No? No No ~~No~~	 Field determined Field determined HCl ~~H_2SO_4, pH<2~~	 None None 28 days[2] ~~7 days[2]~~
General Chemistry	1	1 Liter	Plastic	Yes	No	HNO_3,4pH<2	not specified in DMP
Phenolics	1	1 Liter	Amber Glass	Yes	No	H_2SO_4, pH<2	not specified in DMP
Metals/Cations	2	1 Liter	Plastic	Yes	No	HNO_3, pH<2	6 months[2,3]
VOC	4	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Non-Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
BN/As	1	½ Gallon	Amber Glass	Yes	No	None	
TCLP	1	1 Liter	Plastic	Yes	No	HNO_3, pH<2	7 days[2]
Cyanide (Total)	1	1 Liter	Plastic	Yes	No	NaOH, pH>12	14 days[2]
Sulfide	1	250 ml	Amber Glass	Yes	No	NaOH + Zn Acetate	28 days[2]
Radionuclides	1	1 Gallon	Plastic Cube	Yes	Yes	HNO_3, pH<2	6 months[2]

1 = RCRA Detection Monitoring Analytes

2 = As specified in Table 4-1 of the RCRA TEGD

3 = Reduced holding time of 1 week for WIPP-specific Divalent cation 2 samples noted in the GMD

Note: Unless otherwise indicated, data are from DOE Procedure WP 02-EM1006 methods and are provided as information only.

Note: Deviations from this table are allowed with prior approval by the NMED.

00315

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FIGURES

: 00317

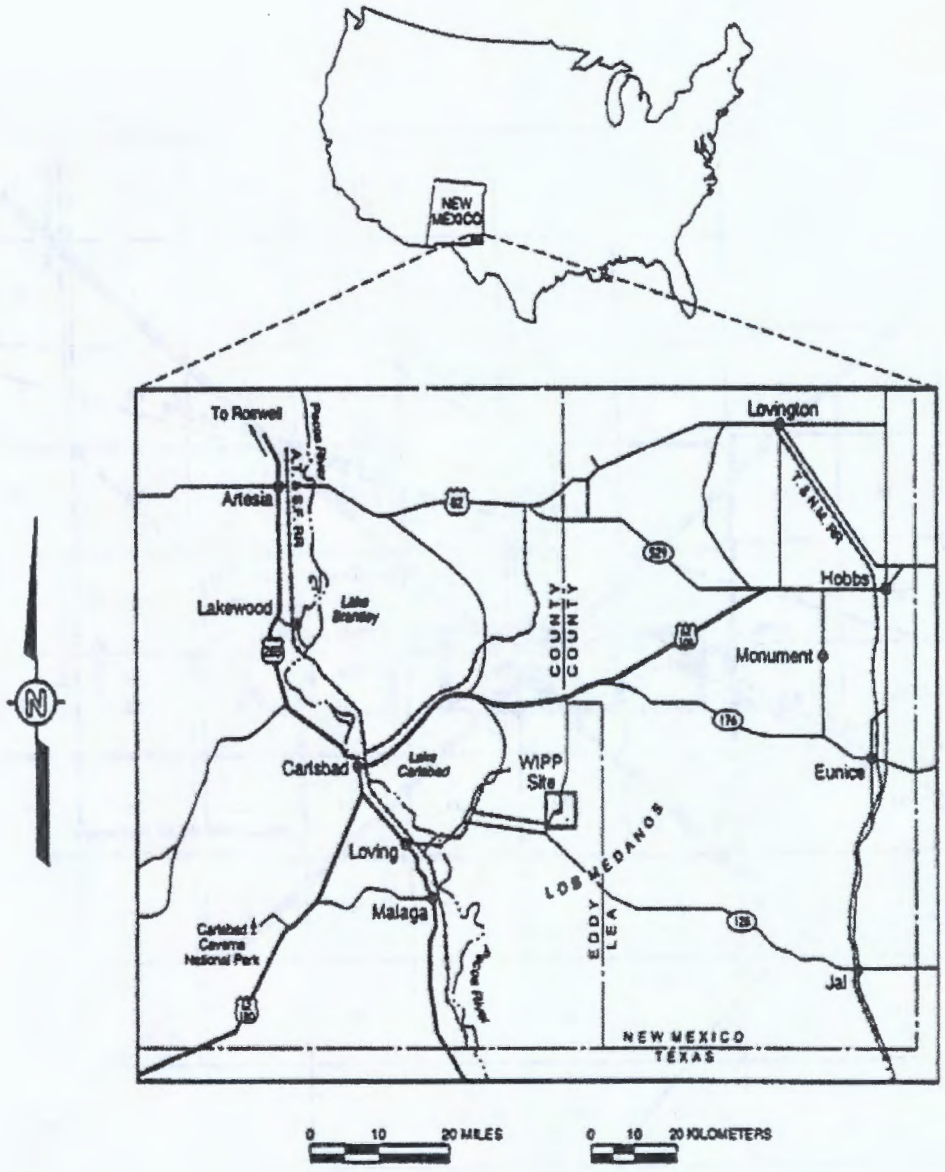
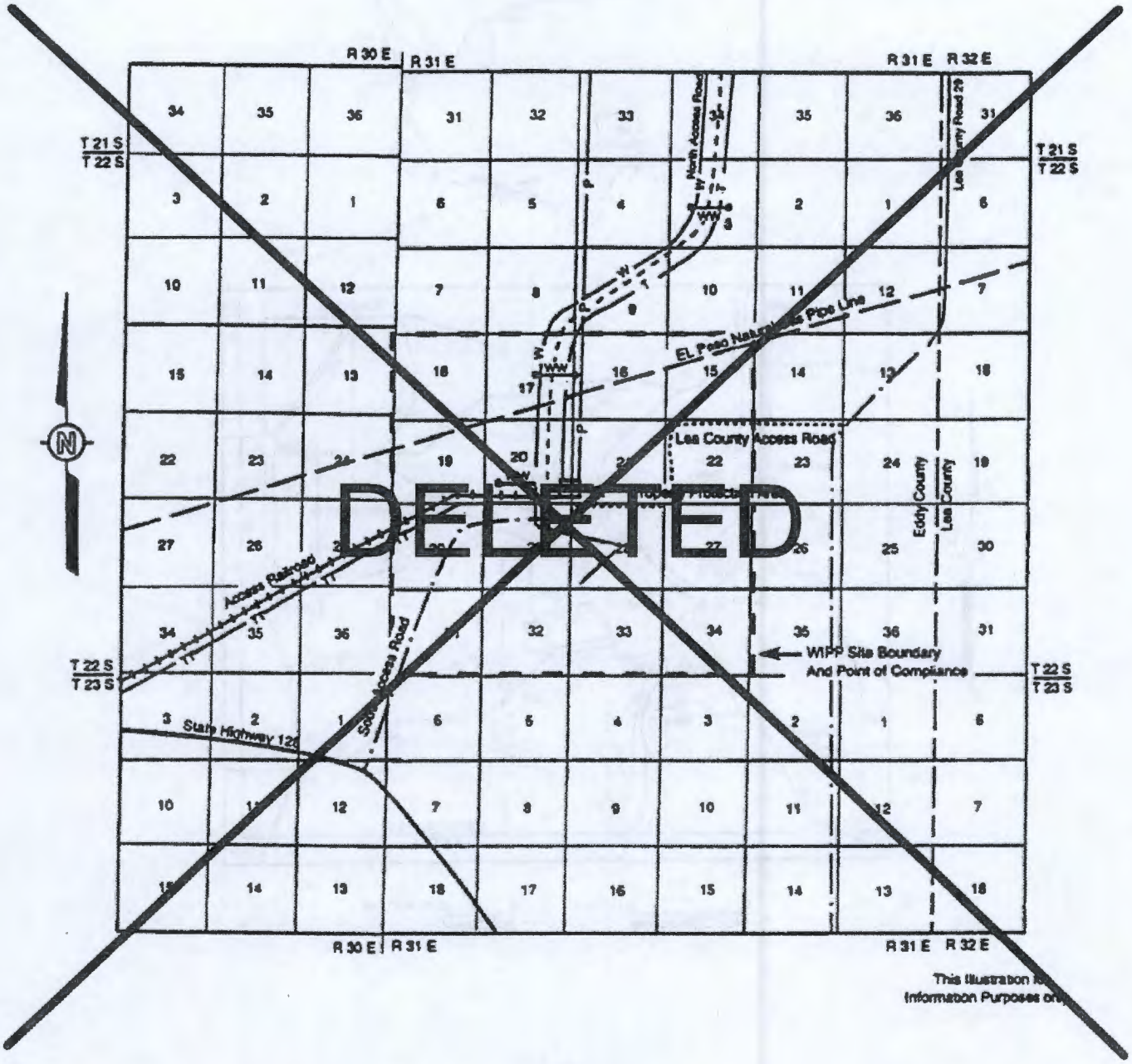


Figure L-1
General Location of the WIPP Facility

00318



~~Figure L-2~~
~~WIPP Facility Boundaries Showing 16-Square-Mile Land Withdrawal Boundary~~

00319

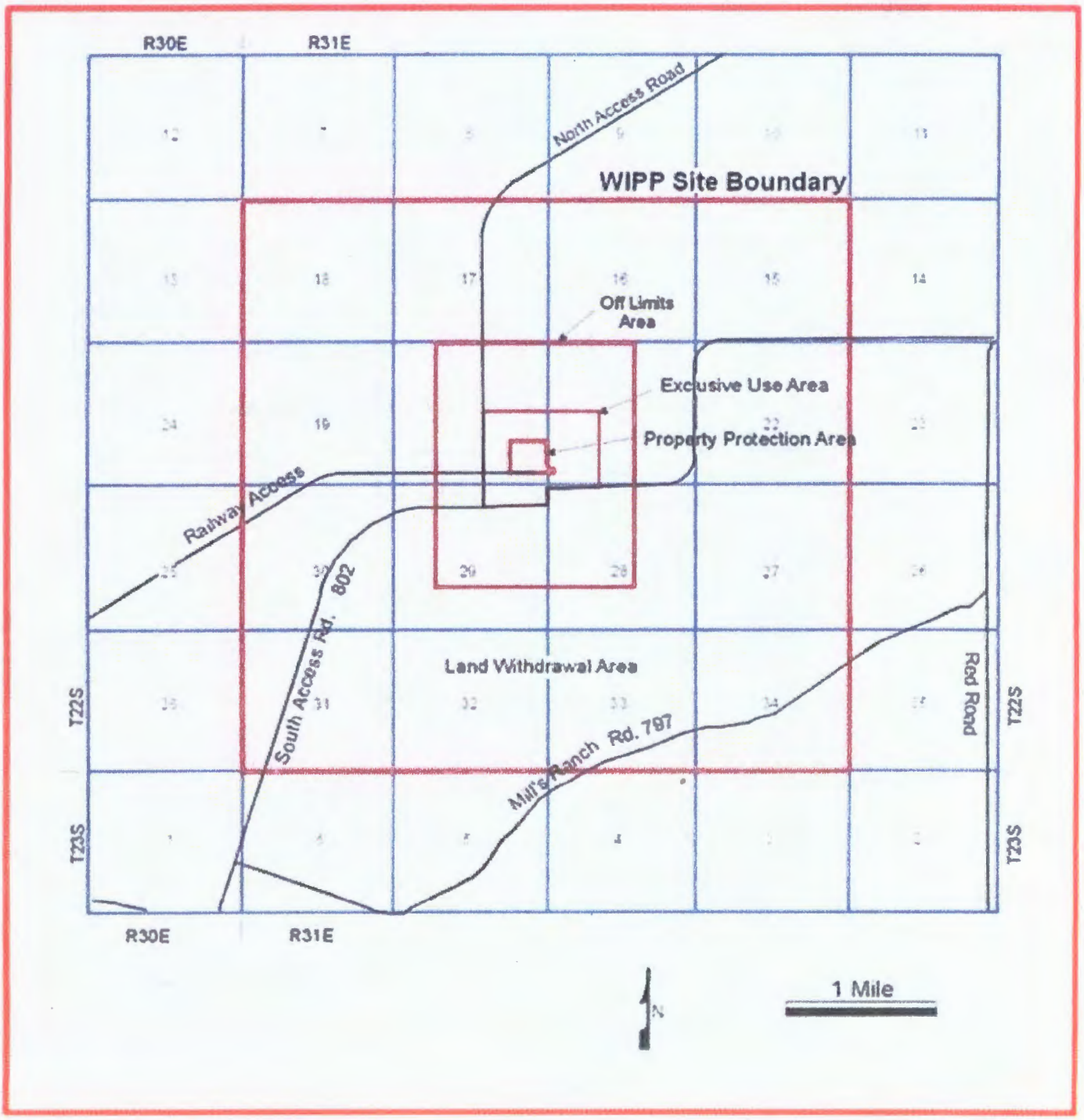


Figure L-2
WIPP Facility Boundaries Showing 17-square-Mile Land Withdrawal Boundary

00320

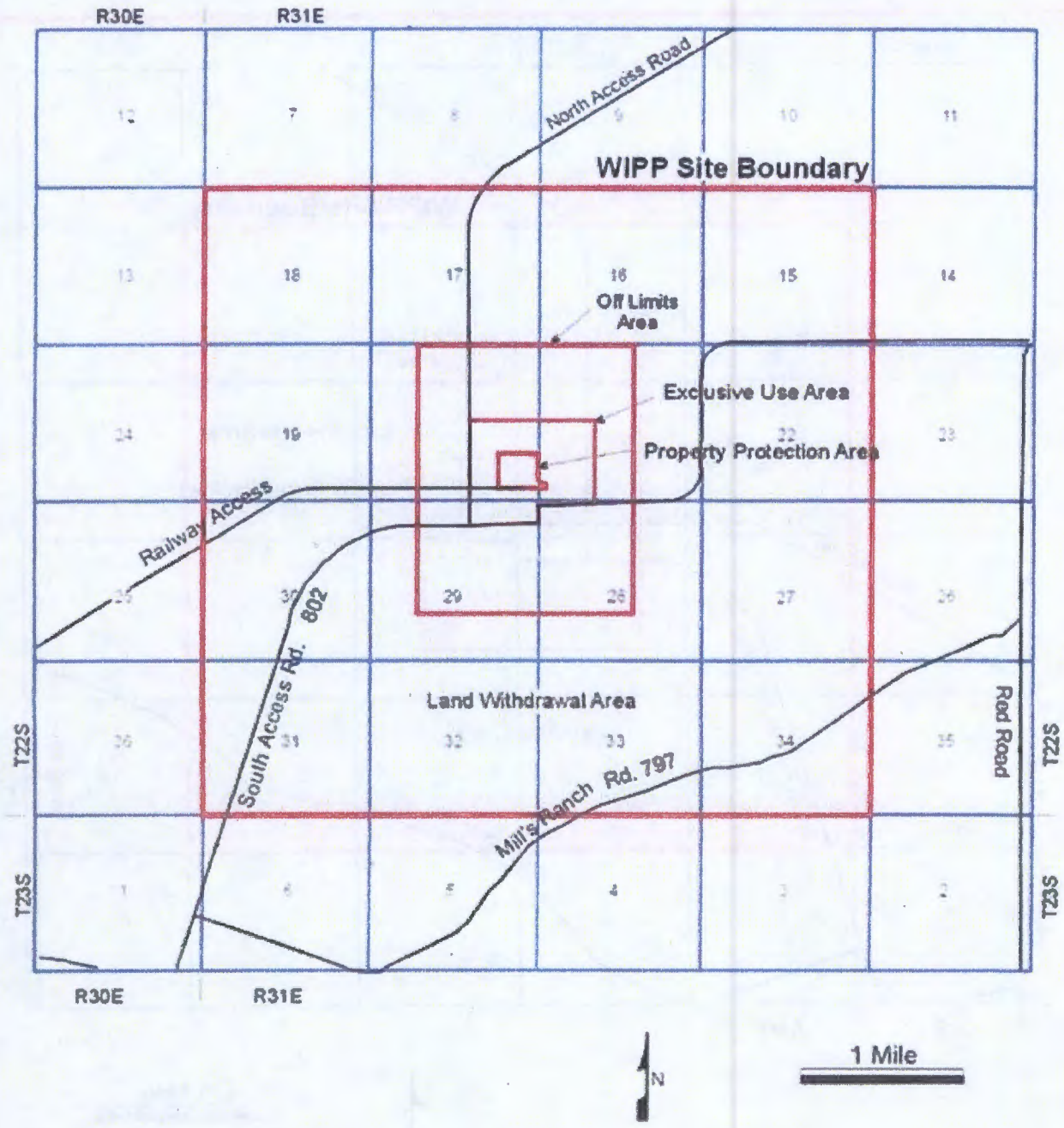


Figure L-2
WIPP Facility Boundaries Showing 17-square-Mile Land Withdrawal Boundary

00321

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		**DEWEY LAKE**	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				~~Unnamed~~Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	**BELL CANYON**	
			CHERRY CANYON	
			BRUSHY CANYON	

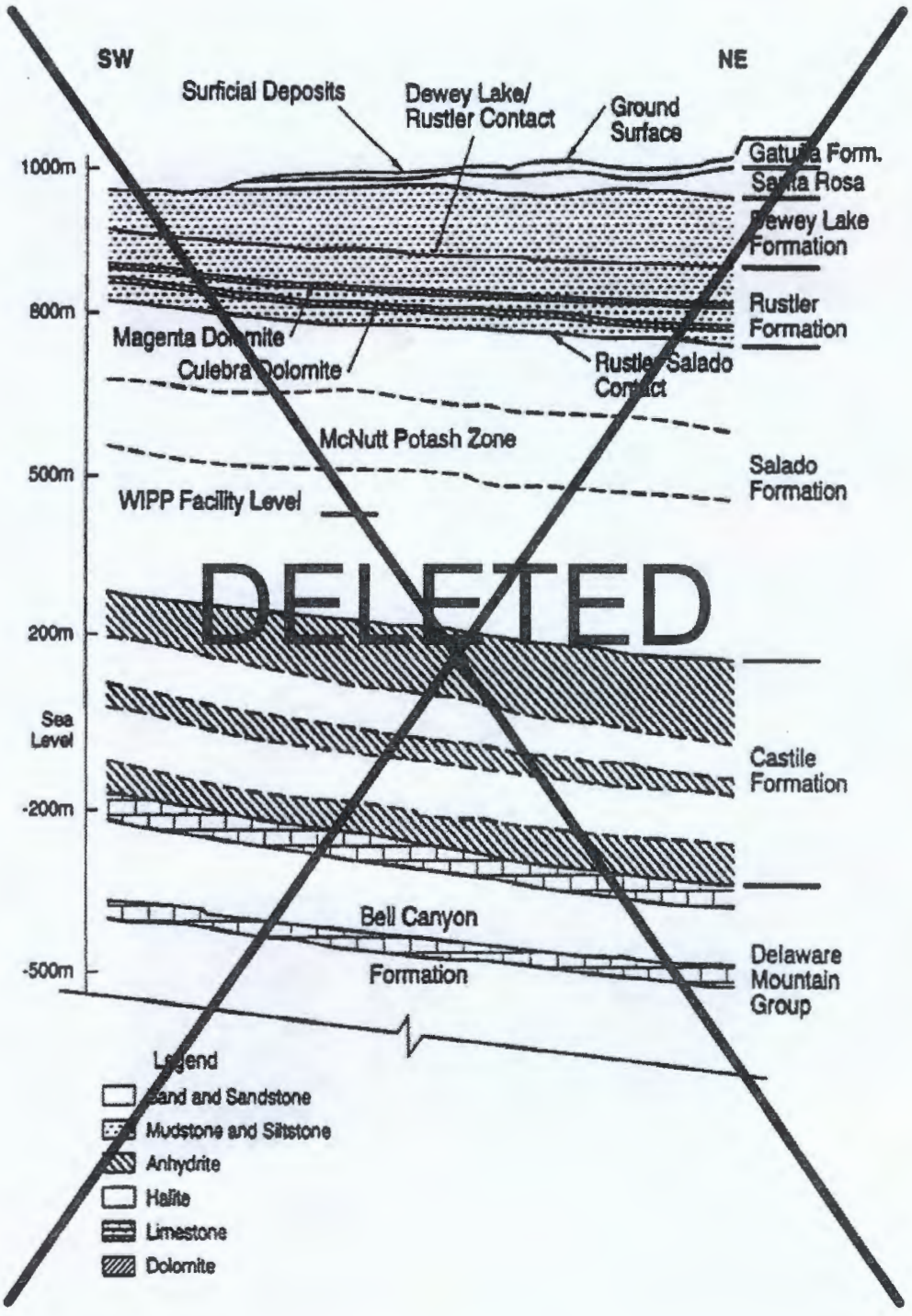
Figure L-3
Site Geologic Column

: 00322

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		**DEWEY LAKE**	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	**BELL CANYON**	
			CHERRY CANYON	
			BRUSHY CANYON	

Figure L-3
Site Geologic Column

: 00323



~~Figure L-4~~
~~Generalized Statigraphic Cross Section Above Bell Canyon Formation at WIPP Site~~

: 00324

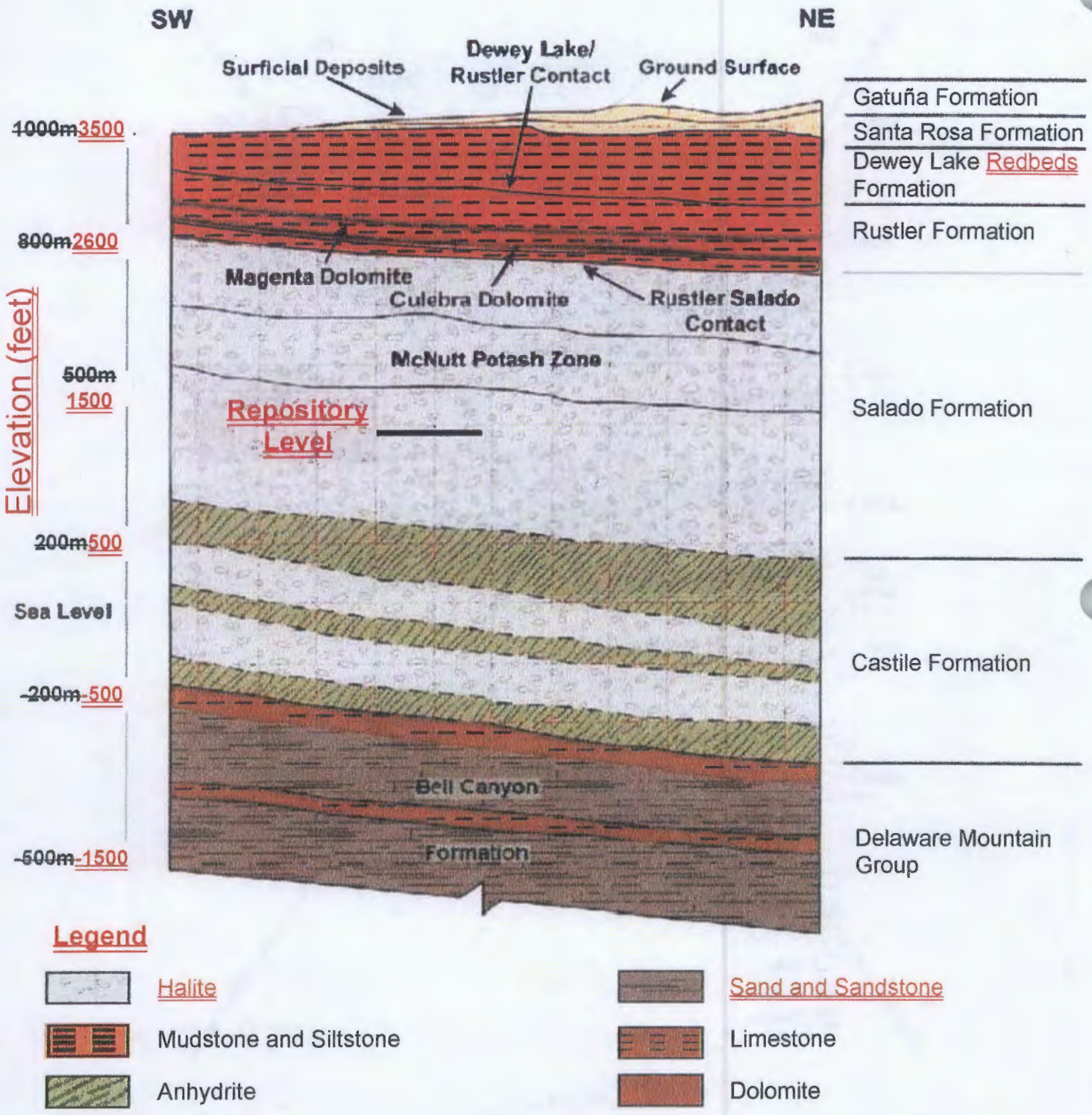


Figure L-4
Generalized Stratigraphic Cross Section Above Bell Canyon Formation at WIPP Site

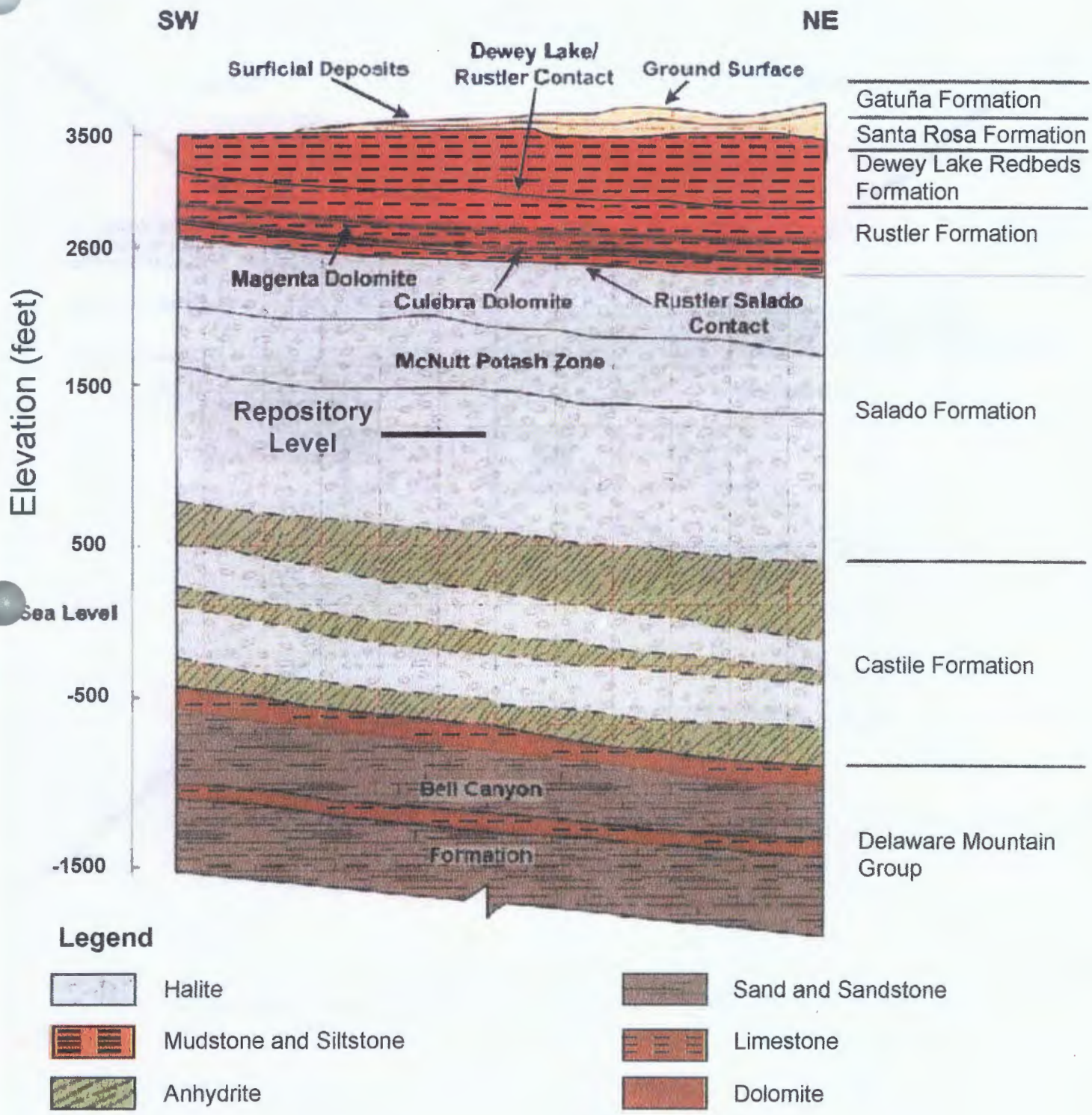
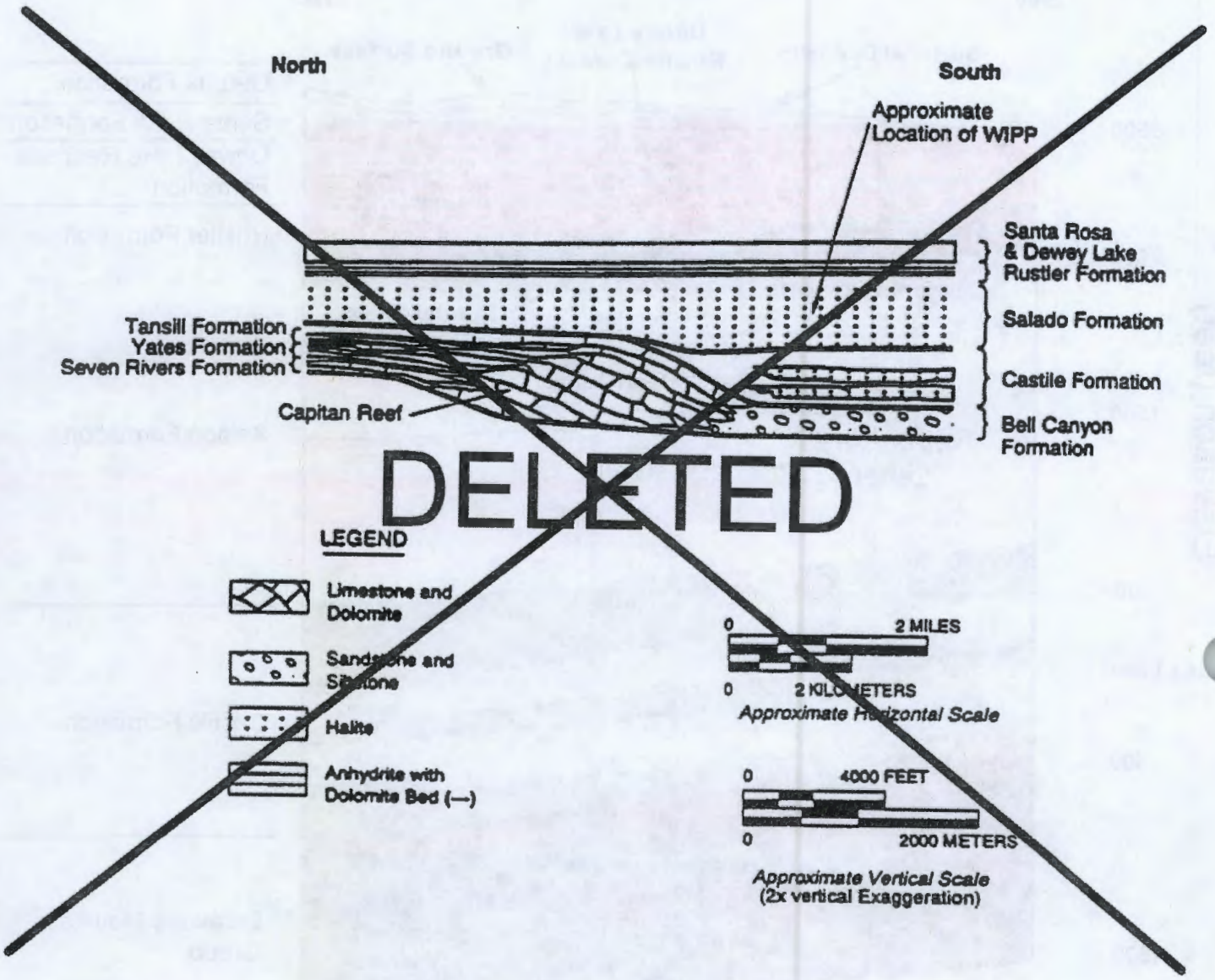


Figure L-4
Generalized Stratigraphic Cross Section Above Bell Canyon Formation at WIPP Site

00326



~~Figure L-5~~
~~Schematic North-South Cross Section Through the North Delaware Basin~~

00327

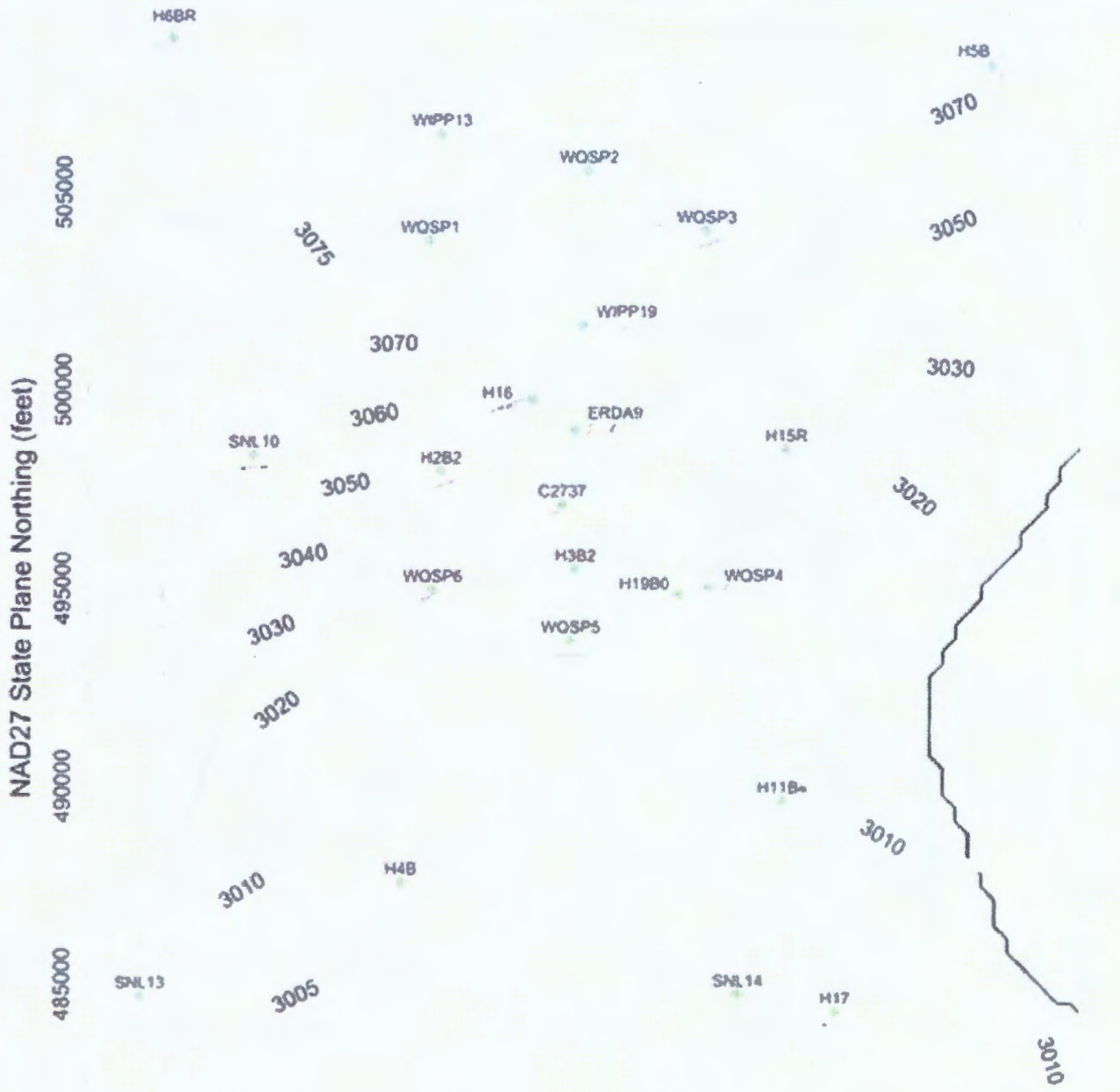


Figure L-5
Culebra Freshwater-Head Potentiometric Surface

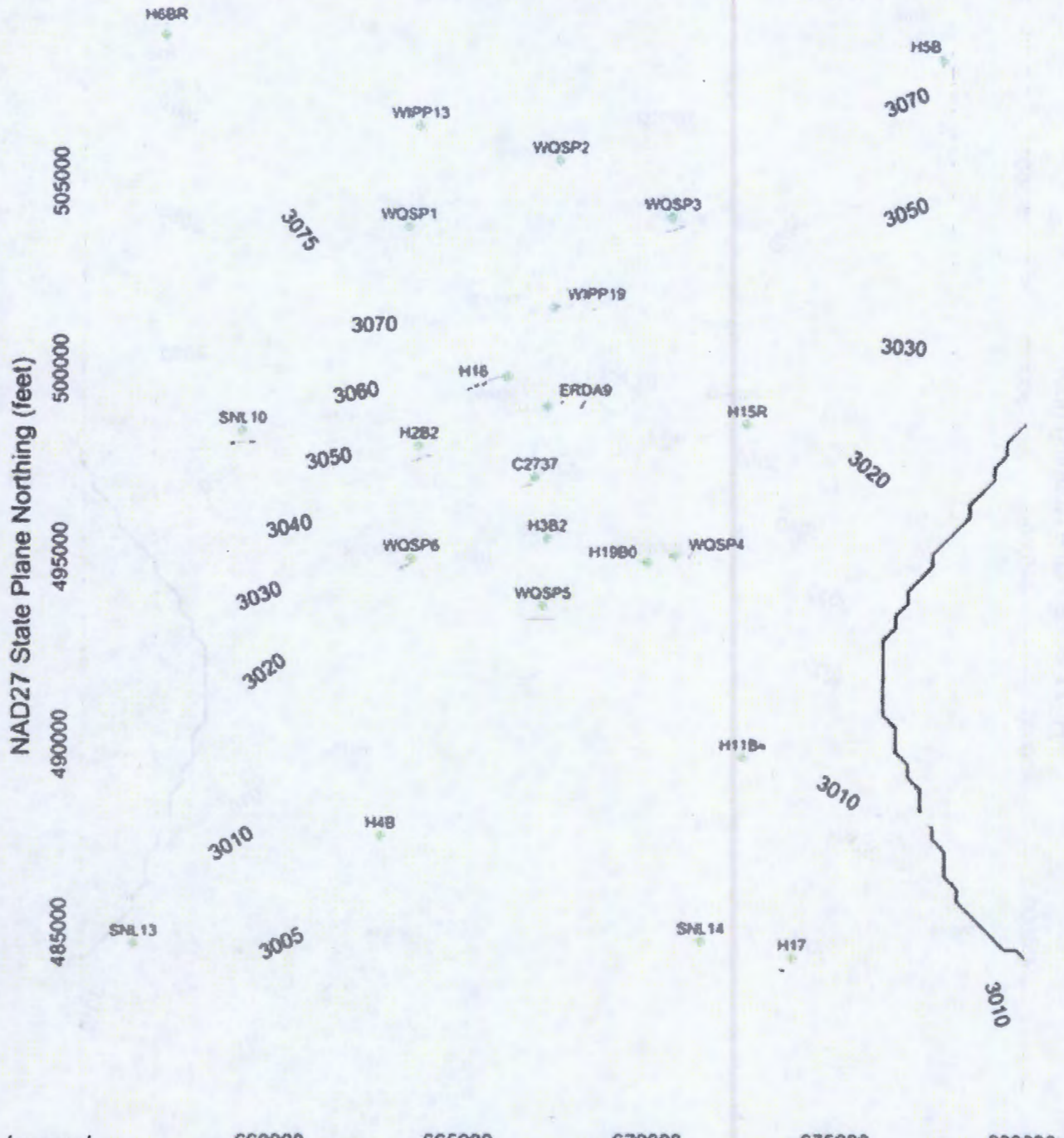
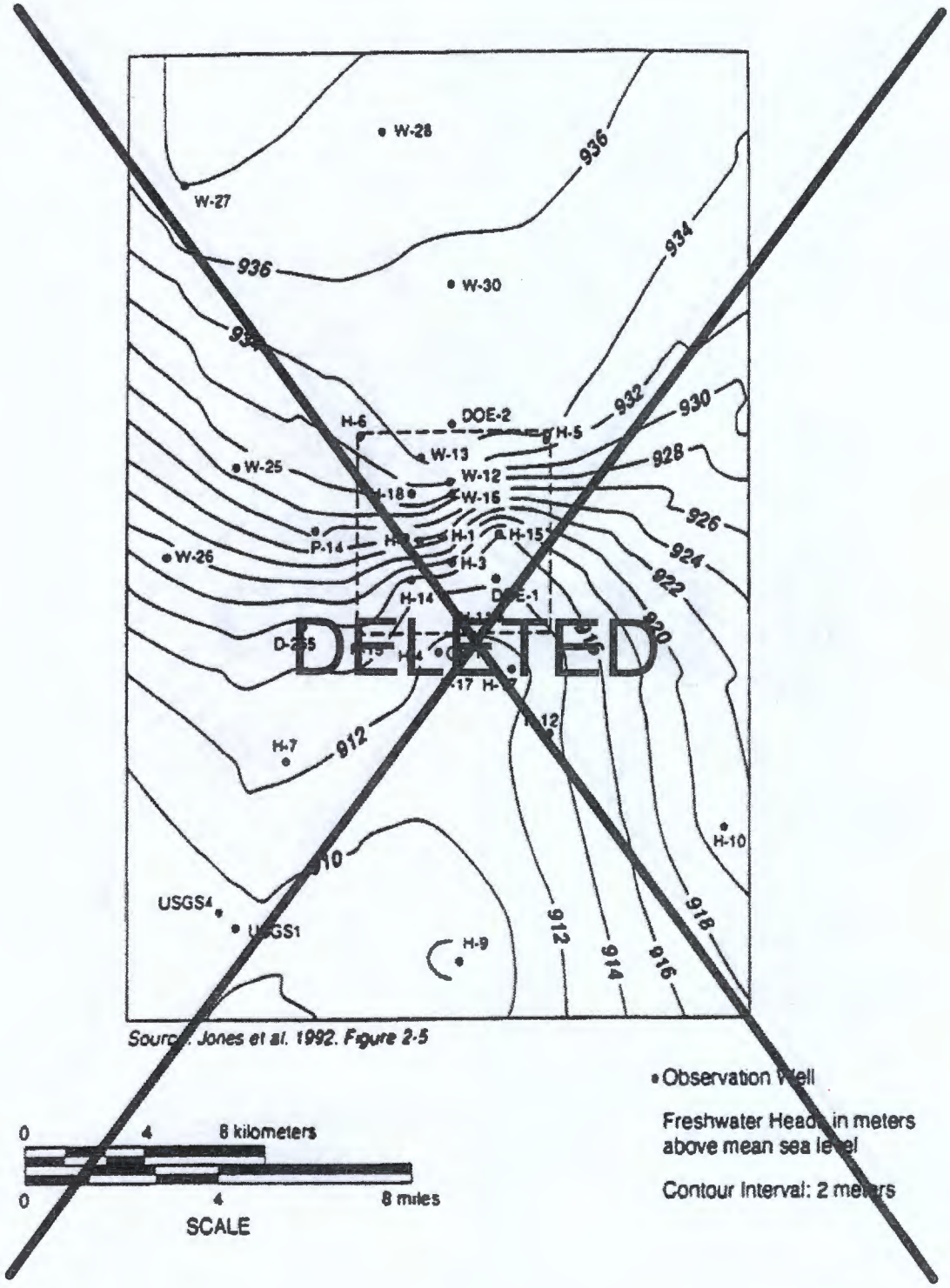
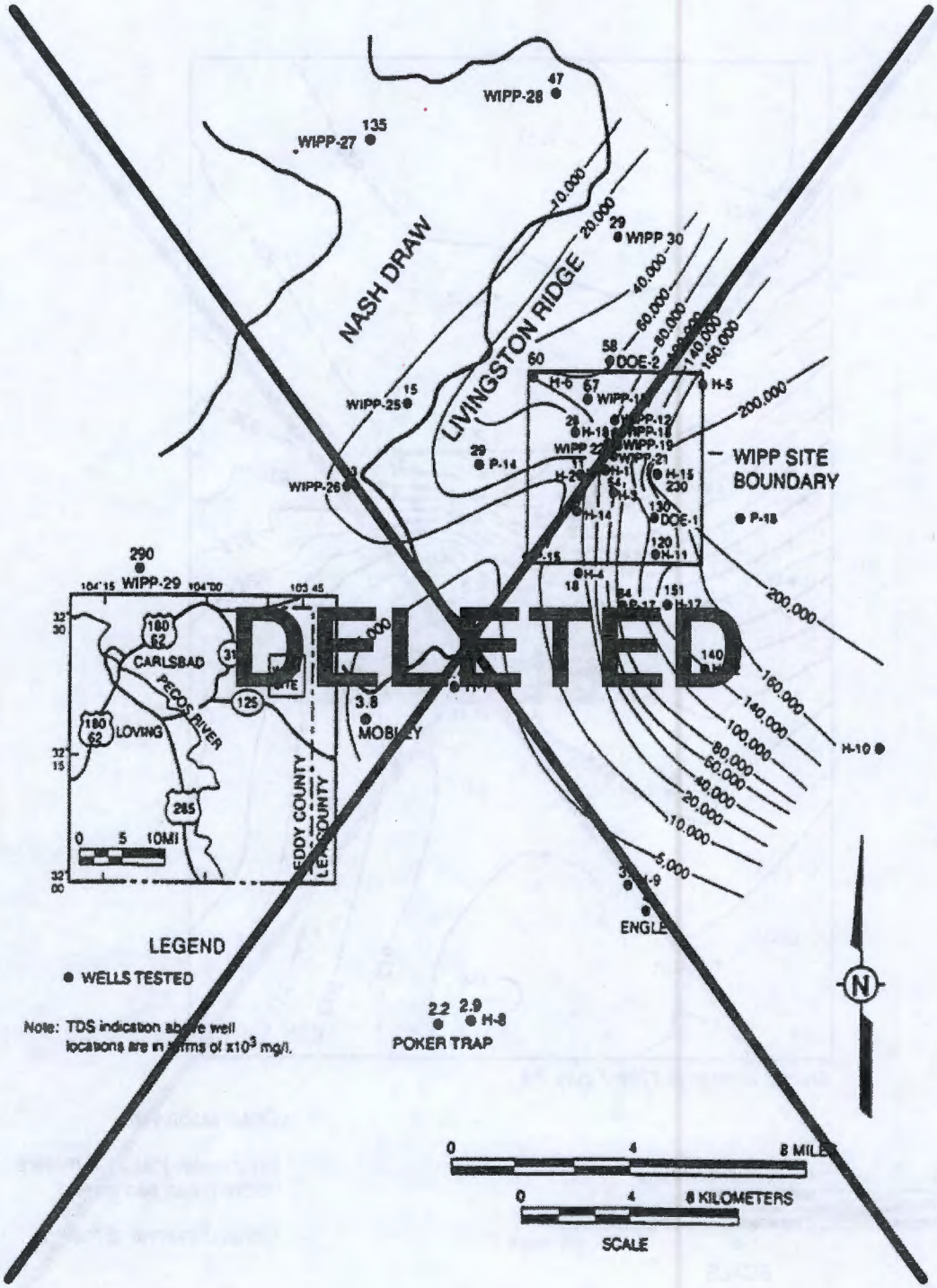


Figure L-5
Culebra Freshwater-Head Potentiometric Surface

00329

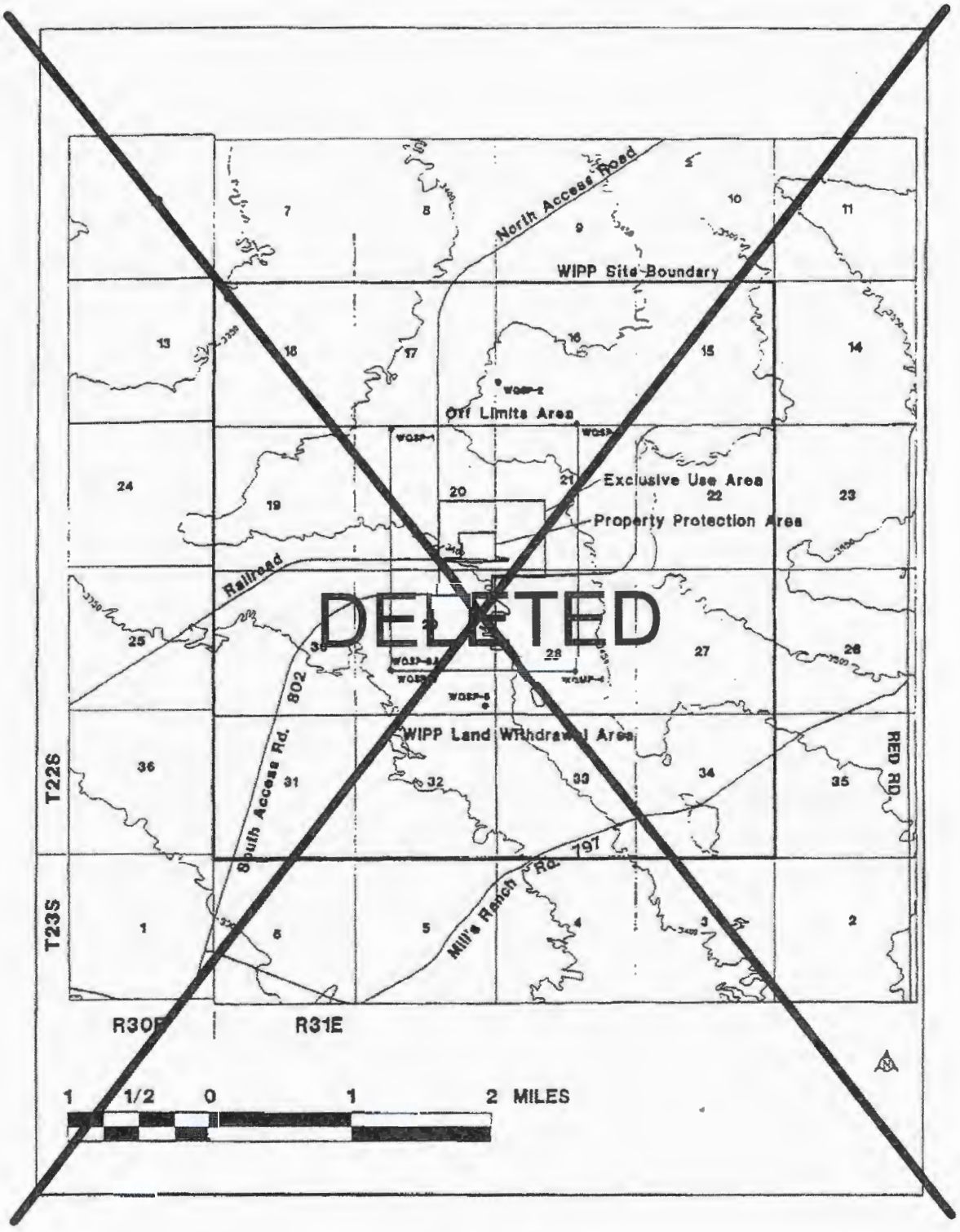


~~Figure L-6~~
~~Culebra Freshwater-Head Contour Surface~~



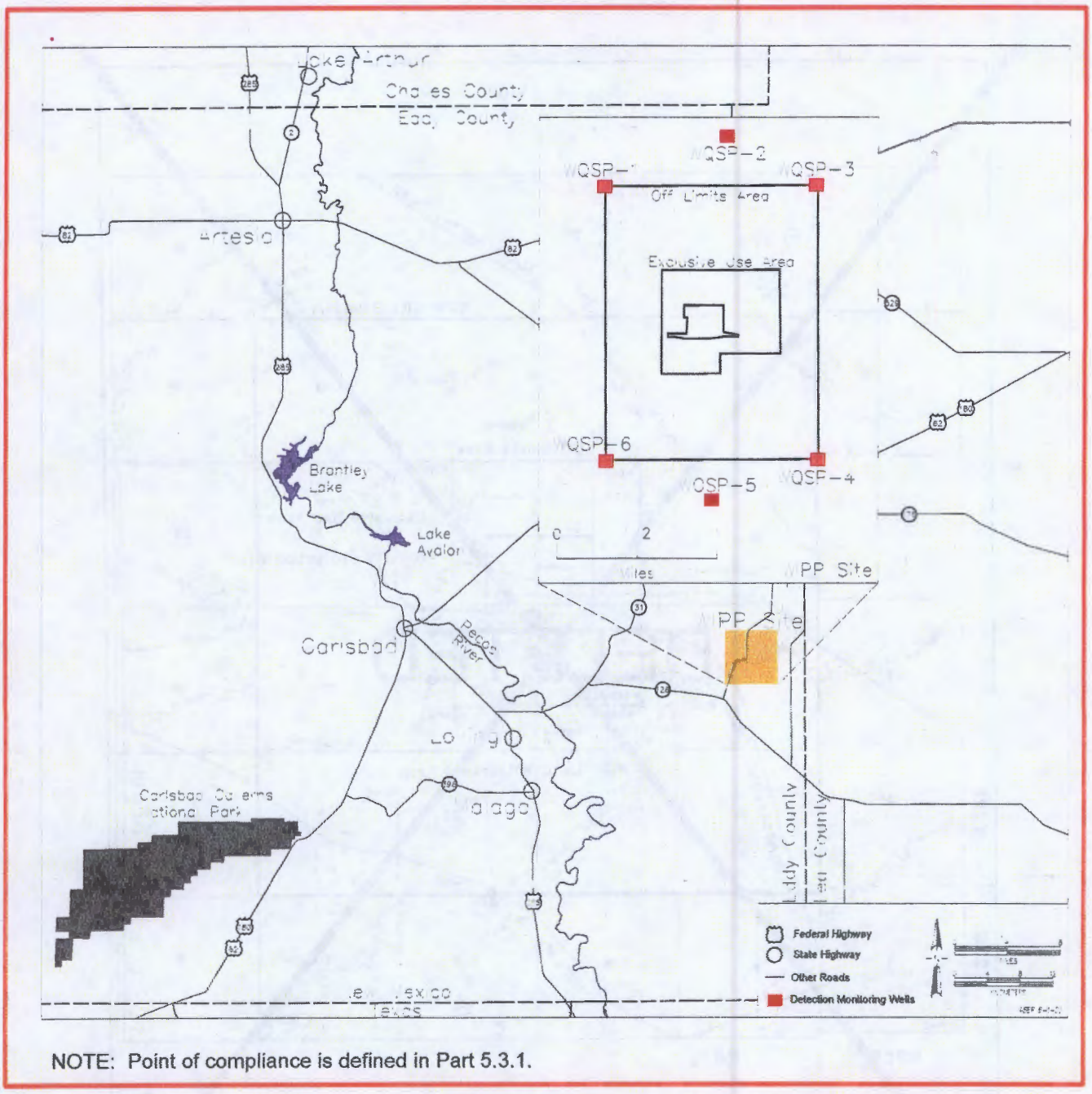
~~Figure L-7~~
~~Total Dissolved Solids Distribution in the Culebra~~

00331



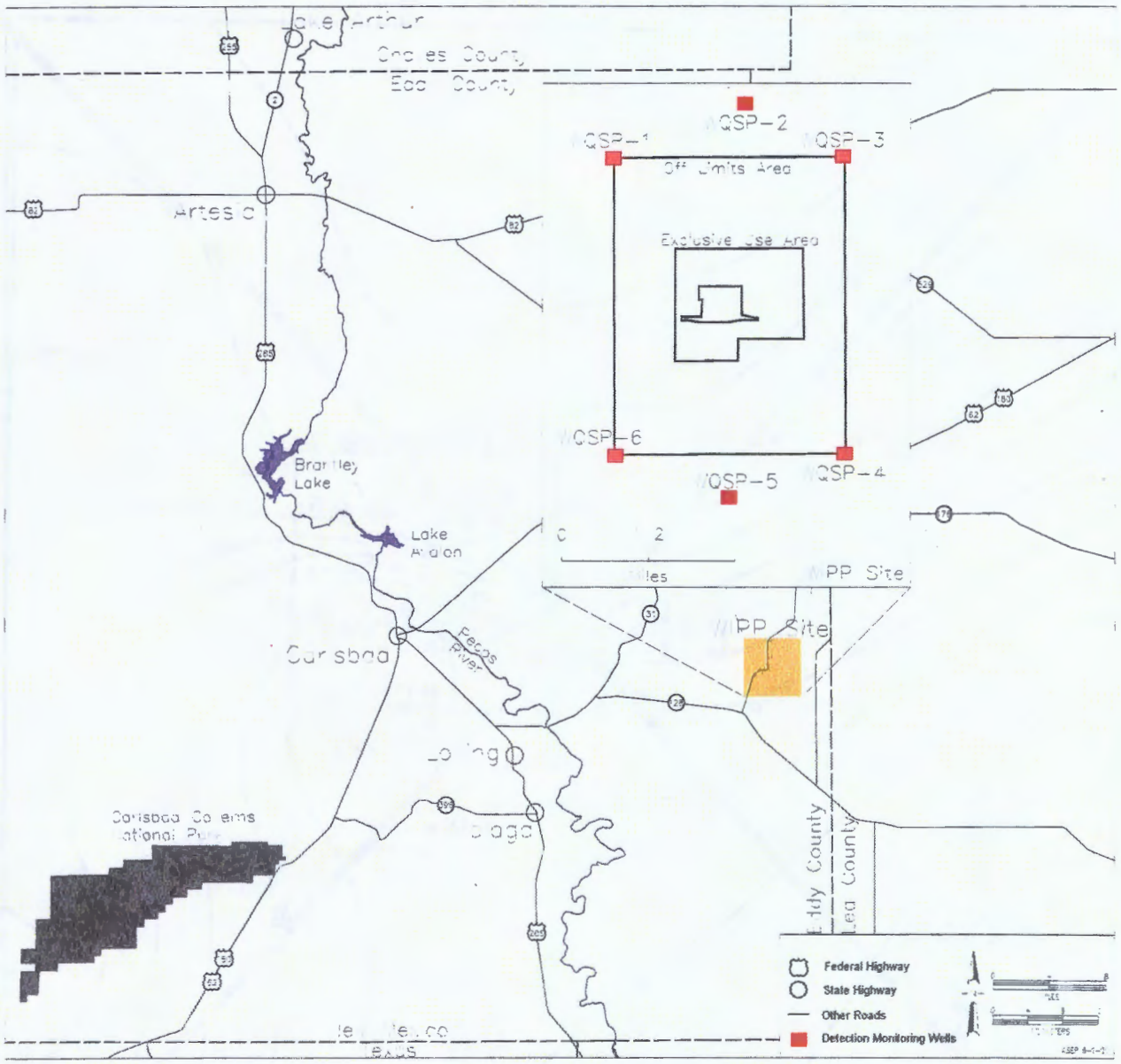
~~Figure L-8~~
~~WQSP Monitor Well Locations~~

00332



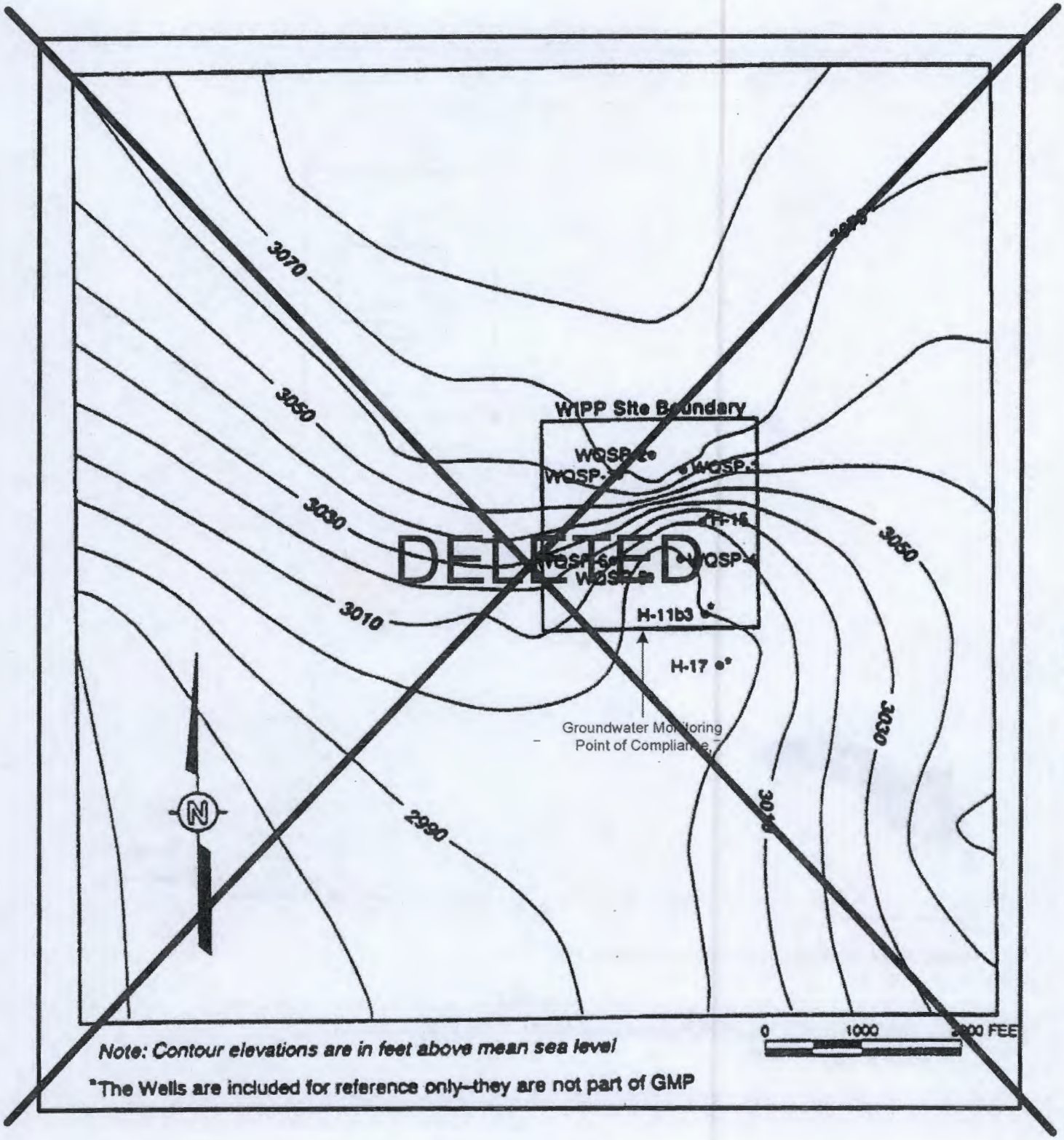
NOTE: Point of compliance is defined in Part 5.3.1.

Figure L-~~8~~6
~~WQSP~~ Detection Monitoring Well Locations



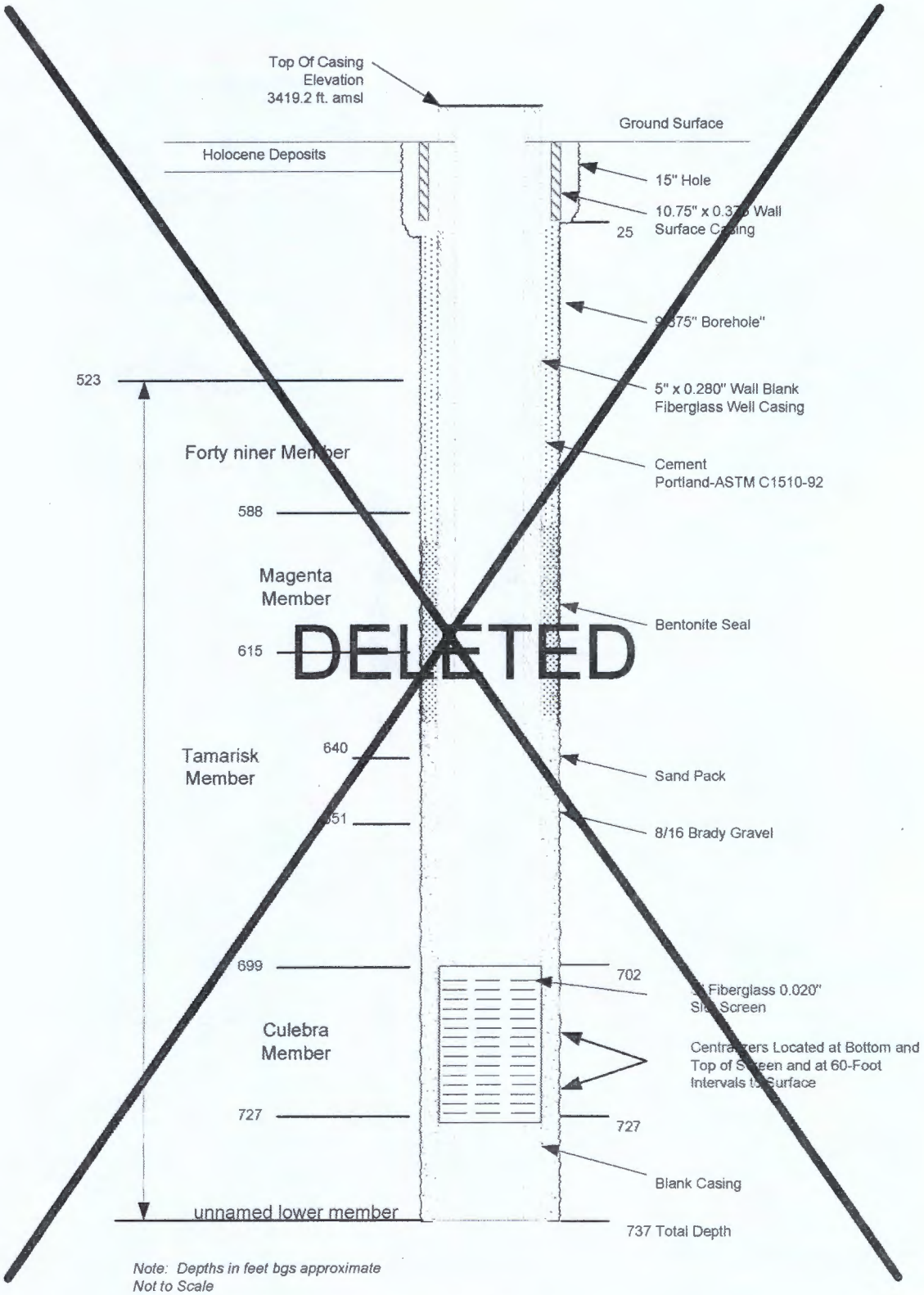
NOTE: Point of compliance is defined in Part 5.3.1.

Figure 6
WQSP Detection Monitoring Well Locations



~~Figure L-9~~
~~WIPP DMP Monitor Well Locations and Potentiometric Surface of the Culebra Near the WIPP Site as of 12/96 (adjusted to equivalent freshwater head)~~

00335



~~Figure L-10~~
~~As-Built Configuration of Well WQSP-1~~

: 00336

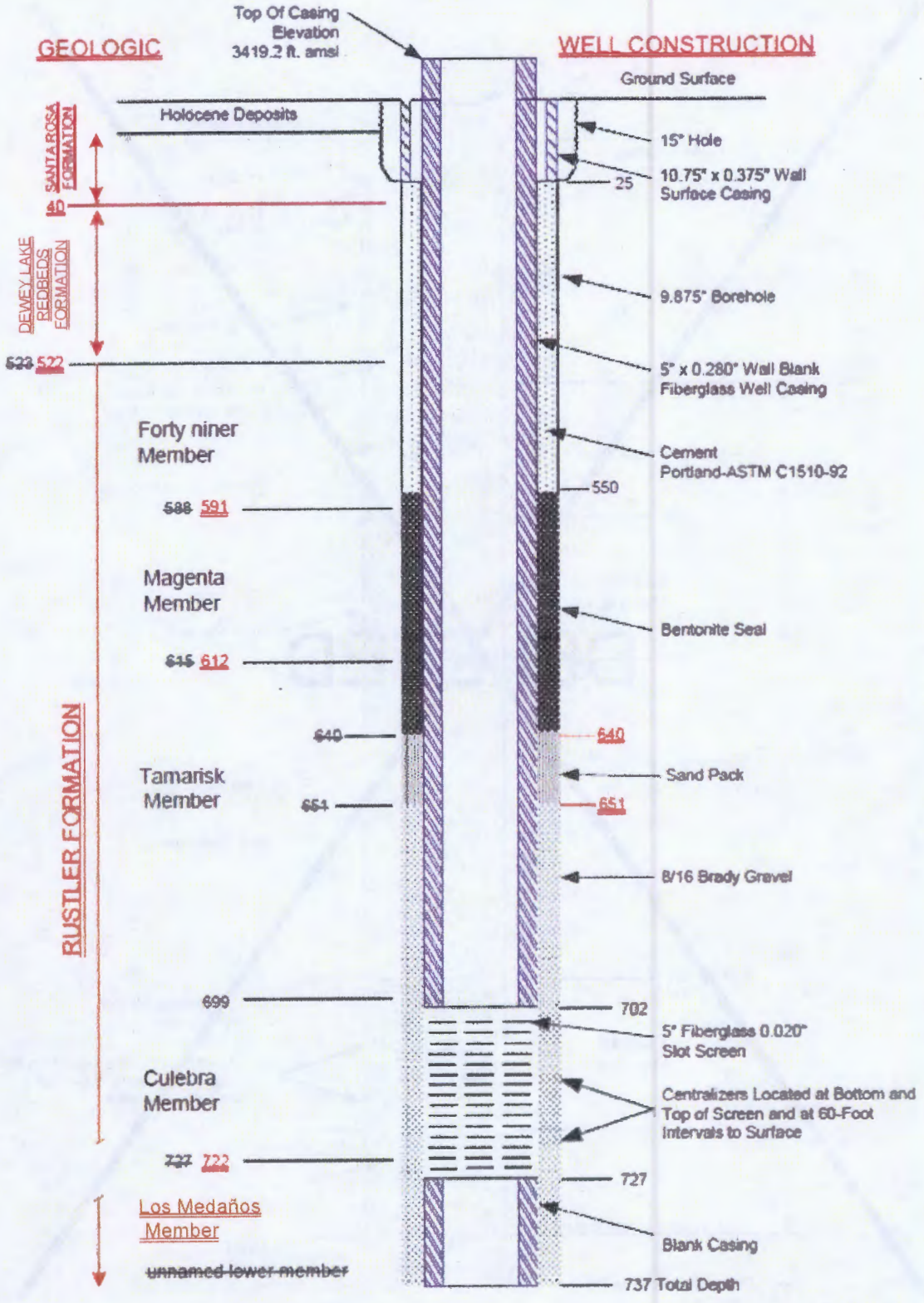
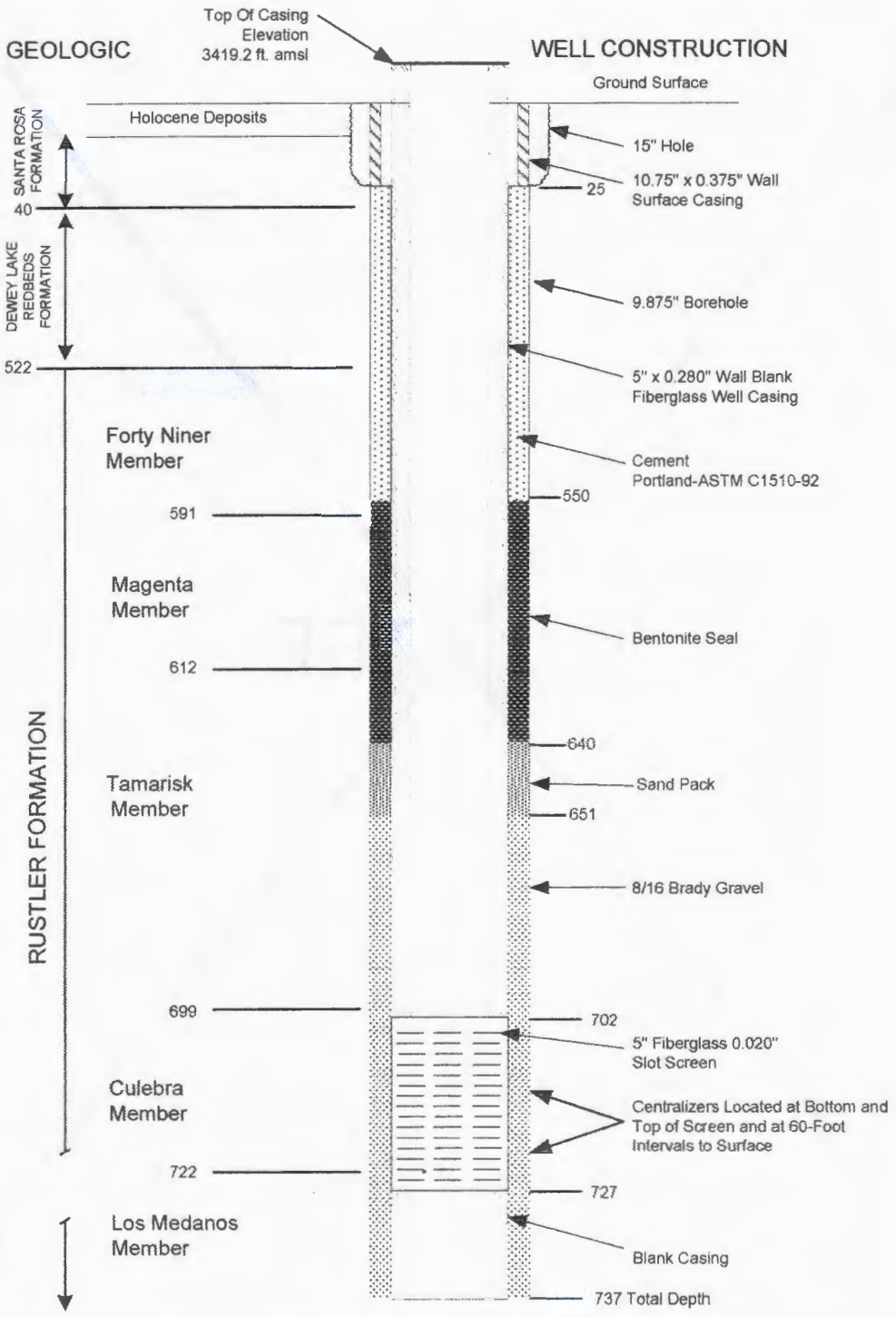


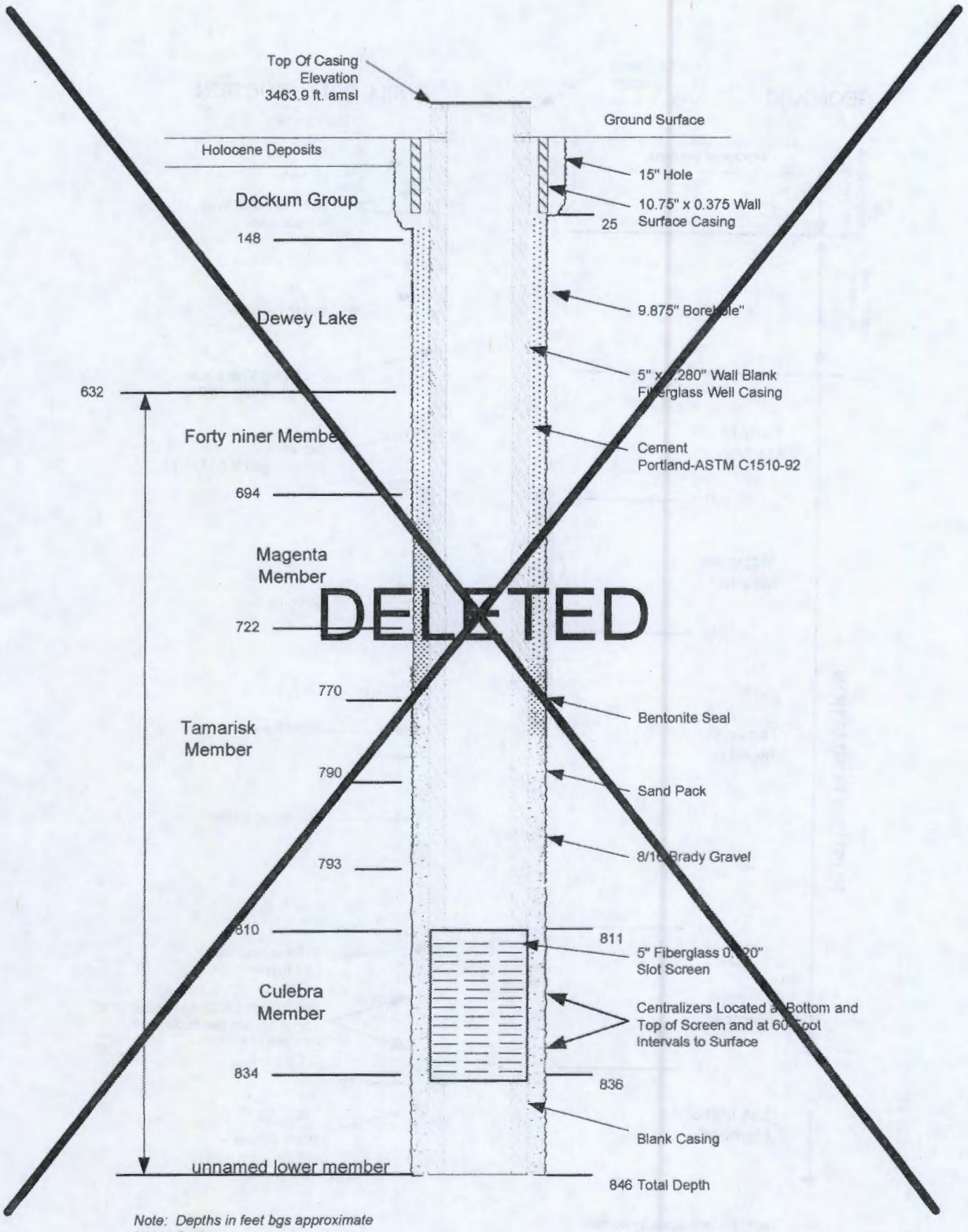
Figure L-~~10~~7
As-Built Configuration of Well WQSP-1
B-91



Note: Depths in feet bgs approximate
Not to Scale

Figure L-7
As-Built Configuration of Well WQSP-1

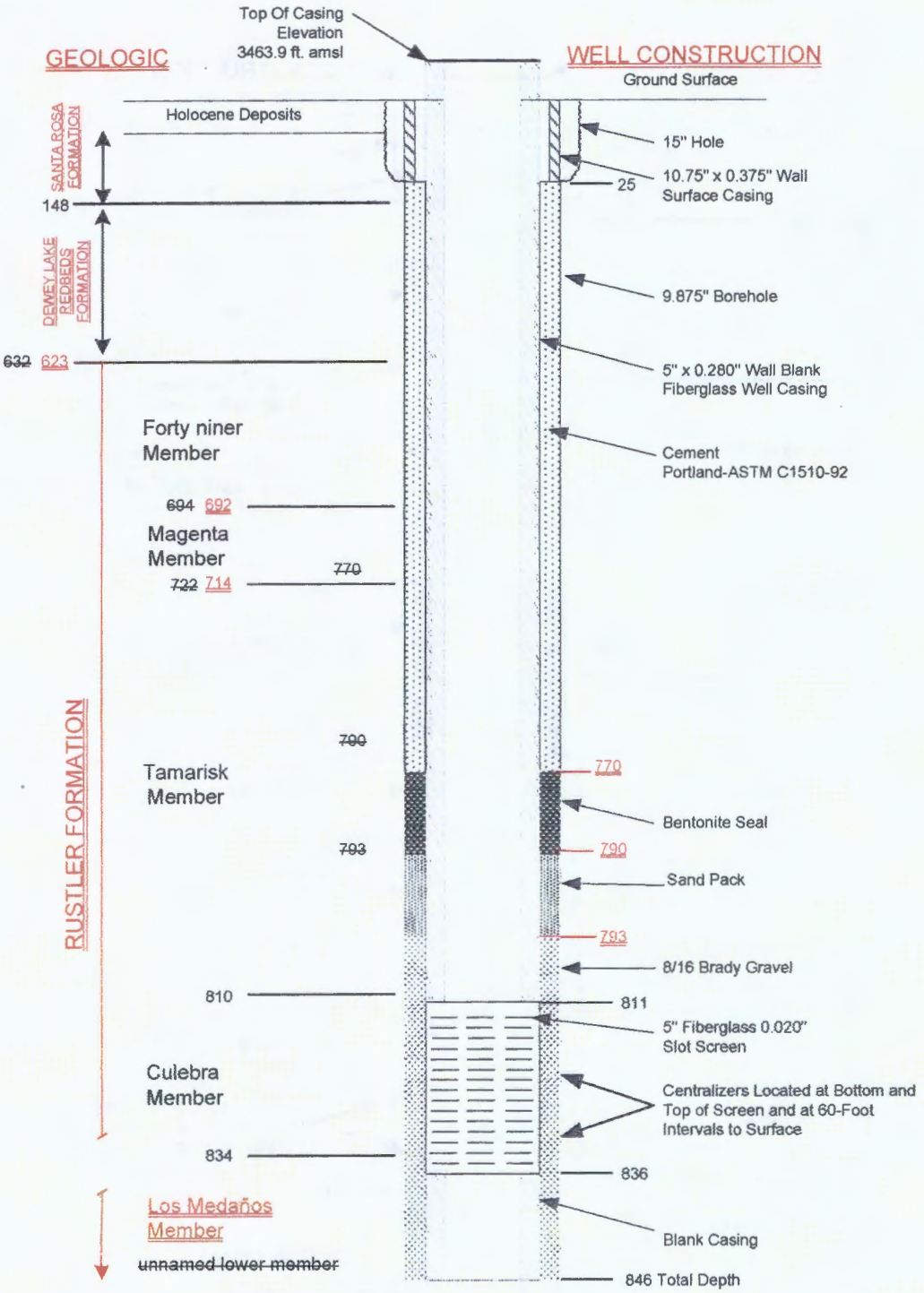
00338



Note: Depths in feet bgs approximate
Not to Scale

~~Figure L-11~~
~~As-Built Configuration of Well WQSP-2~~

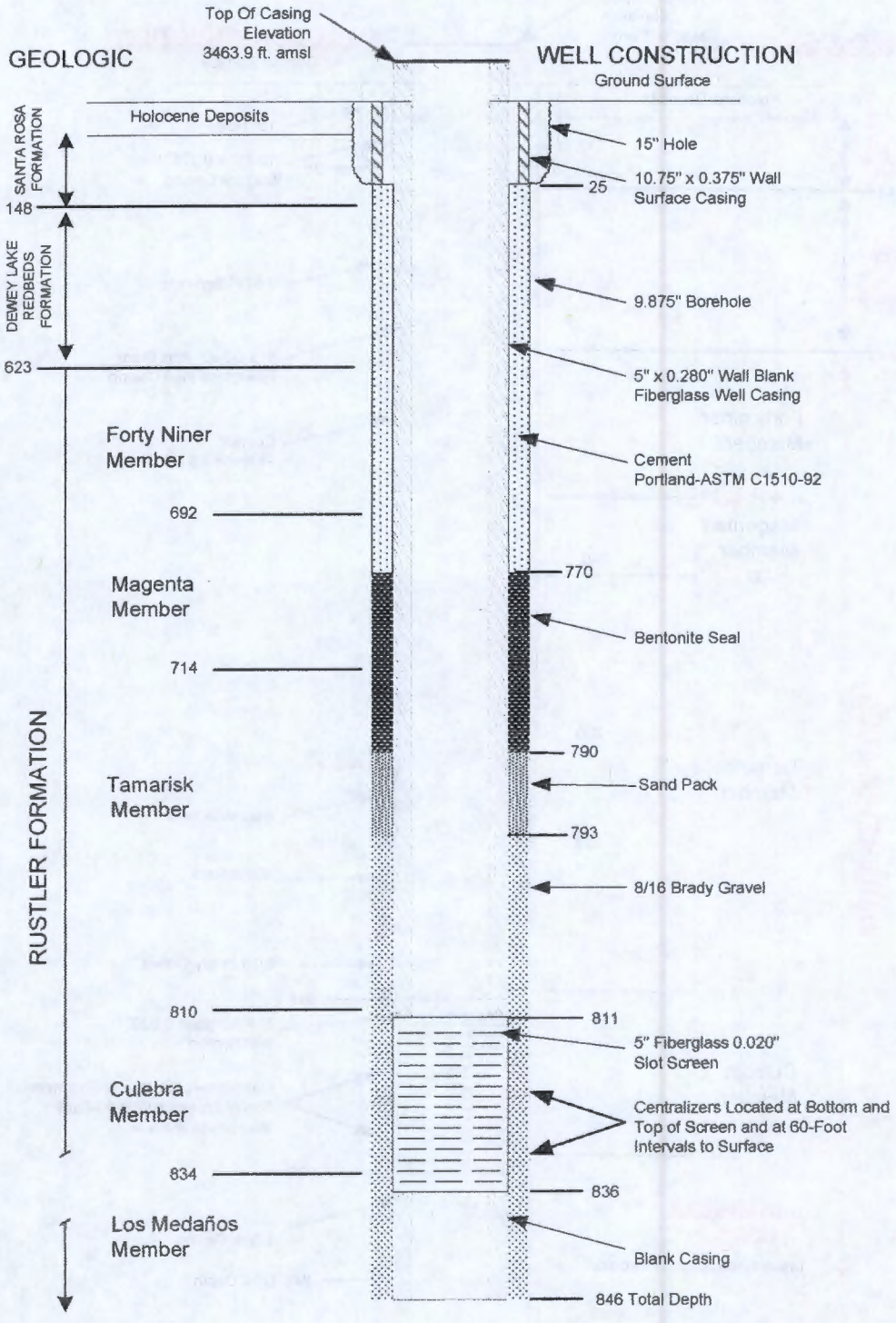
: 00339



Note: Depths in feet bgs approximate
Not to Scale

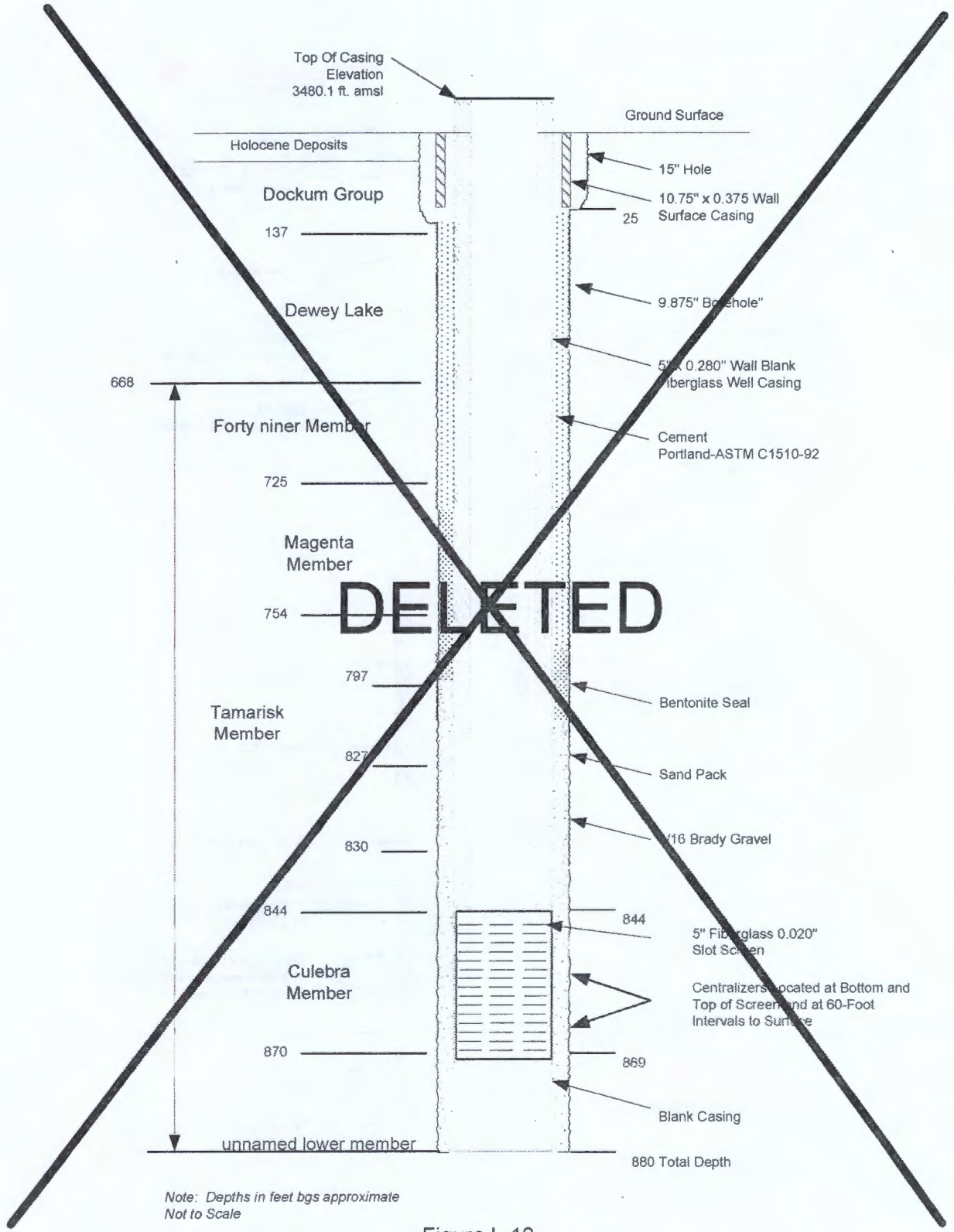
Figure L-~~11~~8
As-Built Configuration of Well WQSP-2

00340



Note: Depths in feet bgs approximate
Not to Scale

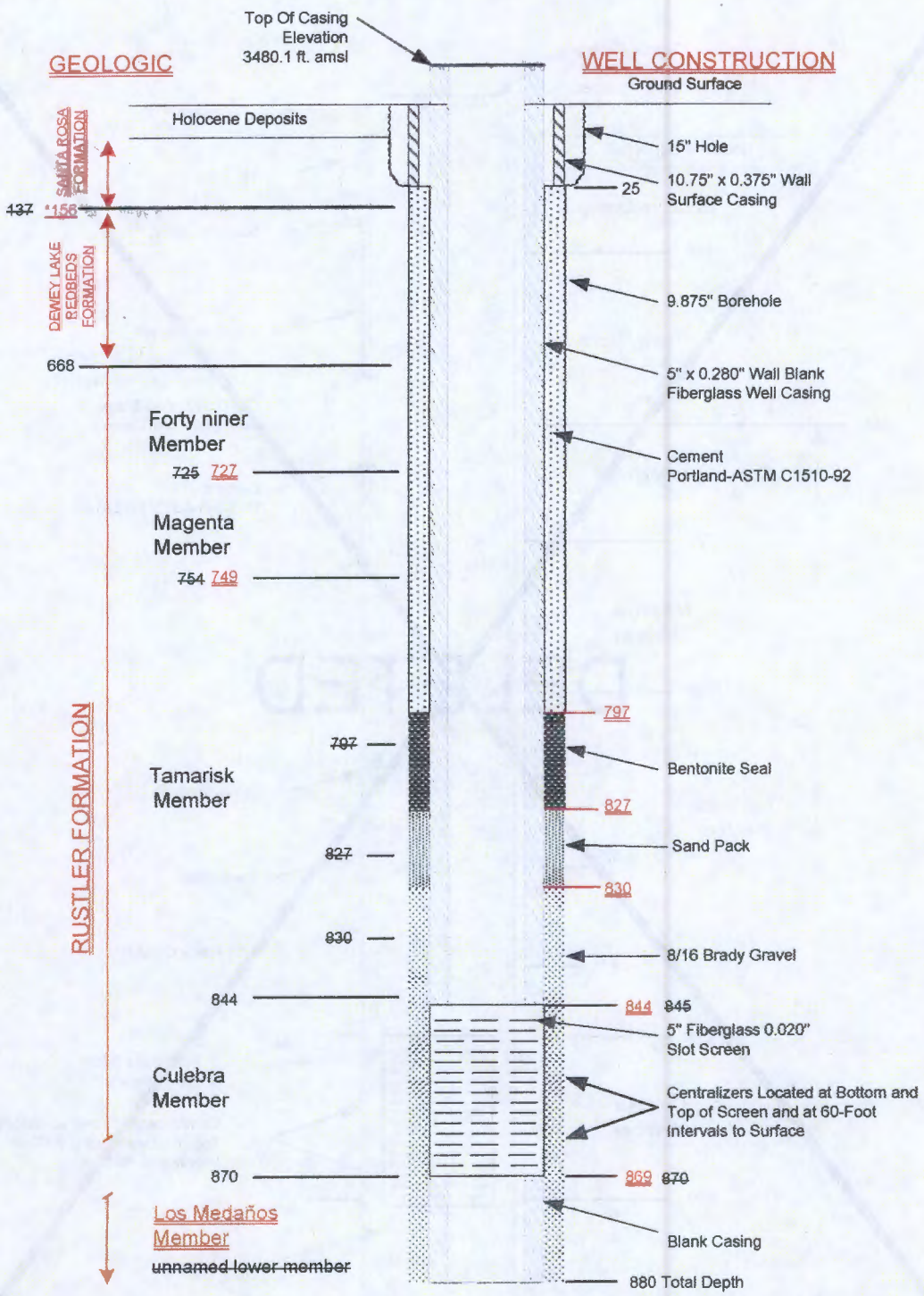
Figure L-8
As-Built Configuration of Well WQSP-2



Note: Depths in feet bgs approximate
Not to Scale

~~Figure L-12~~
~~As-Built Configuration of Well WQSP-3~~

: 00342

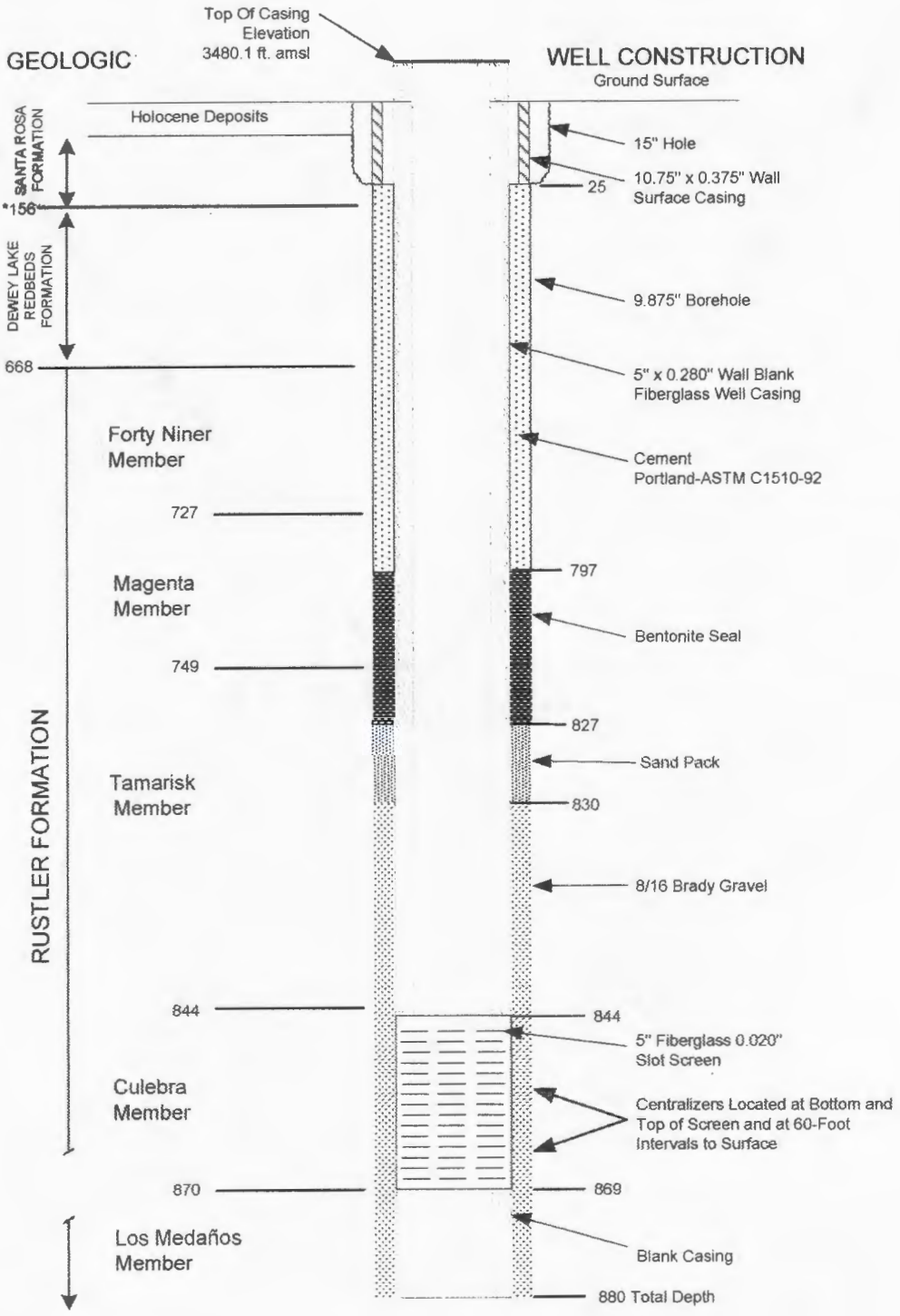


Note: Depths in feet bgs approximate
Not to Scale

**from DOE/WIPP-95-2154*

Figure L-~~12~~9
As-Built Configuration of Well WQSP-3

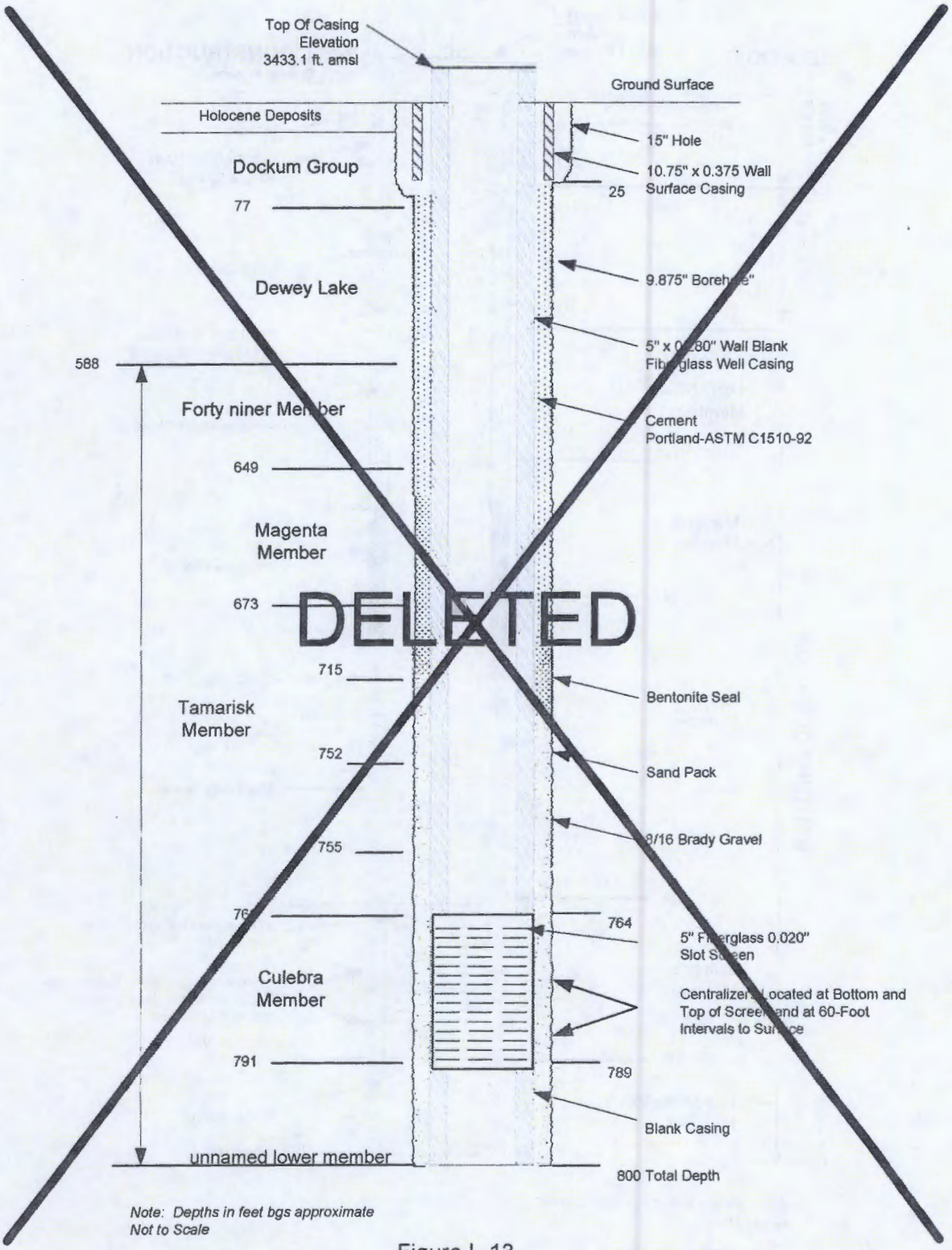
00343



Note: Depths in feet bgs approximate
Not to Scale

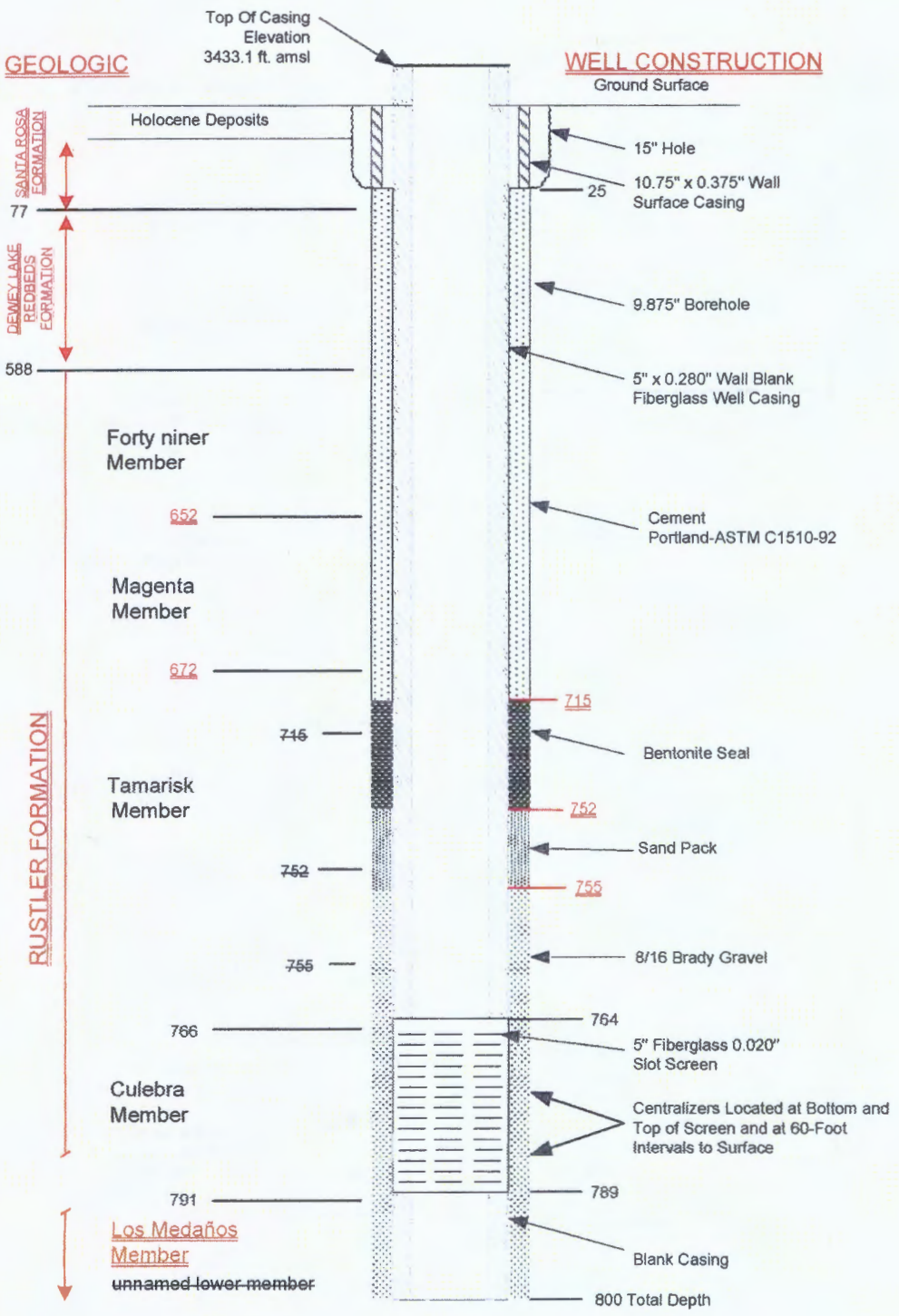
**from DOE/WIPP-95-2154*

Figure L-9
As-Built Configuration of Well WQSP-3



~~Figure L-13~~
~~As-Built Configuration of Well WQSP-4~~

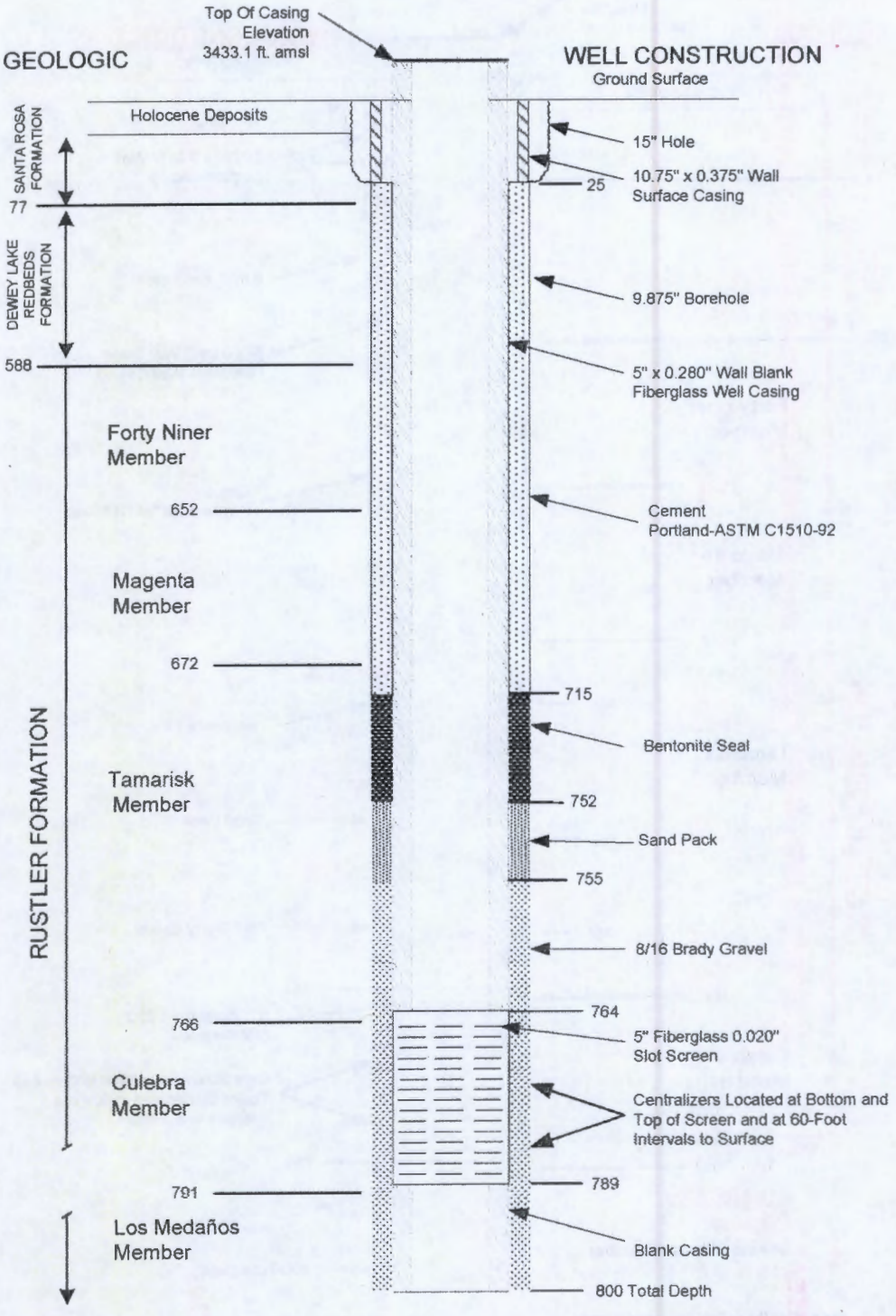
00345



Note: Depths in feet bgs approximate
Not to Scale

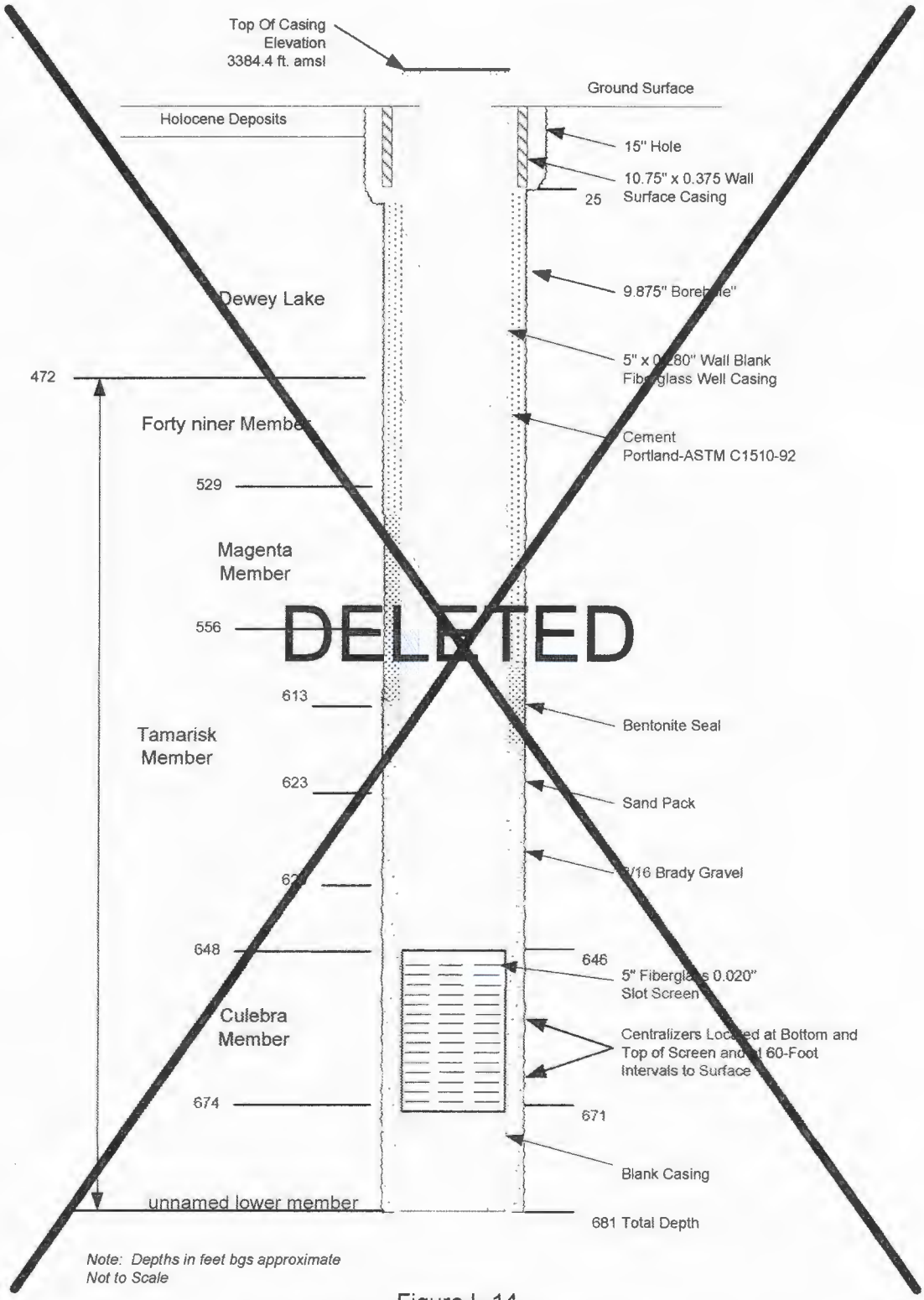
Figure L-~~13~~10
As-Built Configuration of Well WQSP-4

00346

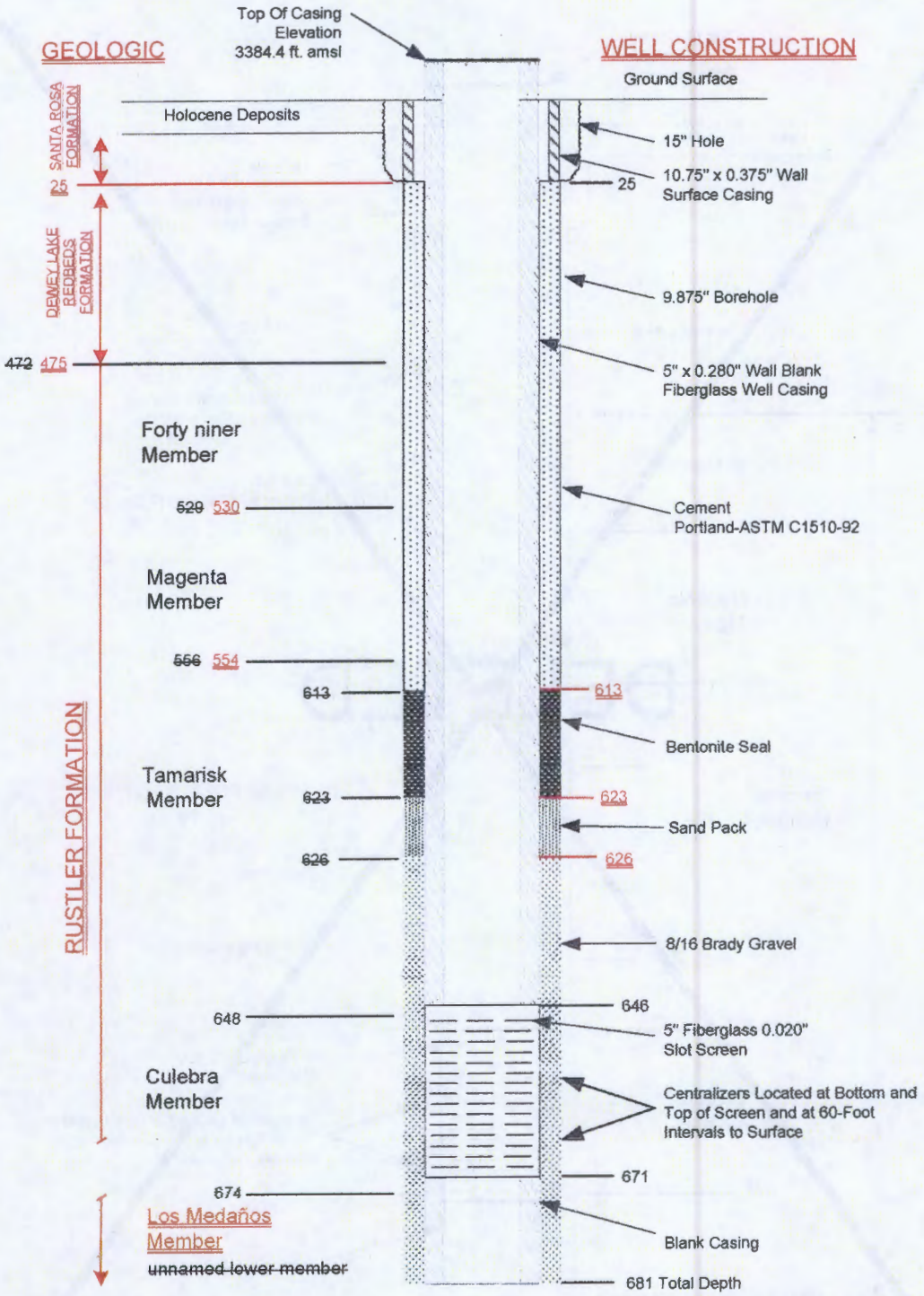


Note: Depths in feet bgs approximate
Not to Scale

Figure L-10
As-Built Configuration of Well WQSP-4

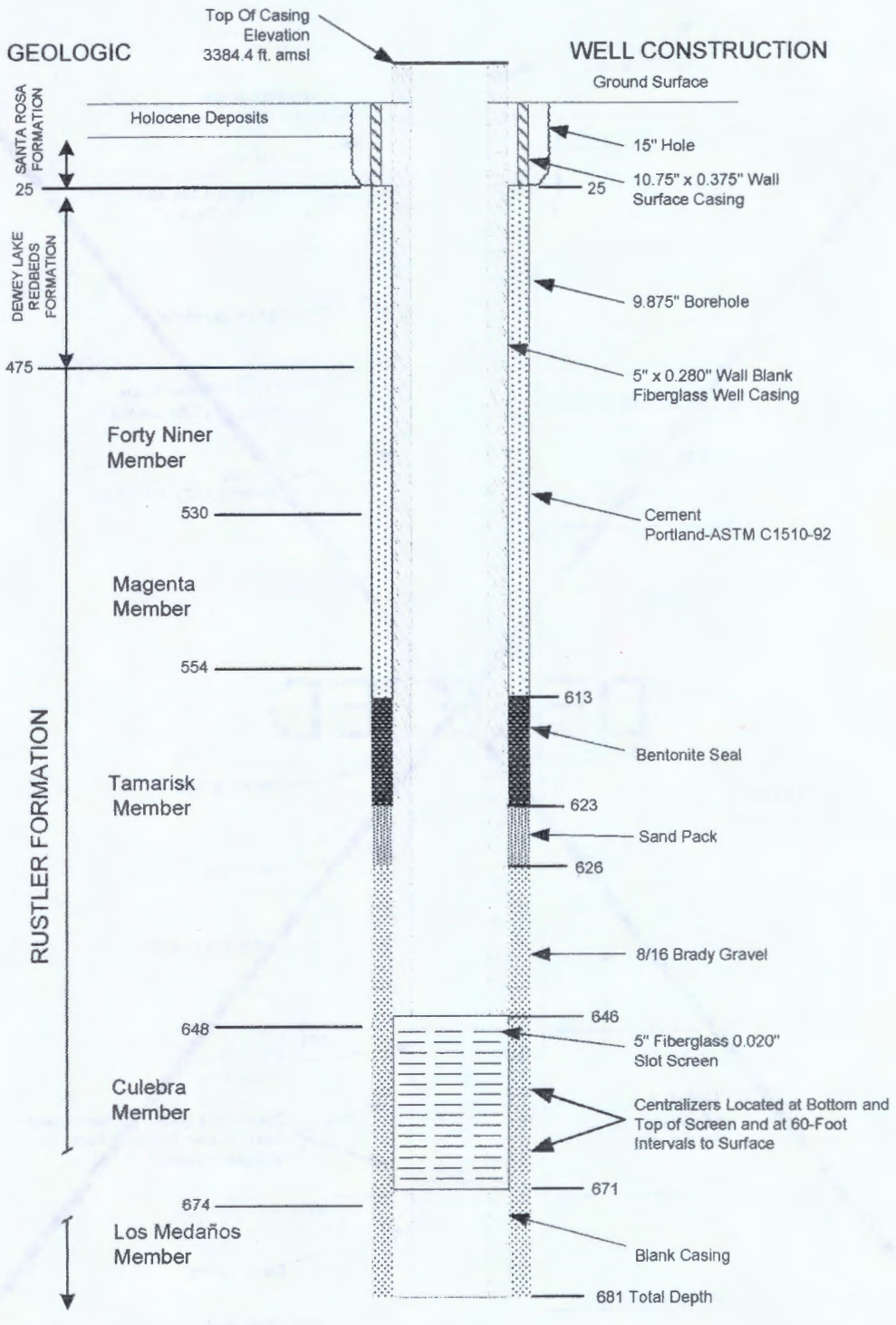


~~Figure L-14~~
~~As-Built Configuration of Well WQSP-5~~



Note: Depths in feet bgs approximate
Not to Scale

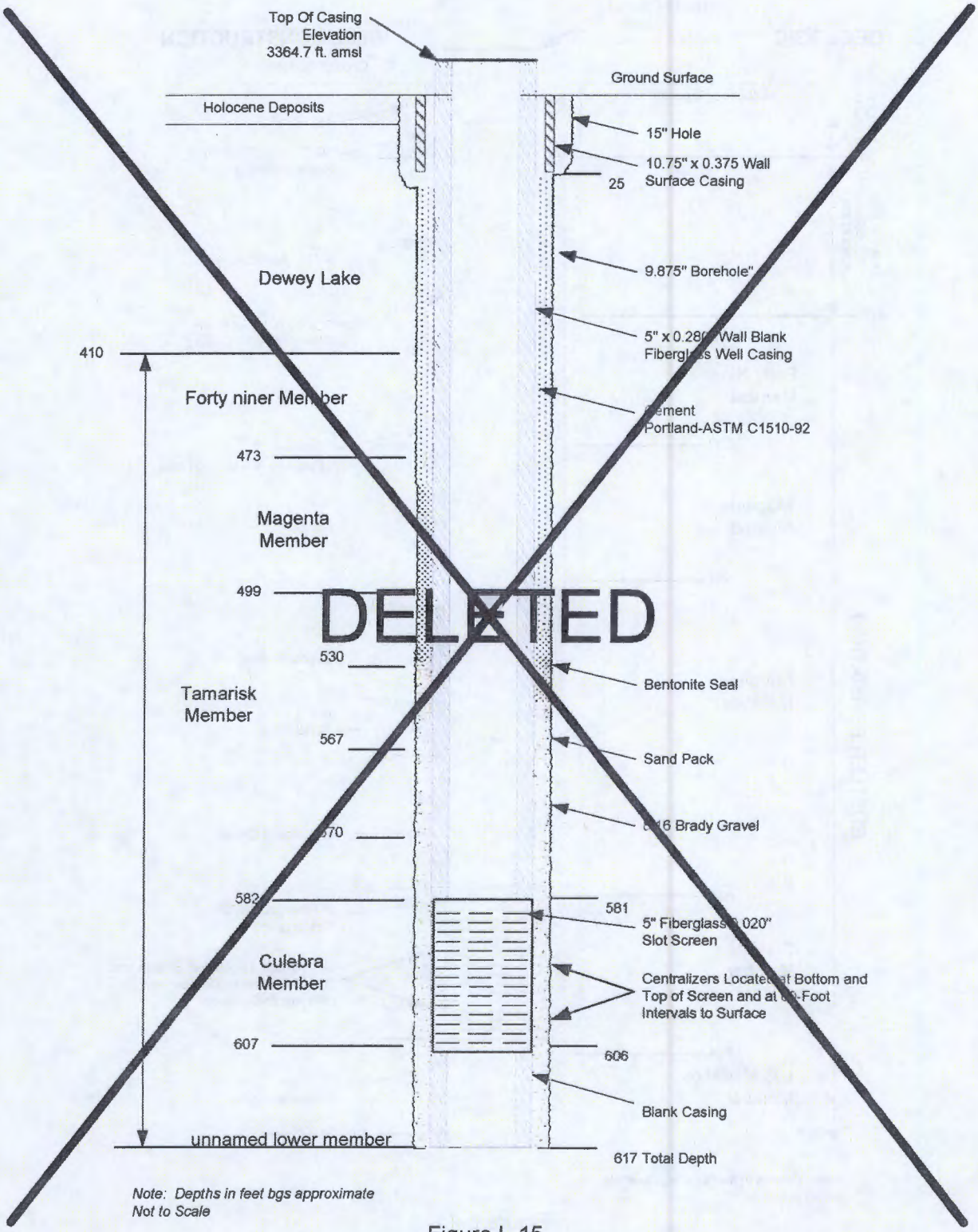
Figure L-~~44~~11
As-Built Configuration of Well WQSP-5



Note: Depths in feet bgs approximate
Not to Scale

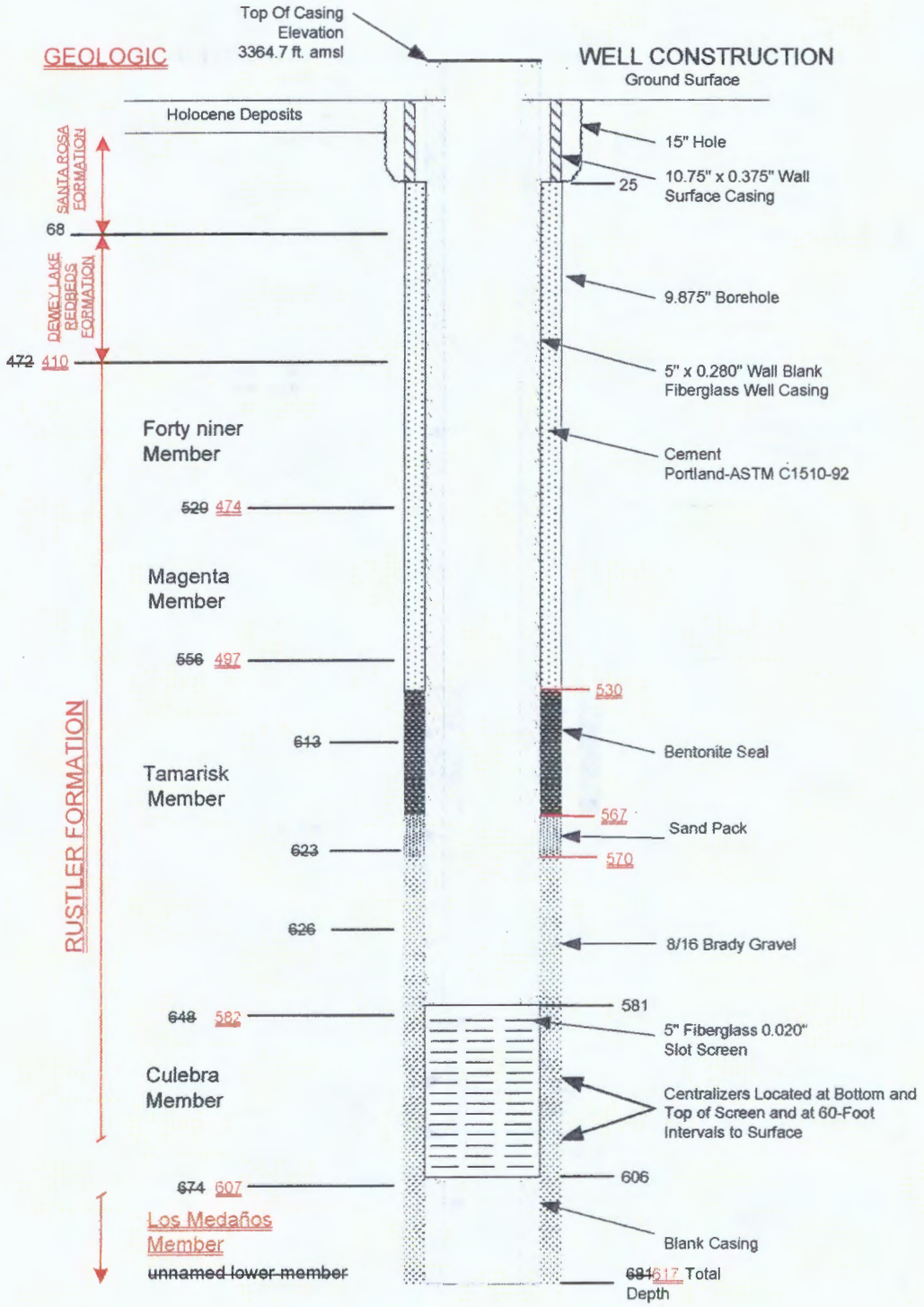
Figure L-11
As-Built Configuration of Well WQSP-5

: 00350



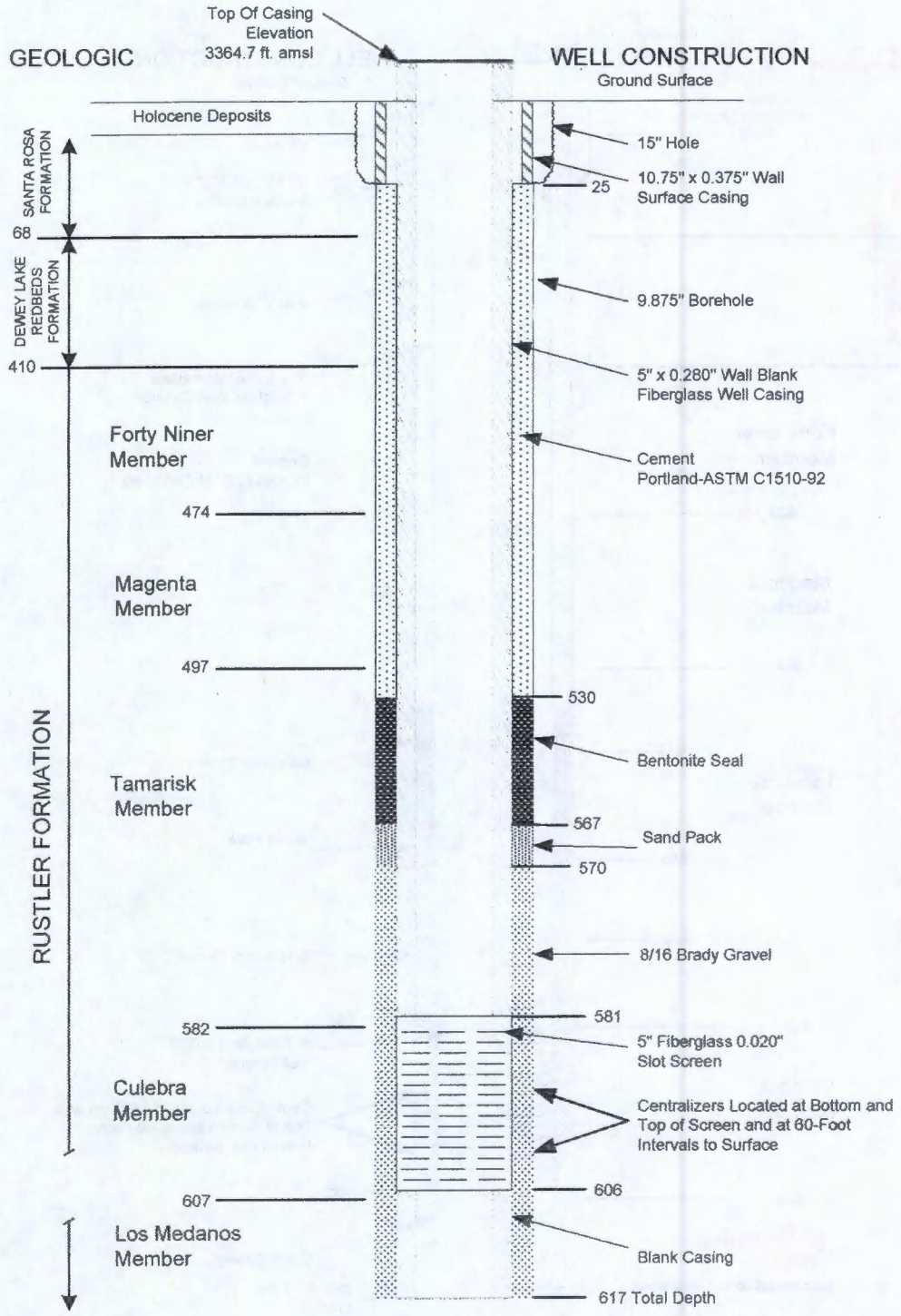
~~Figure L-15~~
~~As-Built Configuration of Well WQSP 6~~

00351



Note: Depths in feet bgs approximate
Not to Scale

Figure L-~~15~~12
As-Built Configuration of Well WQSP-6



Note: Depths in feet bgs approximate
Not to Scale

Figure L-12
As-Built Configuration of Well WQSP-6

~~Figure L-16~~
~~Reserved~~

: 00354

Chain of Custody Record

{MCC Name and Address}

C of C Control No. _____

RFA Control No. _____

SAMPLING PROGRAM _____ LAB DESTINATION _____

SAMPLE TEAM MEMBERS _____ CARRIER/WAYBILL NO. _____

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.

DELETED

Special Instructions _____

Possible Sample Hazards: _____

Signatures: (Name, Company, Date and Time: _____

1. Relinquished By: _____
   Received By: _____
2. Relinquished By: _____
   Received By: _____
3. Relinquished By: _____
   Received By: _____
4. Relinquished By: _____
   Received By: _____

WHITE - Original, to accompany samples YELLOW- Field Copy PINK- OTHER

~~Figure L-17a~~
~~Example Chain-of-Custody Record~~

REQUEST FOR ANALYSIS

{MOC Name and Address}

R/A Control _____

C/C Control No. _____

Date Sample Shipped _____

Lab Destination _____

Laboratory Contact _____

Send Lab Report To _____

VOC Monitoring Program _____

Purchase Order No. _____

Date Report Required _____

Project Contact _____

Project Contact Phone No. _____

Serial No.	Sample No.	C-of-C No.	Sample Type	Sample Pressure	Preservative	Contract-Specific Testing	Special Instructions

TURNAROUND TIME REQUIRED (Rush must be approved by appropriate Manager) NORMAL_____ RUSH____(Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or contain high levels of hazardous substances.)

NONHAZARD_____FLAMMABLE_____SKIN IRRITANT_____HIGHLY TOXIC_____BIOLOGICAL_____OTHER

SAMPLE DISPOSAL (Please indicate disposition of sample following analysis.) RETURN TO CLIENT_____DISPOSAL BY LAB_____ (Please Specify)

FOR LAB USE ONLY

RECEIVED BY _____ DATE/TIME _____

DELETED

Figure L-17b
Example Request for Analysis

CHAIN OF CUSTODY RECORD

Page ____ of ____

Project Number	Project Name:	Total Number of Containers	Container Size / Request Analyses	Contract Laboratory
Samplers:	Date:			

Date	Time	Matrix	Sample Number

EXAMPLE

Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)	Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)
Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)	Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)

Requested Turnaround Time:	Sample Receipt Remarks:	Special instructions:
☐ *Routine* ☐ *Rush* _____		
Sample Disposal: ☐ *Return to Client* ☐ *Disposal by Lab*	Results To:	
Carrier / Airbill No.:		

WHITE – Testing Laboratory
AF – Air Filter(s)
SE – Sediment

YELLOW – Field copy
AN – Animal(s)
SO – Soil

PINK – Record Copy
DI – Deionized Water
SW – Surface Water

GW – Ground Water
VG – Vegetation

WP 02-EM3001, revision xx

Figure L-~~17a~~13
Example Chain-of-Custody/Request for Analysis Form ~~Record~~

CHAIN OF CUSTODY RECORD

Page ____ of ____

Project Number	Project Name:	Total Number of Containers	Container Size / Request Analyses	Contract Laboratory
Samplers:	Date:			

Date	Time	Matrix	Sample Number

EXAMPLE

Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)	Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)
Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)	Relinquished By: (*Signature*)	Date / Time	Received By: (*Signature*)

Requested Turnaround Time:	Sample Receipt Remarks:	Special Instructions:
☐ *Routine* ☐ *Rush*		
Sample Disposal: ☐ *Return to Client* ☐ *Disposal by Lab*	Results To:	
Carrier / Airbill No.:		

WHITE – Testing Laboratory
AF – Air Filter(s)
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YELLOW – Field copy
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SO – Soil
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DI – Deionized Water
SW – Surface Water
GW – Ground Water
VG – Vegetation

WP 02-EM3001, revision xx

Figure L-13
Example Chain-of-Custody/Request for Analysis Form

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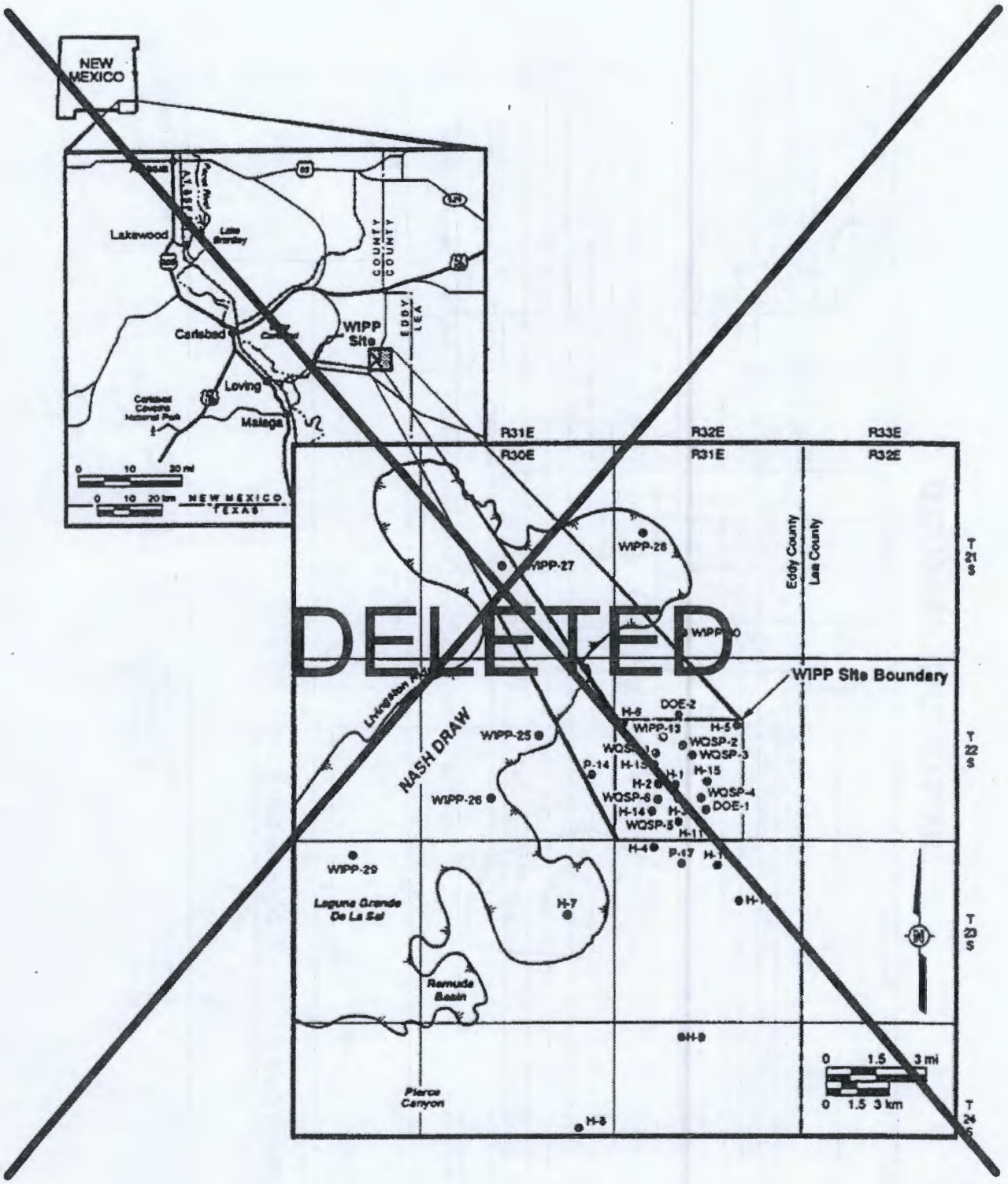

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~~Figure L-18~~
~~Ground-water Surface Elevation Monitoring Locations~~

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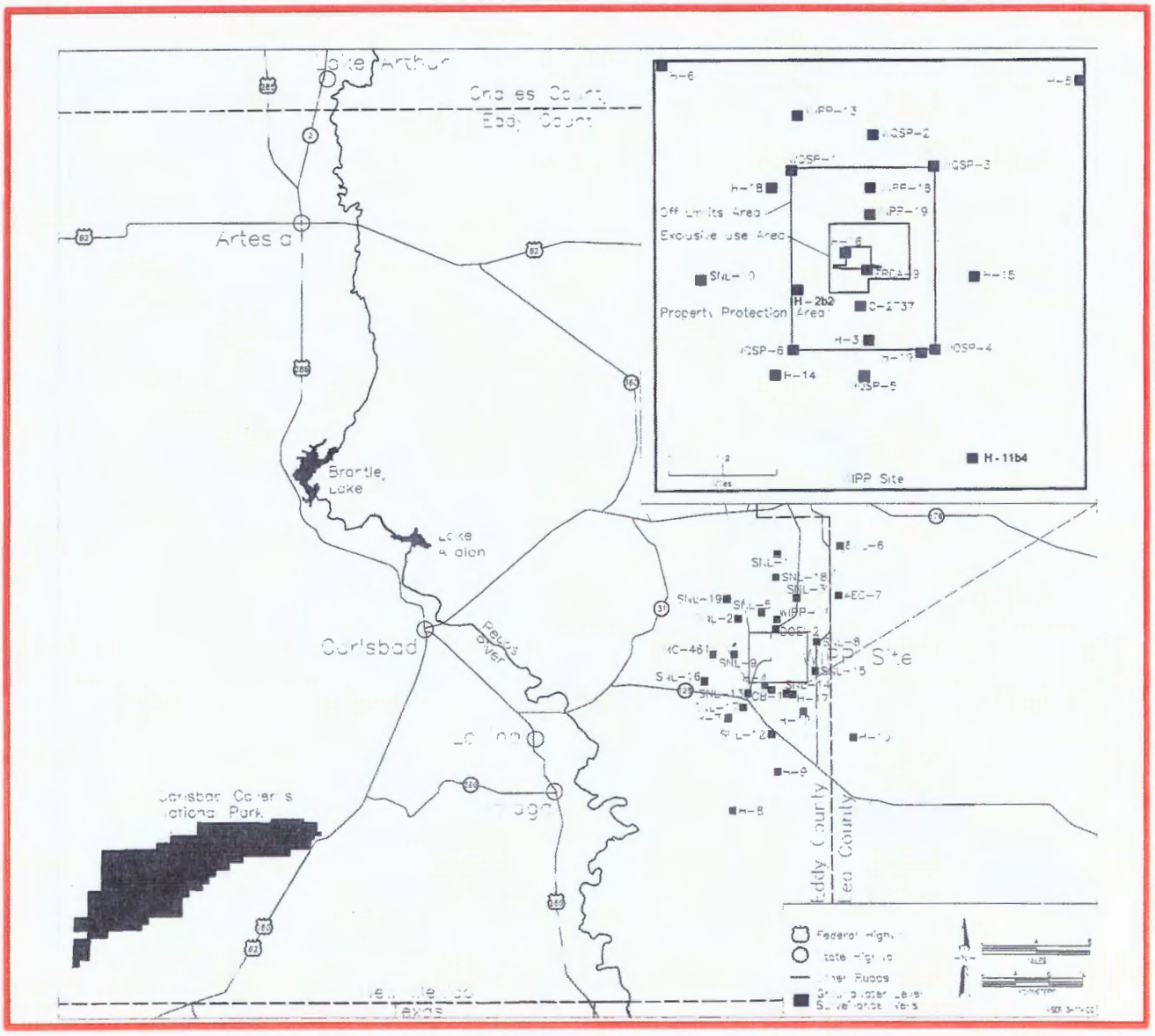

Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

: 00360

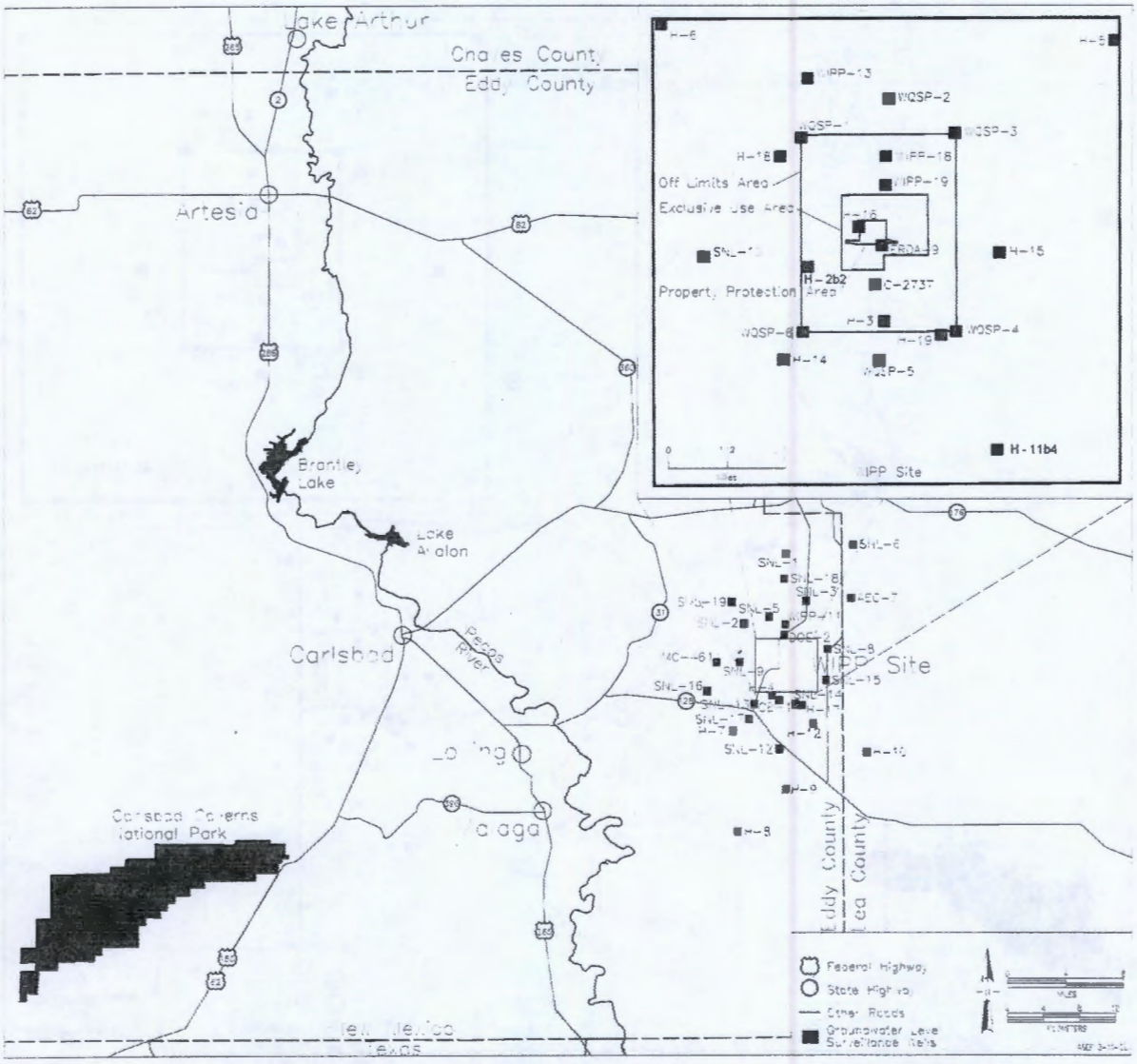

Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

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Attachment C

Groundwater Work Plan and Groundwater Work Plan Approval and References

: 00362

GROUNDWATER PERMIT MODIFICATION WORK PLAN

1. OVERVIEW

Pursuant to the New Mexico Environment Department (**NMED**) Stipulated Final Order No. HWB-09-47 (**Order**), the United States Department of Energy and Washington TRU Solutions, LLC, hereinafter referred to as the Permittees, are submitting this document to comply with Item 10.a. of the Order. This item requires the Permittees to describe the proposed contents of a Class 2 Permit Modification Request (**PMR**) to include, but not be limited to, revising all alleged sources of confusion and ambiguities in Module V, Groundwater Detection Monitoring, and Attachment L, WIPP Groundwater Detection Monitoring Program Plan, and incorporating proposed mapping methodology for generating a Culebra Potentiometric Surface Map.

This work plan addresses the content of the PMR and the process that the Permittees will follow to prepare and submit the PMR. At a minimum, the PMR will be submitted pursuant to Item 10.b. of the Order and Waste Isolation Pilot Plant Hazardous Waste Permit (**Permit**) Condition I.B.1 and address the following requirements:

- It will contain the exact changes to be made to the Permit conditions and supporting documents per 20.4.1.900 New Mexico Administrative Code (**NMAC**) (incorporating 40 Code of Federal Regulations (**CFR**) 270.42(b)(1)(i)).
- It will identify that it is a Class 2 modification per 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(ii)).
- It will explain why the modification is needed per 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iii)).
- It will provide a regulatory crosswalk to the appropriate sections of the regulations per 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iv)).
- It will contain a signed certification statement per 20.4.1.900 NMAC (incorporating 40 CFR 270.11(d)(1) and 40 CFR 270.30(k)).

2. PROPOSED PERMIT REVISIONS

The PMR will include, but will not necessarily be limited to the modifications listed below.

- Revise sources of confusion and ambiguities.
    - Specifically identify which wells are used for density measurements.
        - Specify the frequency for density measurements and assessment.
        - Specify how density measurements are performed.

- Include a specific list of wells that must be monitored for water levels.
    - Exclude non-Culebra wells from those required for water level measurements.
- Remove all references to the non-Culebra sampling wells identified as WQSP-6A.
- Clarify the need for, and use of, written procedures for both field work and non-field work including the procedure for developing a potentiometric surface map annually.
- Clarify the data quality objectives section and explain data quality objectives and quality assurance objectives and the difference between quality assurance objectives for field work and for laboratory analysis.
- Remove specificity regarding departments and organizations and replace those terms with "the Permittees."

- Add background values from the Waste Isolation Pilot Plant Resource Conservation and Recovery Act Background Groundwater Quality Baseline Report and Addendum 1, IT Corporation, July 2000 to be used for making statistical determinations of contamination.
- Separate parameters from constituents so that general chemistry parameters (e.g., pH, calcium) are separated from the hazardous constituents.
- Clarify serial sampling requirements including the following:
    - Remove several field parameters that are not indicators of stabilization, such as chloride, divalent cations, alkalinity, total iron, and Eh.
    - Remove the bubbler line requirements.
    - Restrict serial sampling for stabilization to no more than three well bore volumes.
- Change the frequency of performing groundwater sampling and analysis to an annual basis rather than semi-annually.
    - Change the frequency of reporting to annually rather than semi-annually.
- Change the frequency of reporting water level values to twice per year rather than monthly.
    - Include enhanced interpretation in the form of annotated hydrographs.
- Include flow rate and direction determination in the annual detection monitoring report.
    - Remove the Annual Site Environmental Report as a means of reporting flow rate and direction.

- Revise the statistical process for data analysis to be consistent with 20.4.1.500 NMAC (incorporating 40 CFR 264.97(h)).
- Update figures, tables and text with current information.
- Describe the methodology (see Attachment A) for generation of the Culebra Potentiometric Surface Map whereby the Permittees determine the groundwater flow rate and direction annually in accordance with 20.4.1.500 NMAC (incorporating 40 CFR 264.98(e)).

3. DISCUSS DRAFT PMR AND MAPPING METHODOLOGY WITH STAKEHOLDERS AND NMED

The Permittees will conduct a pre-submittal stakeholder information meeting to obtain feedback from stakeholders prior to finalizing the PMR. Stakeholders will be given 10 days to review the draft prior to the meeting.

4. REVISE DRAFT PMR AND METHODOLOGY TO INCORPORATE NMED AND STAKEHOLDER INPUT

To the extent possible, the Permittees will address stakeholder comments in the PMR.

5. SUBMIT PMR TO NMED

Within 60 days from the NMED approval of the work plan, the Permittees shall submit a Class 2 Permit Modification Request.

Tentative Schedule

Day 0	NMED Approves Work Plan
Day 30	Develop Draft PMR
Day 40	Complete WIPP Internal Reviews
Day 41	Submit Draft PMR to Stakeholders
Day 50	Discuss Draft PMR with Stakeholders and NMED
Day 55	Revise PMR to Incorporate NMED and Stakeholder Input
Day 59	Complete Final Review PMR
Day 60	Submit PMR to NMED

Attachment A:
Methodology for Generating the Culebra Potentiometric Surface Map

The Potentiometric surface map for a given calendar year shall be generated using the following steps:

1. Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.

2. Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.

3. Fit trend surface through freshwater heads.

4. Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Baseline Calculations (PABC) and define initial fixed-head boundary conditions based on the trend surface.

5. Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.

6. Run MODFLOW with optimal boundary conditions fit.

7. Contour MODFLOW head results on WIPP site.

8. Compute particle path and travel time from the waste handling shaft to the Land Withdrawal Boundary.

9. Data analysis that will accompany the potentiometric surface map will include

    - Measured versus modeled scatter plot
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 5 meters (16.4 feet)

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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DAVE MARTIN
Secretary

RAJ SOLOMON, P.E.
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

August 5, 2011

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RE: NOTICE OF APPROVAL
GROUNDWATER PERMIT MODIFICATION WORK PLAN
WASTE ISOLATION PILOT PLANT
EPA I.D. NUMBER NM4890139088

Dear Messrs. Ziemianski and Sharif:

On December 21, 2009, the New Mexico Environment Department (**NMED**) received from the United States Department of Energy Carlsbad Field Office and Washington TRU Solutions (collectively, the **Permittees**) the document entitled *Groundwater Permit Modification Work Plan* (hereafter, the **Plan**). NMED has reviewed the Plan and hereby issues this Notice of Approval.

In accordance with paragraph 10.b of Stipulated Final Order (**SFO**) number HWB 09-47, dated December 1, 2009, the Permittees must submit a Class 2 Permit Modification Request (**PMR**) within 60 days from NMED's approval. Therefore the PMR must be submitted no later than October 4, 2011.

If you have any questions regarding this matter, please contact me at (505) 476-6035 or Tim Hall at (505) 476-6049.

Sincerely,

John E. Kieling
Acting Bureau Chief
Hazardous Waste Bureau

JEK/th

cc: Tim Hall, NMED HWB
George Basabilvaso, DOE CBFO
Thomas Kesterson, DOE OB
Julia Marple, DOE OB
File: Red WIPP '11

554054

Analysis Report
AP-111 Revision 1

Culebra Water Level Monitoring Network Design

(AP-111: Analysis Plan for Optimization and Minimization of the Culebra Monitoring Network for the WIPP)

Task Number 1.4.2.3
Report Date: August 4, 2010

Author: _____ Date: 8/4/10

Kristopher L. Kuhlman
Repository Performance Department (6712)

Technical Review: Mario Chavez for Date: 8/6/10

Sean A. McKenna
National Security Applications Department (6311)

QA Review: Mario Chavez Date: 8/6/10

Mario J. Chavez
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Management Review _____ Date: 8/4/2010

Christi D. Leigh
Manager, Repository Performance Department (6712)

WIPP:1.4.2.3:TD:QA-L:RECERT:540476

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Acknowledgements

Thanks to David Hart and Sean McKenna for their previous work on the calibration of the transmissivity fields, utilized as inputs in Section 4 of this analysis. Thanks to Rick Beauheim for his comments and guidance on early drafts of this report.

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Executive Summary

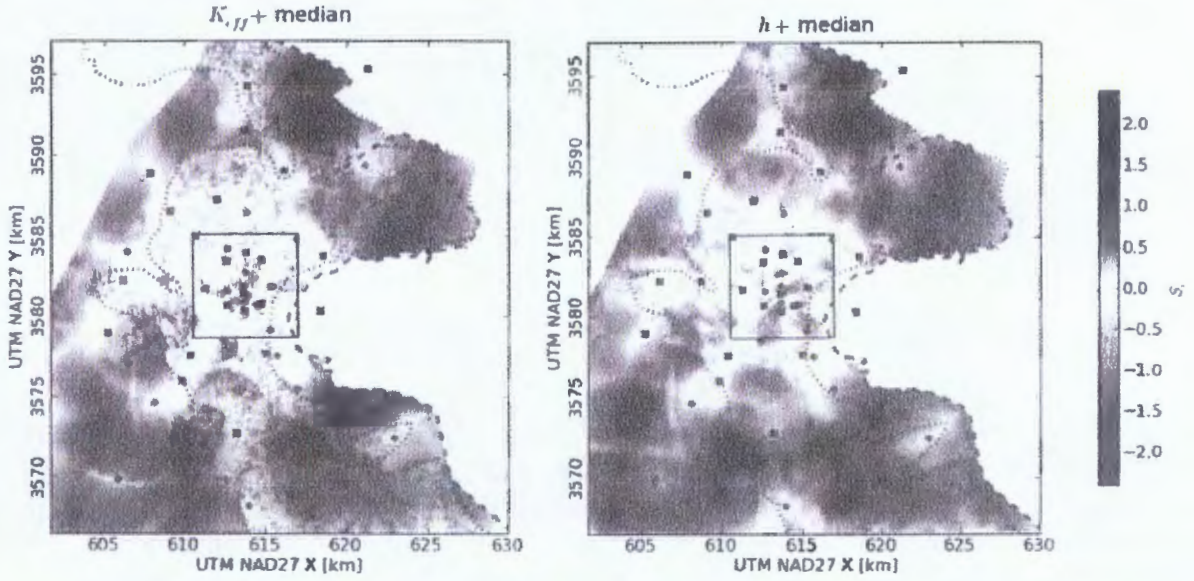
This analysis report presents the methods, data, and results of calculations done in support of Culebra head and hydraulic gradient monitoring network design and optimization. The three metrics used include:

1. freshwater head kriging variance reduction,
2. triangle geometry shape quality maximization, and
3. identification of areas where there is a high statistical correlation between model-predicted travel times and either
    a. model input effective hydraulic conductivity (K_{eff}) or
    b. heads (h)

These three different and largely independent approaches to monitoring network design are discussed individually in detail (Sections 2, 3 and 4) and are combined (Section 5) for two different types of results,

1. ranking of possible locations for new wells, and
2. ranking the importance of maintaining existing locations.

The combinations of the three metrics for the suitability of a location for a new monitoring location are shown in the following two figures (discussed more fully in the Section 5).



In these two figures, red and orange areas are poor locations for a new well, while dark blue and purple areas are good locations for a new well. The left figure includes metrics 1, 2, and 3a (from the top bulleted list), while the right fiure includes metrics 1, 2, and 3b. While the two figures are different in some details, they both show that the areas between monitoring locations that are distant from the WIPP LWB (interior black square) rank highly overall (dark blue). Areas roughly consisting of 'spokes" radiating away from the WIPP LWB – between closely spaced monitoring wells – rank poorly overall (yellow and orange).

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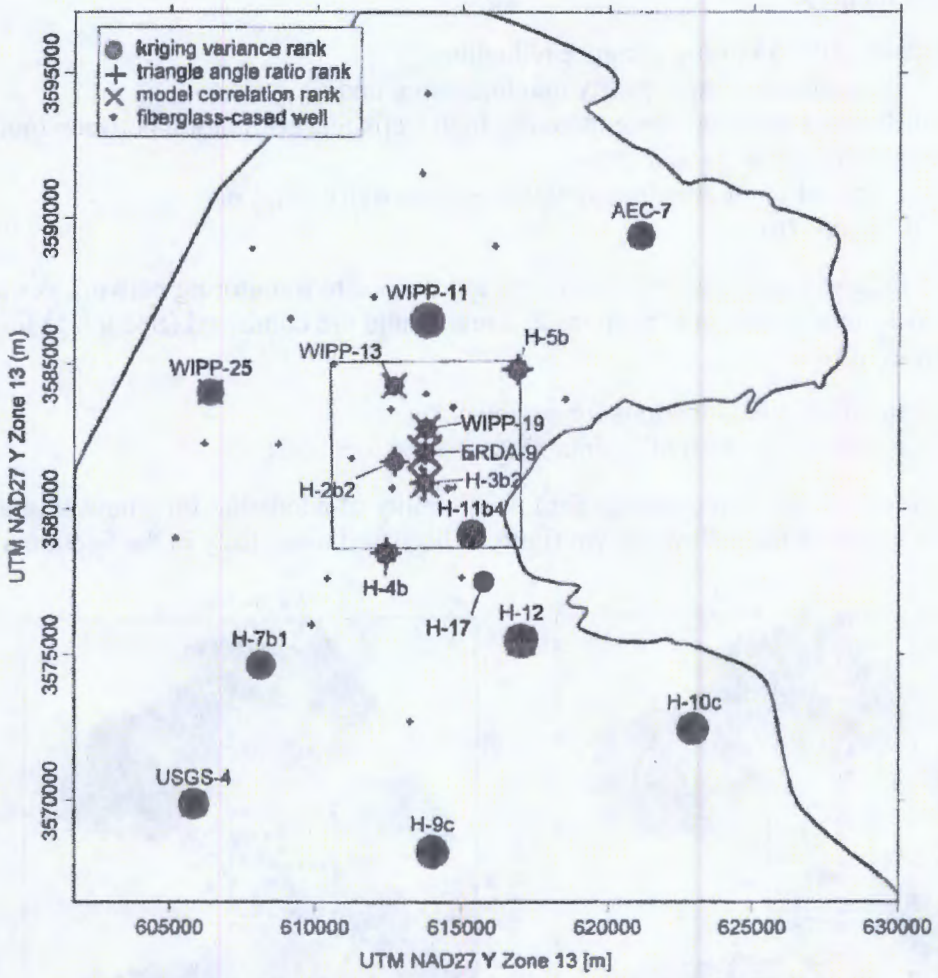
Using the same three metrics for ranking the existing steel-cased wells (assuming fiberglass-cased wells will have a long life), the results are combined in the following figure (discussed more fully in Section 5).



In this figure, the size of the different symbols is related to the relative importance of each of the steel-cased wells, ranked via the three metrics. Many wells are important to one or two metrics and unimportant to another (e.g., closely-spaced wells inside the WIPP LWB perform poorly in the kriging variance reduction, but might be in important areas for the model input/output correlation). Overall, wells H-12, H-10c, and AEC-7 have relatively high ranks in all three metrics. These wells are somewhat isolated and therefore are individually important in their contributions to the success of the overall monitoring network.

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1.0 Introduction

This analysis report presents the methods, data, and results of calculations done in support of Culebra head and hydraulic gradient monitoring network design and optimization. Three different and largely independent approaches to monitoring network design are examined. These approaches include optimal locations for additional monitoring wells and identification of wells in the current monitoring network that could be removed with minimal effect on meeting the monitoring objectives. The three different sets of results are then combined into a final set of maps indicating potential areas for the installation of new monitoring wells. Additionally, several wells in the existing network could be removed with minimal effect on the ability of the monitoring network to predict heads at unmonitored locations and to detect changes in the hydraulic gradient. The three approaches used here are similar to approaches used in the 2004 ground water monitoring network design calculations, and this allows for direct comparison of some results with those obtained five years ago.

1.1. Background

The Waste Isolation Pilot Plant (WIPP) is located in southeastern New Mexico and has been developed by the U.S. Department of Energy (DOE) for the geologic (deep underground) disposal of transuranic (TRU) waste. Containment of TRU waste at the WIPP is regulated by the U.S. Environmental Protection Agency (EPA) according to the regulations set forth at Title 40 of the Code of Federal Regulations, Parts 191 and 194. The DOE demonstrates compliance with the containment requirements in the regulations by means of a performance assessment (PA), which estimates releases from the repository for the regulatory period of 10,000 years after closure.

Groundwater monitoring and modeling activities at the WIPP are an integral part of the DOE's broader requirements to demonstrate that WIPP operations are performed in a manner that ensures protection of the environment, the health and safety of workers and the public, proper characterization of the disposal system, and compliance of the WIPP with applicable regulations. Continued compliance with regulations must be demonstrated every five years during the operational phase of the WIPP. The monitoring requirements apply not only for the current operational phase (~35 years), but extend through the post-closure phase of the facility to meet applicable regulations. Because of these long-term requirements, DOE's Carlsbad Field Office (CBFO) has developed the WIPP Groundwater Protection Program Plan (DOE, 2009) that describes: relevant regulatory (EPA and New Mexico Environment Department) drivers; the current groundwater-monitoring network and how it has evolved over time; current groundwater program elements; strategies for maintaining compliance; methods for implementing the strategies; and roles and responsibilities of monitoring program participants.

This analysis report is a revision of McKenna (2004), which identified wells that could be removed from the existing network as well as looked at potential locations to expand the monitoring network. Since 2004, the number of monitoring wells available for analysis have increased by 40%, from 30 to 42. Now after the SNL-series fiberglass-cased wells have been constructed, this report is re-evaluating the well network based on the new information obtained from these new wells and the updated Culebra PA flow model, completed for the compliance recertification application (CRA) 2009 performance assessment baseline calculation (PABC).

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1.2. Purpose

The purpose of these calculations is primarily to determine which of the remaining steel-cased wells can be plugged and abandoned (P&Aed) without degrading the monitoring network. A secondary goal is to identify optimal locations for any new Culebra monitoring wells. The calculations herein will be focused on meeting the goals of:

1. The monitoring network must allow the determination of the direction and rate of groundwater flow across the WIPP site. This is both an NMED and an EPA requirement (NMAC, 2000 incorporating 40 CFR Part 194 §264.98(e) (U.S. EPA, 1996));
2. The monitoring network must provide data needed to infer causes of changes in water levels that might be observed. This is an EPA requirement, 40 CFR Part 194, Subpart C §194.42 (U.S. EPA, 1996); and
3. The monitoring network must provide spatially distributed head data adequate to allow both defensible boundary conditions to be inferred for Culebra flow models and defensible calibration of those models (PA requirements).

The degree to which these objectives can be reduced to quantitative measures is evaluated as part of the work reported in this analysis report.

The minimized and optimized monitoring network will be created using available information including existing wells and up to date understanding of the hydrology of the Culebra. The optimization and minimization process takes the following factors into consideration:

1. Existing locations of fiberglass-cased wells
2. Existing well locations that are not needed
3. Culebra hydraulic property variations and geologic boundaries

1.3. Outline

This report documents the data, methods, and summary results of the work completed under Analysis Plan 111 (Kuhlman, 2008). The analysis has four main components, which look at the network optimization from the perspective of:

1. **kriging**: considers the spatial clustering of observation points and the geostatistical structure of the data via the variogram (see Section 2.0);
2. **local gradient estimators**: Delaunay triangles that consider the geometric quality of the well network and the observed gradient across the well network (see Section 3.0);
3. **flow model correlation**: uses the structure embodied in the calibrated flow model regarding formation heterogeneity and geologic processes (see Section 4.0);
4. combining the results of the three above methods into one result (see Section 5.0)

1.4. Calculation domain

The spatial domain used for the different calculations in support of monitoring network design is the same as the model domain used in the two-dimensional (2D) Culebra groundwater flow model (Hart et al., 2008; 2009). This model domain is aligned with the Universal Transverse Mercator (UTM) coordinate system and is 30.7 km long by 28.4 km wide (872 km^2 total, 587

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km^2 active). The corners of the Culebra numerical groundwater model domain are listed in Table 1-1. Relative to the CRA 2004 calculations, the eastern extent of the model domain has moved from 624000 m to 630000 m UTM 1927 North American datum (NAD27) meters, as explained in (Hart et al., (2008), §2.1). These coordinates define the center of 100 m × 100 m model cells at the four corners of the model domain. All monitoring calculations that produce results on a spatial grid employ the same grid as used for the 2D Culebra flow model (see e.g., Kuhlman, 2010b), unless otherwise noted.

Table 1-1. Culebra flow model domain UTM NAD27 Zone 13 coordinates

Model domain corner	X [m]	Y [m]
Northeast	630000	3597100
Northwest	601700	3597100
Southeast	630000	3566500
Southwest	601700	3566500

The WIPP land-withdrawal boundary (LWB) encloses 16 township and range sections (approximately 41 km^2) near the center of the MODFLOW model domain. The boundary of the WIPP site is defined by the corners of the 16 sections, which have the UTM coordinates given in Table 1-2. For the calculations described in this report, the coordinates given in Table 1-1 and Table 1-2 are used to delineate areas, across which we average different measures of effectiveness for the monitoring network.

Table 1-2. The WIPP LWB UTM NAD27 Zone 13 coordinates

WIPP boundary corner	X [m]	Y [m]
Northeast	616941	3585109
Northwest	610495	3585068
Southeast	617015	3578681
Southwest	610567	3578623

1.5. Observed Data

The approaches developed in this report can be applied to any set of nearly-simultaneous undisturbed head measurements (i.e., a "snapshot" in time of the hydraulic head in the Culebra). The wells used here are shown in Figure 1-1 and the data observed at these wells are listed in Table 1-3 (freshwater head data from (Johnson, 2009)). The majority of the calculated freshwater head values correspond to those used in the calibration of the CRA-2009 PABC transmissivity fields (Hart et al., 2009) with four exceptions and one note:

1. A representative 2004 value from AEC-7 was used (this well was left out of the flow model calibration due to known configuration problems in 2007). Freshwater heads at AEC-7 have been very stable historically (1988 through 2004), and are now representative of previous trends after well reconfiguration. Over 15 years (12/1988 through 3/2004) there were 172 head measurements with a standard deviation of only 0.56 m;

2. Freshwater heads from March 2007 were used at the H-19 wellpad, to include the six redundant wells (H-19b{2,3,4,5,6,7}), which are only monitored quarterly. These wells are only included in the variogram modeling, to better constrain head variation at short distance scales (see discussion about optimal well networks for estimating variograms in Warrick & Myers (1984) or Conwell, et al. (1997)). The central H-19b0 well is used as

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the sole H-19b well in the rest of the analyses discussed in this report. The coordinates of the H-19b wells reflect their computed UTM x, y locations at the Culebra (229 m below ground surface (bgs)), accounting for observed deviations from vertical completion (Meigs et al., 2000). H-19b0 freshwater heads are within 2 cm between the March and May 2007 observation times.

3. SNL-6 and SNL-15 have not recovered since being drilled in 2005, and will likely take hundreds of years to recover to "static" conditions. These wells use land-surface elevations in place of water levels in the model calibration (>1000 m above mean sea level (AMSL)); they are not used in situations where a representative head value is needed (e.g., variogram modeling and gradient estimation), but their locations are included otherwise (e.g., kriging and network geometry optimization).
4. WIPP-30 is not included in the network optimization, since this well was plugged and abandoned in May 2007.
5. WIPP-25 is used both here and in the CRA-2009 PABC Culebra flow modeling exercise, although this well was P&Aed in 2009.

In addition to the calculated May 2007 freshwater heads, calibration results from the most recent iteration of the Culebra PA T-fields (Hart et al., 2009) are also used. These results include the simulated head values, calibrated transmissivity and anisotropy values, and particle travel times from C-2737 to the WIPP LWB for each of the 100 model realizations. These results are used in the third sensitivity-based approach.

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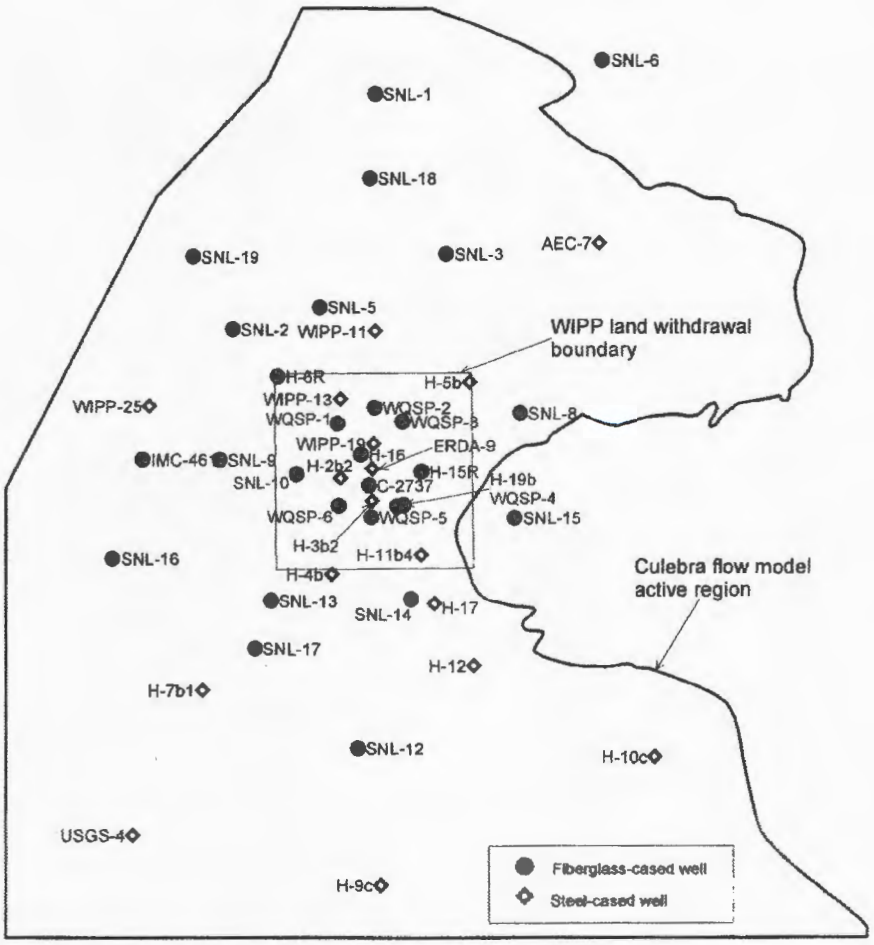

Figure 1-1. Locations of monitoring wells used in this study

Table 1-3. Freshwater Heads from May 2007 used in analysis (Johnson, 2009)

	Well	UTM NAD27 *x* Zone 13[m]	UTM NAD27 *y* Zone 13 [m]	Freshwater Head [m AMSL]
1	AEC-7[1]	621126	3589381	933.03
2	C-2737	613598.0	3581400.9	921.23
3	ERDA-9	613696.1	3581944.3	924.88
4	H-2b2	612662.5	3581639.7	929.62
5	H-3b2	613693.6	3580899.6	918.68
6	H-4b	612376.0	3578478.5	916.34
7	H-5b	616866.0	3584807.0	939.12
8	H-6b	610598.6	3584986.9	936.44
9	H-7b1	608122.8	3574646.4	914.58
10	H-9c	613971.1	3568237.2	912.80
11	H-10c	622976.3	3572444.3	922.02
12	H-11b4	615297.3	3579123.5	917.09
13	H-12	617022.0	3575460.5	916.53
14	H-15	615310.0	3581855.2	920.32
15	H-17	615717.0	3577507.8	916.24
16	H-19b0[2]	614515.2	3580718.9	918.82
17	H-19b2[2]	614516.2	3580693.8	918.64
18	H-19b3[2]	614526.1	3580719.6	918.57
19	H-19b4[2]	614494.6	3580727.6	918.77
20	H-19b5[2]	614502.3	3580713.6	918.60
21	H-19b6[2]	614518.0	3580738.5	918.58
22	H-19b7[2]	614516.0	3580706.7	918.54
23	IMC-461	606182.6	3582246.4	928.95
24	SNL-1	613781.4	3594299.0	941.86
25	SNL-2	609113.1	3586529.1	937.65
26	SNL-3	616103.0	3589046.9	939.81
27	SNL-5	611970.2	3587284.7	938.59
28	SNL-6[3]	621244.6	3595390.0	856.00
29	SNL-8	618522.8	3583783.3	929.94
30	SNL-9	608704.8	3582237.7	932.05
31	SNL-10	611229.3	3581764.8	931.54
32	SNL-12	613223.4	3572727.4	915.24
33	SNL-13	610394.3	3577599.8	918.19
34	SNL-14	614989.7	3577652.0	916.33
35	SNL-15[3]	618353.2	3580336.4	865.65
36	SNL-16	605191.8	3578999.7	918.68
37	SNL-17	609863.2	3576016.1	916.78
38	SNL-18	613605.8	3591528.6	939.87
39	SNL-19	607813.5	3588947.4	937.58
49	USGS-4	605841.0	3569887.0	911.11
41	WIPP-11	613788.2	3586474.0	940.65
42	WIPP-13	612645.0	3584241.7	939.78
43	WIPP-19	613738.8	3582773.5	933.66
44	WIPP-25	606385.7	3584022.8	937.57
45	WQSP-1	612559.4	3583430.3	938.28
46	WQSP-2	613770.4	3583972.2	939.87
47	WQSP-3	614685.5	3583506.8	936.43
48	WQSP-4	614724.5	3580762.8	919.50
49	WQSP-5	613666.5	3580353.6	918.18
50	WQSP-6	612602.3	3580737.9	921.96

1. representative water level from 2004
2. H-19 wells from March 2007
3. not used in variogram estimation

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1.6. Run Control

Nearly all the calculations done for this analysis report were completed on a Dell Precision 690 workstation, equipped with two quad-core 2.66-GHz Intel Xeon chips (X5355). The work was done on this system running the Microsoft Windows XP (service pack 2) operating system. Two of the scripts were run on the PA Pentium 4 Linux cluster (`alice.sandia.gov`); these scripts checked the Culebra MODFLOW model results out of CVS (only accessible from Linux) and performed the binary-to-ASCII conversion on the model-produced heads before creating a zip archive of the files for transfer to Windows. The input files, scripts, and outputs are contained within the `analysis` directory on the CD-ROM associated with this analysis report; the contents of the CD are listed in Section 8.1.

Each section has a run control subsection describing the software and scripts that were used to perform the analysis in that section. All scripts created for this analysis report are listed in Section 8.0 with syntax highlighting and line numbers. Table 1-4 lists the software used throughout this report, all software is either commercial off the shelf (COTS), or it is qualified for use with WIPP PA.

Table 1-4. Summary of software used

Software	Version	Type	Use
Golden Software Surfer	9.9	COTS	Map plotting / Variograms
Microsoft Office Excel	2007 (SP1)	COTS	Plotting / Regression
R	2.10	COTS	Statistical Script Interpreter
Enthought Python (EPD)	6.1	COTS	Script Interpreter / Plotting
GSLIB program KT3D	2.0 (1996)	Qualified	Kriging
The Mathworks MATLAB	R2009b	COTS	Script Interpreter / Plotting
Gnu Bash	3.00.15	COTS	Script Interpreter (Linux)
Windows XP `cmd.exe`	5.1.2600	COTS	Script Interpreter (Windows)

Scripts for Python, R, Bash, and MATLAB are ASCII and are listed in Section 8.0, while Surfer and Excel input files are binary and therefore are included on the CD (see listing of contents of CD in Section 8.1).

1.7. Notation

Throughout this analysis report the following conventions are used:

1. file names and directory paths are listed in the `Courier New` monospaced font;
2. source code excerpts are listed in the `Lucida Console` monospaced font;
3. program functions and classes are listed as code excerpts with trailing parentheses for clarity;
4. units are given in metric, specified in square brackets (unless used as an adjective);
5. scalar variables are in italic font; and
6. vector variables are in bold font.

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2.0 Geostatistical Variance Reduction

Geostatistics is the modeling and prediction of spatially-correlated information and it has been used extensively over the past 30 years in areas including ore reserve estimation, contaminant mapping in soils and groundwater, and modeling spatial variability of physical properties of aquifers and petroleum reservoirs. Kriging is the geostatistical algorithm used for spatial estimation; compared to other spatial interpolation algorithms (e.g., inverse distance or linear interpolation), kriging uniquely estimates both a value and its variance at unsampled locations.

Previous studies (Rouhani, 1985) have used kriging variance as a measure of the ability of a groundwater monitoring network to predict hydraulic heads at locations where no wells exist. Groundwater monitoring network design can be optimized to either minimize average kriging variance across the domain or to minimize the maximum predicted kriging variance. The estimation variance can also be used as a metric to justify removing wells from an existing network such that the overall kriging variance has a minimal increase. As an example, (Tuckfield et al., 2001) used the kriging variance of contaminants in a plume to determine the redundancy of groundwater contaminant monitoring wells and targeted those wells with the highest redundancy for removal from the network.

Kriging variance is a direct function of the spatial distribution of observations and the variogram (which is fitted to observed data). Kriging variance is only indirectly a function of the observed values; this is a major advantage of using kriging in monitoring network optimization. Therefore, changes in the kriging variance from the addition or removal of a well can be estimated prior to adding or removing that well with a standard kriging calculation.

The geostatistical analysis presented here utilizes ordinary kriging of the residual freshwater heads, after removing a linear trend. The freshwater heads in the Culebra across the model domain have a clear trend (i.e., the regional north-south gradient, see Figure 2-1). Although it is possible to krige values while simultaneously estimating a trend (i.e., universal kriging), this approach is not used here. Universal kriging does obviate the need to first estimate the linear trend for the kriging, but model-fitting to the observed variogram is made more complex, requiring a non-linear optimization or iterative refinement between variogram fitting and kriging with a trend (Armstrong, 1984; Goovaerts, 1998).

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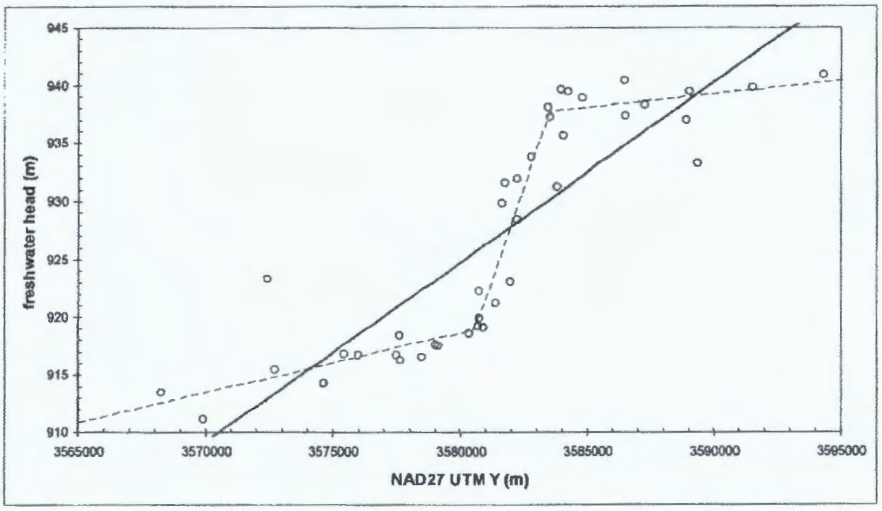

Figure 2-1.Projection of freshwater heads (circles), piecewise linear trend (blue dashed line), and best-fit linear trend (red line) onto *y*-head plane at *x*-midpoint of MODFLOW model domain.

2.1. Trend Fitting and Residual Calculations

The residuals associated with the head observations from May 2007 are used for the geostatistical variance reduction analysis. A best-fit linear surface through these heads was calculated using the COTS statistical software R. The equation for the best-fit plane through May 2007 freshwater heads is

$$h(x,y) = Ax + By + C\,. \tag{1}$$

The results of fitting this equation to the data in Table 1-3 are $A = -9.0\times10^{-5}$, $B = 1.5\times10^{-3}$ and $C = -4.6\times10^{3}$ m (see Table 2-1 for more significant digits and fit statistics). The *y* component (*B*) of the gradient is approximately an order of magnitude larger than the *x* component (*A*). Both *B* and *C* have *t* statistic values indicating significance ($|t|>2$), but *A* does not (see Table 2-1); the east-west component of the regional gradient cannot be estimated accurately from the given data. This same linear fit resulted in coefficients of $A = 1.98\times10^{-4}$, $B = 1.62\times10^{-3}$ and C = -5007.74 in the 2004 version of this analysis. The *y*-component of the gradient (*B*) has not changed much, but the *x*-component (*A*) and the additive constant (*C*) have changed. Overall, the resulting gradient vectors are quite similar (see Figure 2-2), considering the large number of wells that have changed between the two studies.

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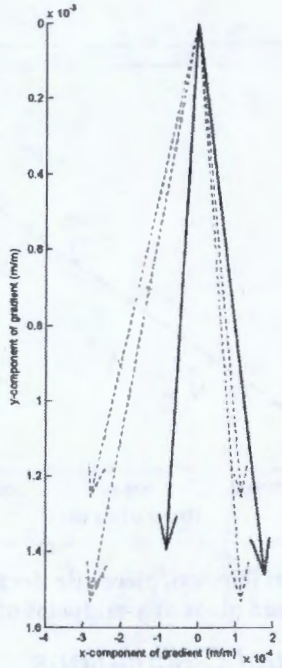

Figure 2-2. Comparison of gradient vectors corresponding to best-fit planes through 2003 (black) and 2007 (red) data. Red dotted lines correspond to estimated gradient ± gradient standard error.

Figure 2-3 illustrates several plots related to the fit of Equation (1) to freshwater heads. The upper-left plot shows the residual (measured – trend) as a function of the trend. The outliers from the moving-average residual trend are H-10c, WQSP-2 and WIPP-13 (see red line and labeled points in the upper left plot in Figure 2-3). The upper-right normal quantile plot (Q-Q) shows that aside from the extreme values, the residuals are ordered approximately normally (plotting quantiles, rather than values makes this plot non-parametric). The lower-left scale-location plot shows magnitude of residuals against the trend value, illustrating that the steep gradient across the WIPP site (920-935 m elevation) is where residuals are largest on average. The lower-right leverage plot shows the relative effects that removing a well has on the predicted surface, plotted against residuals. The wells with the most leverage and the largest residuals are wells at the extremities of the domain, including H-10c, H-9c and AEC-7.

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Table 2-1. Fit statistics for linear surface (Equation 1) through freshwater head data (Table 1-3)

```
(Intercept)             x             y
-4.563833e+03 -9.023153e-05  1.548563e-03

Residuals:
    Min      1Q  Median      3Q     Max
-7.361 -4.833 -0.459   3.901   9.911

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -4.564e+03  5.594e+02  -8.158 5.83e-10 ***
x           -9.023e-05  2.231e-04  -0.405    0.688
y            1.549e-03  1.537e-04  10.077 2.06e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.392 on 39 degrees of freedom
Multiple R-squared: 0.7226,     Adjusted R-squared: 0.7083
F-statistic: 50.79 on 2 and 39 DF,  p-value: 1.386e-11
```

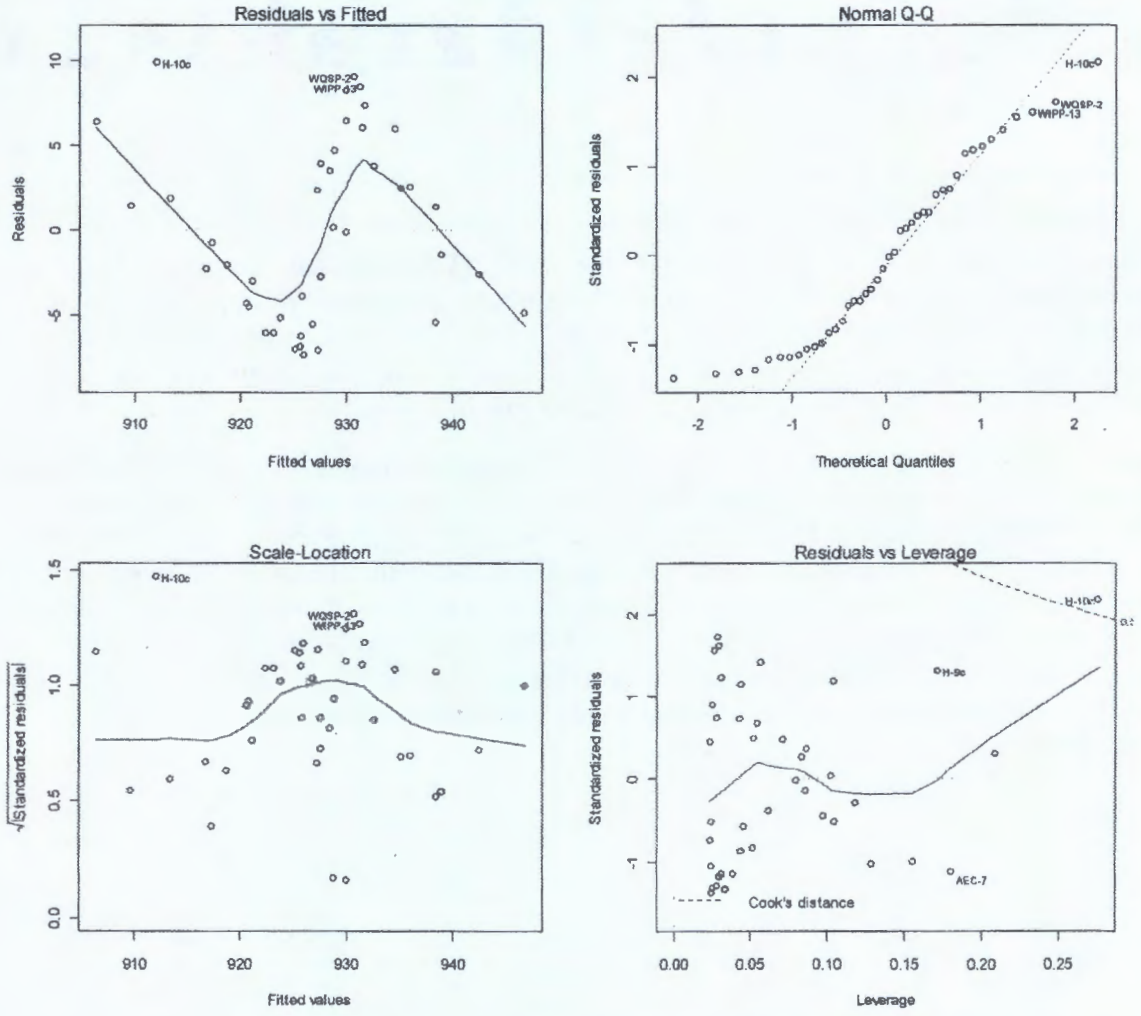

Figure 2-3. Statistics of linear surface (Equation 1) fit to May 2007 freshwater heads

With these parameter values, Equation 1 fits the May 2007 heads with R^2=0.7083 (see penultimate row of Table 2-1). This best-fit plane has a hydraulic gradient of 1.55×10^{-3} and a

flow direction 3 degrees east of south, but the exact angle is poorly defined. The residuals between the estimated and measured heads are used as the input data for the geostatistical analysis. In the 2004 version of this analysis, R^2=0.6, the gradient magnitude and angle were computed to be 1.64×10^{-3} and 7 degrees east of south (see Figure 2-2 for comparison).

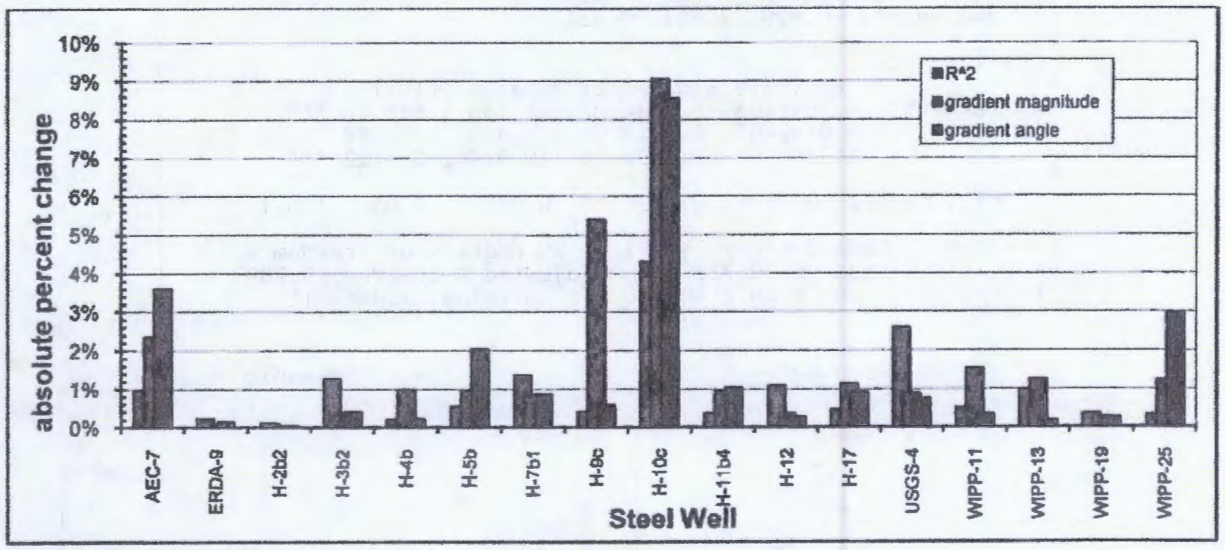

Figure 2-4. Effects of removing a steel-cased well on parameters related to the estimated linear trend.

Adding or removing a single data point from the dataset (Table 2-2) has two potential effects on the results of kriging. First, the best-fit trend surface can change (see "residuals vs. leverage" plot in Figure 2-3 and Figure 2-4), especially if the point being added or removed is at the extremities of the domain (e.g., wells AEC-7, H-9c, and H-10c). Second, the experimental variogram computed from the residuals can change (see next section).

Figure 2-4 shows the results of removing each steel-cased well individually, and fitting Equation (1) using least-squares to the resulting smaller dataset. As was shown in the "residuals vs. leverage" plot in Figure 2-3, H-10c, H-9c, and AEC-7 have a large effect on the R^2 measure of the fit quality. The blue and green bars in Figure 2-4 illustrate the change on the magnitude and angle of the gradient due to removing a single steel-cased well. H-9c has a large effect on the magnitude but not the angle of the gradient; it is located in the south-central portion of the domain. In contrast, WIPP-25 and AEC-7 have larger effects on the angle than the magnitude of the gradient; these wells are on the east and west extremities of the MODFLOW domain, respectively.

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Table 2-2. May 2007 freshwater head (FWH) data and residual. The residuals in the right column are calculated as measured – modeled head, sorted by residual magnitude.

	Well	Observed FWH [m]	Residual [m]
1	H-3b2	918.68	-7.36
2	H-19b6	918.58	-7.14
3	H-19b7	918.54	-7.13
4	H-19b3	918.57	-7.12
5	H-19b5	918.6	-7.08
6	H-15	920.32	-7.05
7	WQSP-5	918.18	-7.02
8	H-19b2	918.64	-7.01
9	H-19b4	918.77	-6.93
10	H-19b0	918.82	-6.87
11	WQSP-4	919.5	-6.24
12	H-4b	916.34	-6.07
13	H-11b4	917.09	-6.06
14	C-2737	921.23	-5.60
15	AEC-7	933.03	-5.47
16	SNL-16	918.68	-5.19
17	SNL-1	941.86	-4.92
18	SNL-14	916.33	-4.56
19	H-17	916.24	-4.37
20	WQSP-6	921.96	-3.93
21	SNL-13	918.19	-3.04
22	ERDA-9	924.88	-2.78
23	SNL-18	939.87	-2.64
24	H-7b1	914.58	-2.28
25	SNL-17	916.78	-2.04
26	SNL-19	937.58	-1.45
27	H-12	916.53	-0.79
28	SNL-8	929.94	-0.13
29	IMC-461	928.95	0.15
30	SNL-3	939.81	1.37
31	USGS-4	911.11	1.41
32	SNL-12	915.24	1.81
33	H-2b2	929.62	2.34
34	SNL-2	937.65	2.48
35	SNL-5	938.59	2.51
36	SNL-9	932.05	3.49
37	H-6b	936.44	3.79
38	SNL-10	931.54	3.94
39	WIPP-19	933.66	4.72
40	WIPP-11	940.65	5.99
41	WIPP-25	937.57	6.03
42	H-9c	912.8	6.39
43	WQSP-3	936.43	6.44
44	H-5b	939.12	7.31
45	WQSP-1	938.28	8.22
46	WIPP-13	939.78	8.47
47	WQSP-2	939.87	9.08
48	H-10c	922.02	9.91

2.2. *Variogram Estimation and Modeling*

The experimental variogram is calculated and modeled using Surfer. Introductions to variogram modeling and geostatistics in general are found in many places in the geostatistics literature; e.g., (Isaaks and Srivastava, 1989; American Society of Civil Engineers, 1990; Kitanidis, 1997). The experimental variogram is calculated in Surfer as

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$$\hat{\gamma}(\boldsymbol{h}) = \frac{1}{2N(\boldsymbol{h})} \sum_{i=1}^{N(\boldsymbol{h})} [z(\mathbf{u}_i) - z(\mathbf{u}_i + \boldsymbol{h})]^2 , \quad (2)$$

where $\boldsymbol{h}$ is the lag spacing vector [m] (most generally $\boldsymbol{h}$ is a vector, but later it will assumed to be a scalar distance), $z(\mathbf{u}_i)$ are the residual freshwater head values at $\mathbf{u}_i$, $\mathbf{u}_i$ is a vector of spatial coordinates (x,y) for the sample locations of each residual value, and $N(\boldsymbol{h})$ is the number of pairs of data points separated by $\boldsymbol{h}$ (within a given tolerance of $\boldsymbol{h}$). The values of the experimental variogram $\hat{\gamma}$, are plotted as a function of $|\boldsymbol{h}|$ and a variogram model (a mathematical function) is fit to these data. Valid variogram models ensure a positive-definite covariance matrix in the kriging equations.

In the current analysis, the infinitely differentiable Gaussian variogram model is chosen to fit the experimental variogram. Since freshwater hydraulic head and residuals computed from it are assumed to be smoothly varying properties (with well-defined first and second spatial derivatives), a variogram that is at least second-order smooth is appropriate. The Gaussian variogram model, as implemented in the kriging program KT3D in GSLIB (Deutsch and Journel, 1998) is

$$\gamma(\boldsymbol{h}) = C\left\{1 - \exp\left[-\left(\frac{3\boldsymbol{h}}{a}\right)^2\right]\right\} \quad (3)$$

where C is the sill [m^2] and a is the range [m]. The variogram modeling is performed using Surfer, which models the Gaussian variogram model without the factor 3 in the exponential. The Gaussian model fit to the experimental variogram, computed from the residual heads, is shown in Figure 2-5. This model has a nugget value of 0.1 m^2, a sill of 40 m^2 and an effective range of 7500 m (the 2004 report had a nugget of 13.0 m^2, a sill of 45.2 m^2, and an effective range of 9000 m). The numbers of data pairs used in the calculation of each point in the experimental variogram are also shown. The calculation of the experimental variogram was done by considering combinations of pairs of data points in all directions. By not considering direction, only distance, the variogram is an omnidirectional calculation using h, where h is the length of the vector $\boldsymbol{h}$. An omnidirectional variogram was also used in the 2004 version of this analysis.

Although a small number of pairs (<30) exist for many of the shorter lag spacing in Figure 2-5, it is felt this variogram is still valid and representative. The only short-lag observation pairs are the redundant wells on the H-19 wellpad. These wells were included in the variogram analysis to get some approximation of the short-lag behavior of freshwater head residual, coupled with the knowledge that the freshwater head residual is a smooth function (i.e., the reason the differentiable Gaussian variogram was used in the first place). The model variogram used in 2004 had a much larger nugget value than the current model does (13 m^2 – compared to 0.1 m^2), but the 2004 model did not use the redundant H-19 wells, which solely contribute to the short-lag experimental variogram.

Although it is possible to calculate directionally dependent variograms, this was not done. The steep north-south hydraulic head gradient observed in the Culebra across the WIPP site is coincident with the densest clustering of observation wells (see steep segment in the center of Figure 2-1). This produces a greater east-west correlation between data compared to correlation in the north-south direction (across the steep gradient) for the entire domain. Since most of the

domain where kriging is being used to estimate values is outside the LWB, an anisotropic model would be misrepresentative of this apparent anisotropy, although it may fit the observed data. Although kriging effectively handles clustered data during the estimation process, the effects which data clustering can have on the variogram modeling process must be considered by the analyst.

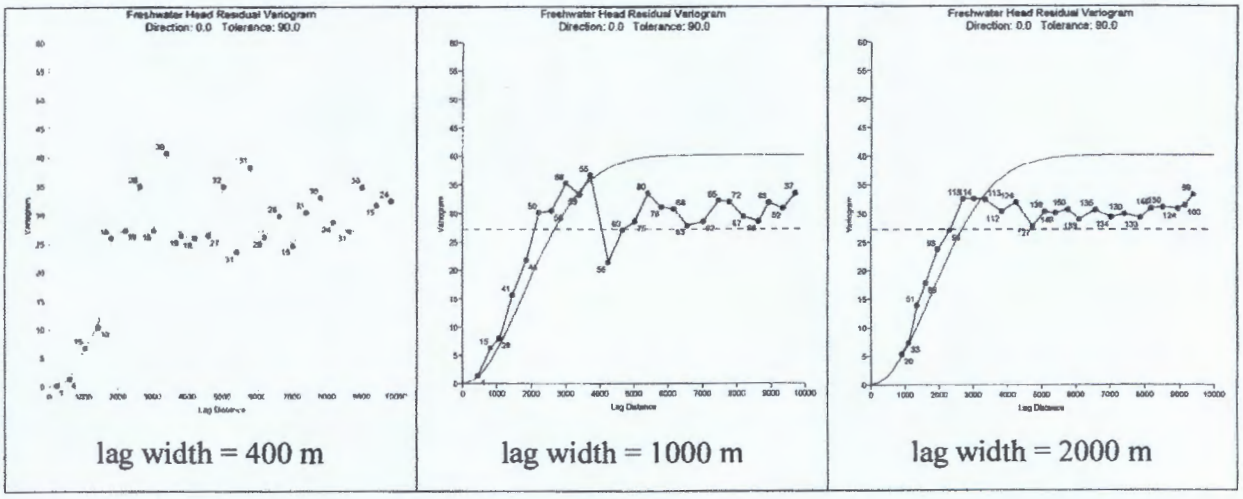

Figure 2-5. Experimental variograms (points) and best-fit Gaussian model variogram (lines) for three different lag widths. NB: there is a factor-of-three difference in definition of variograms between Surfer and GSLIB (multiply lag by 3.0).

It is possible to fit different models or models with different parameters to the same data, but it is felt that the choice of variogram model and parameters given here sufficiently represents the data and corroborates with the presumed knowledge of the system. If a different type of surface were fit to the data, the residuals would have a different structure and therefore a different variogram as well.

Following up on results of the trend surface sensitivity to removing a steel-cased well (see Section 2.1), the experimental variogram is re-computed for each well removed and shown in Figure 2-6. The exact values of the experimental variograms are not important, just the qualitative observation that the relative variability between the different experimental variograms is small. Both the change in the best-fit surface, and the subsequent changes in the variogram of head residuals, due to removing (or adding) a single observation will diminish as the dataset becomes larger. For the current dataset of over 40 monitoring points, the variogram is virtually unchanged upon removal of a steel well, re-calculation of the trend surface (see Figure 2-4) and residuals and model variogram calculation (see Figure 2-6).

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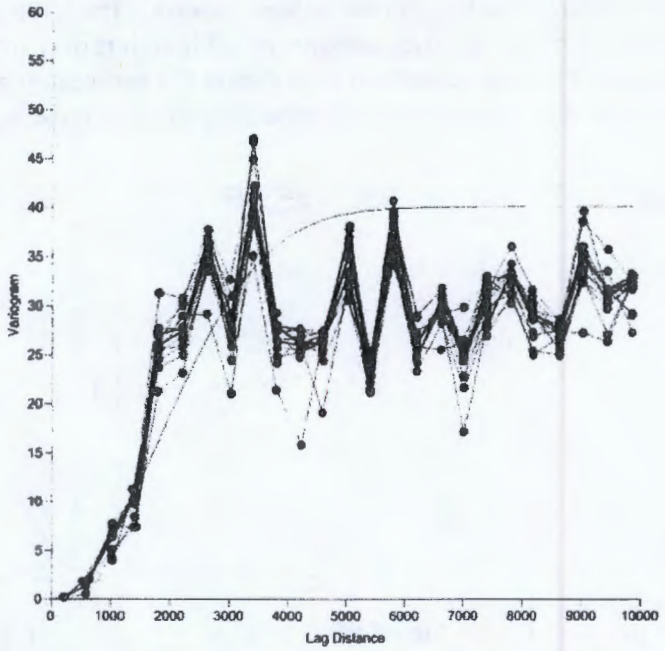

Figure 2-6. Experimental variograms after removing a steel-cased well (variogram for all wells shown in red). Residuals are re-computed based on the best-fit linear trend for each new set of wells and the variogram is re-computed for each new set of residuals.

2.3. *Ordinary Kriging*

Kriging is a geostatistical algorithm for estimating a property at unsampled locations. The kriging equations are formulated to provide an unbiased, minimum variance estimate of the property from a linear combination of the surrounding measured data. Kriging additionally provides a measure of the uncertainty associated with each estimate. The uncertainty measure is known as the kriging variance or the estimation variance. Details on the many variants of the kriging algorithm and its application can be found in the literature, e.g., (Deutsch and Journel, 1998; Goovaerts, 1998). For this work, we use ordinary kriging (OK) and the details of the OK algorithm are presented briefly.

Consider the problem of estimating the value of a continuous attribute, z, (e.g. head residual) at an unsampled location $\mathbf{u}$. The information available consists of measurements of z at n locations $\mathbf{u}_\alpha$, $z(\mathbf{u}_\alpha)$, $\alpha = 1,2, ..., n$. Kriging is a form of generalized least-squares regression and therefore all univariate kriging estimates are variants of the general linear regression estimate $z^*(\mathbf{u})$ defined as

$$z^*(\mathbf{u}) - m(\mathbf{u}) = \sum_{\alpha=1}^{n(\mathbf{u})} \lambda_\alpha(\mathbf{u})\left[z(\mathbf{u}_\alpha) - m(\mathbf{u}_\alpha)\right] \quad (4)$$

where $\lambda_\alpha(\mathbf{u})$ is the dimensionless weight indicating the contribution of $z(\mathbf{u}_\alpha)$ - $m(\mathbf{u}_\alpha)$ to the estimate of z^* (z at unsampled locations), and $m(\mathbf{u})$ is the trend or mean component of the spatially varying attribute [m].

The most common kriging estimator is OK, which estimates the unsampled value $z^*(\mathbf{u})$ as a linear combination of neighboring observations

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$$z^*_{OK}(\mathbf{u}) = \sum_{\alpha=1}^{n(\mathbf{u})} \lambda_\alpha(\mathbf{u}) z(\mathbf{u}_\alpha) \tag{5}$$

OK weights λ_α are determined so as to minimize the error or estimation variance $\sigma^2(\mathbf{u}) = \text{Var}\{z^*(\mathbf{u}) - z(\mathbf{u})\}$ under the constraint of unbiasedness of the estimate. These weights are obtained by solving a system of linear equations, which is known as the ordinary kriging system of equations. Solution of the kriging system requires that covariance, $\text{Cov}(\boldsymbol{u}_\alpha,\boldsymbol{u}_\beta)$, between any two locations be calculated. Covariance is derived from the variogram model under an assumption of second-order stationarity. The unbiasedness of the OK estimator is ensured by constraining the weights to sum to one, which requires the definition of the Lagrange parameter $\mu(\mathbf{u})$ within the system of equations (Bazaraa et al., 1993),

$$\begin{cases} \sum_{\beta=1}^{n(\mathbf{u})} \lambda_\beta(\mathbf{u}) \gamma(\mathbf{u}_\alpha - \mathbf{u}_\beta) - \mu(\mathbf{u}) = \gamma(\mathbf{u}_\alpha - \mathbf{u}) \qquad \alpha = 1,\ldots,n(\mathbf{u}) \\ \sum_{\beta=1}^{n(\mathbf{u})} \lambda_\beta(\mathbf{u}) = 1. \end{cases} \tag{6}$$

The kriging variance is also derived from the set of weights and the Lagrange parameter determined through solution of (6) and it is given as:

$$\sigma^2_{OK}(\mathbf{u}) = \text{Cov}(\mathbf{u},\mathbf{u}) - \sum_{\alpha=1}^{N} \lambda_\alpha \text{Cov}(\mathbf{u},\mathbf{u}_\alpha) - \mu \tag{7}$$

The covariance [m^2] used to calculate the ordinary kriging variance is derived from the model variogram. The covariance between two points separated by zero lag, $\text{Cov}(\mathbf{u},\mathbf{u}) = \text{Cov}(0)$ is equal to the variance of the data set. It is important to note that the OK variance is not a direct function of the specific data values, other than how those data values define the experimental variogram of the residuals (see discussion associated with Figure 2-6), to which the model variogram is fit.

2.4. Estimation Variance Calculations

The program KT3D (Deutsch and Journel, 1998) is used with the model variogram determined above (estimated and plotted using Surfer) to calculate both the estimated residuals and variance at all locations. The full calculation domain is 87188 100-m × 100-m cells, with 36213 of those cells (41 percent) inactive, lying either beyond the no-flow boundary on the west or the composite H2/M2 – H3/M3 Rustler halite margins on the east. Those inactive cells are not included in the calculations of estimation variance. For the calculations done herein, the average estimation variance both within the flow domain and within the WIPP site are calculated for different monitoring well configurations.

The map of estimation variance for the May 2007 monitoring network defined in Table 2-2 is shown in Figure 2-7. The effect of the monitoring network configuration on the resulting estimates of variance is obvious. The lowest estimation variance values (blue) occur at the well locations and the highest values (red) occur at locations that are beyond the distance of the variogram range (7500 m) away from existing wells. The minimum possible value of the kriging variance is the value of the nugget in the variogram model (0.1 m^2). The maximum kriging

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variance in these calculations is approximately 46.4 m^2. In the following analysis, the actual values of the kriging variance are not significant, it is only the relative changes in the kriging variance due to the addition, or subtraction, of wells to or from the monitoring network that are of interest.

The full monitoring network of 48 wells and the model variogram calculated from the head residuals at those wells produce an average estimation variance within the flow domain of 29.1 m^2 and an average estimation variance within the land withdrawal boundary of 7.0 m^2. From Figure 2-7 it is obvious that there are many locations outside of the WIPP site where the addition of a well would have large impact on the estimation variance. Within the WIPP site, the estimation variance is already relatively low at nearly all locations. In fact, given the small distances between some wells relative to the range of the variogram, it is possible to remove some of the existing wells within the WIPP site boundary with only minimal increase in the estimation variance.

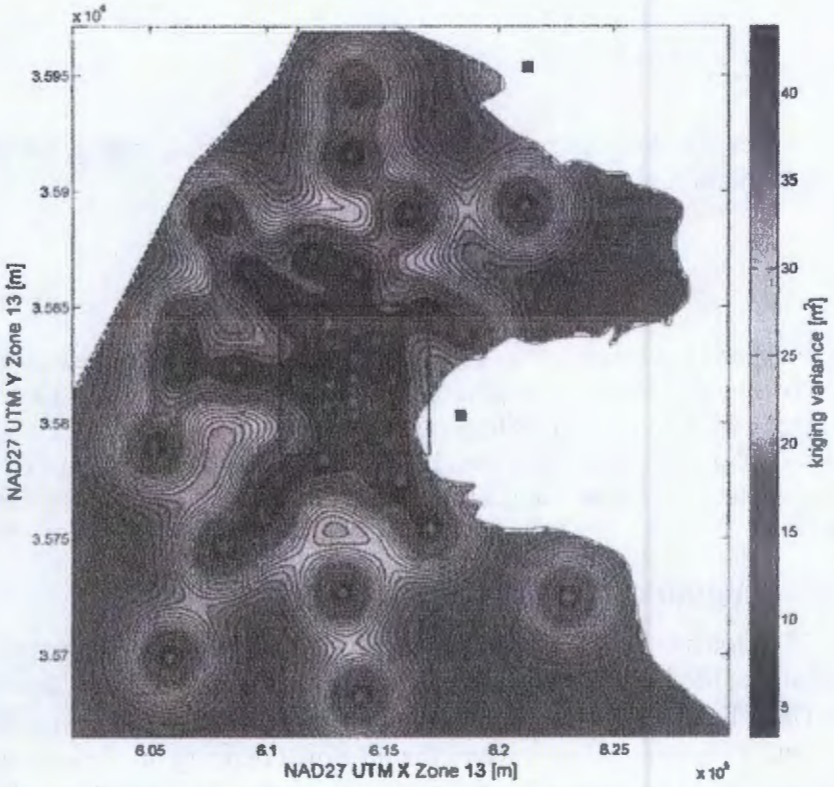

Figure 2-7. Kriging estimation variance for freshwater head residuals. Steel-cased wells are red circles, fiberglass wells are green squares, WIPP LWB is solid black line.

2.4.1. Add one new well

Any proposed new well locations can be added to the current well network and the estimation variance can be recalculated including the additional point. This approach takes advantage of the fact that the estimation variance does not depend on the data values, only on their spatial configuration. This approach does require the assumption that the model variogram does not change significantly with the addition of new locations (analogous to the qualitative sensitivity study illustrated in Figure 2-4 and Figure 2-6 for the case of removing one well).

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Figure 2-8 and Figure 2-9 show the relative effects an additional observation point has on the model-domain-wide mean and median of the kriging variance, computed as

$$\Delta\sigma^2_{+1} = -\frac{\langle\sigma^2_{+1}\rangle - \langle\sigma^2_{base}\rangle}{\langle\sigma^2_{base}\rangle} \quad (8)$$

where σ^2_{+1} is the kriging variance for the case with one additional well, σ^2_{base} is the variance for the base case with the 2007 well network and $\langle x\rangle$ is the averaging operator (in this case averaged over the model domain). Steel-cased wells are red circles, fiberglass-cased wells are green squares. The contours in these figures illustrate the decrease in the domain-wide average variance, not the distribution of the variance due to any one distribution of wells. While the mean and median largely show the same trends, the median values are larger and their distribution is less sensitive to a few extreme high or low values, which can skew the mean. Areas with a small average decrease (i.e., inside and near the LWB) indicate an additional observation at these locations would not significantly improve the estimation variance, averaged over the entire domain. The highest values (i.e., the red 'bulls-eye' areas in Figure 2-8 and Figure 2-9) are located midway between wells along the periphery of the monitoring well network.

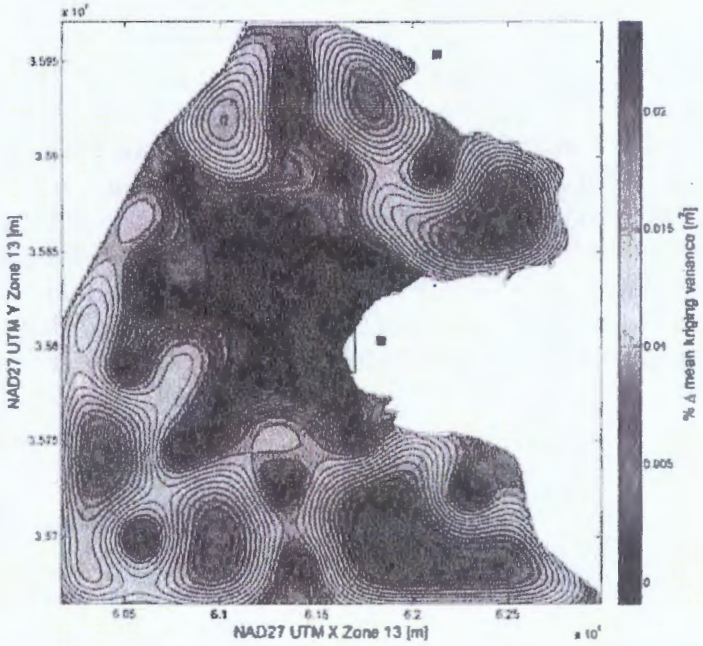

Figure 2-8. Percent decrease in mean kriging variance over model domain due to one additional well

Figure 2-8 and Figure 2-9 account for edge effects near the boundaries of the domain. Areas of high kriging variance (i.e., the red regions in Figure 2-7) mostly correspond to the areas where the largest mean change in variance occurs upon the addition of a new observation point. In the corners of the model domain (especially the southeast corner), the increase is not so large, indicating that much of the effects of a new observation point at this location would be "wasted" outside the model domain.

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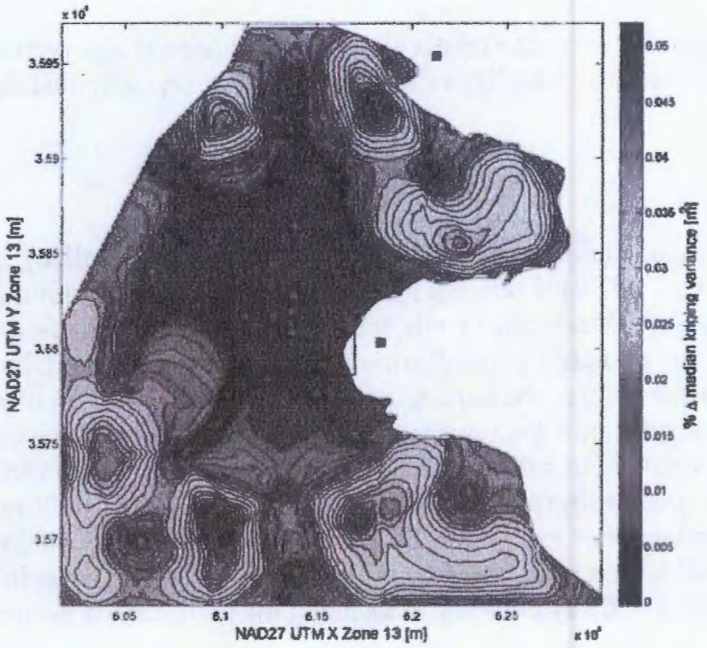

Figure 2-9. Percent decrease in median kriging variance over model domain due to one additional well

Figure 2-10 shows the fractional change in the standard deviation of the kriging variance due to the addition of one more observation location. The standard deviation of the values in the kriging variance field is computed across the entire matrix of values corresponding to adding one additional observation location, without regard to spatial distribution of values. A negative value (blue) indicates the additional location will "smooth out" the kriging variance field (lowering its standard deviation), while a positive number (red) indicates the kriging variance field becomes more variable; a heavy black line indicates the zero-change contour. The positive (red) regions are located in areas distant to the WIPP LWB, and indicate where an additional well would "extend" the current network. The negative regions (blue) are located closer to the WIPP LWB, and indicate where an additional well would "fill in a gap" in the current network.

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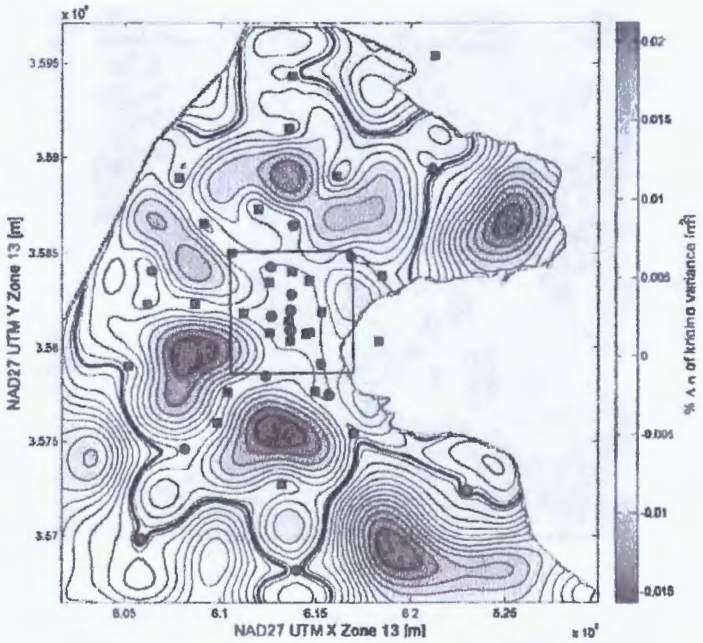

Figure 2-10. Percent change in standard deviation of kriging variance over model domain due to one additional well; heavy black line is zero contour.

Similar calculations were also done with the WIPP LWB as the area of interest, excluding a small area in the southeast corner of the LWB that is constant head in the Culebra MODFLOW model. The region that affects the results within the WIPP LWB is confined to the center of the model domain. The edge effects are clearly evident for the case of averaging over the WIPP LWB, only the LWB and a 3.5-km region surrounding the LWB are shown in Figure 2-11 through Figure 2-13.

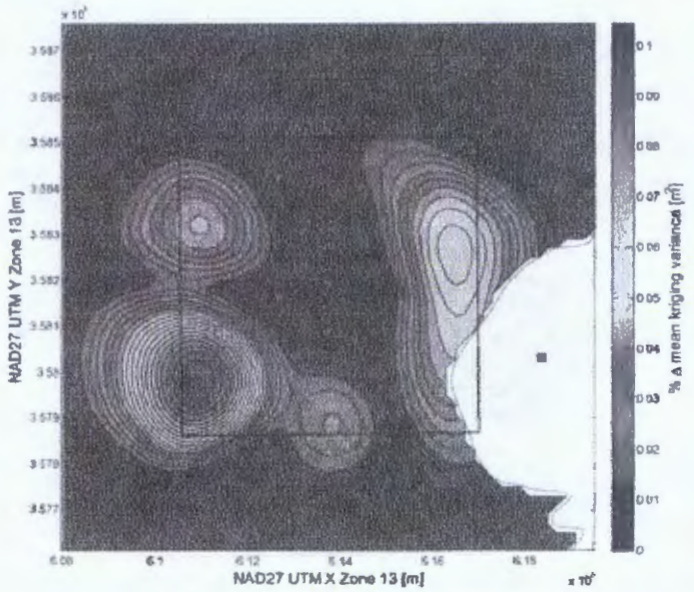

Figure 2-11. Change in mean kriging variance over WIPP LWB due to one additional well

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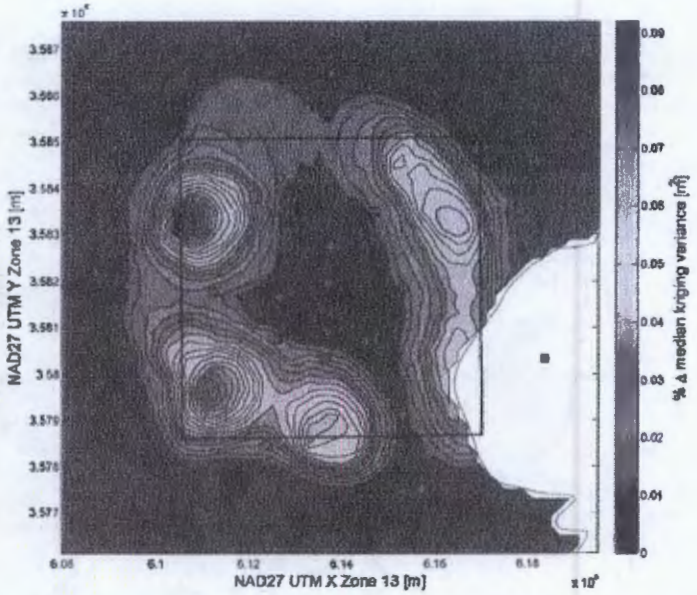

Figure 2-12. Change in median kriging variance over WIPP LWB due to one additional well

Figure 2-11, Figure 2-12, and Figure 2-13 indicate the southwest corner of the LWB is the location that would maximally benefit from an additional monitoring location. The northeast corner is next in relative importance for a new location. Figure 2-12 indicates that the northwest corner would have the largest effect on the median kriging variance across the WIPP LWB. All three figures indicate that the areas along the periphery of the LWB, where there are no existing wells would be good locations for reducing uncertainty through an additional observation point, because a large number of wells already exist in the center of the WIPP LWB.

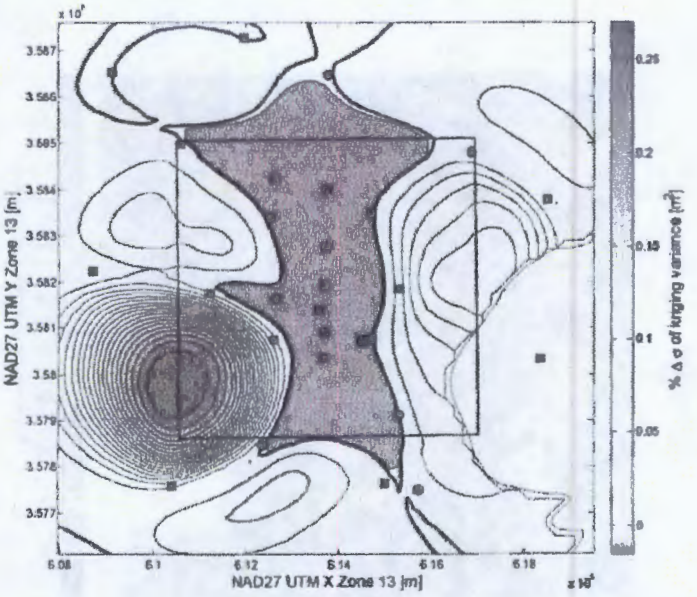

Figure 2-13. Change in standard deviation of kriging variance over WIPP LWB due to one additional well

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2.4.2. Remove one steel well

The same approach for determining the variance reduction due to the addition of a new monitoring well can also be used to compute the potential increase in the estimation variance from the removal of an existing well. In this case, it is possible to recalculate the variogram model from the remaining wells after any number of wells are removed; however, to make the process more efficient, the same variogram is used for all calculations done herein. This approach assumes that the variogram does not change significantly with the loss of any one of the wells (see discussion associated with Figure 2-6).

Each existing steel-cased well is removed and the average estimation variances across the flow domain and the WIPP site are recalculated. Those wells that cause the smallest increase in average estimation variance are the ones that could be removed with a minimal impact on the ability of the monitoring network to provide accurate predictions of heads at locations without monitoring wells. The results of these calculations are shown in Table 2-3.

Table 2-3 shows the change in the average estimation variance within the flow domain as well as within the WIPP site area as calculated for the less-by-one networks associated with removing steel-cased wells. Removal of fiberglass-cased wells is not considered, since they are expected to have a long useful life. Table 2-4 shows the same results only averaged over the WIPP LWB when steel-cased wells are removed from the network. Removal of wells that result in the largest increases in the estimation variance are the wells that are most important with respect to the ability of the network to predict heads. Therefore, if the goal is to predict heads across the entire domain, the wells that create the largest increases in estimation variance when removed are generally those located distant from other wells: H-10c, USGS-4, H-9c, AEC-7, H-11b4, and WIPP-11. Small decreases in the estimation variance can also occur with the removal of a well (e.g., ERDA-9, H-3b2, H-2b2, and WIPP-19). These decreases are due to the configuration of the current wells creating negative kriging weights in the solution of kriging equations (see positive values in mean and median columns of Table 2-3 and Table 2-4). These decreases are always less than two-tenths of one percent of the original variance and are considered as insignificant near-zero changes in this work.

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Table 2-3. Results of estimation variance changes over the entire model domain for the removal of one steel-cased well from the network. A large integer rank indicates an important well, while a small rank is associated with wells with little impact on the entire model domain.

	|Δ standard deviation|		Δ mean		Δ median		avg rank
ERDA-9	0.48%	2	0.19%	1	0.13%	2	1.67
H-3b2	0.49%	3	0.19%	2	0.13%	1	2.00
H-2b2	0.52%	4	0.18%	3	0.13%	2	3.00
WIPP-19	0.75%	5	0.09%	4	0.13%	2	3.67
H-17	1.36%	9	-0.24%	5	0.02%	6	6.67
H-12	0.46%	1	-1.78%	10	-3.13%	11	7.33
H-4b	1.46%	10	-0.36%	6	-0.13%	7	7.67
WIPP-25	1.04%	7	-1.10%	8	-1.49%	9	8.00
WIPP-13	2.00%	13	-0.70%	7	0.07%	5	8.33
H-7b1	1.22%	8	-2.13%	11	-2.54%	10	9.67
H-5b	2.51%	15	-1.26%	9	-1.09%	8	10.67
WIPP-11	0.80%	6	-3.26%	14	-3.52%	13	11.00
H-11b4	1.67%	11	-2.62%	13	-3.47%	12	12.00
AEC-7	2.15%	14	-2.52%	12	-3.86%	14	13.33
H-9c	1.88%	12	-3.97%	15	-7.20%	16	14.33
USGS-4	2.59%	16	-4.39%	16	-6.98%	15	15.67
H-10c	3.90%	17	-4.88%	17	-7.80%	17	17.00

The five wells that could be removed from the network and create the smallest increase in the mean or median estimation variance are those wells in close proximity to other existing wells. These include: ERDA-9, H-2b2, H-3b2, H-17, and WIPP-19 (see Table 2-3 and Figure 2-14). The change in the standard deviation of the kriging variance is shown in Figure 2-14.

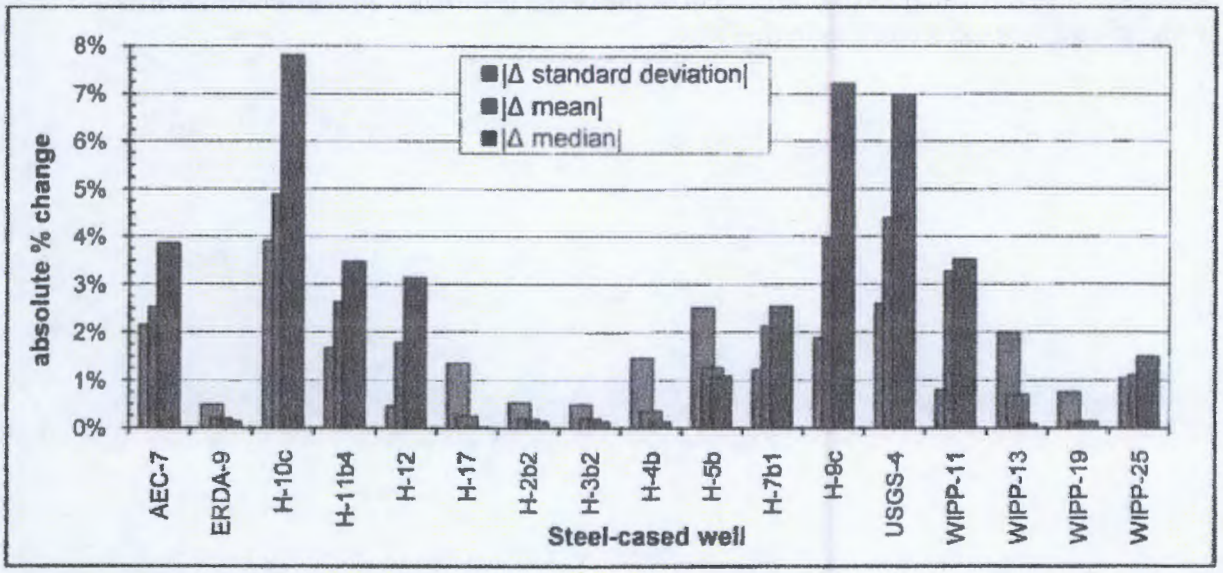

Figure 2-14. Change in estimation variance averaged across entire model domain (data from Table 2-3)

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The wells on the other end of the spectrum, which would have the largest effect on the mean or median estimation variance, include wells on the periphery of the domain (i.e., large bars in Figure 2-14).

Table 2-4. Results of estimation variance changes over WIPP Land Withdrawal Boundary for removal of one well from the network. A high rank indicates importance while a low rank indicates little impact on the area within the LWB.

	|Δ standard deviation|		Δ mean		Δ median		avg rank
H-10c	0.0001%	1	0.00001%	1	0%	1	1.00
AEC-7	0.0001%	2	-0.0001%	2	0%	1	1.67
USGS-4	0.01%	3	-0.02%	3	0%	1	2.33
H-9c	0.48%	7	-0.09%	4	-0.02%	5	5.33
WIPP-11	0.23%	4	-0.72%	5	-0.65%	8	5.67
WIPP-25	0.84%	8	-0.89%	6	-0.01%	4	6.00
H-3b2	0.33%	6	-1.32%	7	-0.51%	7	6.67
ERDA-9	0.87%	9	-1.37%	8	-0.42%	6	7.67
H-2b2	1.07%	10	-1.88%	9	-0.90%	9	9.33
WIPP-13	0.27%	5	-2.83%	10	-5.67%	16	10.33
WIPP-19	1.65%	11	-2.85%	11	-4.31%	11	11.00
H-7b1	24.04%	14	-7.51%	13	-1.57%	10	12.33
H-11b4	11.87%	12	-7.35%	12	-5.64%	14	12.67
H-12	12.88%	13	-7.70%	14	-5.66%	15	14.00
H-4b	28.12%	15	-11.73%	16	-4.65%	12	14.33
H-17	29.34%	16	-11.57%	15	-4.75%	13	14.67
H-5b	47.64%	17	-19.15%	17	-6.72%	17	17.00

The removal of wells far from the WIPP site creates the largest increases in the estimation variance averaged over the flow domain, but the removal of many of these steel-cased wells has little or no effect on the estimation variance averaged across the WIPP site. These wells, AEC-7, H-9c, H-10c, USGS-4, and WIPP-25 are too far away from the WIPP site to directly impact the mean or median estimation variance inside the LWB. The most important monitoring wells, those that create the largest variance mean or median increase upon removal, for predicting heads within the WIPP site are: H-5b, H-4b, H-11b4, H-12, and H-17. All these wells are located near the LWB (H-12 being the furthest away from the LWB). Some of the wells have very large effects on the standard deviation of the kriging variance within the site, but the trends also follow those for the mean and median kriging variance.

Figure 2-15 summarizes the results in Table 2-3 and Table 2-4 graphically, indicating where the wells with high or low rank are located geographically.

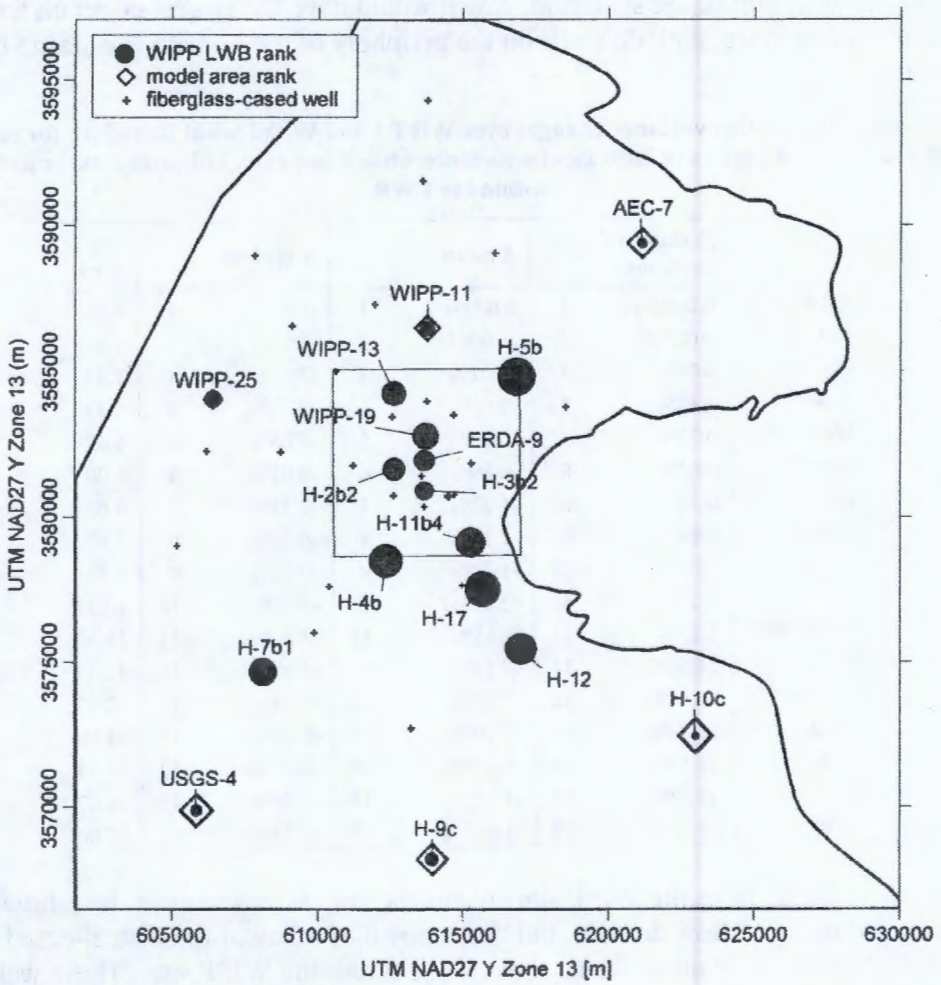

Figure 2-15. Steel-cased wells ranked by effect of removal on kriging variance; symbol sizes are proportional to overall rank (and therefore importance), data in Table 2-3 and Table 2-4. MODFLOW active model domain delineated in green, WIPP LWB is black square.

The wells that create the smallest increases in estimation variance upon removal for both the WIPP site and the flow domain are: ERDA-9, H-2b2, and H-3b2. Any one of these three wells could be removed with minimal effect on the ability of the network to predict heads across both the domain and the WIPP site. These calculations are for removal of a single well.

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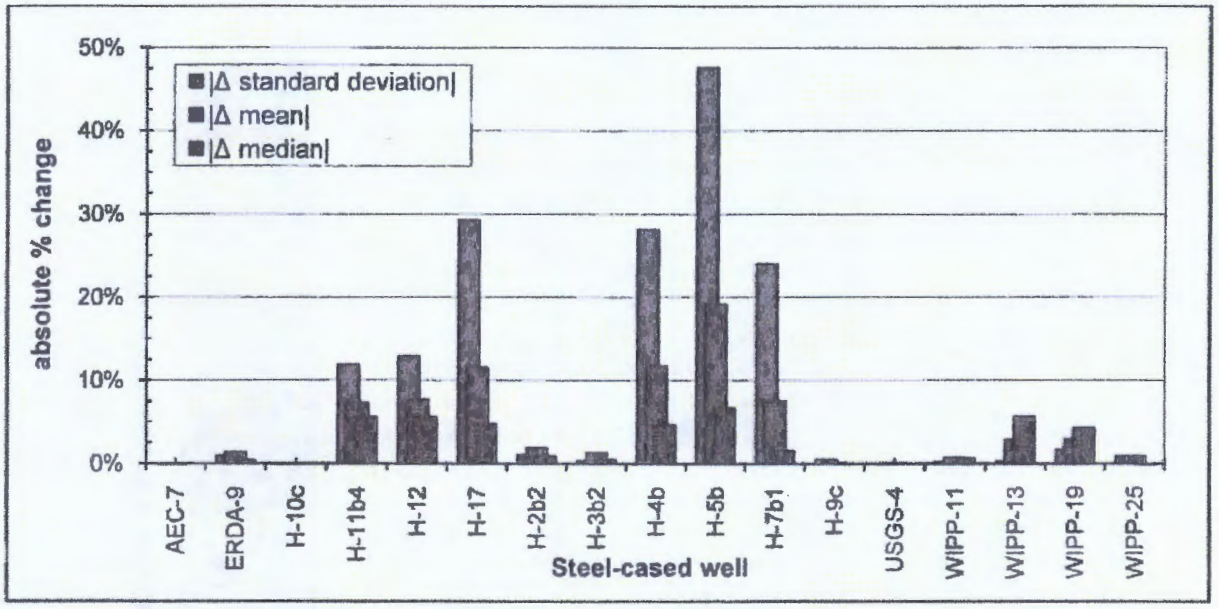

Figure 2-16. Change in estimation variance averaged across WIPP LWB, data in Table 2-4

2.4.3. Remove Two Steel Wells

Based on expectations that the following steel wells will soon need to be replaced or P&Aed: WIPP-25, WIPP-13, H-12 and H-7b1; the analysis of the previous section is carried out removing each of these wells, then additionally removing each of the remaining steel-cased wells one at a time.

Table 2-5 shows the percent change in the kriging variance averaged across the entire model domain computed as (changed - base)/base for combinations of steel-cased wells being removed. The 4×17 image shows the same results in the table. This shows that removing AEC-7 and H-9c, along with any of the three wells represented as columns, makes a large relative change across the entire model domain. This is to be expected, as both of these wells are far away from other wells; removing two wells a large distance from each other affects the largest potential area. Conversely, the column corresponding to WIPP-13 leads to the smallest relative changes (some even being slightly positive), indicating the kriging area of influence for this well has a large amount of overlap with those from other wells, since this well is located in the north-central portion of the WIPP LWB.

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Table 2-5. Change in mean kriging variance across model domain upon removal of two steel-cased wells; integer values indicate rank within each column

		H-12		H-7b1		WIPP-13		WIPP-25	
1	AEC-7	-4.15%	15	-4.17%	15	-2.49%	14	-3.70%	14
2	ERDA-9	-1.52%	3	-1.53%	3	0.11%	2	-1.09%	2
3	H-10c	-4.18%	16	-1.73%	8	-2.51%	15	-3.72%	15
4	H-11b4	-1.78%	8	-3.27%	14	-0.09%	5	-1.29%	6
5	H-12			-1.76%	9	-1.61%	11	-2.81%	11
6	H-17	-1.51%	1	-1.52%	1	-0.10%	6	-1.30%	7
7	H-2b2	-1.53%	5	-1.55%	5	0.09%	3	-1.10%	4
8	H-3b2	-1.51%	2	-1.53%	2	0.12%	1	-1.08%	1
9	H-4b	-2.09%	9	-2.10%	10	-0.46%	7	-1.65%	8
10	H-5b	-2.41%	11	-2.43%	12	-0.78%	9	-1.98%	10
11	H-7b1	-3.27%	13			-1.62%	12	-2.84%	12
12	H-9c	-3.95%	14	-4.19%	16	-2.29%	13	-3.51%	13
13	USGS-4	-2.31%	10	-2.33%	11	-2.56%	16	-3.78%	16
14	WIPP-11	-1.61%	7	-1.62%	7	-0.70%	8	-1.88%	9
15	WIPP-13	-1.53%	4	-1.55%	4			-1.18%	5
16	WIPP-19	-2.81%	12	-2.84%	13	-1.18%	10	-1.10%	3
17	WIPP-25	-1.58%	6	-1.60%	6	-0.05%	4		

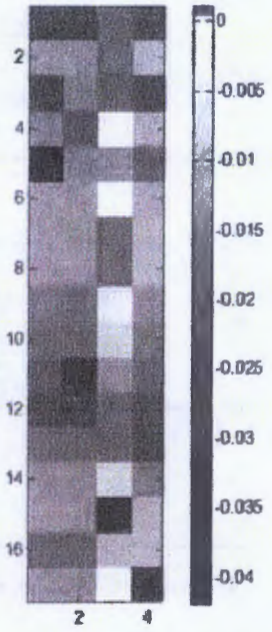

Table 2-6 gives the same statistics as in Table 2-5, but the results are averaged over the area within the WIPP LWB only (rather than the entire model domain). The conclusions from this analysis are different, since WIPP-13 is now the column which on average is darkest blue, (rather than lightest in Table 2-5). Wells H-4b and H-5b are the two "row" wells which have the largest negative change across the four columns. These wells are located on or near the WIPP LWB, similar to how AEC-7 and H-9c from the analysis in the previous paragraph, are located along the periphery of the model domain.

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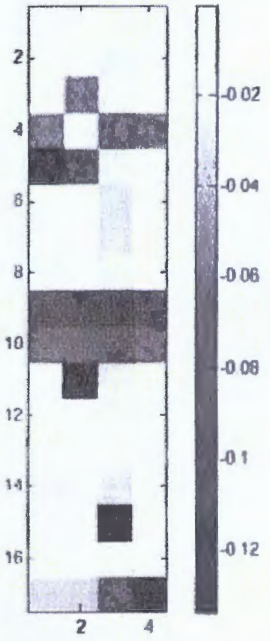
Table 2-6. Change in mean kriging variance across WIPP LWB upon removal of two steel-cased wells; integer values indicate rank within each column

		H-12		H-7b1		WIPP-13		WIPP-25	
1	AEC-7	-0.03%	3	-0.09%	2	-1.95%	2	0.00%	2
2	ERDA-9	-0.69%	8	-0.76%	7	-2.65%	9	-0.67%	8
3	H-10c	-0.03%	1	-7.45%	13	-1.95%	1	0.00%	1
4	H-11b4	-7.70%	14	-0.12%	4	-9.32%	13	-7.36%	14
5	H-12			-10.50%	15	-1.97%	6	-0.03%	5
6	H-17	-0.08%	5	-0.14%	5	-3.07%	12	-1.13%	12
7	H-2b2	-1.05%	11	-1.12%	10	-2.99%	11	-1.03%	11
8	H-3b2	-0.30%	7	-0.37%	6	-2.22%	8	-0.28%	7
9	H-4b	-11.49%	16	-11.64%	16	-13.40%	16	-11.46%	16
10	H-5b	-7.71%	15	-7.78%	14	-9.66%	14	-7.69%	15
11	H-7b1	-0.12%	6			-2.04%	7	-0.10%	6
12	H-9c	-0.03%	2	-0.09%	1	-1.95%	4	0.00%	4
13	USGS-4	-0.75%	9	-0.81%	8	-1.95%	3	0.00%	3
14	WIPP-11	-1.97%	12	-2.04%	11	-2.83%	10	-0.72%	9
15	WIPP-13	-0.92%	10	-0.98%	9			-1.95%	13
16	WIPP-19	-0.03%	4	-0.10%	3	-1.95%	5	-0.89%	10
17	WIPP-25	-3.35%	13	-3.41%	12	-10.32%	15		



In Figure 2-17 and Figure 2-18 the overall rank (between all 64 combinations of two steel-cased wells, rather than 16 steel-cased wells individually) is plotted against the distance between the two wells comprising the pair as a measure of the impact of removing a pair of wells. The overall rank is computed as an average of the results of three metrics (mean, median and standard deviation of the change in the kriging variance).

Figure 2-17 shows a weak positive correlation (R^2=0.35 fit through all points) between the relative impact of removing a pair of steel wells and the distance between those wells, when the impact is averaged over the entire model domain. A high rank indicates a higher impact to the kriging variance averaged over the model domain; a low rank indicates low impact. Wells which are separated by large distances tend to have the largest cumulative effect. The different symbols in the figure show that individual wells (these four symbols correspond to the wells represented as columns in Table 2-5) tend to also follow this trend

Figure 2-18 shows the same results, only averaging the impact over the area encompassed by the WIPP LWB. Here the correlation is even weaker, and also negative. Wells that are closer together have a larger relative impact when they are removed. WIPP-13 (black triangles) is only associated with higher rank pairs (>32), but in general all the individual wells follow the weak overall trend.

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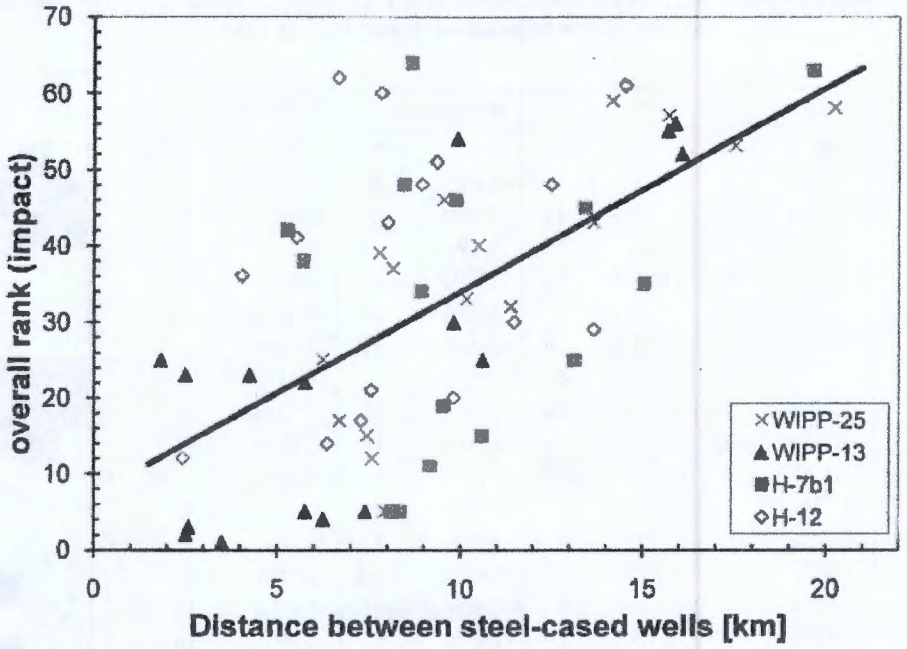

Figure 2-17. Rank and distance between wells for removal of pairs of steel-cased wells, averaging effects across the entire model domain (R^2=0.35 for linear fit). High numerical rank indicates a large impact on the model-wide kriging variance.

WIPP-25, H-12, and H-7b1 are all located outside the WIPP LWB. WIPP-13 is inside the WIPP LWB, and all pairs of wells including WIPP-13 have high rank in Figure 2-18. The smallest linear dimension across the WIPP LWB is 6.4 km (east-west or north-south), while the largest linear dimension of the WIPP LWB would be a diagonal across the site 9.09 km. Pairs of wells with distances larger than these values must include at least one well outside the LWB, possibly both. The pairs of wells with very large separations are pairs of wells where both wells are distant from the WIPP site. Removing these wells would obviously have little direct impact on the region inside the WIPP LWB.

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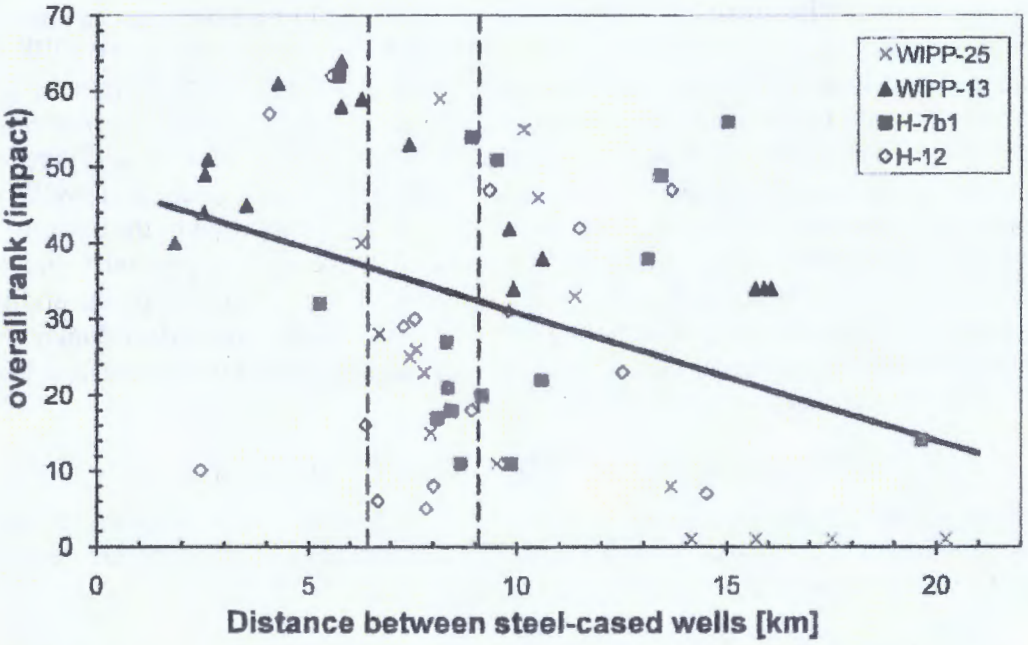

Figure 2-18. Rank and distance between pairs of steel-cased wells, considering WIPP LWB (R^2=0.14 for linear fit). Vertical dashed lines represent the min (6.4 km) and max (9.1 km) distances across the LWB. High numerical rank indicates a large impact on the kriging variance inside the WIPP LWB.

This analysis supports the idea that removing two distant steel-cased wells from the network has the largest impact on the kriging variance, averaged over the entire model domain. The relationship that inter-well distance plays in the removing of two wells, when only considering the area within the LWB is more complex and less conclusive. Apparently, there is a negative correlation between distance and importance, but likely because wells with large inter-well separations are likely distant to the WIPP LWB as well.

All the well-removal scenarios in this section have the assumption that the variogram does not change upon removal of the selected wells. In situations where we are only removing one well, this is a very good assumption (see discussion associated with Figure 2-6); removing two or more wells still should not violate the assumption that their removal would not change the variogram.

2.5. Kriging Variance Reduction Summary

It is relatively simple to calculate the decrease or increase in the kriging estimation variance over a specified area from the addition or removal of one or more monitoring wells. The maximum reduction in estimation variance, or increase in the ability to predict heads, can be achieved by placing a new monitoring well in any location of the flow domain that is far away from an existing well or the model boundary. There are a large number of locations in the domain where a new well could be placed to meet this condition. At this point in the analysis, a maximal reduction in variance from a new well can be considered as a necessary input, but not sufficient condition for locating a new well.

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Removal of wells from the existing monitoring network was also examined using the kriging estimation variance. The impact of well removal was evaluated by calculating the increase in estimation variance for both the entire flow domain and the area within the WIPP LWB. These calculations were done for the removal of a single well from a base case of 42 wells and the results are only valid for the removal of the one specified well. These results also safely assume that the variogram is constant across all monitoring network configurations (see Figure 2-6). These calculations were completed again for removal of combinations of multiple wells when those combinations of interest are defined. Wells that are most important to the existing monitoring network that should not be removed are listed above and are, generally, those wells most distant from any existing wells. Wells that have the smallest influence on the ability of the current network to predict heads at unmeasured locations across the entire flow domain as well as within the WIPP site are also listed above. If more than one well is to be removed, the combinations of wells should be selected from this list.

2.6. Kriging Variance Reduction Run Control Summary

The kriging variance reduction analysis performed in this section is described here in terms of files, programs, and scripts used. The required files are located on the CD and are described in sufficient detail to allow recreation of the results given in the text.

2.6.1. Linear trend fit and variogram calculations

The linear trend fitting to the computed freshwater head values (see Section 2.1, Table 2-1, and Figure 2-3) was computed in the COTS statistical software R. The script `plot_linear_fit_summary.R` (Section 8.2.1) uses the built-in linear model function `lm()` to produce a linear fit, then standard statistics are produced by summarizing this fit (see see Table 2-1 produced by `summary()` in line 15 of script) and standard diagnostic plots (see Figure 2-3) are created by plotting this fit (see lines 16 and 17 of script).

The sensitivity of the experimental variogram to removal of a single steel-cased well was investigated (see Figure 2-4 and Figure 2-6) using the Python script `remove_one_variogram_effects.py` (Section 8.2.2). This script loaded the well data (lines 4 through 35) and performed a least-squares fit of a linear surface (see Equation 1) through the data (e.g., see Menke (1984), Chapter 3), looping through the data to remove one steel-cased well at a time, re-computing the fit (lines 37 to 58). An ASCII text file was output (see line 24 for the filename) with summary statistics relating to each network-minus-one fit corresponding to the lines of the output file. This csv file was imported into MS-Excel, resulting in the plot of relative percent change in the slope and direction of the best-fit linear surface due to removing each steel-cased well, as shown in Figure 2-4 (see file `trend_surface_remove_one_results.xls` on the CD in the `report/figures/02_kriging` directory).

This same Python script also wrote a set of data files corresponding to the main dataset less a single steel-cased well for variogram analysis. These data files were imported into Surfer for experimental variogram plotting to create Figure 2-6; see the CD in directory `report/figures/02_kriging` for the data files and resulting Surfer file `perturbation_spread_of_variograms.srf` used to plot this figure. In the same directory on the CD, the Surfer file used to generate the final experimental variogram plot in Figure 2-5 can be found (`may2007_variogram_modela.srf`).

2.6.2. Kriging variance reduction calculation

The kriging variance minimization (see Section 2.4) consisted of a main Python script, `krig_plus_one.py` (Section 8.2.3), which drives the kriging process for different inputs and summarizes the outputs. This main script uses two subsidiary scripts `shared_data.py` (Section 8.2.4) and `kt3d_driver.bat` (Section 8.2.5) to perform its duties.

2.6.2.1. Kriging add one

The `krig_plus_one.py` script is explained here. Most of the first half of the file (lines 18 to 130) is the definition of the function `krig()`, which is called with arguments related to where to put an additional data point. Lines 28 through 53 are the input file for KT3D saved as a string having key parameters in the input file substituted with variables passed to the function (e.g., see pattern `%(varname)d` on lines 38 and 39). The data file used as input to KT3D is written on lines 56 to 61, potentially with an additional point appended to the end of the file. The DOS batch file `kt3d_driver.bat` is called to run `kt3d.exe` on lines 65 to 73. The kriging variance output created by running KT3D is read on lines 75 to 78, while certain subsets of the variance arrays are selected on lines 87 and 88. Lines 91 through 130 are located inside a threading `with` lock block, since they are writing summary results to a global variable (there are potentially more than one thread running at a time and the lock is to prevent two threads attempting to write at the same time and corrupting the data). Lines 95 through 115 are related to model-domain wide statistics, while lines 117 through 130 are related to the same statistics but only computed over the WIPP LWB.

The actual program flow begins at line 139, with the reading and preparation of various data from disk (lines 139 to 207). The last portion of the script (inside the `if __name__ == "__main__"` conditional on line 214) is only executed if the script is called from the command line. This portion is not executed if the script is imported (as is done in the `krig_remove_one_steel.py` and `krig_remove_two_steel.py` scripts). This final section sets up the arrays for saving the results (lines 216 to 218), calls `krig()` with the original unmodified dataset for comparison (line 220), and loops over all locations on a grid, adding one point at a time to the analysis (lines 229 through 242). Finally, the results of the entire analysis are saved to disk (lines 251 through 260 – these results are on the CD in the `analysis/kriging/kriging_add_well/output` directory); these matrices of results are used to plot the color figures in Section 2.4.1 using the MATLAB script `krig_add_one_plotting.m` one the CD in the `report/figure/02_kriging/` directory (since this MATLAB script was not used for analysis (only creation of color contour maps from ASCII data files), it is not listed in Section 8.2).

At lines 171 through 175, ASCII matrices are imported that indicate whether a given model cell is inside the active portion of the MODFLOW model domain. These matrices are written by the MATLAB script `generate_model_cell_masks.m` (Section 8.2.6), which uses the built-in function `inpolygon()` to determine which cells are inside the irregular polygon defining the MODFLOW active model area.

The `krig_plus_one.py` script is threaded because each call to KT3D takes roughly 10 to 15 seconds and there are tens of thousands of locations in the model domain where a point can be added; since the results of adding each point are done individually, the problem lends itself well to parallelization (i.e., a speedup of over four times using eight processors).

2.6.2.2. Kriging remove wells

As already stated, the scripts that run KT3D for the analysis of removing a well from the network import the majority of their functionality from the `krig_plus_one.py` script described in the previous section. The scripts for removing one (Section 8.2.7) and two wells (Section 8.2.8) are quite similar, and are described here. Each script reads in the relevant well and model domain data, the in the remove-one well case each steel well is individually removed from the network and the `krig()` function defined in the import `krig_plus_one.py` script are called to do run KT3D and summarize the results (lines 34 to 49). The results are written to ASCII files (see lines 44 through 49) for summarizing into Table 2-3, Table 2-4, Figure 2-14, and Figure 2-16. The source of the tables and bar-chart figures is saved in the spreadsheet `remove_one_well_results2_2010.xls` on the CD in the `analysis/kriging/kriging_remove_steel/` directory.

The map in Figure 2-15, showing the relative importance of removing steel-cased wells from the network with respect to the entire domain and the WIPP LWB, was created in Surfer from the tabular results. The Surfer file (`remove_one_steel_well.srf`) is included on the CD in the `report/figure/02_kriging/` directory.

In the remove-two-wells case, a list of four "most likely to be removed" steel-cased wells are used as the first well, then the remaining steel-cased wells are each additionally removed, similarly calling the imported `krig()` function to run kt3d and summarize the results (lines 38 to 68). Similarly, these results are written to files for summary in Table 2-5 and Table 2-6.

The source of the scatter plots in Figure 2-17 and Figure 2-18 and the tables of data is the spreadsheet `remove_two_well_results3.xls`, located on the CD in the `report/figure/02_kriging/` directory.

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3.0 Local Gradient Estimation with Triangulation

The methodology used for local gradient estimation in the previous revision of this analysis report (McKenna, 2004) and in the associated follow-up paper (McKenna and Wahi, 2006) involved the use of "three-point estimators" to assess the ability to estimate head gradients in a 2D aquifer. The analysis presented here is instead in terms of a simpler approach using non-overlapping Delaunay triangles (a small subset of the triangles included in the three-point estimators).

Although three-point estimators have been used several places in the literature to estimate a regional gradient value from observed data; see e.g., (Cole and Silliman, 1996; Conwell et al., 1997; Silliman and Frost, 1998; Silliman and Mantz, 2000; McKenna and Wahi, 2006), few practicing hydrologists take this approach to estimating the gradients when presented with 2D head data. It is a more common approach to contour observed heads (i.e., potentials), estimating gradients from equipotential contours. While there are numerous techniques for creating contour maps from point measurements (e.g., kriging, inverse distance, splines), linear interpolation could be considered the most basic and easily understood approach. Often a geologist will sketch in the results of linear interpolation between data as a first step to hand contouring depth or thickness data, and then they will modify these results with their own professional judgment. In two dimensions, three points define both a triangle and a piecewise-constant estimate of the gradient across that triangle. A group of more than three points defines a network of triangles (bounded by their convex hull) and a piecewise-constant estimate of the gradient across the area inside the convex hull.

Linear interpolation is used for the local gradient-based estimation, since linear interpolation is a straightforward method that is easy to visualize and understand, and triangulation is readily implemented using available tools in the COTS software MATLAB (i.e., the built-in functions `delaunay()` and `voroni()`).

3.1. Delaunay Triangulation

In the three-point estimator approach of (McKenna, 2004), all possible combinations of three points were constructed into triangles to assess the quality of the network (with a fraction of the triangles discarded based on selection criteria). Many thousand overlapping triangles made visualization of results difficult (see Figure 3-1). For 30 wells, there are 4060 possible three-well combinations and for 40 wells there are 9880 possible combinations. In the current approach, the much smaller subset of non-overlapping triangles produced by Delaunay triangulation is used.

Since the triangles will not overlap, the gradients estimated with this technique are as local as possible with the given set of points. When using overlapping triangles, the selection of one gradient estimate over another (when two triangles cover the same area) may become complex, or some sort of averaging must be done to produce a useful result.

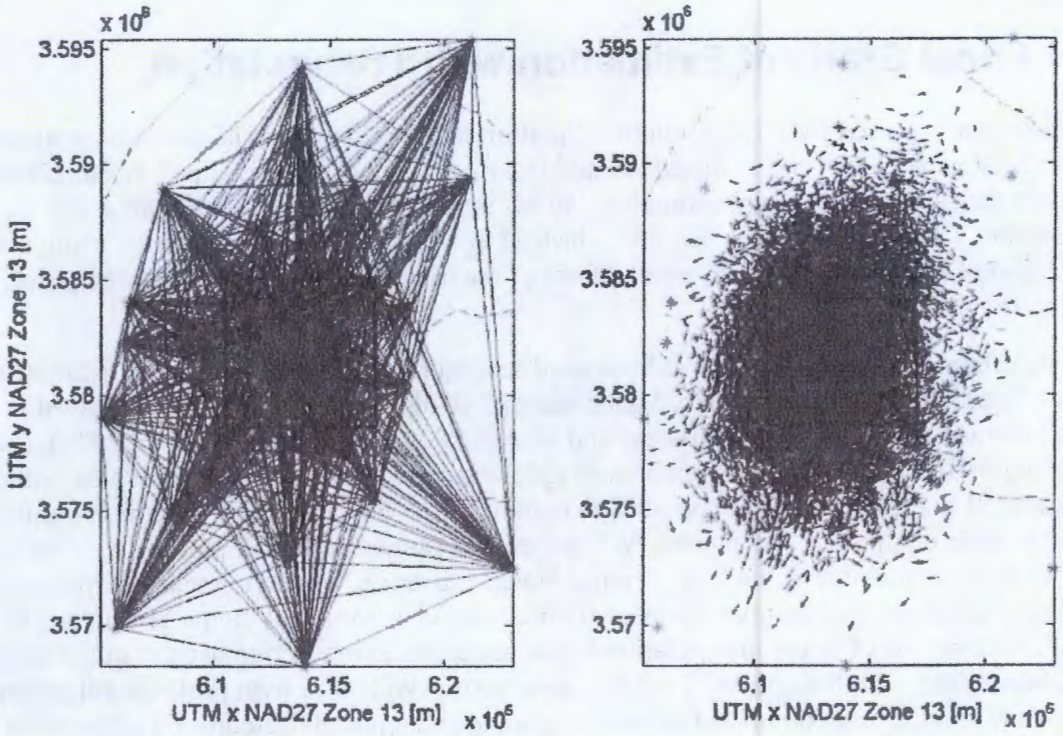

Figure 3-1. All possible triangles (left) and corresponding gradient vectors (right) for May 2007 Culebra monitoring network (as was used in the three-point estimator approach from first revision of this report). Vectors are $\log_{10}$ length scaled; tails of vectors are anchored at the center of their triangle.

Given a 2D set of data points, Delaunay triangulation produces a set of triangles, where each triangle bounds a point and its natural neighbors (see Figure 3-2a). Delaunay triangles are directly related to Voronoi polygons, which are the unique polygons circumscribing the area closer to a given observation well than any other well (see Figure 3-2b).

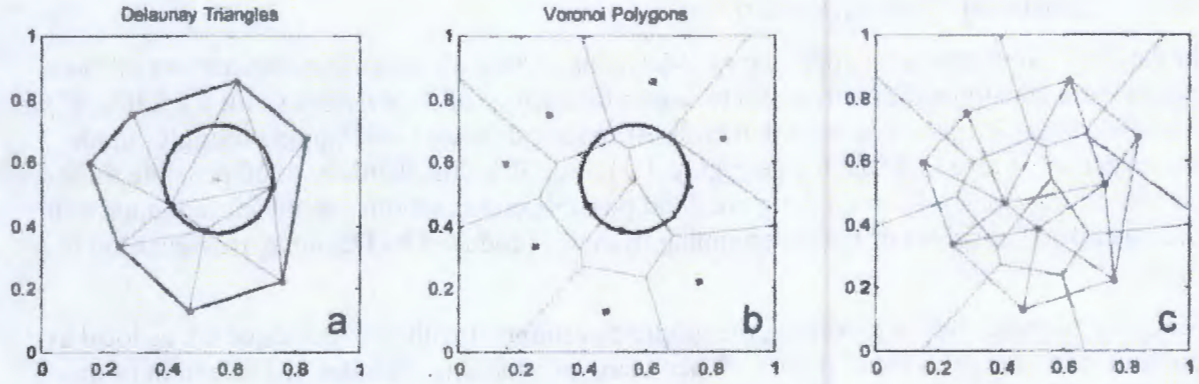

Figure 3-2. Delaunay triangles and Voronoi polygons for 10 randomly located points (red symbols). Black circle with green center used to illustrate the relationship between triangles (a) and polygons (b). Red lines indicate the convex hull, (c) shows both sets of polygons together.

Some properties of these unique triangles and polygons are:

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- Delaunay triangles uniquely tessellate the area within a convex hull enclosing the data (except in certain symmetric cases);
- Voronoi polygons fill the entire plane; the polygons corresponding to the data on the convex hull have infinite area;
- Vertices of Voronoi polygons correspond to the centers of circles that uniquely go through the three neighboring points (see Figure 3-2b);
- In a square grid of points, Delaunay triangles become right isosceles triangles (two equal angles and sides) and Voronoi polygons become squares (see Figure 3-3).
- In a triangular grid of points, Delaunay triangles become equilateral and Voronoi polygons become regular hexagons (see Figure 3-4).

Three points are the minimum required to estimate direction and magnitude of a gradient from 2D point observations; Delaunay triangles therefore define piecewise-constant gradient over the area enclosed by the convex hull surrounding all points. Delaunay triangles, when assigned z values at the vertices (i.e., heads), become a triangular irregular network (TIN); these are often used in engineering to approximate irregular surfaces.

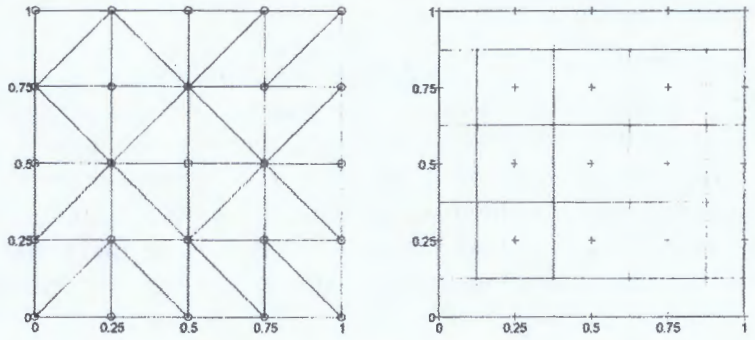

Figure 3-3. Delaunay triangles and Voronoi polygons for symmetric square grid; note ambiguity in triangles

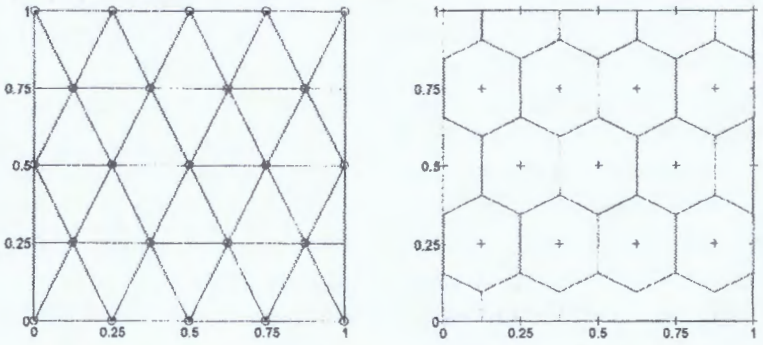

Figure 3-4. Delaunay triangles and Voronoi polygons for symmetric triangular mesh

The regular grids of points in Figure 3-3 and Figure 3-4 illustrate the shapes of triangles that arise under these ideal conditions (compared to the random arrangement of points in Figure 3-2, and seen in the following Culebra monitoring network analysis).

Voronoi polygons are not used in this analysis, but they are included in this introductory discussion because it is clear that they are unique for a given set of points and there is a unique mapping from Voronoi polygons to Delaunay triangles, therefore it is illustrated how the Delaunay triangles are also unique. The non-unique case corresponds to the extreme symmetry shown in Figure 3-3; squares can equivalently be cut into triangles along either diagonal. This will not affect the results of this analysis, since the Culebra monitoring wells are not located on a symmetric rectangular grid.

3.2. Triangle Shape Metric

To rank the quality of the shape of triangles, the ratio of the minimum and maximum of the interior angles is assessed; this value is believed to capture the quality of a triangle for the purposes of gradient estimation from three data points. The lengths of the sides of the triangles can be related to the size of the angles through the law of sines,

$$\frac{a}{b} = \frac{\sin(A)}{\sin(B)}, \tag{9}$$

where a and b are the shortest and longest sides of the triangle (i.e., the min/max length ratio), and A and B are the corresponding largest and smallest angles of the triangle – angle A opens up to side a (i.e., the ratio of the sines of the min/max angles).

In the case illustrated in Figure 3-3, the triangles have angle ratios of 0.5 (one 90° and two 45° degree angles). Figure 3-4 illustrates triangles with an angle ratio of 1 (three 60° angles); this is the maximum ratio. Using the angle ratio as the metric, therefore the "best" triangle is an isosceles one. Likewise, triangles with one dimension or angle much smaller than the others will have a very small angle ratio, approaching zero in the limit as the three points become collinear. Triangles with large aspect ratios (proportional to the inverse of the angle ratio) tend to produce worse estimates of the gradient, based on an assumed unbiased normal distribution of errors associated with observing heads in a well (McKenna and Wahi, 2006).

Figure 3-5 shows the distribution of triangle size, interior angle ratio and the magnitude of the gradient computed from observed May 2007 freshwater heads. In Figure 3-5a, the logarithm of area is used to color-code the triangles that make up the 2007 Culebra monitoring network. Some very elongate triangles have small areas, considering how distant the wells are that make up their corners (e.g., the blue triangle along the west-central edge of the area, comprising wells WIPP-25, IMC-461, and SNL-16). Figure 3-5b shows the distribution of the angle ratio, for the 2007 Culebra network; the dark red triangles are nearly isosceles, while the dark blue triangles have one large obtuse angle. Figure 3-5c shows the logarithm of the head gradient magnitude, computed from the three corner wells. Aside from the two anomalously high gradient areas associated with SNL-6 and SNL-15 (east-central and north-east areas), there is an east-west yellow band across the middle of the model area, with blues north and south of it, representing the observed higher freshwater head gradient across the center of the LWB (e.g., see Figure 2-1).

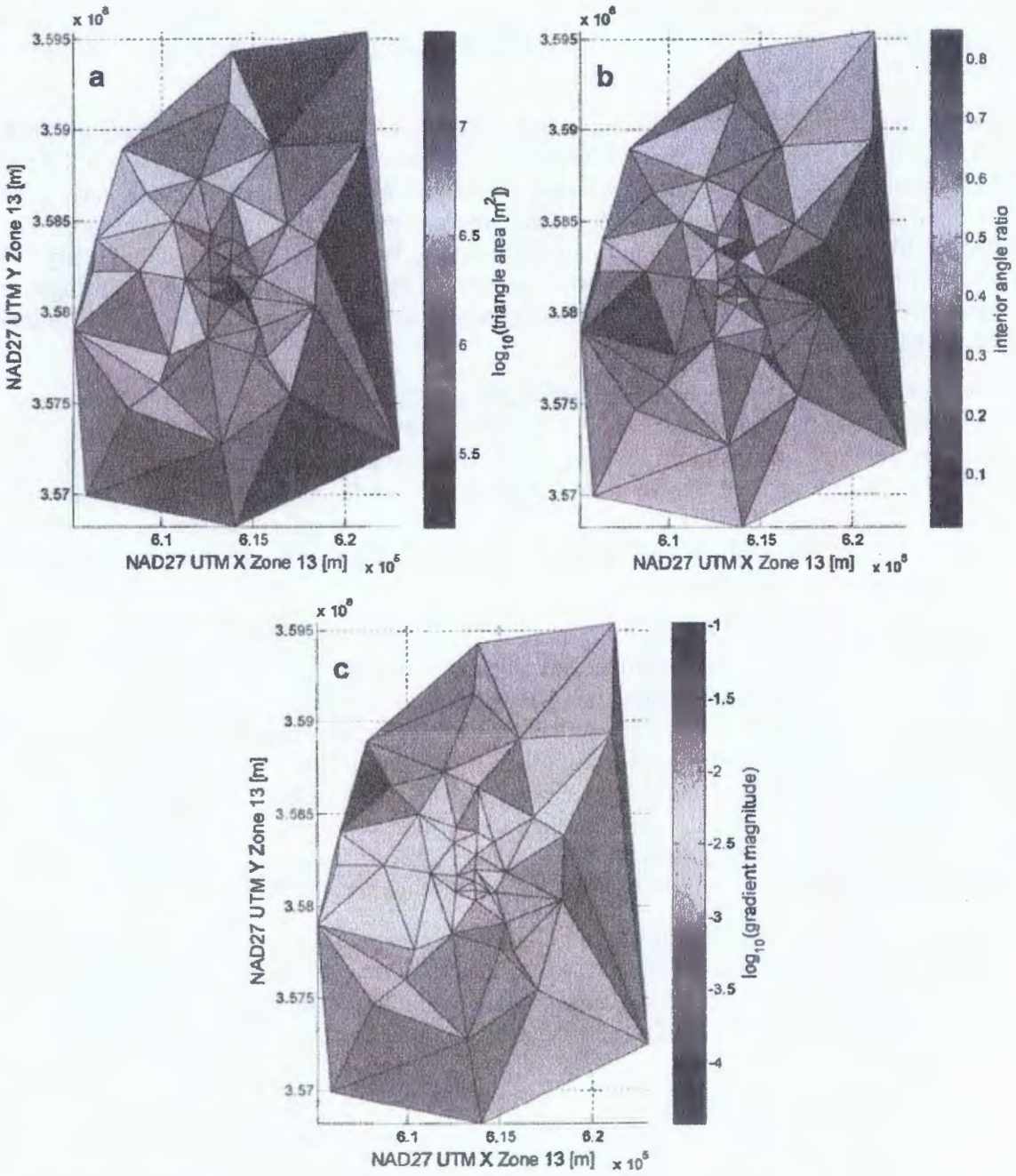

Figure 3-5. Distribution of geometry metrics for 2007 Culebra well network: (a) area of triangle, (b) angle ratio, and (c) May 2007 freshwater head gradient magnitude.

Figure 3-6 shows scatter plots of the quantities represented spatially in Figure 3-5 (each dot represents a triangle); these illustrate that there is essentially no correlation (positive or negative) between the triangle angle ratio and area (a), or the angle ratio and the magnitude of the gradient (b). This is because angle ratio represents the triangle shape, while shape and size are two unrelated quantities (in this case). Additionally, the gradient is a function of the head observed at the wells, while the angle ratio is not affected by observed head. Figure 3-6c indicates a possible, but very weak, negative correlation between the size of triangles and the gradient

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magnitude. There is a greater density of wells within the WIPP LWB, where steeper gradients are observed; this trend is corrupted by the anomalous steep gradients associated with large triangles containing SNL-6 and SNL-15.

Based on this heuristic analysis, the angle ratio is thought to be an adequate primary metric for triangle quality. Triangle size is considered to be independent information, but it is not directly correlated with a desired monitoring network objective. While smaller triangles resolve more detail than larger ones, a dense network is much more expensive and large triangles are allowable in the portions of the domain further from the WIPP land withdrawal boundary. This metric obviously only considers the network geometry; there may be important hydrologic or geologic information to be gained from locating a well at locations which may be sub-optimal solely from a geometric point of view.

Freshwater head gradient direction and magnitude are illustrated in Figure 3-7 using vectors scaled to the gradient magnitude. Figure 3-7a shows the network for the 2007 Culebra monitoring network, while Figure 3-7b shows the remaining network after leaving out SNL-6 and SNL-15, which are non-representative of heads west of the composite H2/M2 – H3/M3 Rustler halite margins (Johnson, 2009). Leaving out these two wells removes the spurious large gradients around these wells, but also changes the overall shape of the network on the eastern third of the domain (see Figure 3-7).

Figure 3-8 and Figure 3-9 show the same quantities in Figure 3-5 and Figure 3-6 for the Delaunay triangles that correspond to the existing network without SNL-6 and SNL-15. Most of the triangles in the domain are unaffected by leaving these wells out, since only 10 triangles include either of these points in the existing network. Apparent changes elsewhere in the domain are due to rescaling of the color gradient in the figures, because the minimum or maximum values are linked to triangles changed by leaving out these two wells. The steeper gradient across the WIPP LWB is more evident in Figure 3-8c (due to color scaling). The negative correlation between area and gradient is also clearer in Figure 3-9c, as most of the large triangles with steep gradients were connected to the low values in either SNL-6 or SNL-15.

This section introduces the triangle interior angle ratio as a continuous metric that identifies isosceles-like triangles and is not spuriously correlated to triangle size or observed gradient between head observations at wells. Based on the comparison with and without SNL-6 and SNL-15, these wells are left out of any analysis that requires head values (i.e., the remove-one-well analysis)

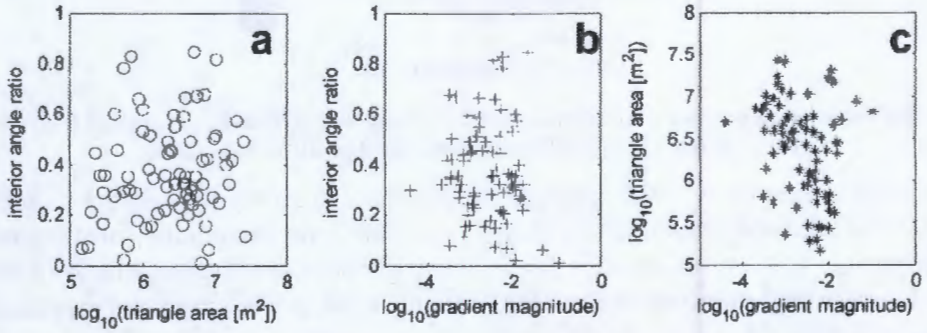

Figure 3-6. Scatter plots of relationships between different triangle metrics for 2007 Culebra well network.

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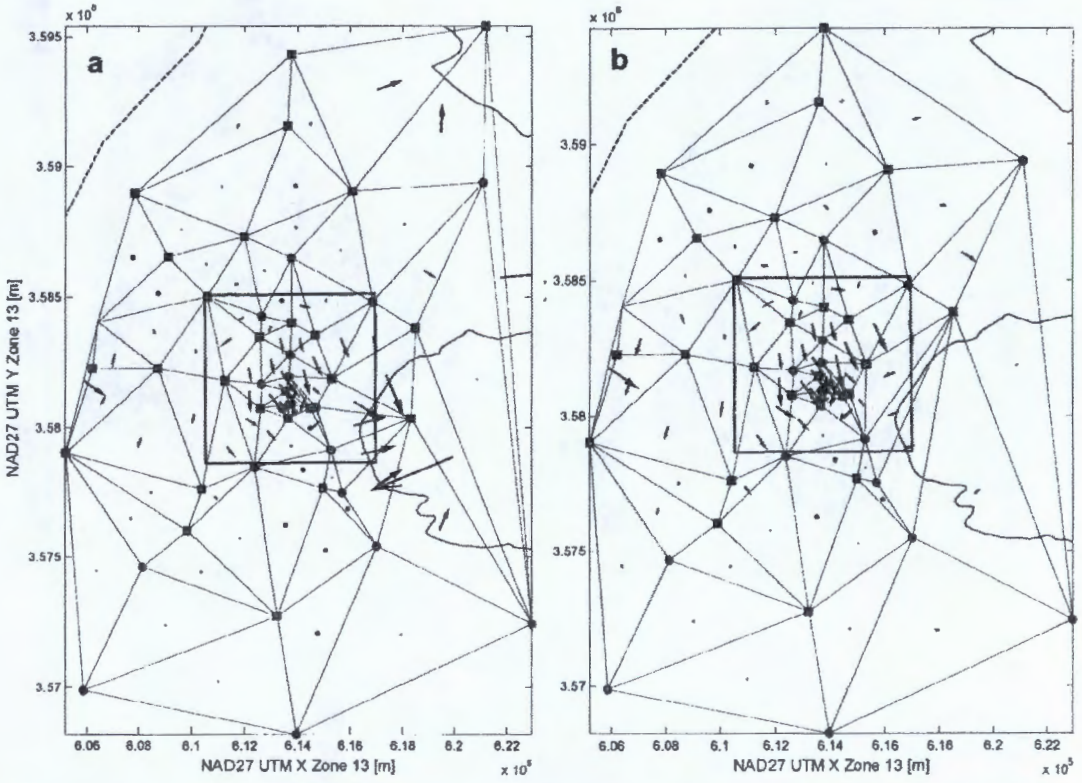

Figure 3-7. Delaunay triangles for 2007 Culebra network (a) with and (b) without SNL-6 and SNL-15. Gradient plotted as arrows (tails starting at center of triangle); length of arrow is proportional to magnitude gradient, arrow orientation indicates groundwater flow direction. WIPP LWB (black solid), M2/H2 - M3/H3 composite Rustler halite margins (magenta), and no-flow (black dashed) boundaries shown.

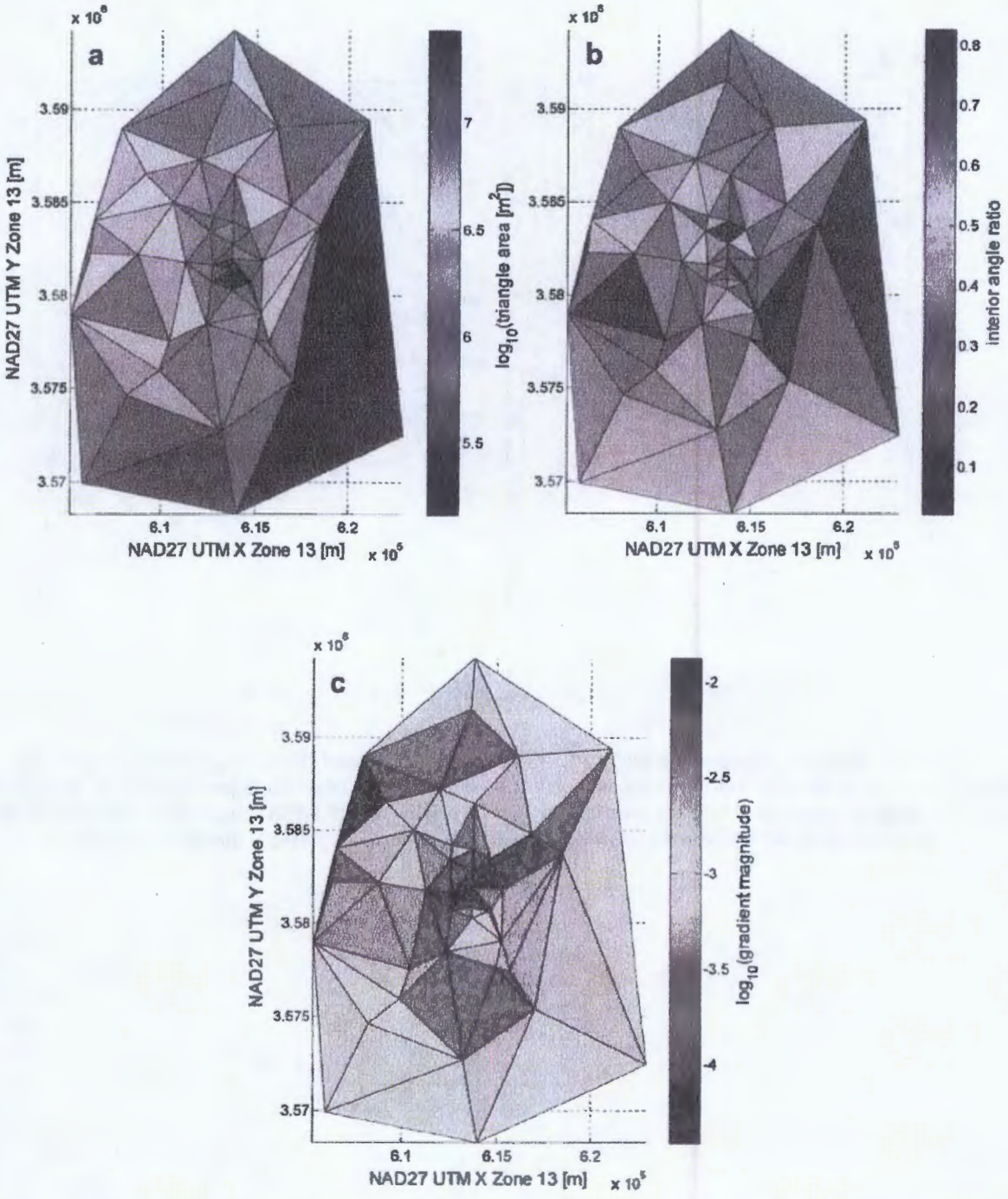

Figure 3-8. Distribution of triangle geometry metrics: (a)triangle size, (b) interior angle ratio, and (c) May 2007 freshwater head gradient magnitude for 2007 network without SNL-6 and SNL-15

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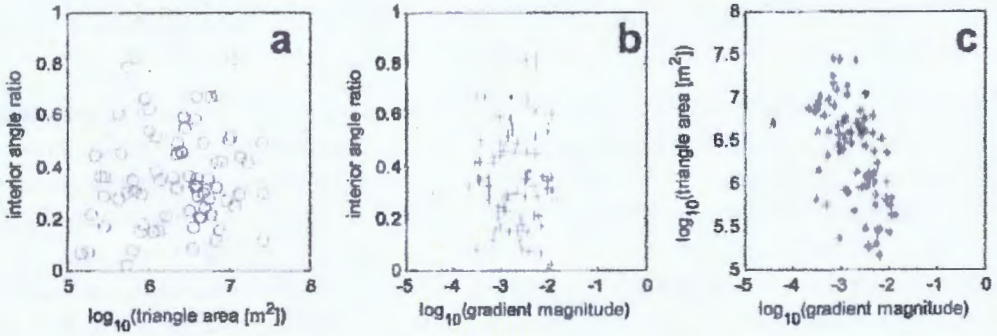

Figure 3-9. Scatter plots of relationships between different triangle metrics for 2007 network without SNL-6 and SNL-15.

3.3. Add One New Well

Similar to Section 2.4.1, we explore the effects of adding one more monitoring well to the network, but using the angle ratio metric discussed in the previous section. For each model cell in the Culebra MODFLOW model grid, a monitoring point is added, and the triangulation process is repeated. Statistics regarding the resulting triangular network are summarized in the following plots.

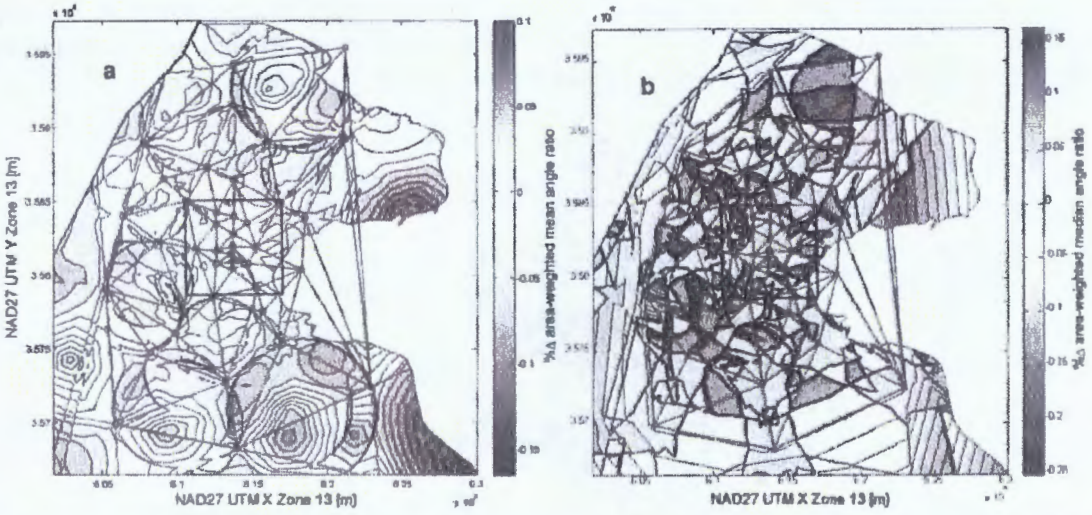

Figure 3-10. Increase (red) or decrease (blue) in area-weighted (a) median and (b) mean angle ratio for triangle network, due to one additional well.

The addition of an observation point can only be judged using geometry metrics, because the head that would be observed at the new location is yet unknown. Figure 3-10 shows the 2007 Culebra monitoring network (red circles are well locations, green lines are the Delaunay triangles for the 2007 Culebra well network). Contour colors indicate whether adding a well at that location and re-triangulating the network (not shown) would increase or decrease the interior angle ratio, averaged over the model domain.

The mean and median angle ratios shown in Figure 3-10 are weighted by triangle area. Each triangle's angle ratio is multiplied by its area, and then the mean or median of these products (for all the triangles in the network) is divided by the total area covered by the network. The total

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area inside the convex hull surrounding the whole network may increase if the proposed monitoring point is located outside the convex hull of the current network.

Areas that are blue in Figure 3-10 indicate locations where a new well would create additional large elongate triangles in the Delaunay network. Triangles with low angle ratios make poor estimators of the local gradient. Areas between wells in the southern and eastern parts of the domain show the largest relative increase (red) in both the mean and median triangle shape metric averaged across the model domain. The north-central portion of the domain shows a large positive increase in the median triangle shape metric, but not in the mean (the median is less sensitive to large changes in a single triangle, e.g., along the southern edge of the network). An additional monitoring point at a red location in Figure 3-10a or b would be the best in terms of the relative geometry of the resulting network. These locations change large elongate triangles into smaller triangles with three similar angles; smaller, more symmetric triangles are better for estimating local gradients, given the same relation between the observed gradient and measurement error.

McKenna and Wahi (2006) (and likewise the 2004 version of this analysis) performed statistical analyses of three-point estimators to evaluate their ability to estimate the gradient from three point measurements, as a function of the relative head measurement error (RHME), the orientation of the principle groundwater flow direction, and triangle shape. This analysis only takes the triangle shape or size into account. Triangles that are small and symmetric, but which cover an area of very low gradient magnitude may be bad estimators as well, given the current distribution of heads. This analysis only considers the geometry of the network.

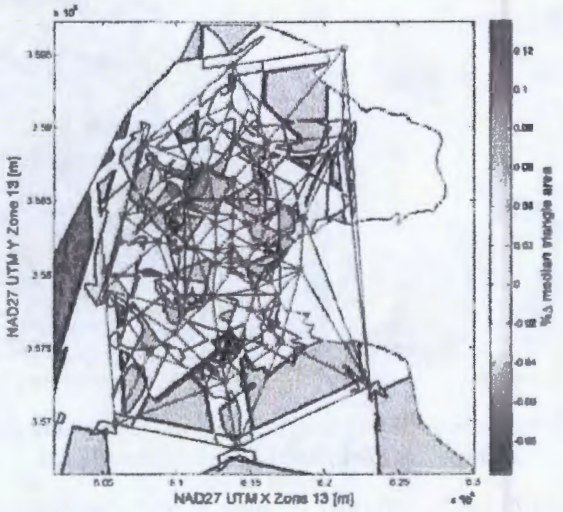

Figure 3-11. Increase (red) or decrease (blue) in median triangle area, due to including one additional well

In Figure 3-11, the relative change in the median triangle size is shown for the same scenario of adding one additional well to the network. Although triangle size is not the main metric, it shows different information from the angle ratio plot. Since adding a monitoring point to the network will always create more triangles, but the total network area will only change if the additional well is outside the original convex hull; Figure 3-11 shows whether the additional location will make nearby triangles smaller or larger. Most of the regions within and near the WIPP LWB are blue, indicating the triangles in the proposed network will on average become smaller, while new wells located at the extremities of the existing network will increase the

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median triangle size, especially the area along the southern end of the no-flow boundary (see bright red area in west-central portion of Figure 3-11).

Following common sense, Figure 3-11 shows that adding monitoring locations near the edges of the domain will add more large triangles to the existing network. Adding a point near the middle of the domain will instead add more small triangles to the existing network, since the density of wells inside the WIPP LWB is already high. This does not consider the fact that expanding the overall size of the monitoring network would likely add useful information, regardless of the network shape.

3.4. Remove One Steel Well

Compared to the addition of a new well, more can be said about the removal of a well from the network, since heads have been observed at the location proposed for removal. In this section, the effect of removing a well is computed by first copying the results of triangulation (which assigns a piecewise-constant gradient value to every point inside the convex hull) onto points corresponding to the centers of the finite-difference cells of the MODFLOW model grid. Only points in the MODFLOW grid which fall within the convex hull are compared.

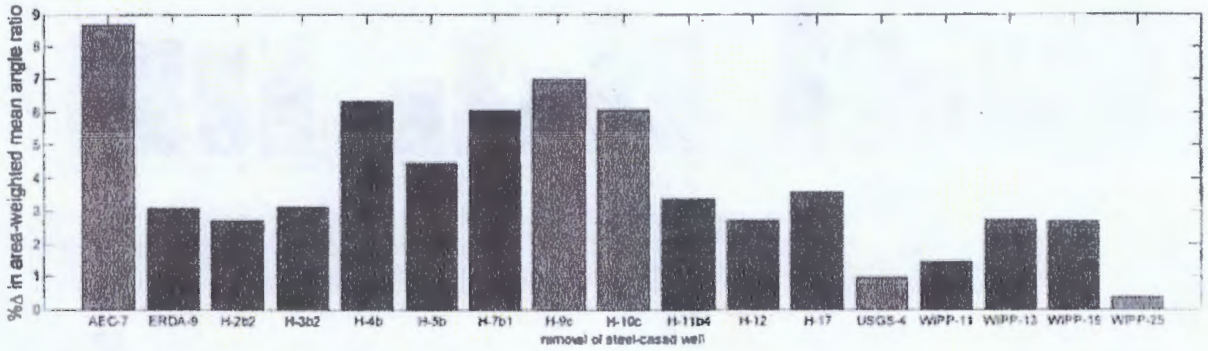

Figure 3-12. Change in mean area-weighted angle ratio (averaged over model domain) upon removal of each steel well from monitoring network (no SNL-6 or SNL-15). Red bars are wells located on convex hull.

In Figure 3-12, AEC-7 has the largest impact on the mean area-weighted angle ratio metric. Excluding the steel cased wells which form the boundary of the triangulation (shown in red) leaves H-4b, H-7b1, and H-5b with the largest impact, with wells USGS-4 and WIPP-25 having the smallest impact, even though they makeup part of the convex hull.

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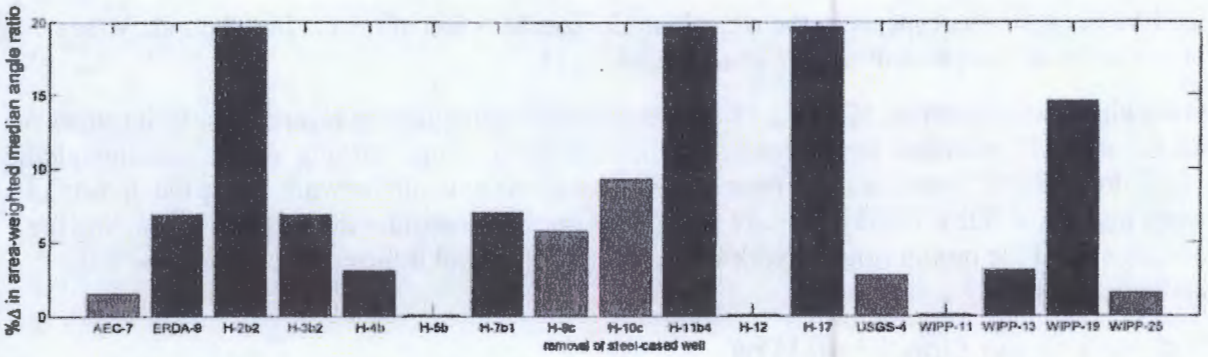

Figure 3-13. Change in median area-weighted angle ratio upon removal of each steel well from monitoring network (no SNL-6 or SNL-15).

In Figure 3-13 H-2b2, H-11b4 and H-17has the approximately the same impact on the median area-weighted angle ratio, but wells H-2b2, H-11b4 and WIPP-19 now also have large percent change values (compared to Figure 3-12). These two bar charts (Figure 3-12 and Figure 3-13) correspond to Figure 3-10 parts a and b for the case of removing one well to the network.

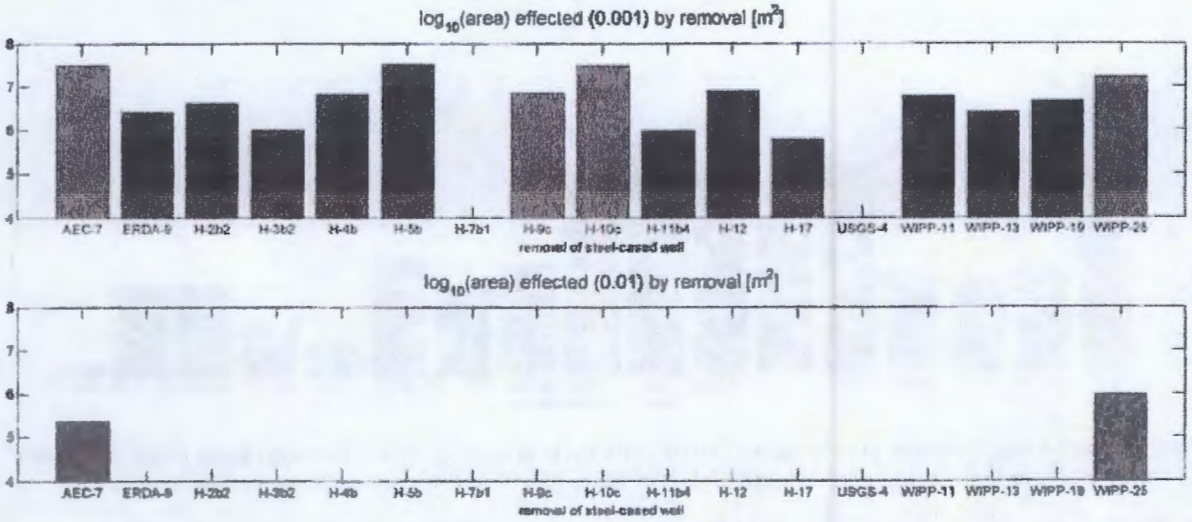

Figure 3-14. Area affected (Δ gradient magnitude ≥ 0.01) by removal of steel well

Figure 3-14 shows the area affected by the predicted change in gradient between the 2007 monitoring network and the reduced network with the corresponding steel-cased well removed. The changed area is defined as the area where the relative change in gradient magnitude is greater than or equal to 0.01 (lower figure) or 0.001 (upper figure). After removing each well, the Delaunay triangulation is recomputed, and the observed gradient is computed for each resulting triangle. The marked difference between the two bar charts in Figure 3-14 indicates that although there is a very large amount of area that would be slightly affected by removing any one steel well (large number of bars in the upper figure), there is very little of the model domain that would be significantly affected by any one well being removed (bottom figure).

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Table 3-1. Ranking of steel-cased wells based on triangle gradient estimators. A low numerical rank indicates importance.

	%Δ mean angle ratio		%Δ median angle ratio		average rank
H-17	3.58	7	19.61	1	4
H-10c	6.09	4	9.27	5	4.5
H-11b4	3.38	8	19.61	1	4.5
H-7b1	6.07	5	7.04	6	5.5
H-9c	7.02	2	5.75	9	5.5
H-2b2	2.73	12	19.61	1	6.5
H-4b	6.34	3	3.09	10	6.5
AEC-7	8.65	1	1.51	14	7.5
H-3b2	3.13	9	6.87	7	8
ERDA-9	3.09	10	6.87	7	8.5
WIPP-19	2.70	14	14.61	4	9
H-5b	4.47	6	0.00	16	11
WIPP-13	2.75	11	3.08	11	11
USGS-4	0.96	16	2.74	12	14
H-12	2.72	13	0.00	17	15
WIPP-11	1.44	15	0.00	15	15
WIPP-25	0.36	17	1.51	13	15

These bars represent the areas colored in the figures in the figures in Section 9.0. The individual figures in Section 9.0 show the localized effects of removing a well from the network; the colored areas only immediately surround the well being removed. The effects due to removing wells in areas with small triangles (e.g., inside and near the WIPP LWB) will obviously only propagate out to a small area. Wells that are part of large triangles along the periphery of the domain will affect larger areas when removed.

3.5. Remove Two Steel Wells

Using the same list of "probable" wells from section 2.4.3 (kriging variance reduction), the local gradient estimator analysis of the previous section can be repeated for each of the networks with one of the steel-cased wells already removed. Table 3-2 shows the cumulative effect that removing two steel-cased wells has on the domain-average mean angle ratio (see Figure 3-12 for the corresponding single-well analysis). The percent changes (illustrated in the color image) show that removing any pair of wells including H-10c (row 9) or most wells in a pair with well H-7b1 (row 7, column 4) lead to improvements in the geometric layout of the observation wells, because these wells are involved in several large elongate triangles. These types of improvements are not the goal of this analysis. Well H-9c (row 8) shows the largest decrease in the domain-average angle ratio metric, corresponding to the worst effects on the well network; this well is on the southern edge of the network.

Table 3-3 shows how median triangle size in the network increases (red) or decreases (blue) as pairs of steel-cased wells are removed from the network. Removing other steel-cased wells in conjunction with H-10c (row 9) would decrease average triangle size because the convex hull becomes smaller upon removal of this well.

Table 3-2. Change in domain-average mean angle ratio upon removal of 2 steel-cased wells. Image illustrates percentages given in table, in same row/column order.

		WIPP-25		WIPP-13		H-12		H-7b1	
1	AEC-7	3.7%	1	5.7%	1	5.7%	1	9.5%	1
2	ERDA-9	-1.4%	9	0.3%	9	0.2%	8	3.5%	8
3	H-2b2	-1.7%	11	-0.1%	10	-0.1%	10	3.2%	10
4	H-3b2	-1.4%	8	0.3%	8	0.3%	7	3.5%	7
5	H-4b	1.8%	2	3.4%	2	3.4%	2	6.7%	3
6	H-5b	-0.1%	5	1.6%	5	1.6%	4	4.8%	4
7	H-7b1	1.5%	3	3.2%	4	3.2%	3		
8	H-9c	-10.1%	16	-8.3%	16	-4.1%	16	-4.8%	16
9	H-10c	1.1%	4	3.2%	3	0.4%	6	7.3%	2
10	H-11b4	-1.1%	7	0.6%	7	0.5%	5	3.8%	6
11	H-12	-1.8%	12	-0.1%	11			3.2%	11
12	H-17	-0.9%	6	0.8%	6	-1.2%	12	4.0%	5
13	USGS-4	-3.7%	15	-1.8%	15	-1.8%	15	-3.9%	15
14	WIPP-11	-3.0%	14	-0.8%	13	-1.4%	13	1.9%	13
15	WIPP-13	-1.7%	10			-0.1%	9	3.2%	9
16	WIPP-19	-1.8%	13	-0.1%	12	-0.1%	11	3.1%	12
17	WIPP-25			-1.7%	14	-1.8%	14	1.5%	14

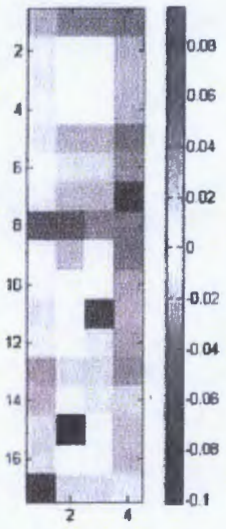
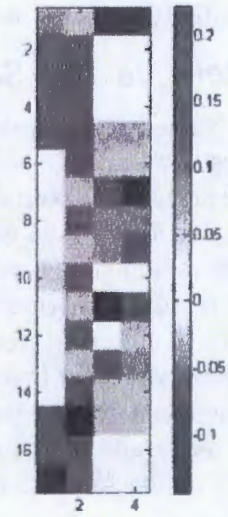


Table 3-3. Change in domain-average median triangle size upon removal of 2 steel-cased wells. Image illustrates percentages given in table, in same row/column order.

		WIPP-25		WIPP-13		H-12		H-7b1	
1	AEC-7	-5.2%	16	-3.4%	16	-14.4%	16	-14.4%	16
2	ERDA-9	15.2%	3	21.9%	2	0.0%	3	0.0%	3
3	H-2b2	15.2%	3	21.9%	2	0.0%	3	0.0%	3
4	H-3b2	15.2%	3	21.9%	2	0.0%	3	0.0%	3
5	H-4b	16.5%	1	22.1%	1	8.5%	1	8.5%	1
6	H-5b	1.7%	8	16.1%	8	-3.4%	10	-3.4%	9
7	H-7b1	-1.7%	12	6.7%	12	-8.3%	14		
8	H-9c	0.0%	11	15.2%	11	-5.2%	12	-5.2%	12
9	H-10c	-1.7%	12	6.7%	12	-5.2%	12	-8.3%	14
10	H-11b4	6.1%	7	15.9%	9	0.0%	3	0.0%	3
11	H-12	-1.7%	12	6.7%	12			-8.3%	14
12	H-17	1.7%	8	15.9%	9	0.0%	3	-3.4%	9
13	USGS-4	-1.7%	12	6.7%	12	-8.3%	14	-5.2%	12
14	WIPP-11	1.7%	8	21.3%	6	-3.4%	10	-3.4%	9
15	WIPP-13	16.5%	1			6.7%	2	6.7%	2
16	WIPP-19	15.2%	3	21.9%	2	0.0%	3	0.0%	3
17	WIPP-25			16.5%	7	-1.7%	9	-1.7%	8



3.6. Local Gradient Estimator Summary

The local gradient estimator analysis presented in this section considers the effects of adding a well and removing a well or two, from the perspective of the network and head gradient estimation geometry. The metric which was used to compare potential triangular networks was

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mainly the ratio of the maximum and minimum angles, with the median triangle size used as a secondary metric.

3.7. Local Gradient Estimator Run Control Summary

The local gradient estimator analysis performed in this section is described here in terms of files, programs, and scripts used. The required files are on the CD and are described in sufficient detail to allow recreation of the results given in the text. All the analysis in this section was done using MATLAB, and the calculation and plotting of results are partially mixed together in the scripts.

3.7.1. Triangles: add a well

The MATLAB script `triangles_add_one.m` (Section 8.3.1) is the main script that performs the calculations for the evaluation of additional locations in terms of Delaunay triangles. This section describes the script's basic behavior. The first lines of this script load in the required data from files (lines 1 to 30). A rectangular array of x and y locations (UTM NAD27 Zone 13 [m]) are created using `meshgrid()` (lines 32 through 34), which is then compared to the polygon defining the active model domain using `inpolygon()` (line 36), to determine the cells that are inside the active MODFLOW domain. These matrices are then unwrapped into vectors to simplify indexing (line 40).

The main loop of this script (lines 45 through 111) goes over each potential new location (plus one for the base case with no additional monitoring locations), re-triangulating the network (line 59). The results of `delaunay()` is a matrix with three columns corresponding to the three vertices of each triangle, and a row for each triangle. The values in this matrix are integer indices pointing to the values of the x and y coordinates passed to `delaunay()`. For example, if `tri=delaunay(x,y)`, where `x` and `y` are each a vector of 3 locations, `tri` will be a 1×3 matrix, where the corners of the triangle specified by the first (and only) row of `tri` are obtained addressed like `x(tri(1,[1,2,3])), y(tri(1,[1,2,3]))`. The `geom` matrix stores the results of the geometric calculations for each triangle in the network; rows 1-3 are the lengths of the sides (computed using the Pythagorean theorem – lines 70 to 77), rows 4-6 are the angles between the sides (computed using the cosine law – lines 80 to 87), and row 7 is the area of the triangle (computed using the built-in MATLAB function `polyarea()` – line 90). The interior angle ratio is computed from the maximum and minimum interior angles (line 93). Some summary statistics regarding the entire triangle network are saved into the matrix `Q`; the area-weighted angle ratio average and median are computed, as wells as the average and median triangle size are computed (lines 95 to 109).

After looping over all possible locations, the matrix `Q` contains different average results for each point in the domain that is inside the active MODFLOW flow domain. The results for the existing Culebra network with (Figure 3-5, Figure 3-6, and Figure 3-7) and without SNL-6 and SNL-15 (Figure 3-7, Figure 3-8, and Figure 3-9) were plotted from the `geom` matrix, for the case with no additional wells.

These summarizing results (`Q` matrix) are saved to ASCII file (lines 116 to 123 – see files in `analysis\triangle_metric\output\` directory on CD) and plotted to make color contour maps shown in Figure 3-10, and Figure 3-11.

The MATLAB script `redwhitemap.m` (see Section 8.3.2) is used by the `triangles_add_one.m` script just described, to create a color legend corresponding to blue being negative, red being positive and white being zero, based on a vector of data passed. This script only is used for creating a colormap for plotting figures in MATLAB, but is included here for completeness.

3.7.2. Triangles: removal steel-cased wells

The `triangles_remove_one.m` MATLAB script (Section 8.3.3) does much of the same that the `triangles_add_one.m` script in the previous section did, but it also computes things related to the freshwater head gradient across triangles between wells.

Similar to the previous triangle metric script, the first portion of the script loads data from file (lines 8 to 34), but here a series of nested for loops are used to find the wells on the convex hull (for marking them in the bar chart figures – lines 38 to 46). The main loop of the script re-computes the metrics related to the triangle, removing a different steel-cased well each time through the loop. In addition to geometry metrics related to the triangles (`geom` and `Q` matrices, line 144 through 176), the gradient defined by the freshwater head observed at the three corners of the triangles is also computed using Cramer's rule and saved into the `coeff` matrix (lines 98 to 122).

The gradient estimates are individual values for each triangle in the network (piecewise constant), but to compare the effects of removing a well from the network, which will result in a different network, the values are copied onto a 100 m square grid at each step (lines 125 to 136). This is done by cycling through the triangles in the network (typically about 30 or 40 triangles), each time selecting the cells from the 100 m square grid that are inside the triangle (using `inpolygon()`), assigning the gradient from the triangle to all the cells that fall inside it. The rest of the script is used to plot figures for the analysis report (Figure 3-12, Figure 3-13, and Figure 3-14, and the figures in Section 9.0), using the data computed in the main loop.

The `triangles_remove_two.m` MATLAB script does essentially the same thing as the remove-one script, but takes a list of four "likely to be P&Aed" wells, removing each of these first, then doing the remove-one-well process outlined above. The matrices resulting from this script are made into Table 3-2 and Table 3-3.

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4.0 Model Correlation Analysis

In addition to the variance reduction and local gradient estimator approaches to monitoring network design, a third approach is used here to incorporate uncertainty captured in the performance assessment (PA) simulation into the monitoring network design. These calculations also incorporate recent updates in the geologic conceptual model and the influence of these updates on the spatial distribution of transmissivity within the Culebra. These recent updates in the geologic conceptual model have been used to produce the base transmissivity fields used in this study and are summarized in the Culebra T-fields summary report (Kuhlman, 2010b).

4.1. Background

The goal of this portion of the report is to include a third independent metric in the overall optimization that specifically addresses the PA monitoring network design goal of providing head and aquifer transmissivity data for defensible calibration of PA models. Additionally, the approach developed here specifically incorporates PA information in the form of groundwater travel times from the repository area to the boundaries of the WIPP LWB. This approach makes use of the existing ensemble of calibrated transmissivity fields (Hart et al., 2009) such that no additional groundwater flow and/or transport modeling is necessary.

4.2. Calculating Sensitivity Coefficients

The sensitivity of model outputs to changes in model inputs arises in the calibration, uncertainty analysis, and cost optimization of both analytic and numerical models. A model can range in complexity from a linear analytic expression to a complex numerical model. In general, a sensitivity coefficient, S, is calculated as the partial derivative of a model output with respect to each model input parameter:

$$S_{ij} = \frac{\partial O_i}{\partial P_j} \tag{10}$$

where S_{ij} is the sensitivity coefficient of the model prediction, O, at the ith observation point to the jth model parameter, P_j. S_{ij} is an $n \times m$ matrix (i.e., the Jacobian matrix) with the number of rows equal to the number of model parameters (n) and the number of columns equal to the number of observations (m) (Zheng and Bennett, 2002). S_{ij} is often given in a normalized or dimensionless form, through appropriate scaling factors; this matrix often plays a key role in parameter estimation techniques such as in the conjugate gradient, Newton iteration, or Levenberg-Marquard algorithms.

4.2.1. Sensitivity Equation Method

The expression governing the process which controls how parameters (P_j) are related to outputs (O_i) can sometimes be differentiated using calculus. This method is usually only applicable to simple lumped-parameter or analytic equation models. Although this approach is quite problem-specific, it leads to closed-form expressions for the sensitivity matrix. The form of the sensitivity equations often provides insight to the underlying process without needing to evaluate the problem for specific parameter values. Because the PA model considered here is an

ensemble of calibrated MODFLOW models with irregular distribution of parameters and boundary conditions, this analytic sensitivity equation approach is infeasible.

4.2.2. Perturbation Approach

The derivative in Equation (10) can be approximated using finite differences. A small perturbation is made in a single model input (ΔP_j), leading to a set of perturbed model outputs which are differenced with model predictions from a base case $O_i(P_j)$, and normalized by the change in the parameter.

$$S_{ij} = \frac{\partial O_i}{\partial P_j} \approx \frac{O_i(P_j + \Delta P_j) - O_i(P_j)}{\Delta P_j} \tag{11}$$

This is the most generally-applicable and widely-used approach to estimating sensitivity coefficients; for example, this is the approach taken in inverse-modeling codes such as PEST (Doherty, 2002).

If a model has n parameters for which sensitivity information is desired, then at least n+1 model runs must be performed to compute the one-sided finite difference given in Equation (11). For higher-order accuracy, often $2n$+1 model runs can be used to estimate derivatives via centered finite differences. For large highly-parameterized models (i.e., thousands of parameters or more), the perturbation approach often leads to unmanageably large computing demands. For the inverse problem, there are many approaches for either reducing the number of parameters which require derivatives; e.g., pilot points and singular value decomposition are both methods used with PEST in the WIPP Culebra PA model calibration (Hart et al., 2009).

When working with an ensemble of independent calibrated models, S_{ij} is computed separately for each realization, and then ensemble sensitivity can be computed by appropriately averaging across the realizations. Although this approach was used to calibrate the PA models and the resulting PEST-computed sensitivity matrices (i.e., Jacobians) are saved in CVS, this approach was not used due to two complications. First, the sensitivities in the MODFLOW model are computed between observed heads and pilot point values (not particle travel times to individual parameter values in the model grid). Second, these sensitivity matrices were only computed at the beginning of the calibration, due to the use of the singular value decomposition, which works with "super pilot points" rather than the pilot points themselves.

4.2.3. Adjoint Sensitivity Approach

An alternate approach to computing S_{ij} using finite differences is the use of the adjoint sensitivity equations, where a system of adjoint equations are derived (similar in form to the diffusion equation) and solved using the same model grid with modified boundary conditions and source terms. The sensitivity coefficients are related directly to the adjoint variable, rather than the main variable (typically head or pressure). Although this method is very problem-specific, it has the advantage of making the number of model runs needed to compute S_{ij} proportional to the number of model predictions or observations (m), rather than the number of model parameters (n) (see e.g., Sykes et al., (1985) (1985)). The adjoint approach was used at WIPP during the CCA, in the GRASPII inverse modeling code (see e.g., RamaRao and Reeves (1990)).

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Like the perturbation-based approach, the adjoint method works independently on each realization, requiring appropriate averaging across realizations to develop ensemble-based estimates of parameter sensitivity to model predictions.

4.2.4. Sampling-Based Correlation Approach

In the three sensitivity calculation approaches outlined above, the changes in model predictions, due to perturbing each parameter are kept separate; the derivative in Equation 10 is a partial derivative indicating all other independent variables are held constant while each P_j is varied. Individually perturbing each of the model parameters has the benefit of isolating each parameter's effects on the model predictions, but it demands a large number of forward model runs to fill in the large sensitivity matrix. For the WIPP Culebra PA flow model, we have an existing ensemble of calibrated model realizations, which can be used to statistically investigate the correlation between input parameters and the predictions in a post-mortem sense, after all the model runs are finished. The previous three approaches were for a single realization, requiring averaging to reach an ensemble average; the correlation-based approach uses all the realizations to develop a proxy for sensitivity applicable to the WIPP PA model results.

The correlation-based approach used here begins with an ensemble of 100 calibrated models and the metric for relative importance of one model parameter over another is the parameter's correlation with the model prediction, across the ensemble of model realizations.

Each of the 100 simulations associated with the calibrated T-fields prepared for CRA 2009 PABC (Hart et al., 2009) is a realization where all the parameters are "perturbed" together, rather than individually perturbing parameters by ΔP_j. For a given element in the Culebra flow model, there are 100 values of each parameter (e.g., transmissivity); a histogram of $\log_{10}(K_{eff})$ in a cell south of the WIPP site, and histogram of the travel time to the WIPP LWB are plotted across all 100 realizations in Figure 4-1.

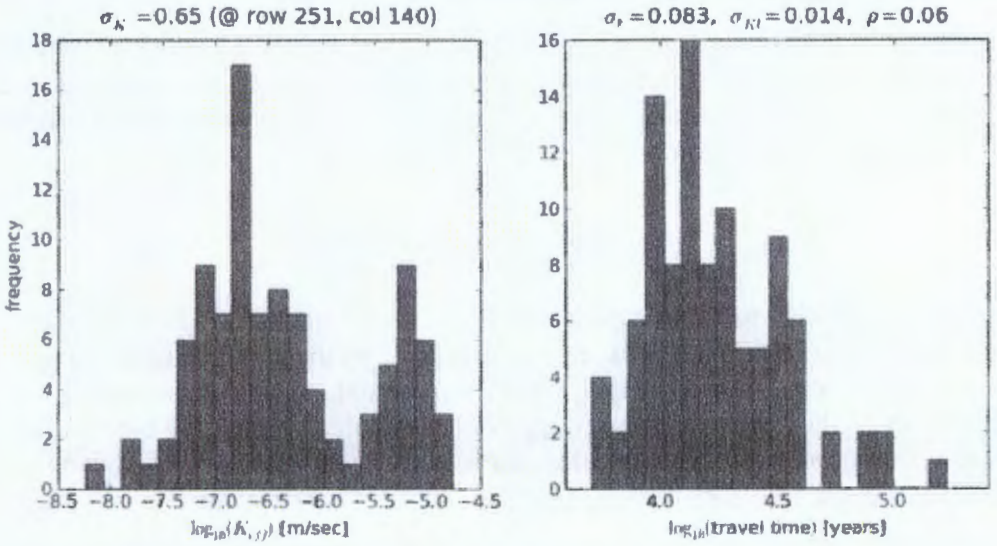

Figure 4-1. Example histograms of a model parameter ($\log_{10}(K_{eff})$) at a particular cell and model prediction ($\log_{10}$(travel time to WIPP LWB)) across all 100 realizations.

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The ensemble correlation approach requires multiple calibrated model realizations, and therefore captures some of the uncertainty captured by the ensemble of models. This is in contrast with the perturbation or adjoint sensitivity approaches which take one calibrated model and use it to estimate parameter sensitivity (essentially assuming a linear approximation of the actual model). To capture the uncertainty given by the ensemble, the perturbation sensitivity approach would have to be performed for each realization of the ensemble – a computationally exasperating process (tens of thousands of individual parameters in each of hundreds of models, with potentially long run-times for each forward run).

McKenna (2004) compared sensitivity coefficients computed using the sampling correlation approach for 100 realizations to those computed with the perturbation sensitivity approach for a single realization, and found that they were similarly but not identically distributed. Although in the sampling-based approach it is not possible to completely differentiate between true and spurious correlations (partial correlation does account for some of this in a statistical sense), the approach is used here based on its computational feasibility and the availability of the 100 realizations.

As opposed to S_{ij}, which is the slope of the linearized relationship between model inputs and outputs, the correlation coefficient, ρ, is a measure of the quality of the linear relationship between two variables (regardless of slope). The correlation coefficient is given by

$$\rho_{PO} = \frac{\frac{1}{n}\sum_{i=1}^{n}(P_i - m_P)(O_i - m_O)}{\sigma_O \sigma_P} = \frac{\sigma_{PO}}{\sigma_O \sigma_P} \tag{12}$$

Where σ_P is the variance of the parameter P, m_P and m_O are the means of P and O respectively, σ_O is the variance of the observation O, and σ_{PO} is the covariance between P and O. ρ indicates the portion of the variance of O which is explained by the variance in P, through an assumed linear relationship (e.g., see Isaaks and Srivastava, (1989), Chapter 3).

When there is more than one free parameter varied at a time, partial correlation is defined as the correlation attributable to a single variable, statistically holding others constant (e.g., see Helton, et al., (2006) §6.4). Partial correlation is demonstrated for the case where a third variable Z is introduced into the problem illustrated in Equation (12);

$$\rho_{PO.Z} = \frac{\rho_{PO} - \rho_{PZ}\rho_{OZ}}{\sqrt{(1-\rho_{PZ}^2)(1-\rho_{OZ}^2)}} \tag{13}$$

where the variables to the right of the dot in the subscript are statistically held constant. This expression reduces the correlation between two variables, by the amount attributed to the spurious correlation between both variables and a third one (here Z). When dealing with more than three variables, there are two primary approaches to computing partial correlation. Conceptually, the simplest is a recursive definition, which is an extension of Equation (13) (e.g., (Spiegel and Stephens, 1999), chapter 15),

$$\rho_{PO.YZ} = \frac{\rho_{PO.Z} - \rho_{PY.Z}\rho_{OY.Z}}{\sqrt{(1-\rho_{PY.Z}^2)(1-\rho_{OY.Z}^2)}} = \frac{\rho_{PO.Y} - \rho_{PZ.Y}\rho_{OZ.Y}}{\sqrt{(1-\rho_{PZ.Y}^2)(1-\rho_{OZ.Y}^2)}} \tag{14}$$

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but this recursive approach becomes difficult to compute as the number of variables gets above 4 or 5 (being impossible for hundreds or thousands of variables as in the case for the WIPP model). An alternate definition of Equation (14), in terms of correlation matrices is

$$\rho_{ij.(k\neq i,j)} = \frac{-a_{ij}}{\sqrt{a_{ii}\, a_{jj}}} \tag{15}$$

where $\rho_{ij.(k\neq i,j)}$ is the partial correlation of variables i and j, accounting for the effects of all other variables; a_{ij} is the matrix inverse of the symmetric correlation matrix C, which in the 3×3 case is

$$C = -\begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{21} & 1 & \rho_{23} \\ \rho_{31} & \rho_{32} & 1 \end{bmatrix} \tag{16}$$

Often C can be poorly scaled and computing partial correlation due to many variables can be numerically unstable, as C can be nearly singular and therefore has an ill-defined inverse. The COTS statistical software R includes an implementation (cor2pcor) which computes partial correlation of systems with many variables, utilizing a numerically stable pseudo-inverse approach, automatically scaling the matrices to improve stability. Even though the improved numerical approaches help, the matrix-based approach is intractable for very large problems, because a $n \times n$ matrix must be made (where n is the number of active parameters, here over 50,000) in memory; even for single-precision variables this is on the order of a 30-gigabyte matrix. A comparison is made between regular and partial correlation in the results section, using only the area immediately surrounding the WIPP site.

4.3. Model Correlation Results

The calibration of the 100 T fields to steady-state and transient heads did not incorporate the groundwater travel time as an estimation variable. The travel time from the center of the WIPP panels (also the location of the Culebra well C-2737) to the WIPP LWB was a separate calculation done after the T fields were calibrated; see Figure 4-2 for the travel times and Figure 4-3 for the particle tracks across all 100 realizations.

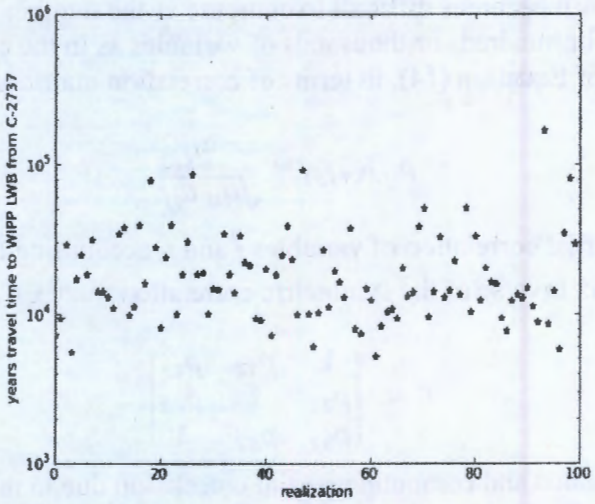

Figure 4-2. Travel times to WIPP LWB for conservative particle (non-dispersive, reactive, with no decay) for 100 realizations used in correlation analysis

The sampling-based sensitivity approach was applied to the results of the 100 calibrated T fields and used to determine the sensitivity of the groundwater travel time to the WIPP boundary with respect to the simulated heads, and effective hydraulic conductivity K_{eff} (the geometric mean of the x- and y-direction hydraulic conductivities),

(17)

where A is the horizontal hydraulic conductivity anisotropy and $K_y=K_xA$. Transmissivity (T) and hydraulic conductivity (K) differ in the Culebra MODFLOW model by a constant thickness, which does not affect correlation calculations. The distribution of K_{eff}, including the mean and standard deviation, across all 100 realizations is plotted in Figure 4-4. The results of these calculations for the K_{eff} are shown in Figure 4-5. Nearly all the wells shown in Figure 4-5 were used in the calibration of the K_{eff} parameter fields (except AEC-7 – see discussion in Section 1.5).

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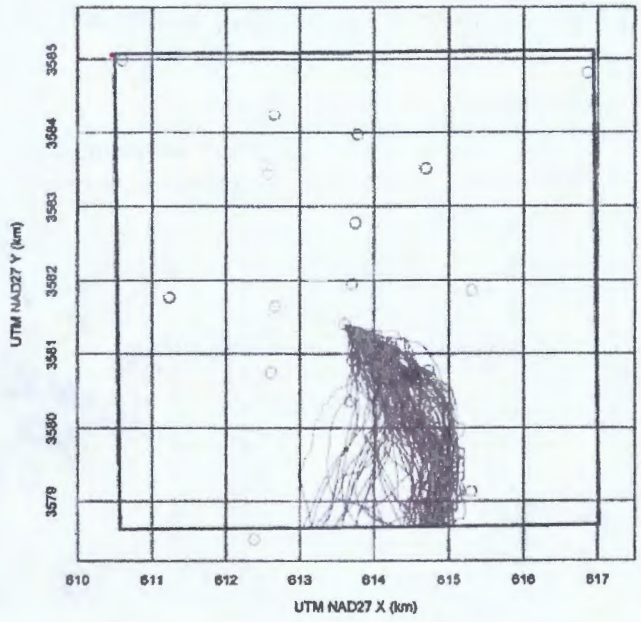

Figure 4-3. Marked water particle tracks from each of the 100 realizations; each track goes from the release point at C-2737 to the WIPP LWB (heavy black square). Green circles are Culebra monitoring wells.

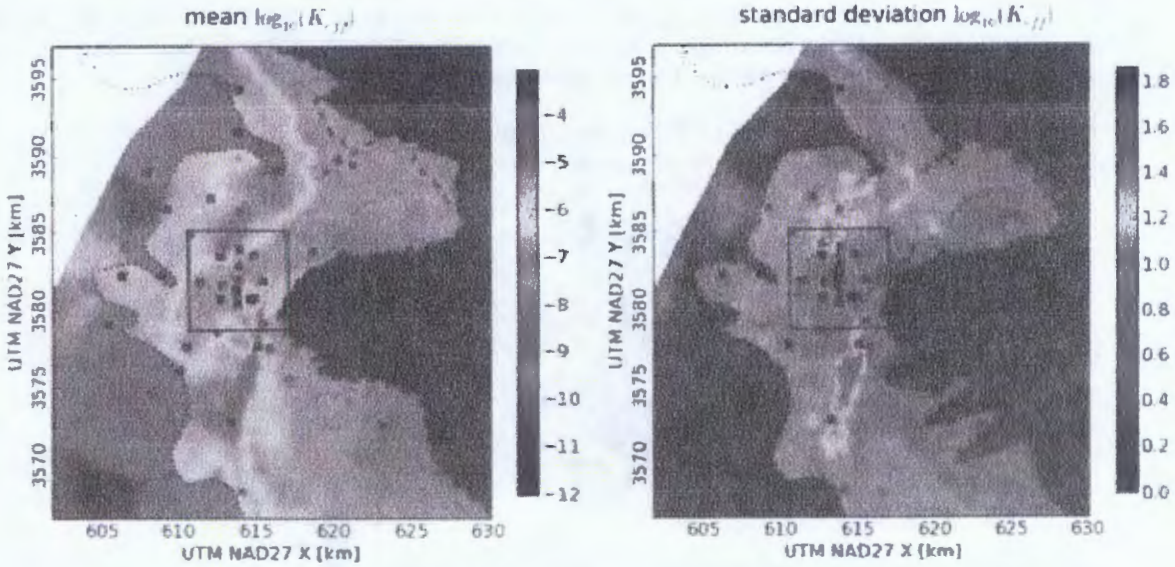

Figure 4-4. Mean and standard deviation of $\log_{10}(K_{eff})$ across all 100 realizations

The correlation results for K_{eff} (see Figure 4-5) show that the magnitudes of the correlation coefficients are not very large in most areas, signifying weak to moderate correlation, both positive and negative, between the travel time to the WIPP boundary and K values used in the model to calculate those travel times. However, the results clearly show regions of relatively higher and lower travel time sensitivity to the two input parameters. The partial correlation statistic (see Figure 4-6) is computed for K_{eff} in each element near the WIPP LWB, accounting for cross-correlation between each element and all other K_{eff} values in the vicinity of WIPP (within 1.5 km of the LWB). Although there are small differences in the distribution of the partial and standard correlation coefficients, the main difference is the absolute value. The

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partial correlation coefficient is approximately 100 times smaller than the standard correlation coefficient.

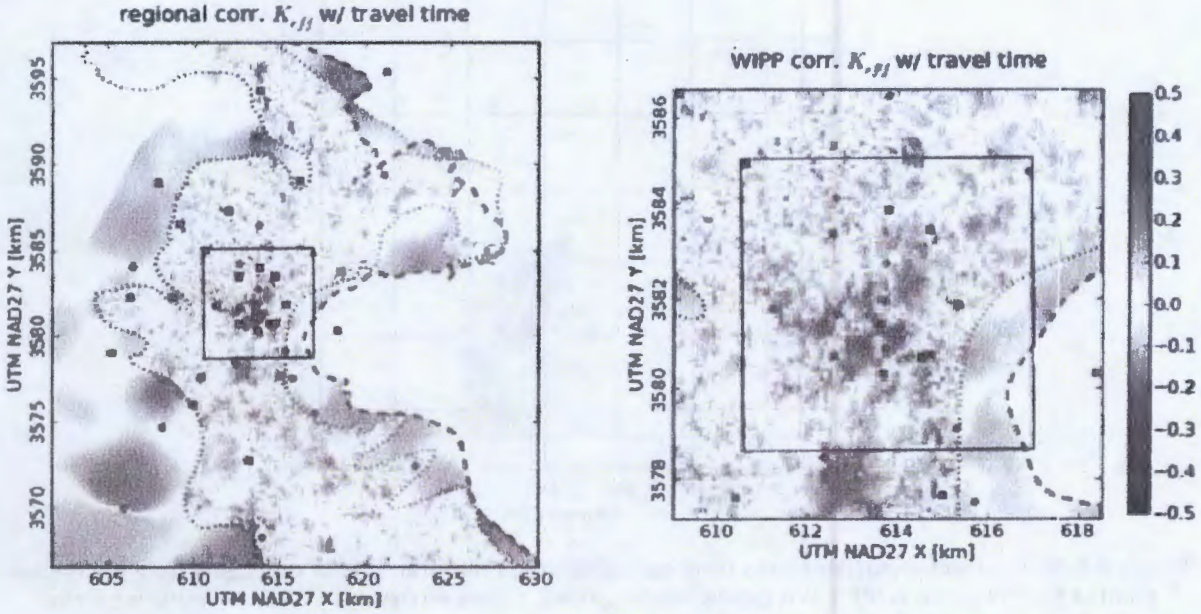

Figure 4-5. Correlation coefficient between $\log_{10}(K_{eff})$ and $\log_{10}$ travel time to WIPP LWB. Steel-cased wells are red circles; fiberglass-cased wells are green squares. Salado dissolution and Rustler halite margins are indicated with dashed lines. Plot on right contains same data plotted on left.

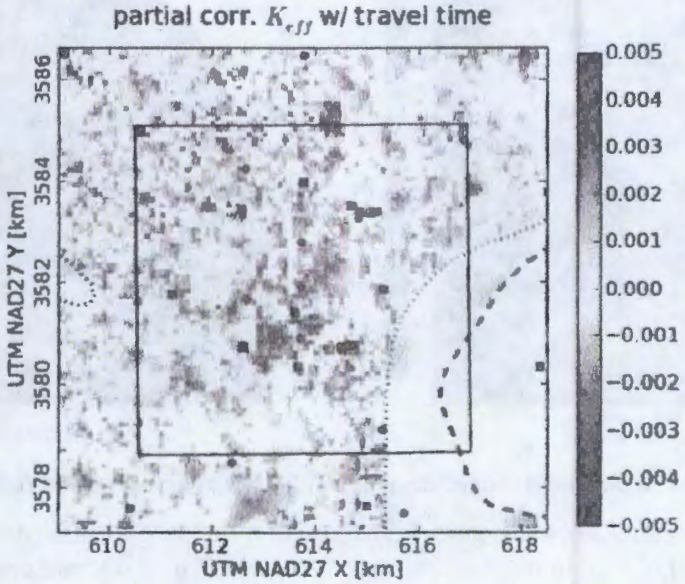

Figure 4-6. Partial correlation between log10(K_{eff}) and $\log_{10}$(travel time) to WIPP LWB

The distribution of model-generated head, across all 100 realizations, is shown in Figure 4-7; here the $\log_{10}$ of the standard deviation is plotted to emphasize the variation in the head across the WIPP LWB. It is interesting to note that visually, areas with the highest variability in K_{eff}

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(Figure 4-4) – one of the main inputs to the Culebra flow model – do not correlate with areas of the highest variability in head (Figure 4-7).

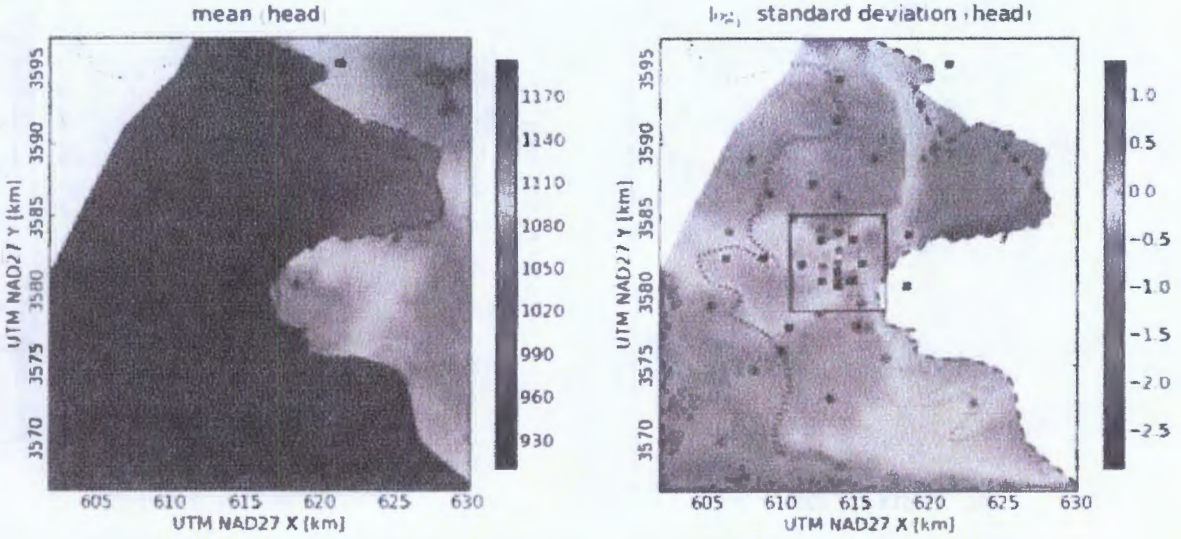

Figure 4-7. Mean and $\log_{10}$ standard deviation of model-simulated head across all 100 realizations

Figure 4-8 shows correlation of $\log_{10}$ model-predicted travel time to model-predicted head (output vs. output); this field is much more smoothly varying than the map of correlation between $\log_{10}$ travel time and K_{eff} (output vs. input). These results are consistent with the difference between model outputs (which must obey the diffusion equation) and the model outputs (which only are forced to have certain geostatistical structure, but are otherwise random).

The partial correlation statistic between model-generated heads and travel times is given in Figure 4-9. Like K_{eff} to travel-time correlation, the partial correlation coefficient is much smaller, but the difference here is only a factor of approximately 30, rather than 100.

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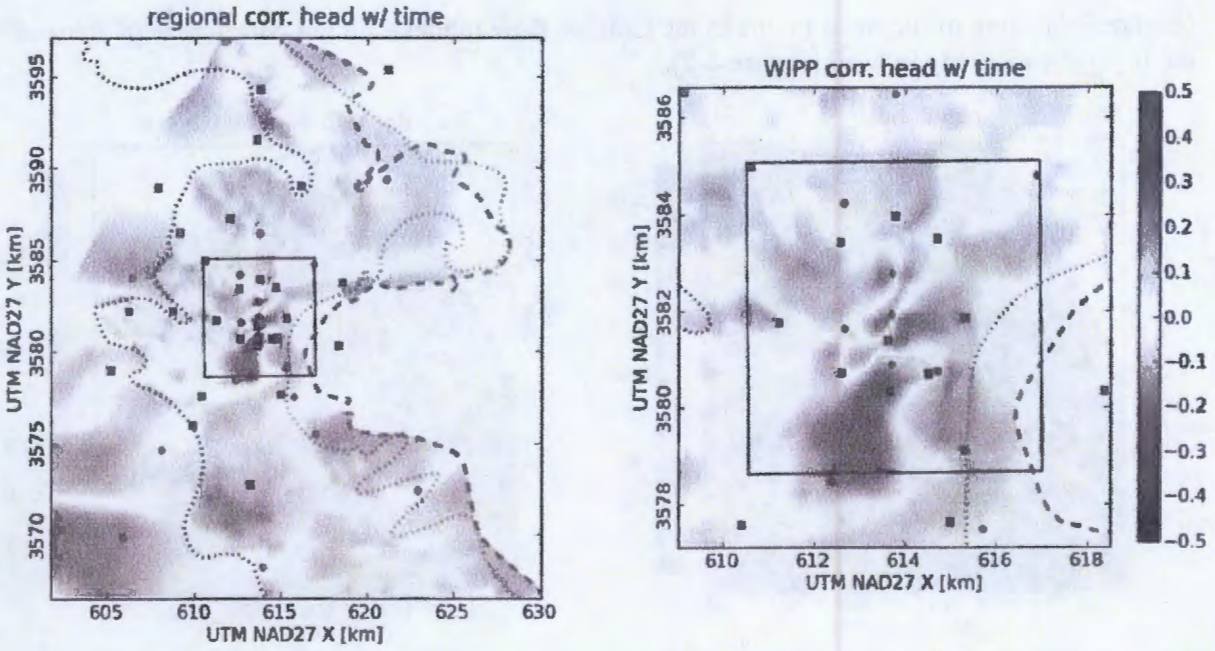

Figure 4-8. Correlation coefficient between model-predicted heads and $\log_{10}$(travel time) to WIPP LWB. Plot on right contains same data plotted on left.

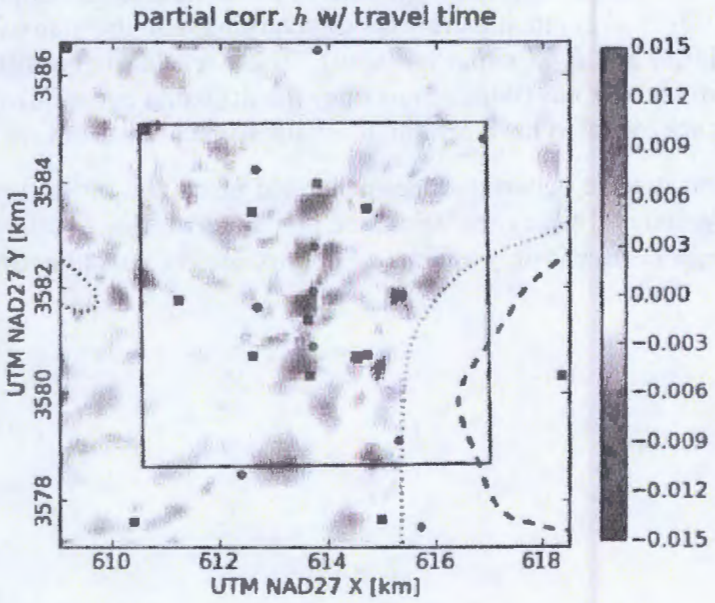

Figure 4-9. Partial correlation coefficient between model-predicted heads and $\log_{10}$(travel time) to WIPP LWB.

The model correlation analysis is the only one of the three given in this report which is not sensitive to the clustering of existing wells. Aside from the fact that the model was calibrated with data collected at the wells, the location of the individual Culebra monitoring wells and model correlation to inputs or output are largely de-coupled. The locations of highest model input/output correlation might occur adjacent to existing monitoring wells.

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4.4. Remove One Steel Well

The results of the sampling-based correlation analysis are sampled at locations across the model domain, corresponding to the locations of existing steel-cased wells. The results of this are given in Table 4-1, where the numbers are simply the numerical values sampled from the images of correlation results shown in Figure 4-5 and Figure 4-8.

Table 4-1. Correlation-based analysis results at locations of steel-cased wells. A smaller rank number indicates a higher correlation and therefore assumed importance.

	ρK_{eff}	$\lvert\rho K_{eff}\rvert$	rank	ρ head	$\lvert\rho$ head$\rvert$	rank	avg rank
ERDA-9	-2.989×10^{-1}	2.989×10^{-1}	1	-2.050×10^{-1}	2.050×10^{-1}	2	1.5
H-3b2	-9.670×10^{-2}	9.670×10^{-2}	6	-1.936×10^{-1}	1.936×10^{-1}	3	4.5
WIPP-19	-9.941×10^{-2}	9.941×10^{-2}	5	1.885×10^{-1}	1.885×10^{-1}	5	5
H-12	1.553×10^{-1}	1.553×10^{-1}	3	-1.462×10^{-1}	1.462×10^{-1}	8	5.5
WIPP-11	1.502×10^{-1}	1.502×10^{-1}	4	-9.576×10^{-2}	9.576×10^{-2}	9	6.5
WIPP-13	2.199×10^{-1}	2.199×10^{-1}	2	-6.001×10^{-2}	6.001×10^{-2}	11	6.5
WIPP-25	-4.109×10^{-2}	4.109×10^{-2}	13	2.250×10^{-1}	2.250×10^{-1}	1	7
USGS-4	-5.631×10^{-2}	5.631×10^{-2}	11	-1.931×10^{-1}	1.931×10^{-1}	4	7.5
AEC-7	7.392×10^{-2}	7.392×10^{-2}	8	7.241×10^{-2}	7.241×10^{-2}	10	9
H-11b4	-5.339×10^{-2}	5.339×10^{-2}	12	1.734×10^{-1}	1.734×10^{-1}	6	9
H-4b	3.852×10^{-2}	3.852×10^{-2}	14	-1.627×10^{-1}	1.627×10^{-1}	7	10.5
H-5b	-7.394×10^{-2}	7.394×10^{-2}	7	1.670×10^{-4}	1.670×10^{-4}	17	12
H-10c	6.302×10^{-2}	6.302×10^{-2}	9	-1.243×10^{-2}	1.243×10^{-2}	16	12.5
H-17	5.662×10^{-2}	5.662×10^{-2}	10	3.295×10^{-2}	3.295×10^{-2}	15	12.5
H-7b1	-1.089×10^{-2}	1.089×10^{-2}	16	5.448×10^{-2}	5.448×10^{-2}	12	14
H-9c	-2.776×10^{-2}	2.776×10^{-2}	15	5.202×10^{-2}	5.202×10^{-2}	13	14
H-2b2	2.715×10^{-3}	2.715×10^{-3}	17	3.768×10^{-2}	3.768×10^{-2}	14	15.5

The results in Table 4-1 are sorted by the average rank between the steel-cased wells for the K_{eff} / $\log_{10}$ travel time correlation (see Figure 4-5) and the head / $\log_{10}$ travel time correlation (see Figure 4-8). A smaller rank number indicates a higher relative correlation in the two cases. Wells with large rank numbers are wells that are located in areas with less correlation between model inputs and outputs.

4.5. Model Correlation Summary

Here, we approximate a true sensitivity analysis using a sampling-based correlation analysis. These sampling-based correlation coefficients are consistent with, but different from, the average sensitivities calculated as numerical derivatives, as was illustrated in (McKenna, 2004). The advantage of this approach to approximating sensitivity is that it is computationally efficient. The sampling-based sensitivity coefficients require an ensemble of calibrated K_{eff} fields, which is computationally burdensome, but they provide an integrated measure of correlation to all of the calibrated K_{eff} fields at once. This approach captures the non-uniqueness of the K_{eff} calibration by using all 100 calibrated fields and also provides a measure of output sensitivity to the input variables at all locations within the domain.

Application of the sampling-based sensitivity approach to the Culebra shows distinct regions of higher and lower correlation to travel time with respect to both calibrated heads and K_{eff}. For travel time sensitivity with respect to heads, the regions of high and low sensitivity are broad and fall mainly within and directly to the south of the WIPP site. Results of travel time sensitivity with respect to K_{eff} show regions of high and low sensitivity that are considerably more localized. The two regions with the greatest absolute correlation for both K_{eff} and model-predicted head are near the C-2737 release point, between the release point and the southern edge

of the WIPP LWB, and immediately upstream (north) of the C-2737 release point. These regions of high or low sensitivity can be identified and targeted for additional head monitoring wells and measurements of K_{eff}. Results of the spatial sensitivity calculations are combined with results of other approaches to monitoring well optimization in the following section

4.6. Model Correlation Run Control Summary

4.6.1. Model file checkout and pre-processing run control (Linux)

The model inputs (transmissivity and anisotropy) and outputs (head) were checked out from the `Tfields` and `MiningMod` CVS repositories that are accessible from the PA Linux cluster (`alice.sandia.gov`). The same files exist for each calibrated model realization (see Table 4-2), and they exist in 100 subdirectories with the names `rnnn`, where *nnn* is a three-digit number corresponding to the realization name (the numbers range from 001 to 999 and are therefore non-contiguous). The Bash shell script `checkout_model_data.sh` (Section 8.4.1) checks the required files out of CVS (lines 9, 18, 49, and 51), does some manipulation of the directories to simplify the resulting directory structure (lines 30 through 44), and converts the binary MODFLOW head files to ASCII arrays (line 67). Finally the entire file tree of input and output files are zipped up to simplify transfer to Windows from Linux (see lines 72 to 75 – located on the CD in the `analysis\model_correlation` directory inside the `model_files.zip` archive).

Table 4-2. Model files from each calibrated MODFLOW realization

Model File	Description
`rnnn/modeled_K_field.mod`	calibrated transmissivity field for realization *rnnn*
`rnnn/modeled_A_field mod`	calibrated anisotropy field for realization *rnnn*
`rnnn/modeled_head.hed`	model-generated steady-state head for realization *rnnn*
`rnnn/dtrk.out`	particle tracking results for realization *rnnn*
`rnnn/{Update,Update2,}`	empty file indicating if the realization originated in the `Update` or `Update2` directories (potentially no file).

The Python script `head_bin2ascii.py` (Section 8.4.2) is used on Linux to convert the binary MODFLOW head files (saved as record-based Fortran unformatted files) to ASCII arrays, based upon the knowledge of the type of data to be expected in the files. Lines 4 through 54 of this Python script define the `FortranFile()` class which is used to encapsulate the functionality needed to read the binary files. Two utility functions (`reshapev2m()` and `floatmatsave()`) are defined in lines 56 through 70. The structure of the MODFLOW binary head files are quite simple; each files is comprised of a single header record and a single array of single-precision head values unwrapped as a vector. The header record contains integers related to the size of the model array subsequently saved, and the head array is saved after that. The Python script reshapes the vector into an array and writes it to an ASCII file in floating point format (line 111).

4.6.2. Partial correlation analysis run control (Windows)

The utility Python script `load_model_data.py` (Section 8.4.3) is called as a library from two other Python scripts to load the 100 realizations of MODFLOW input and output files. This script loops over the 100 *rnnn* subdirectories reading hydraulic conductivity, horizontal anisotropy, travel time to the WIPP LWB, and the model-generated steady-state heads (see Table 4-2). The script then takes the $\log_{10}$ of the K, A and travel times, and defines a logical mask

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(`wippmask`) for addressing a subset of the model domain only including the WIPP LWB and a buffer of cells surrounding it (lines 58 to 62).

Once the zip archive of ASCII model files is transferred to Windows, the analysis begins with the Python script `export_pcor_inputs.py`, (Section 8.4.4) which loads the results of the 100 realizations (importing the functionality from the `load_model_data.py` script at line 2), saving the results to two large matrices to be processed in R for partial correlation analysis. The matrices saved include the travel time to the WIPP LWB (a single column) concatenate with the head or K_{eff} matrices from a region including the WIPP LWB and a 1,500-m buffer surrounding the LWB, due to a limitation of the approach. A correlation matrix comprised of every model parameter (or head) to every other parameter (or head) is made, the full 307×284=87,188 model cells would result in a correlation matrix with 7,601,921,721 entries (over 56 gigabytes at double precision). The smaller subset of model parameters (WIPP LWB is 64 100-m elements wide and tall + a buffer of 15 elements on each side) results in a large correlation matrix that only has 78,092,569 entries (just under 596 megabytes at double precision). The R script `compute_partial_correlations.R` (Section 8.4.5) simply reads in the matrices saved by the Python script, performs the partial correlation analysis using optimized and numerically stable algorithms (a scaled pseudo-inverse, rather than the simpler – but numerically unstable – matrix inverse), then writes the partial correlation between travel time to the WIPP LWB and either K_{eff} or head in each model cell inside the area surrounding the WIPP site (the last column of the resulting partial correlation matrix – see lines 12 and 19). Output from `export_pcor_inputs.py` and output from `compute_partial_correlations.R` are saved on the CD, along with the intermediate files, in the `analysis\model_correlation\output\` directory.

4.6.3. Correlation analysis run control (Windows)

The Python script `spearman_rank_coefficient.py` (Section 8.4.6) also loads the model data using the `load_model_data.py` module, and also loads the results of the partial correlation calculation done in R (lines 31 to 39). In the loop from lines 41 to 62, the script computes the head vs. travel time and K_{eff} vs. travel time correlations across the 100 realizations at each element in the model domain. The partial correlation results and standard correlation results are then plotted in several forms for figures in the text (Figure 4-1, Figure 4-2, Figure 4-5, Figure 4-6, Figure 4-8, and Figure 4-9), and saved as matrices for later analysis (files located on CD in the `analysis\model_correlation\output\` directory).

5.0 Combining Approaches

This section discusses the combination of the three approaches towards quantifying both the quality of proposed monitoring well locations, and the relative importance of existing steel-cased well locations

5.1. One Additional Monitoring Location

Three different approaches to identifying optimal additional monitoring well locations have been computed. In the case of the geostatistical estimation variance reduction approach, the change in the estimation variance can be computed after adding more wells. However, the results of this approach leads to many locations with high propensity to reduce overall estimation variance and the results of this approach do not uniquely identify one or even a handful of optimal locations for additional wells. To some extent, combining all three of the approaches into a single map reduces this non-uniqueness. Here, the three approaches are combined to provide a combined score, S_c, that identifies the best locations for new wells. The higher the value of the score is, the better that location is for a new well.

The combined score is the sum of the three different fields calculated in the three monitoring approaches scaled appropriately and combined as

$$S_c = \sigma_{OK}^2 + A_r + |r_s| \quad (18)$$

The three components of S_c are the relative change in the average ordinary kriging variance, σ^2_{OK}, the change in the average triangle interior angle ratio, and the absolute value of the correlation coefficient between travel time to the WIPP boundary and either the estimated transmissivity or head, r_s, each compared relative to the 2007 network. The absolute value of the rank correlation coefficient is used since both positive and negative correlations are of equal importance for locating new monitoring wells. The triangle interior angle ratio is handled differently, because for that metric, negative values are poor places to locate wells. Figure 5-1 shows histograms of the fields that contribute to S_c.

Four different combinations of the input fields are considered, requiring six total input fields. The resulting fields will be comprised of the following four cases:

1. Δ mean kriging variance + Δ mean triangle angle ratio + ρ K_{eff},
2. Δ mean kriging variance + Δ mean triangle angle ratio + ρ head,
3. Δ median kriging variance + Δ median triangle angle ratio + ρ K_{eff},
4. Δ median kriging variance + Δ median triangle angle ratio + ρ head;

either the correlation of travel times to head or Keff are used, and either the mean or median relative kriging and triangle metrics are used.

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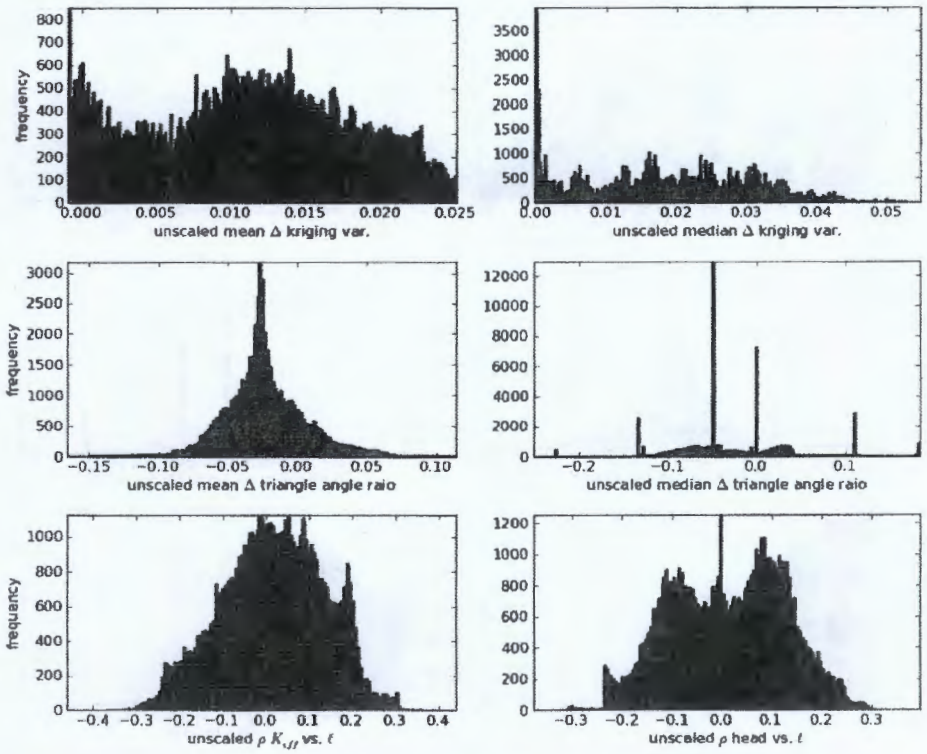

Figure 5-1. Histograms of each component of S_c, before applying scaling.

The three metrics in S_c are already unitless, as reported in their individual previous sections. The results are rescaled here to give them common ranges (a width of unity). The rescaling is accomplished as

$$S_c = \frac{\sigma_{OK}^2 - \min(\sigma_{OK}^2)}{\max(\sigma_{OK}^2) - \min(\sigma_{OK}^2)} + \frac{A_r}{\max(A_r) - \min(A_r)} + \frac{|r_s| - \min(|r_s|)}{\max(|r_s|) - \min(|r_s|)} \tag{19}$$

where the `max()` and `min()` operators define the maximum and minimum values of the different components of the combined score across the entire calculation domain. The triangle metric is handled differently than the others, as it is not shifted to a zero-based origin (no "$-\min(A_r)$" in the numerator); this was done because the negative values of change with respect to the interior angle metric indicate that adding a well at a given location would degrade the quality of the overall average well network.

Histograms of the scaled components to S_c are plotted in Figure 5-2. The top row of plots for the relative change in the kriging variance are simply scaled to the [0,1] interval (they already had a distribution with a minimum value of zero). These distributions are slightly skewed towards 0.0, more so for the change in the median kriging variance. In the second row of plots for the relative change in the triangle angle ratio are scaled to a unit width interval, but they are not shifted (now covering approximately the [-0.6,0.4] interval). These distributions are centrally distributed about a non-zero negative value. The absolute value of the correlation coefficient distribution (bottom row) is now strongly skewed towards 0.0, after taking the absolute value (the original distribution in Figure 5-1 was roughly symmetric about 0.0).

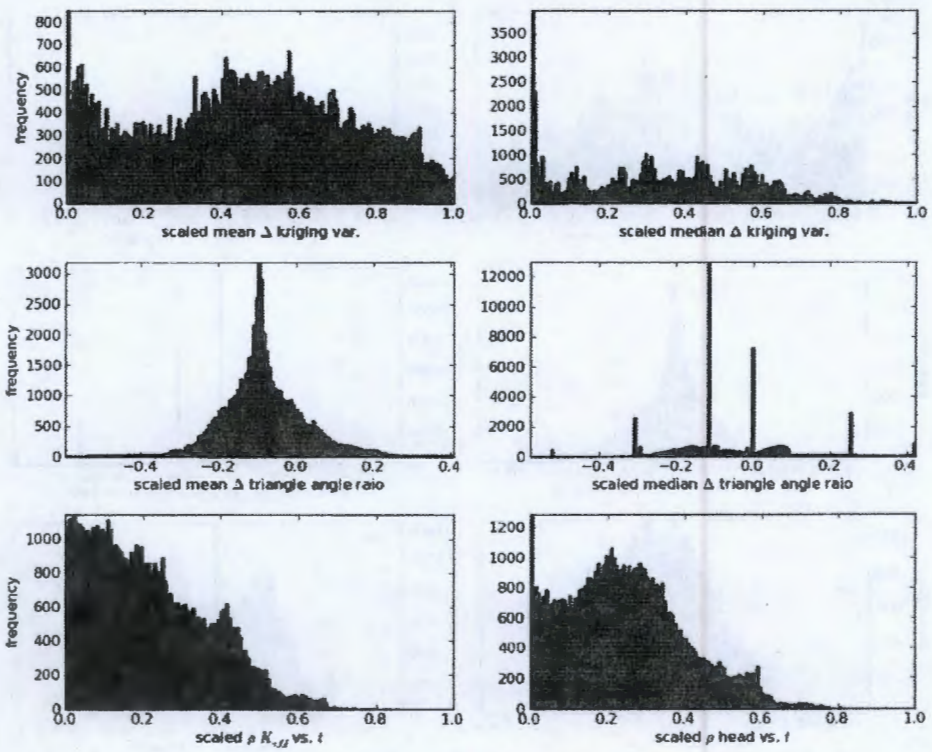

Figure 5-2. Histograms of each component of S_c, after applying scaling

Other than the scaling, one additional change is made to the fields for the mean and median kriging variance. These fields are computed on a two times coarser grid than the triangle angle ratio or the correlation coefficients. The use of this multiplier is to accommodate the long run times for the kriging calculations. The fields resulting from the kriging calculation are copied onto the finer mesh by copying each of the kriging matrix cell's values (without averaging) into the four cells covering the same area in the finer grid. This process is similar to how values were copied from the MODFLOW to SECOTP2D modeling grids in the CRA 2009 PABC calculations (see Kuhlman, (2010a), Appendix A, §1.7).

5.1.1. Results

The theoretical minimum and maximum combined score values for any location in any of the four cases are -0.6 and 2.4 respectively. An image map of the combined score value for case 1 is shown in Figure 5-3. The resulting field is light colored (low score) in most areas surrounding the WIPP LWB and near monitoring wells in the 2007 well network. The resulting image for case 2 is shown in Figure 5-4. The resulting distribution of the case 2 results has lower low values (some negative values, indicated in yellow), and the dark blue location, indicating a good possible location, are more localized than for the means of the same variables (Figure 5-3).

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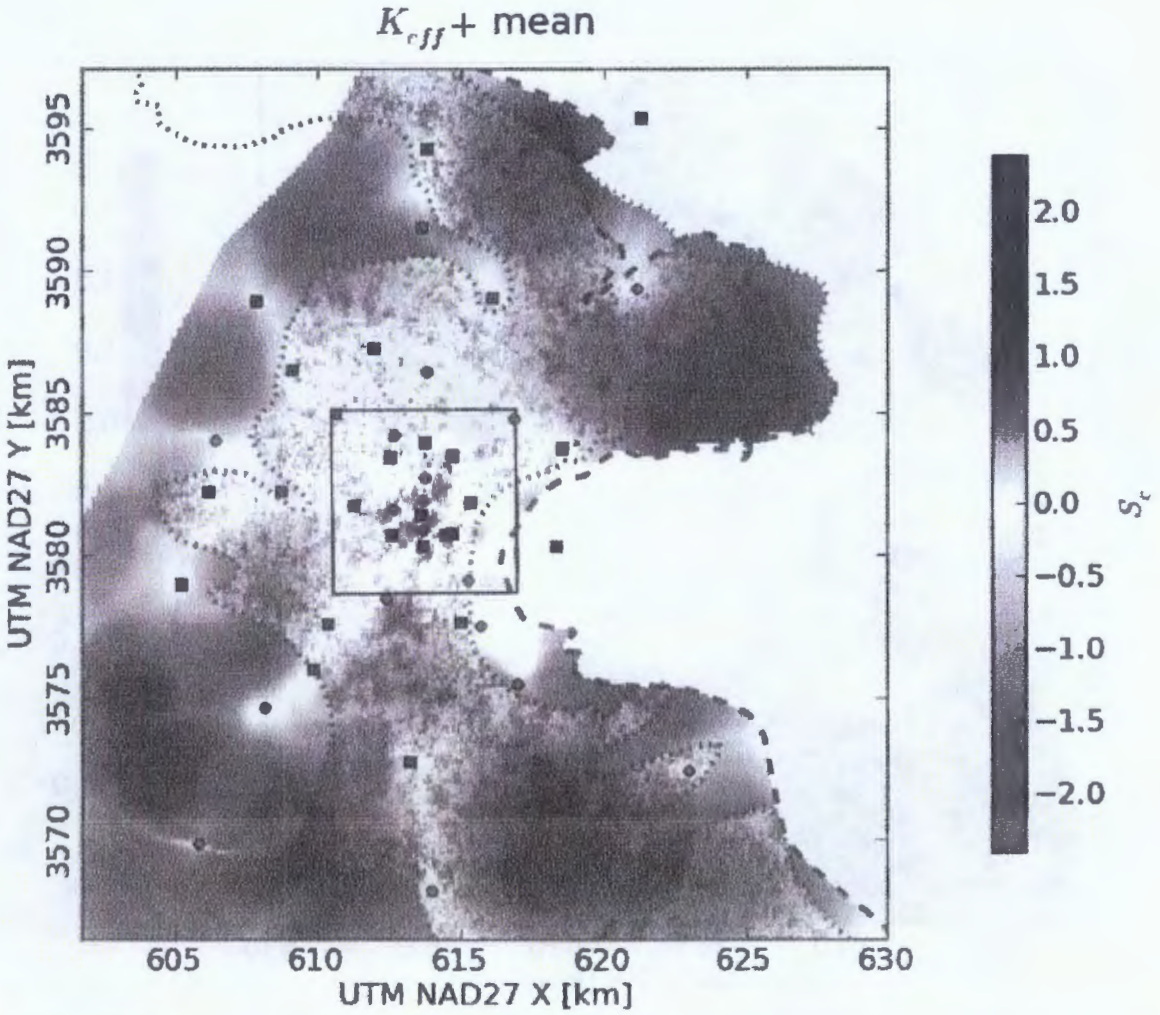

Figure 5-3. Combined scaled results for case 1, using mean Δ kriging variance, mean Δ triangle shape metric, and correlation between K_{eff} and $\log_{10}$ particle travel time. Fiberglass-cased wells are green squares, steel-cased wells are red circles; Salado dissolution and Rustler halite margins are dashed lines; WIPP LWB is black square.

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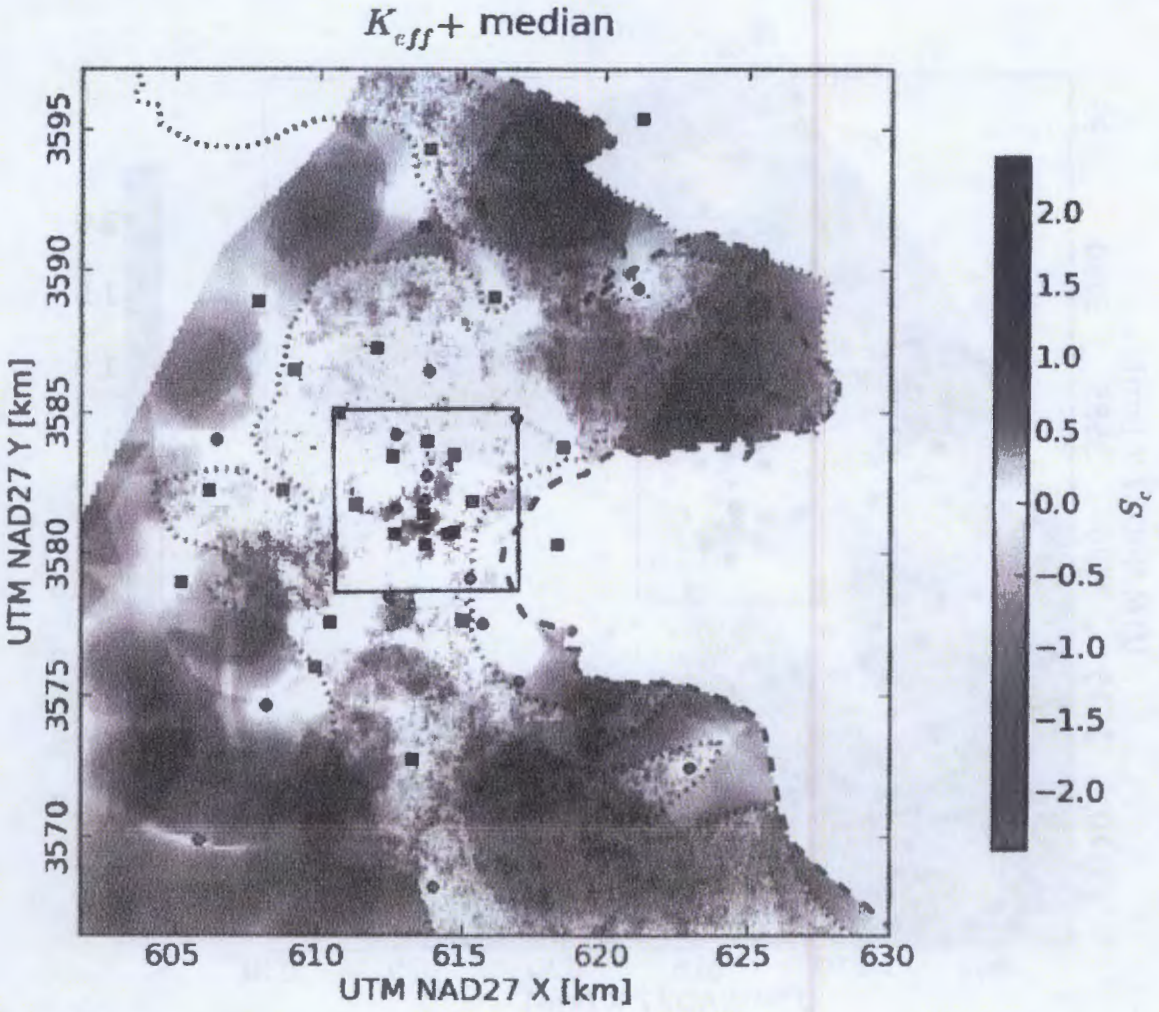

Figure 5-4. Combined scaled results for case 2, using median Δ kriging variance, median Δ triangle shape metric, and correlation between K_{eff} and $\log_{10}$ particle travel time.

The image map showing the results for case 3 is plotted in Figure 5-5. These results are smoother than cases 1 and 2, as was the case for the correlation coefficients that these results contain. There are more isolated possible locations inside the WIPP LWB in case 3 than in cases 1 and 2 (blue areas). The image map showing the results for case 4 is plotted in Figure 5-6. Similar to the differences observed between cases 1 and 2 (Figure 5-3 and Figure 5-4), case 4 has more negative locations (yellow), and the high values outside the WIPP LWB (blue) are more localized than the case considering the mean parameters.

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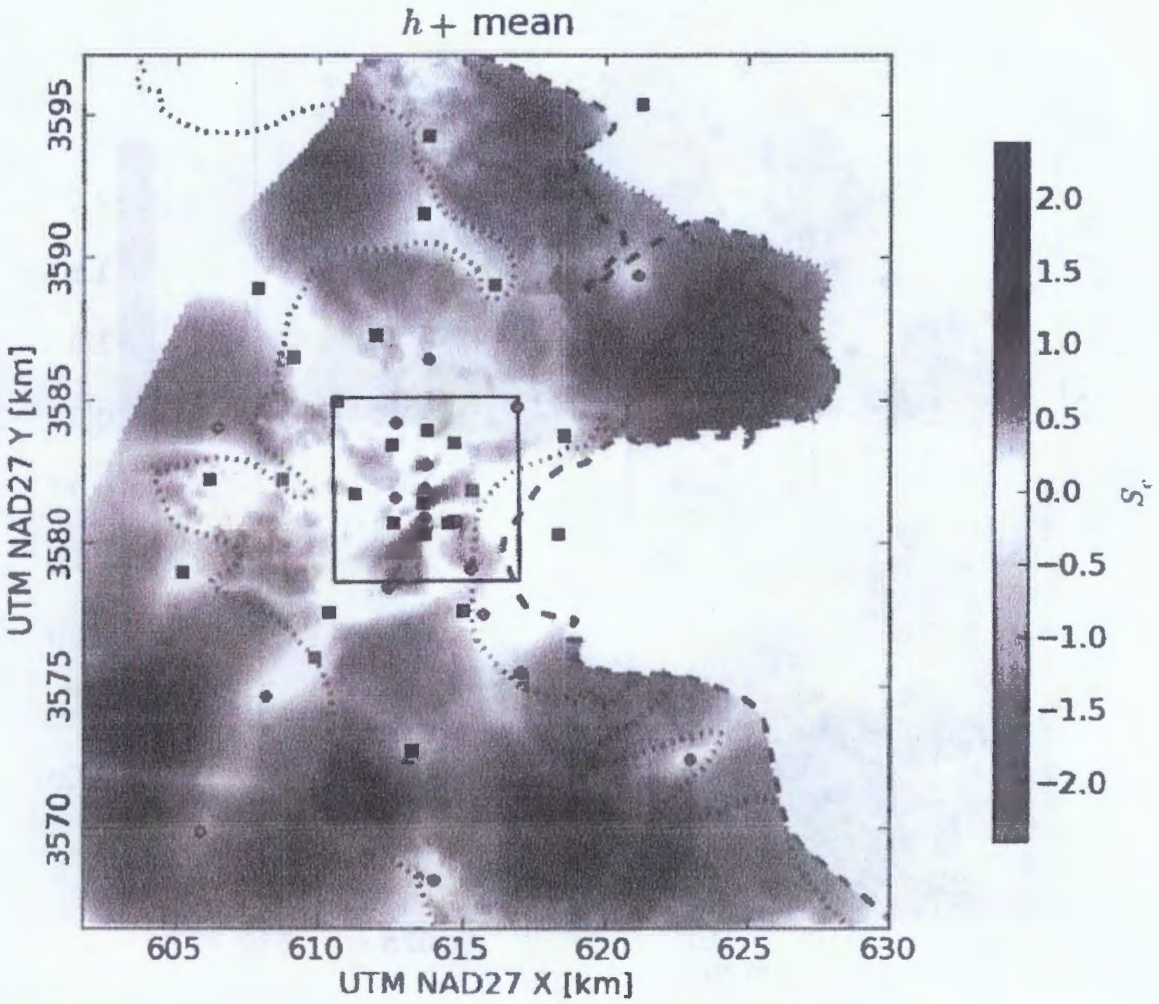

Figure 5-5. Combined scaled results for case 3, using mean Δ kriging variance, mean Δ triangle shape metric, and correlation between modeled head and $\log_{10}$ particle travel time.

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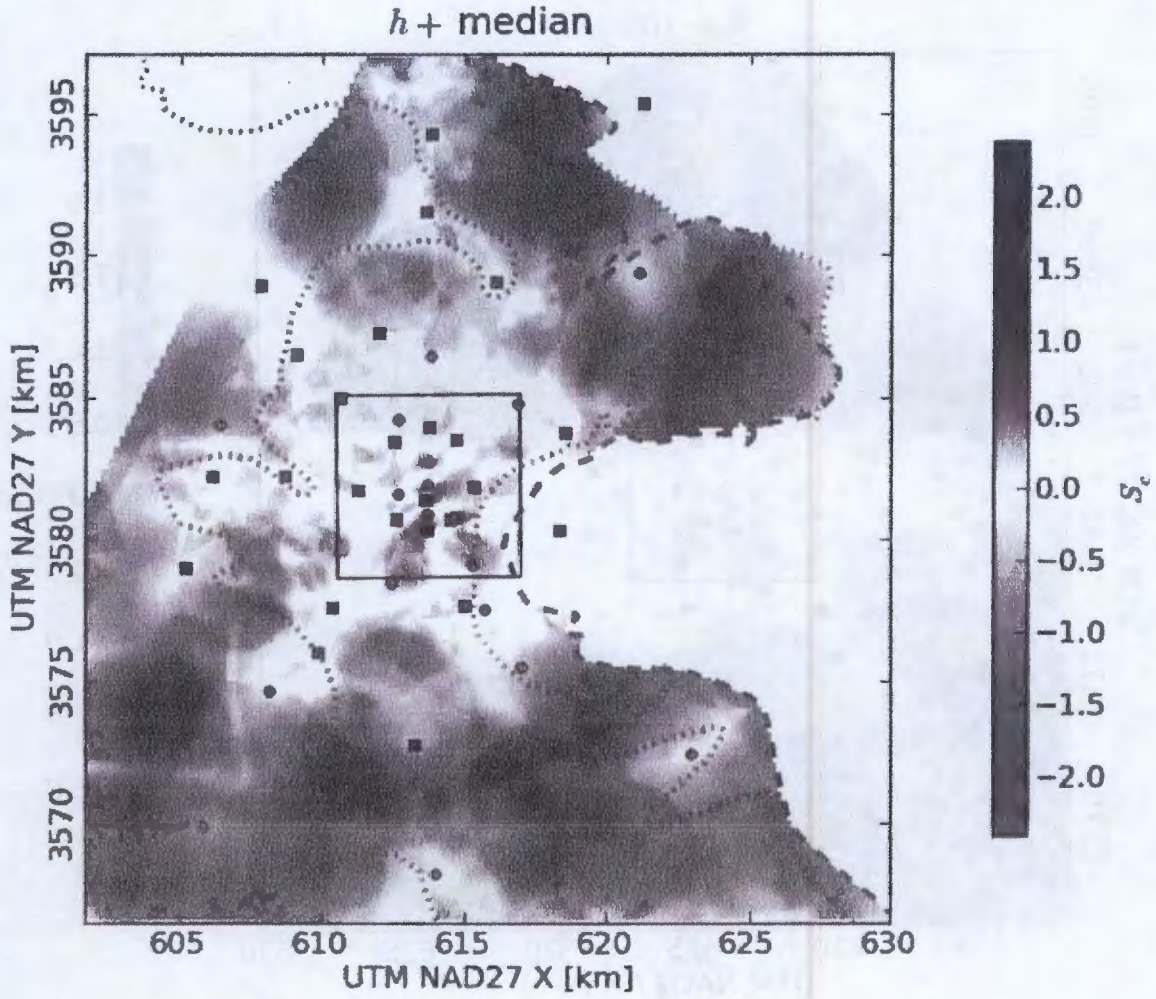

Figure 5-6. Combined scaled results for case 4, using median Δ kriging variance, median Δ triangle shape metric, and correlation between modeled head and $\log_{10}$ particle travel time.

The results of cases 3 and 4 indicate there are areas resulting in relatively high S_c scores inside the WIPP LWB, specifically in the south-central (north of H-4b) and east-central portions (east of the WIPP site buildings). The results in cases 1 and 2 do not indicate any significant high S_c score areas inside the WIPP LWB. This indicates that the methods considered here indicate areas inside the WIPP LWB might be useful for head-monitoring locations regarding head, but additional T values from testing new wells might not be as necessary.

The results outside the WIPP LWB are more focused in cases 2 and 4 (Figure 5-4 and Figure 5-6), where the medians, rather than the means are used. In these cases the two areas with the highest S_c scores (dark blue to purple) are north of the WIPP site between SNL-1 and AEC-7, as well as south of the WIPP site between the DOE Gnome-Coach site (USGS-4) and SNL-12.

In cases 1 and 3, the best new locations for wells would be east of the WIPP LWB, specifically east of SNL-8 and southeast of AEC-7, and south of the WIPP LWB between H-9c and H-10c, also north and west of the DOE Gnome-Coach site (USGS-4).

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5.2. Remove One Steel Well

The results of the remove-one-well analyses from the previous sections were plotted together in Figure 5-7. Symbols are scaled according to numerical rank, small rank number correlating to small symbol size.

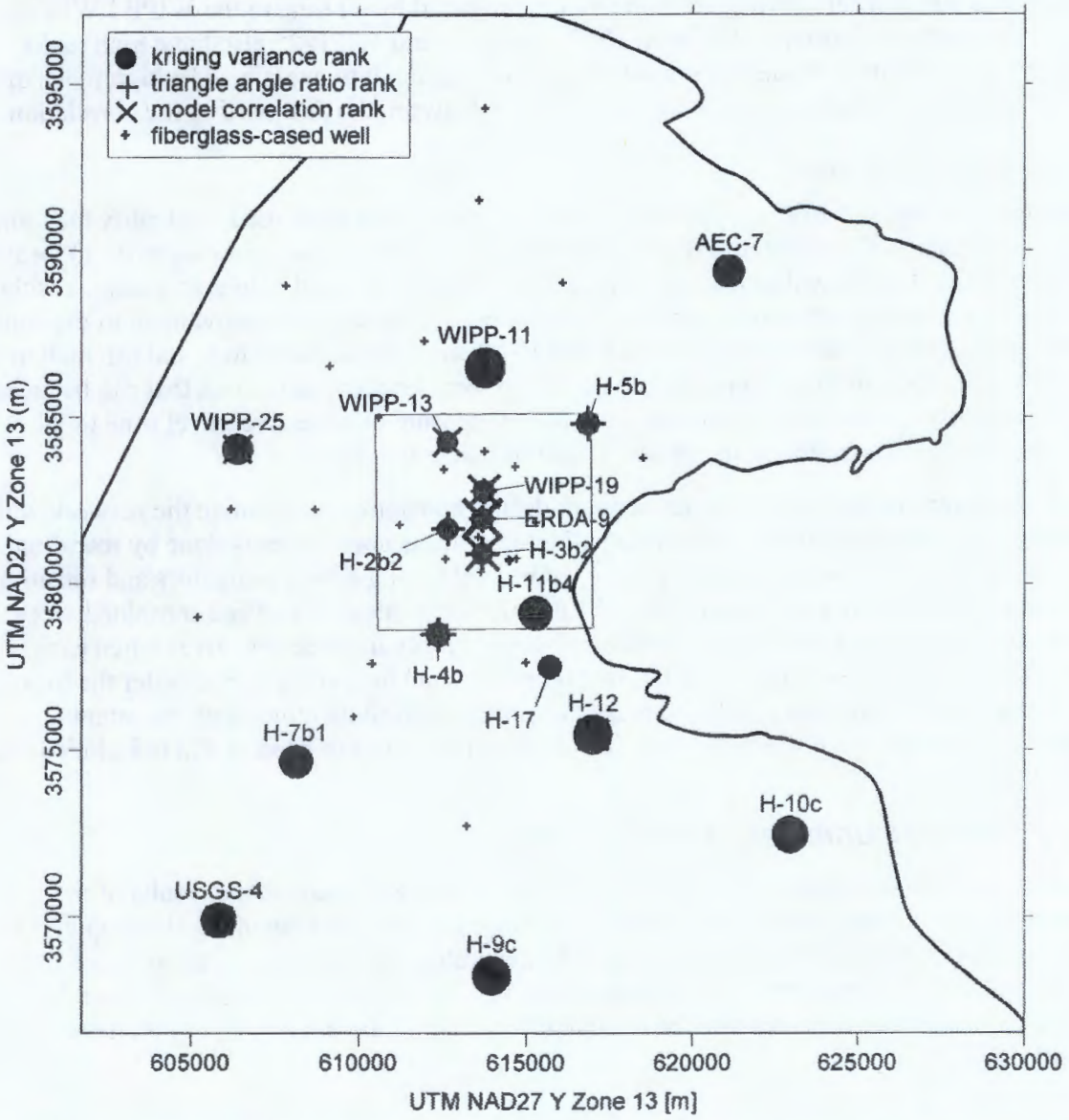

Figure 5-7. Composite plot of steel-cased well rankings from previous sections. Large symbols correspond to greater relative importance for each of the three measures.

Figure 5-7 shows the trend in the kriging variance reduction (filled red circles), where wells inside the WIPP LWB typically have a poor rank, and therefore removing them will have little impact on the kriging variance averaged across the entire model domain (H-11b4 being a slight exception). The results of the triangle gradient estimator maximization process (blue crosses) shows the wells indicated as being most valuable are located in the central and south-east portion of the domain. Aside from the locations inside the WIPP LWB, the wells with high rank

regarding the gradient estimator approach are steel wells that are not very near fiberglass-cased wells (H-10c, H-9c, H-12, H-4b, H-5b and AEC-7). The model correlation results are shown as green X's, with the distribution of important steel-cased wells being a more scattered about the MODFLOW model area. These results do not depend on current well locations, aside from the fact that the current wells were used to calibrate the model. ERDA-9 and H-3b2 are in locations where head and Keff are correlated to the model predicted travel time to the WIPP LWB, as would generally be expected. USGS-4, H-12, WIPP-11 and WIPP-25 also have high ranks based on correlation of model results, which are more difficult to explain. The high ranks of these locations are likely due to spurious correlation between the data used in the correlation.

5.2.1. Summary

Three different approaches to monitoring network optimization were used to identify locations where additional wells could improve the network. These three approaches identify: 1) locations where additional wells will reduce the uncertainty in predicting head values at locations without wells; 2) locations where an additional well will allow for maximum improvement in the ability of the existing monitoring well network to identify changes in the magnitude and orientation of the hydraulic gradient by maximizing the quality of local gradient estimators that can be created; and 3) locations where the performance assessment measure of advective travel time to the WIPP boundary is most correlated to the value of head or transmissivity.

These three approaches to monitoring network design all attempt to optimize the network with respect to different objectives. Combining all three of these approaches is done by rescaling each of the raw maps of estimation variance, additional local gradient estimators and sensitivity to have a range (minimum to maximum) of 1.0 and to be unitless. The final combined score maps show the best places to locate additional wells to meet all three objectives when each of the three objectives is given equal weight. The higher the combined score is, the better the location is for a new well. The final combined maps are similar with some minor, but important differences depending on whether or not sensitivity with respect to head or K_{eff} is included in the combined score.

5.3. Method Combination Run Control

The Python script `combine_plot_methods.py` (Section 8.5) loads in the results of the previous three sections, normalizing them to the range $0 \leq x \leq 1$ and summing them up to create composite plots (Figure 5-3 through Figure 5-6) illustrating the optimum location for additional monitoring wells. Histograms of each component before (Figure 5-1) and after (Figure 5-2) scaling are also made for assessing the relative effect each of the three components has on the overall result.

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6.0 Conclusions

A set of measurements made in 42 head monitoring wells in the Culebra within and surrounding the WIPP from 2007 were used in this analysis. This set of observations mostly coincided with the freshwater heads used for steady-state calibration of the CRA 2009 PABC MODFLOW model. This head-monitoring network provided the input data for three different approaches to optimizing the monitoring well network. Optimization is interpreted broadly here to include both the identification of new locations where wells could be added to the network to meet some objective and also identification of existing wells that could be removed from the monitoring network as they provide redundant information. The three different approaches to monitoring network optimization examined here are: 1) geostatistical variance reduction; 2) local gradient estimation using combinations of three wells; and 3) sampling-based spatial sensitivity coefficients. In short, the gradient has not changed significantly since the 2004 analysis.

6.1. Summary of Calculations

Geostatistical variance reduction is a fairly common optimization approach (e.g., Rouhani, (1985)) that exploits several properties of the kriging variance to identify new locations where a well could be added to an existing monitoring network to provide the greatest reduction in estimation variance. The same approach can be used to determine existing wells that, upon removal from the monitoring network, provide the smallest increase in the overall estimation variance. Kriging provides an ideal approach to these calculations as the estimation variance calculated through kriging is only a function of the data configuration and not the data values. Therefore, the estimation variance reduction/increase for the addition/removal of a new well can be calculated prior to adding/removing that well from the network. This calculation assumes that the variogram calculated for the head, or residual, values in the network does not change with the addition/removal of a well.

Application of the geostatistical estimation variance calculations to the Culebra network shows that there are many locations where a well can be added to the network that will produce a maximum reduction in the average estimation variance. These locations are all outside of the WIPP site boundaries and the majority of these locations are near the extremities of the MODFLOW model domain. Adding new wells within the WIPP site boundary will not have a significant impact on the estimation variance. The geostatistical estimation variance calculations were also applied to the problem of determining which existing wells to remove from the network. Results for this problem can easily be calculated; however, for removal of more than one well at a time, it is necessary to know what combinations of wells need to be removed to make the problem tractable. Four different base cases were run here and the results show that simultaneous removal of WIPP-13 and another steel-cased well makes an insignificant change in the estimation variance relative to the full 42-well network, while removal of either of other pairs of steel-cased wells has a significant impact (Table 2-5). Averaged across the entire model domain, the removal of wells USGS-4, H-9c, H-10c and AEC-7 would have the largest effect (Figure 2-14). Averaged across the WIPP LWB, removal of wells H-4b, H-5b, H-17 and H-7b1 would have the largest effect (Figure 2-16).

A Delaunay triangulation of the wells in the 2007 monitoring network provides a platform for estimating the quality of triangles as gradient estimators. The interior angle ratio (max angle / min angle) is used as a metric for quantifying the quality of a given arrangement of wells. Local

gradient estimators were used to identify the best places to locate additional monitoring wells and the existing wells that could be removed from the network with the smallest impact on the ability of the network to estimate in the gradient.

Results of the calculations to identify locations for additional monitoring wells show that new wells should be located outside of the WIPP site. Additional monitoring wells could optimally be placed north and east of the WIPP LWB, or south between existing wells (Figure 3-10). The well removal calculations were done by removing one well at a time from each of three base case scenarios. Removal of wells in the western portion of the domain, outside the WIPP LWB, has little effect on the quality of the network from the point of view of the triangular gradient estimators (Table 3-1 and Figure 5-7). The removal of steel-cased wells in the southeast or inside the WIPP LWB would have the largest effect on the overall network.

The third approach to monitoring network optimization explored in this report is that of using model correlation to identify locations for new wells where some model output of interest (e.g., travel time) is most sensitive to the transmissivity or head at that location. These correlation coefficients are calculated through a sampling-based technique across 100 calibrated K_{eff} fields. The sampling-based sensitivity coefficients are shown as a map of the sensitivity of the travel time from the repository to the WIPP site boundary with respect to head and transmissivity (Figure 4-5 and Figure 4-8). The results with respect to head show a smoothly varying sensitivity field with large regions of positive and negative correlation between head and travel time. The results with respect to K_{eff} have much more localized regions of positive and negative correlation with travel time being most sensitive to transmissivity at a location directly south of the WIPP site boundary. It is noted that increased knowledge of the spatial variation of the Culebra transmissivity is not a goal of the long-term monitoring network, but transmissivity is an input to the T field calibration process used as input to further PA calculations.

As a final step, the results of the geostatistical estimation variance calculations, the local gradient estimation and the spatial sensitivity coefficients were combined into two "combined score" maps. These maps show, on a normalized scale, the best locations to locate new monitoring wells. In general, these areas are outside of the WIPP site.

6.2. Reexamination of Monitoring Goals

The different purposes, goals and factors that must be taken into account in the design of the Culebra long-term monitoring network were stated in Section 1.2. These goals come from a variety of sources, mainly the state and federal regulatory bodies with WIPP oversight and the ability of the network to provide needed inputs to PA models. Practical factors impacting network design require that the total number of wells in the monitoring network be minimized and that certain wells be retained in the network. The monitoring network should also serve as a vehicle to provide new information to the hydrologic and geologic conceptual models.

The first monitoring network goal is to allow for *determination of the direction and rate of groundwater flow across the WIPP site*. Triangular gradient estimators were developed to meet this goal (Section 3.0). Independently obtained head measurements cannot by themselves determine the direction and magnitude of the hydraulic gradient. For a confined aquifer with a mainly two-dimensional flow pattern, head measurements at three separate locations are necessary to determine the orientation and magnitude of the gradient. Small equilateral triangles are typically the best for estimating gradients over an area from point head measurements,

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assuming the observed heads result in a gradient large enough to measure over the ambient noise in the system.

The second monitoring goal is to *provide data needed to infer causes of changes in water levels.* Detecting water level change can be done in a single well and an implicit requirement to meet this goal is that there are enough wells in key locations both within and around the WIPP site to detect any water level changes. Checking for the adequate distribution of wells in and around the WIPP site is accomplished using a geostatistical variance reduction approach (Section 2.0). These calculations identify where additional wells are needed and which existing wells can be removed from the network. After a change in water level is detected, the cause of that change must be inferred. There must be enough wells in the proper configuration to infer the cause of a change. The geostatistical variance reduction and three-point estimator approaches to monitoring network design provide networks that maintain enough well density with the proper configurations to infer causes of changes.

The third goal is that the *monitoring network must provide spatially distributed head data adequate to allow both defensible boundary conditions to be inferred for Culebra flow models and defensible calibration of those models.* This goal is related to the previous one in that a network that provides enough wells with the spatial distribution and configuration to detect and infer causes of changes in water levels should also provide the data necessary to infer boundary conditions and calibrate Culebra flow models. Therefore both the geostatistical variance reduction and the gradient estimator approaches and the data gaps and redundancies that they identify apply to this goal as well. Additionally, a third approach to monitoring network design based on model correlation analysis was developed to explicitly incorporate the results of calibrated groundwater flow models directly into the monitoring network design. The set of calibrated groundwater models used as the basis of this third approach incorporates the latest geologic and hydrologic conceptual models. This approach to monitoring network design defines areas along the boundaries and within the groundwater flow model where the model results are most sensitive to the calibrated values of head and transmissivity. Regions of high sensitivity are targeted for future well locations.

In addition to meeting these three goals, a number of other factors were considered in the design of the monitoring network. These included preserving the locations of existing fiberglass and steel-cased wells, identifying wells that provide redundant information, incorporating current hydrologic and geologic conceptual models and identifying locations where questions in the conceptual models can be addressed and/or locations where the groundwater flow models used in PA calculations are correlated to the local values of head and transmissivity. Both the geostatistically-based variance reduction approach and the three-point estimator approach to monitoring network design explicitly considered minimization of the number of wells in the monitoring network through removal of existing wells. Tradeoffs between the minimization of the wells in the network and the ability of the network to provide information on changes in heads were examined. The monitoring network design done here was focused on optimization approaches that are readily quantified into different objective functions. Meeting certain, less easily quantified, factors such as locations where conceptual model questions can be addressed is more difficult and the monitoring networks designed here did not explicitly address this factor.

The results of the calculations done to meet the monitoring goals and the other factors are combined into a series of maps (Figure 5-3 through Figure 5-6) that show the best locations for

adding wells to the monitoring network. A map has also been created showing which existing steel-cased wells are the most and least important to maintain within the monitoring network (Figure 5-7).

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8.0 Run Control Script Listings

This appendix lists the source code for the scripts written for and used in this analysis report, and documents them to allow their reasonable verification and future use, according to NP 19-1. The scripts listed in this section neither model physical phenomena nor solve differential equations that model physical phenomena. Rather they are utility codes that process inputs and summarize outputs for other modeling codes (i.e., KT3D). The scripts are heavily commented (green text) to allow the flow of the execution to be easily followed.

8.1. Listing of Files Included on CD

The following directory listing (Table 8-1) corresponds to the directory tree given after it in Figure 8-1.

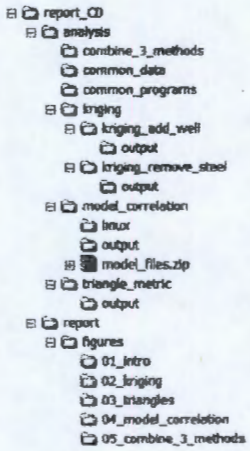

Figure 8-1. Directory Tree of CD

Table 8-1. CD Directory listing

```
C:\report_CD>dir /S /TC
 Volume in drive C is DriveC
 Volume Serial Number is 542A-10F7

 Directory of C:\report_CD

04/10/2010  10:50 AM    <DIR>          .
04/10/2010  10:50 AM    <DIR>          ..
04/07/2010  12:42 PM    <DIR>          analysis
04/07/2010  12:42 PM    <DIR>          report
               0 File(s)              0 bytes

 Directory of C:\report_CD\analysis

04/07/2010  12:42 PM    <DIR>          .
04/07/2010  12:42 PM    <DIR>          ..
04/07/2010  12:51 PM    <DIR>          combine_3_methods
04/07/2010  12:44 PM    <DIR>          common_data
04/07/2010  12:50 PM    <DIR>          common_programs
04/07/2010  12:43 PM    <DIR>          kriging
04/07/2010  12:43 PM    <DIR>          model_correlation
04/07/2010  12:43 PM    <DIR>          triangle_metric
               0 File(s)              0 bytes

 Directory of C:\report_CD\analysis\combine_3_methods

04/07/2010  12:51 PM    <DIR>          .
```


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Table 8-1. CD Directory listing

```
04/07/2010  12:51 PM    <DIR>          ..
04/11/2010  12:10 PM            10,136 combine_plot_methods.py
04/11/2010  04:11 PM               997 composite_remove_one_steel.dat
               2 File(s)         11,133 bytes

 Directory of C:\report_CD\analysis\common_data

04/07/2010  12:44 PM    <DIR>          .
04/07/2010  12:44 PM    <DIR>          ..
04/10/2010  01:46 PM             1,776 2007_well_data.dat
04/10/2010  01:46 PM             1,823 2007_well_data_for_trend.dat
04/10/2010  01:46 PM             1,606 2007_well_data_for_triangles.dat
04/10/2010  01:46 PM             2,210 2007_well_data_with_names.dat
04/10/2010  01:46 PM               379 2007_well_names.dat
04/10/2010  01:46 PM               331 2007_well_names_for_triangles.dat
04/10/2010  01:46 PM             1,694 base_data.dat
04/10/2010  01:46 PM             5,415 h2_200711.bln
04/10/2010  01:46 PM             5,799 h3_200711.bln
04/10/2010  01:46 PM         1,395,622 model_cells_100_inside_totalbdry.dat
04/10/2010  01:46 PM           350,196 model_cells_200_inside_totalbdry.dat
04/10/2010  01:46 PM           156,766 model_cells_300_inside_totalbdry.dat
04/10/2010  01:46 PM            87,626 model_cells_400_inside_totalbdry.dat
04/10/2010  01:46 PM            56,668 model_cells_500_inside_totalbdry.dat
04/10/2010  01:46 PM            40,040 model_cells_600_inside_totalbdry.dat
04/10/2010  01:46 PM                64 model_domain_specs.dat
04/10/2010  01:46 PM               105 modflow_boundary.bln
04/10/2010  01:46 PM               189 no-flow-area-only.bln
04/10/2010  01:46 PM             8,532 total_boundary.bln
04/10/2010  01:46 PM               105 wipp_boundary.bln
              20 File(s)      2,116,946 bytes

 Directory of C:\report_CD\analysis\common_programs

04/07/2010  12:50 PM    <DIR>          .
04/07/2010  12:50 PM    <DIR>          ..
04/07/2010  12:45 PM           157,184 KT3D.EXE
04/07/2010  12:50 PM             1,807 redwhitemap.m
               2 File(s)        158,991 bytes

 Directory of C:\report_CD\analysis\kriging

04/07/2010  12:43 PM    <DIR>          .
04/07/2010  12:43 PM    <DIR>          ..
04/07/2010  12:49 PM    <DIR>          kriging_add_well
04/07/2010  12:50 PM    <DIR>          kriging_remove_steel
               0 File(s)              0 bytes

 Directory of C:\report_CD\analysis\kriging\kriging_add_well

04/07/2010  12:49 PM    <DIR>          .
04/07/2010  12:49 PM    <DIR>          ..
04/07/2010  12:52 PM               882 generate_model_cell_masks.m
04/07/2010  12:44 PM            11,658 krig_plus_one.py
04/07/2010  12:45 PM               327 kt3d_driver.bat
04/10/2010  01:47 PM    <DIR>          output
04/07/2010  12:46 PM                92 shared_data.py
               4 File(s)         12,959 bytes

 Directory of C:\report_CD\analysis\kriging\kriging_add_well\output

04/10/2010  01:47 PM    <DIR>          .
04/10/2010  01:47 PM    <DIR>          ..
04/10/2010  01:47 PM           262,416 addone_mod_results_corrcoef.dat
04/10/2010  01:47 PM           268,008 addone_mod_results_max.dat
04/10/2010  01:47 PM           263,199 addone_mod_results_mean.dat
04/10/2010  01:47 PM           263,393 addone_mod_results_median.dat
04/10/2010  01:47 PM           271,115 addone_mod_results_stdev.dat
04/10/2010  01:47 PM           262,416 addone_wipp_results_corrcoef.dat
```

Table 8-1. CD Directory listing

```
04/10/2010  01:47 PM           267,024 addone_wipp_results_max.dat
04/10/2010  01:47 PM           266,686 addone_wipp_results_mean.dat
04/10/2010  01:47 PM           262,416 addone_wipp_results_median.dat
04/10/2010  01:47 PM           268,976 addone_wipp_results_stdev.dat
04/10/2010  01:47 PM                26 base_stats.out
04/11/2010  03:43 PM           196,812 X.dat
04/11/2010  03:42 PM           218,680 Y.dat
              13 File(s)      3,071,167 bytes

 Directory of C:\report_CD\analysis\kriging\kriging_remove_steel

04/07/2010  12:50 PM    <DIR>          .
04/07/2010  12:50 PM    <DIR>          ..
04/07/2010  12:52 PM             1,696 krig_remove_one_steel.py
04/07/2010  12:52 PM             2,381 krig_remove_two_steel.py
04/10/2010  01:47 PM    <DIR>          output
04/09/2010  11:58 AM            64,512 remove_one_well_results2_2010.xls
04/09/2010  11:59 AM           164,352 remove_two_well_results3.xls
               4 File(s)        232,941 bytes

 Directory of C:\report_CD\analysis\kriging\kriging_remove_steel\output

04/10/2010  01:47 PM    <DIR>          .
04/10/2010  01:47 PM    <DIR>          ..
04/10/2010  01:50 PM             1,671 model_results_one.dat
04/10/2010  01:48 PM             4,161 remove_two_model.csv
04/10/2010  01:48 PM             4,131 remove_two_wipp.csv
04/10/2010  01:50 PM             1,604 wipp_results_one.dat
               4 File(s)         11,567 bytes

 Directory of C:\report_CD\analysis\model_correlation

04/07/2010  12:43 PM    <DIR>          .
04/07/2010  12:43 PM    <DIR>          ..
04/11/2010  02:02 PM               719 compute_partial_correlations.R
04/11/2010  01:57 PM               613 export_pcor_inputs.py
04/11/2010  02:13 PM    <DIR>          linux
04/11/2010  01:58 PM             1,975 load_model_data.py
04/11/2010  11:51 AM       120,751,461 model_files.zip
04/11/2010  01:58 PM    <DIR>          output
04/07/2010  12:55 PM             7,611 spearman_rank_coefficient.py
               5 File(s)    120,762,379 bytes

 Directory of C:\report_CD\analysis\model_correlation\linux

04/11/2010  02:13 PM    <DIR>          .
04/11/2010  02:13 PM    <DIR>          ..
04/11/2010  11:51 AM             2,169 checkout_model_data.sh
04/11/2010  11:51 AM             3,714 head_bin2ascii.py
               2 File(s)          5,883 bytes

 Directory of C:\report_CD\analysis\model_correlation\output

04/11/2010  01:58 PM    <DIR>          .
04/11/2010  01:58 PM    <DIR>          ..
04/11/2010  02:52 PM         1,084,380 corr_head_vs_time.dat
04/11/2010  02:52 PM         1,072,200 corr_keff_vs_time.dat
04/11/2010  01:58 PM        10,670,500 head_trav.dat
04/11/2010  02:12 PM           171,444 hpc.out
04/11/2010  03:59 PM         1,126,533 keff_mean.out
04/11/2010  01:58 PM         9,786,982 keff_trav.dat
04/11/2010  03:59 PM         1,046,563 keff_var.out
04/11/2010  02:12 PM           185,720 kpc.out
               8 File(s)     25,144,322 bytes

 Directory of C:\report_CD\analysis\triangle_metric

04/07/2010  12:43 PM    <DIR>          .
```


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Table 8-1. CD Directory listing

```
04/07/2010  12:43 PM    <DIR>          ..
04/10/2010  03:52 PM    <DIR>          output
04/07/2010  12:53 PM             6,230 triangles_add_one.m
04/07/2010  12:54 PM            13,051 triangles_remove_one.m
04/07/2010  12:54 PM             7,735 triangles_remove_two.m
               3 File(s)         27,016 bytes

 Directory of C:\report_CD\analysis\triangle_metric\output

04/10/2010  03:52 PM    <DIR>          .
04/10/2010  03:52 PM    <DIR>          ..
04/10/2010  03:53 PM         1,395,622 triangles_add_one_mean.dat
04/10/2010  03:53 PM         1,395,622 triangles_add_one_median.dat
               2 File(s)      2,791,244 bytes

 Directory of C:\report_CD\report

04/07/2010  12:42 PM    <DIR>          .
04/07/2010  12:42 PM    <DIR>          ..
04/09/2010  10:38 AM    <DIR>          figures
               0 File(s)              0 bytes

 Directory of C:\report_CD\report\figures

04/09/2010  10:38 AM    <DIR>          .
04/09/2010  10:38 AM    <DIR>          ..
04/09/2010  10:39 AM    <DIR>          01_intro
04/09/2010  10:39 AM    <DIR>          02_kriging
04/09/2010  10:39 AM    <DIR>          03_triangles
04/09/2010  10:40 AM    <DIR>          04_model_correlation
04/09/2010  10:40 AM    <DIR>          05_combine_3_methods
               0 File(s)              0 bytes

 Directory of C:\report_CD\report\figures\01_intro

04/09/2010  10:39 AM    <DIR>          .
04/09/2010  10:39 AM    <DIR>          ..
04/09/2010  10:38 AM            13,001 fig01_fiber_vs_steel_well_locations.srf
               1 File(s)         13,001 bytes

 Directory of C:\report_CD\report\figures\02_kriging

04/09/2010  10:39 AM    <DIR>          .
04/09/2010  10:39 AM    <DIR>          ..
04/10/2010  01:03 PM             3,798 krig_add_one_plotting.m
04/09/2010  12:01 PM           983,627 may2007_variogram_modela.srf
04/09/2010  10:53 AM        16,893,066 perturbation_spread_of_variograms.srf
04/10/2010  11:40 AM           111,616 piecewise_linear_trend.xls
04/09/2010  11:57 AM            15,469 remove_one_steel_well.srf
04/09/2010  10:53 AM            28,672 trend_surface_remove_one_results.xls
               6 File(s)     18,036,248 bytes

 Directory of C:\report_CD\report\figures\03_triangles

04/09/2010  10:39 AM    <DIR>          .
04/09/2010  10:39 AM    <DIR>          ..
04/09/2010  10:40 AM             2,072 random_points_triangle_explanation.mat
04/09/2010  10:42 AM             4,384 three_point_estimator_fig.m
04/09/2010  10:42 AM           539,206 three_point_estimator_log10r.tif
04/09/2010  12:00 PM         1,150,768 three_triangle_metrics.fig
04/09/2010  10:40 AM         1,317,464 triangulation_explanation.fig
               5 File(s)      3,013,894 bytes

 Directory of C:\report_CD\report\figures\04_model_correlation

04/09/2010  10:40 AM    <DIR>          .
04/09/2010  10:40 AM    <DIR>          ..
```

Table 8-1. CD Directory listing

```
 Directory of C:\report_CD\report\figures\05_combine_3_methods

04/09/2010  10:40 AM    <DIR>          .
04/09/2010  10:40 AM    <DIR>          ..
               0 File(s)              0 bytes

     Total Files Listed:
              81 File(s)    175,409,691 bytes
              65 Dir(s)  147,501,948,928 bytes free
```

8.2. Kriging Variance Minimization Scripts

The following scripts were used in the kriging variance minimization (see Section 2.0).

8.2.1. R script `plot_linear_fit_summary.R`

The following R script computes the linear fit surface (Equation 1, in Section 2.1) and the related summary statistics given in Figure 2-3 and Table 2-1 using built-in statistical functions.

```
# this R script computes the best fit linear model through the freshwater
# head data and plots some summary statistics included as figures in the
# analysis report.

# load in data
wells <- read.table('../../common_data/2007_well_data_for_trend.dat')
row.names(wells) <- read.table('../../common_data/2007_well_names.dat')$V1
names(wells) <- c('x','y','fwh','res','casing','flag')
attach(wells)

# don't select SNL-6 and SNL-15 (they have -999 in res column)
# and don't use redundant H-19 wells
mask <- flag == 1
wells.lm <- lm(fwh[mask]~x[mask]+y[mask])
summary(wells.lm)
par(mfrow=c(2,2))
plot(wells.lm)
```

8.2.2. Python script `remove_one_variogram_effects.py`

The following Python script computes the best-fit trend surface through the dataset after individually removing each steel-cased well. The two outputs from this script are the effects of removing a well on the best-fit linear surface (see Figure 2-4) and the resulting smaller-by-one datasets used to compute experimental variograms via Surfer in Figure 2-6.

```
import numpy as np
import os

modelDat = np.loadtxt(r'..\..\common_data\model_domain_specs.dat')

# use midpoint of model domain for origin of surface fitting
# to improve condition number of matrices in least-squares fitting
xmid = (modelDat[2,0] + modelDat[1,0])/2.0
ymid = (modelDat[2,1] + modelDat[1,1])/2.0

fh = open(r'..\..\common_data\2007_well_names.dat','r')
names = [line.rstrip() for line in fh]
fh.close()

wellDat = np.loadtxt(r'..\..\common_data\2007_well_data_for_trend.dat',dtype=np.float64)

# data columns: X,Y,FWH,res,casing,flag
# FWH :: may 2007 freshwater head
# res :: residual computed using R
```


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```
# casing :: 1=steel, 0=fiberglass/pvc
# flag :: 0= do not use in trend analysis, 2=do not use at all,
#         1= use in both trend & variogram analysis

fh = open('trend_surface_remove_one_results.csv','w')
fh.write('well,sum squared error,condition number,rank,R^2,A,B,C,gradient,angle\n')

trendWells = wellDat[wellDat[:,5]==1]
trendNames = [name for (i,name) in enumerate(names) if wellDat[i,5]==1]
ntwells = trendWells.shape[0]
trendNames.append('base_case')

# additional wells used in variogram analysis, but not in trend analysis H-19b{2,3,4,5,6,7}
varioWells = wellDat[wellDat[:,5]==0]
varioNames = [name for (i,name) in enumerate(names) if wellDat[i,5]==0]
nvwells = varioWells.shape[0]

for i in xrange(ntwells+1):
    if i==ntwells or np.abs(trendWells[i,4] - 1.0) < 0.01:

        # make a mask that is all true
        mask = trendWells[:-1,0] > 1.0

        # set the current steel well to false
        if i < ntwells:
            mask[i] = False

        tX = trendWells[mask,0] - xmid
        tY = trendWells[mask,1] - ymid
        tH = trendWells[mask,2]

# using numpy recompute linear trend & compute residuals
# compute statistics about change removing each well has on estimated surface
# relative change in angle, slope & offset of surface
# write wells & residuals to file

        trendA = np.concatenate((tX[:,None],tY[:,None],np.ones((tX.shape[0],1))),axis=1)

        x,residues,rank,singulars = np.linalg.lstsq(trendA,tH)
        # residues is "squared Euclidian norm"

        cond = np.max(singulars)/np.min(singulars)
        # coefficient of determination
        rsq = 1.0 - residues/np.sum((tH - np.mean(tH))**2)
        # rsq = 1 - SS_err / SS_tot

        # write summary of fit as a line in file
        fh.write(','.join(str(z) for z in (trendNames[i],residues[0],cond,rank,rsq[0])) +',')
        fh.write('%.7e,%.7e,' % tuple(x[0:2])) # A and B
        fh.write('%.7e,' % (x[2] - x[0]*xmid - x[1]*ymid,)) # C corrected to original coords
        fh.write(','.join(str(z) for z in (np.sqrt(x[0]**2 + x[1]**2),
                                           np.arctan2(x[1],x[0])/np.pi*180.0))+'\n')

        tHpred = np.dot(trendA,x)
        outdata = np.concatenate((trendWells[mask,0:2],
                                  tHpred[:,None],(tHpred-tH)[:,None]),axis=1)

        # write all trend data to separate file for variogram analysis in Surfer
        np.savetxt('trend_results_'+trendNames[i]+'.dat',outdata,fmt='%.2f')

fh.close()
```

8.2.3. Python script `krig_plus_one.py`

The following Python script drives the GSLIB kriging program `kt3d.exe` during the kriging variance minimization process for adding one well (where it is called as a program). The script is also imported as a library in the remove-one and remove-two kriging variance reduction scripts. This script imports `shared_data.py` (line 8) to act as a container for storing shared variables, and uses the MS-DOS batch script `kt3d_driver.bat` (line 70) to manage directories and executables related to kt3d execution.

```
import os
```

```
import threading
from time import sleep
import numpy as np
from scipy.stats import rankdata
from math import ceil

import shared_data as sh

# this script is part of AP-111
# this python script adds an observation point at points
# in the model domain, each time calling KT3D.exe to krig the
# current network along with this additional observation.

# the kriging variance is read in and some statistics are saved
# for comparison and plotting.

def krig(ii,jj,xx,yy,nxx,nyy,x00,y00,dxx,dyy,base=False,addone=True):
    """ write KT3D input file, call kt3d.exe,
    and read in results for summarizing in global array."""

    # write kt3d parameter file
    d = '%03d_%03d' % (ii,jj)
    os.popen('mkdir ' + d)
    fname = os.path.join(d,'KT3D.PAR')
    fpar = open(fname,'w')

    fpar.write("""Parameters for KT3D\n*******************\n\nSTART OF PARAMETERS:
data.dat                          \\file with data
1   2   0   4   0                 \\   columns for X, Y, Z, var, sec var
-1.0e21   1.0e21                  \\   trimming limits
0                                 \\option: 0=grid, 1=cross, 2=jackknife
xvk.dat                           \\file with jackknife data
1   2   0   3    0                \\   columns for X,Y,Z,vr and sec var
0                                 \\debugging level: 0,1,2,3
kt3d.dbg                          \\file for debugging output
kriged.out                         \\file for kriged output
%(nxx)d  %(x00)g  %(dxx)g          \\nx,xmn,xsiz
%(nyy)d  %(y00)g  %(dyy)g         \\ny,ymn,ysiz
1    0.5     1.0                  \\nz,zmn,zsiz
1    1       1                    \\x,y and z block discretization
0    44                           \\min, max data for kriging
44                                \\max per octant (0-> not used)
40000.0  40000.0  1.0             \\maximum search radii
90.0   0.0   0.0                  \\angles for search ellipsoid
1     0.0                         \\0=SK,1=OK,2=non-st SK,3=exdrift
0 0 0 0 0 0 0 0 0                 \\drift: x,y,z,xx,yy,zz,xy,xz,zy
0                                 \\0, variable; 1, estimate trend
extdrift.dat                      \\gridded file with drift/mean
1                                 \\  column number in gridded file
1    3.0                          \\nst, nugget effect
3   40.0    90.0     0.0   0.0        \\it,cc,ang1,ang2,ang3
           7500.0 7500.0  10.0       \\a_hmax, a_hmin, a_vert\n""" % vars())
    fpar.close()

    # write data back to file, adding new point to end
    finput = open(os.path.join(d,'data.dat'),'w')
    finput.write('data for kriging data + 1 new well \n5 \nX \nY \nfwh \nres \ncasing \n')
    finput.write(sh.data)
    if base == False and addone == True:
        # add one data point (5 columns, tab delimited)
        finput.write('%8.1f\t%9.1f\t 100.00 \t1.00\t0 ' % (xx,yy))
    finput.close()

    # run KT3D via MS-DOS batch script
    output = os.popen('kt3d_driver.bat ' + d)
    for line in output:
        pass
    failure = output.close()
    if failure:
        print '*** KT3D failed ***',ii,jj
    else:
        print '(%03i,%03i) ' % (ii,jj),

    ## read in and calculate summary statistics on kriging variance
    # output from kt3d is a vector, reshape it into a matrix
    var = np.reshape(np.loadtxt(os.path.join(d,'kriged.out'),
                                skiprows=4,usecols=(1,)),(nyy,nxx))

    if base == True:
        sh.base_case_mod =  (var[mod_m[0]:mod_m[1], mod_n[0]:mod_n[1]])
        sh.base_case_wipp = (var[wipp_m[0]:wipp_m[1], wipp_n[0]:wipp_n[1]])
```


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```
            # write base case kriging variance as a matrix for contouring
            np.savetxt('kriged_base_case_var_img.dat',sh.base_case_mod,fmt='%.3f')

        var_mod =  var[mod_m[0]:mod_m[1], mod_n[0]:mod_n[1]]
        var_wipp = var[wipp_m[0]:wipp_m[1], wipp_n[0]:wipp_n[1]]

        # use lock when writing to global variable to prevent thread collisions
        with threading.Lock():
            # compute statistics for sub-block corresponding to model domain,
            # masked by the cells which are inside the area of interest

            # change in aoi-wide standard deviation
            sh.mod_results[ii,jj,0] = (sh.base_case_mod[aoimask].std() -
                                       var_mod[aoimask].std())/
                                       sh.base_case_mod[aoimask].std()
            # change in aoi-wide average
            sh.mod_results[ii,jj,1] = (np.average(sh.base_case_mod[aoimask]) -
                                       np.average(var_mod[aoimask]))/
                                       np.average(sh.base_case_mod[aoimask])

            # change in aoi-wide median
            sh.mod_results[ii,jj,2] = (np.median(sh.base_case_mod[aoimask]) -
                                       np.median(var_mod[aoimask]))/
                                       np.median(sh.base_case_mod[aoimask])

            # correlation coefficient between cases
            sh.mod_results[ii,jj,3] = 1.0 - np.corrcoef(sh.base_case_mod[aoimask].flatten(),
                                                        var_mod[aoimask].flatten())[0,1]

            # change in max variance
            sh.mod_results[ii,jj,4] = (sh.base_case_mod[aoimask].max() -
                                       var_mod[aoimask].max())

            # same statistics for land-withdrawl boundary sub-block
            sh.wipp_results[ii,jj,0] = (sh.base_case_wipp[wippmask].std() -
                                        var_wipp[wippmask].std())/
                                        sh.base_case_wipp[wippmask].std()
            sh.wipp_results[ii,jj,1] = (np.average(sh.base_case_wipp[wippmask]) -
                                        np.average(var_wipp[wippmask]))/
                                        np.average(sh.base_case_wipp[wippmask])
            sh.wipp_results[ii,jj,2] = (np.median(sh.base_case_wipp[wippmask]) -
                                        np.median(var_wipp[wippmask]))/
                                        np.median(sh.base_case_wipp[wippmask])
            sh.wipp_results[ii,jj,3] = 1.0 - np.corrcoef(sh.base_case_wipp[wippmask].flatten(),
                                                         var_wipp[wippmask].flatten())[0,1]
            sh.wipp_results[ii,jj,4] = (sh.base_case_wipp[wippmask].max() -
                                        var_wipp[wippmask].max())


##################################################
# common stuff that is useful for adding or removing wells from the network
# included below, imported elsewhere.

# coordinates of wipp land-withdrawl boundary (McKenna 2004) AP-111, p 13
# averaged to be a N-S square for simple array addressing (it is nearly square anyway)
fh = open(r'..\common_data\wipp_boundary.dat')
wipp_file = [l.rstrip() for l in fh]
fh.close()
coords = []

# corners listed in file in order :NE,SE,SW,NW,NE (NE repeated to close loop)
for line in wipp_file[:-1]:
    coords.append([float(z) for z in line.split()])

wipp_x = ((coords[2][0] + coords[1][0])/2.0, (coords[0][0] + coords[3][0])/2.0)
wipp_y = ((coords[2][1] + coords[3][1])/2.0, (coords[0][1] + coords[1][1])/2.0)

# output grid (the model domain) specifications, number of elements reduced by
# a multiplier to make the run-time feasible
mult = 4.0
fh = open(r'..\common_data\model_domain_specs.dat')
moddata = [l.rstrip() for l in fh]
fh.close()

# always rounds up when determining number of elements
nx,ny = [int(ceil(float(z)/mult)) for z in moddata[0].split()]
x0,y0 = [float(z) for z in moddata[1].split()]
x1,y1 = [float(z) for z in moddata[2].split()]
dx,dy = [float(z)*mult for z in moddata[3].split()]
```

```
    # make vectors
    x = np.array([x0 + i*dx for i in range(nx)])
    y = np.array([y0 + i*dy for i in range(ny)])

    # check that everything adds up correctly to fill the domain
    assert abs(x[-1] - x1) < dx, abs(y[-1] - y1) < dy

    # saved from matlab, this array has 1.00E+0 for cells inside area of interest and
    # 0.00E+0 for cells outside
    size = mult*100
    intmask = np.loadtxt(r'..\common_data\model_cells_%(size)d_inside_totalbdry.dat' % vars())
    aoimask = intmask > 0.99

    print 'model domain',intmask.sum(),'true out of',np.size(intmask)

    # make outerproduct matricies for Matlab plotting
    X = np.outer(np.ones(ny),x)
    Y = np.outer(y,np.ones(nx))

    # indicies for this grid corresponding to the wipp lwb
    wipp_n = (int((wipp_x[0] - x0)/dx), int((wipp_x[1] - x0)/dx))
    wipp_m = (int((wipp_y[0] - y0)/dy), int((wipp_y[1] - y0)/dy))
    sh.base_case_wipp = np.zeros((wipp_m[1]-wipp_m[0], wipp_n[1]-wipp_n[0]))

    wippmask = aoimask[wipp_m[0]:wipp_m[1], wipp_n[0]:wipp_n[1]]
    wippcheck = np.zeros(np.shape(wippmask))
    wippcheck[wippmask] = 1.0
    print 'WIPP boundary',wippcheck.sum(),'true out of',np.size(wippmask)

    # indicies corresponding to the model domain
    mod_n = (int((x0 - x0)/dx), int((x0 - x0)/dx) + nx)
    mod_m = (int((y0 - y0)/dy), int((y0 - y0)/dy) + ny)
    sh.base_case_mod = np.zeros((mod_m[1]-mod_m[0], mod_n[1]-mod_n[0]))

    format = '%.5e'

    # read observed data as one long string
    fh = open(r'..\common_data\2007_well_data.dat','r')
    sh.data = fh.read().strip() # strip off ending / beginning whitespace
    fh.close()

    # make sure data file ends in a newline
    if sh.data[-1] != '\n':
        sh.data = sh.data + '\n'


    # ##################################################
    # only run from here below if called as a program (rather than
    # imported as a library)

    if __name__ == '__main__':

        # global arrays to write results into
        sh.mod_results =  np.ones((ny,nx,5))
        sh.wipp_results = np.ones((ny,nx,5))

        krig(0,0,0.0,0.0,nx,ny,x0,y0,dx,dy,base=True)
        f = open('base_stats.out','w')
        # mean, median, std dev
        f.write(' '.join([str(x) for x in (sh.mod_results[0,0,1],sh.mod_results[0,0,2],
                                           sh.mod_results[0,0,0],'\n')]))
        f.write(' '.join([str(x) for x in (sh.wipp_results[0,0,1],sh.wipp_results[0,0,2],
                                           sh.wipp_results[0,0,0],'\n')]))
        f.close()

        for j in xrange(nx):
            print ' '
            for i in xrange(ny):
                # don't do calculation if point is outside area of interest
                if aoimask[i,j] == True:
                    while True:
                        # limit the number of threads (8 processors)
                        if threading.activeCount() <= 8:
                            threading.Thread(target=krig,
                                             args=(i,j,X[i,j],Y[i,j],nx,ny,
                                                   x0,y0,dx,dy,False)).start()
                            break
                        else:
                            sleep(0.015)

        # wait for all the worker threads to finish before writing output
```


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```
    while True:
246     if threading.activeCount() > 1:
            sleep(1.0)
248     else:
            break
250
    # write output in Matlab-friendly matrix format
252 names = ['stdev','mean','median','corrcoef','max']

254 for i,name in enumerate(names):
        print 'writing', name,i
256     np.savetxt('addone_mod_results_' + name + '.dat',  sh.mod_results[:,:,i],fmt=format)
        np.savetxt('addone_wipp_results_' + name + '.dat', sh.wipp_results[:,:,i],fmt=format)
258
    np.savetxt('X.dat',X,fmt='%.1f')
260 np.savetxt('Y.dat',Y,fmt='%.1f')
```

8.2.4. Python script `shared_data.py`

The following short Python script is used to allow data to be saved and shared in a common module (see line 8 of `krig_plus_one.py`, line 7 of `krig_remove_one_steel.py`).

```
""" this is just for putting global data in, so
2 it can be seen between modules"""

4 pass
```

8.2.5. MS-DOS batch script `kt3d_driver.bat`

The following MS-DOS batch script is called by the Python scripts (see line 70 of `krig_plus_one.py`) that drive kt3d, and is actually responsible for calling `kt3d.exe`, first creating a temporary directory and copying the executable and input files into that directory. This allows the scripts to be threaded and have more than one copy of kt3d running at a time.

```
    echo off
2   rem kriging plus one driver script
    rem this batch file copies the executable into a working directory
4   rem runs it (it expects a standard input filename KT3D.PAR)
    rem and deletes the executable
6   copy /B /Y KT3D.EXE %1
    copy /A /Y response %1
8   chdir %1
    KT3D.EXE < response
10  del /F KT3D.EXE response
    chdir ..\
```

8.2.6. MATLAB script `generate_model_cell_masks.m`

The following MATLAB script generates ASCII matrix files representing the model grid, indicating whether each cell is inside or outside the active MODFLOW region (relying on the MATLAB built-in command `inpolygon()` to do most of the work). The text files generated by this script are read in by krig_plus_one.py (line 176 of Section 8.2.1).

```
    % this Matlab script exports arrays representing whether a cell
2   % from the model grid is inside or outside the area of interest
    % for use in python scripts
4
    clear
6   totalbdry = load('..\common_data\total_boundary.dat');

8   % model grid (for 100x100 elements - the base size)
    grid = load('..\common_data\model_domain_specs.dat');
10  nx = grid(1,1);    ny = grid(1,2);
    xmin = grid(2,1);  ymin = grid(2,2);
```


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```
xmax = grid(3,1);  ymax = grid(3,2);
dx = grid(4,1);    dy = grid(4,2);
clear grid;

for mult = 1:6
    [X,Y] = meshgrid(xmin:mult*dx:xmax, ymin:mult*dy:ymax);
    % create logical mask
    INSIDE = inpolygon(X,Y,totalbdry(:,1),totalbdry(:,2));
    % convert to real to save (Matlab can't write logical values to ASCII)
    inside = +INSIDE;
    filename = ['model_cells_',sprintf('%d',100*mult),'_inside_totalbdry.dat'];
    save('-ASCII',filename,'inside')
end
```

8.2.7. Python script `krig_remove_one_steel.py`

The following Python script imports the main `krig()` routine from `krig_plus_one.py` (see Section 8.2.1), but instead of adding more locations and re-kriging, a single steel-cased well is removed from the existing dataset and the remaining set is re-kriged.

```
import sys
import numpy as np

# most of the functionality is defined in krig_plus_one; import to re-use code
sys.path.append(r'..\kriging_add_well')
import krig_plus_one as k
import shared_data as shared

# this python script removes an observation point, each time calling
#  KT3D.exe to krig the remaining network

fh = open(r'..\common_data\2007_well_names.dat','r')
names = [line.rstrip() for line in fh]
fh.close()

# fifth column is casing type (1=steel, 0=fiberglass)
fh = open(r'..\common_data\2007_well_data.dat','r')
wells = [line.rstrip().split() for line in fh]
fh.close()

shared.mod_results = np.zeros((len(wells)+1,1,5))
shared.wipp_results = np.zeros((len(wells)+1,1,5))

# base case, for computing percentage change
shared.data = '\n'.join('\t'.join(w) for w in wells)
print 'base_case',
k.krig(len(wells),0,0.0,0.0,k.knx,k.kny,k.kx0,k.ky0,k.dx,k.dy,base=True,addone=False)

fm = open('model_results_one.dat','w')
fw = open('wipp_results_one.dat','w')

stnames = []

# remove one steel cased well
for i,well in enumerate(wells):
    if int(well[4]) == 1:
        stnames.append(names[i])

        # make a copy and delete current well from copy
        cwells = list(wells)
        del cwells[i]
        shared.data = '\n'.join('\t'.join(w) for w in cwells)

        print names[i],
        k.krig(i,0,0.0,0.0,k.knx,k.kny,k.kx0,k.ky0,k.dx,k.dy,base=False,addone=False)
        fm.write(', '.join([str(x) for x in shared.mod_results[i,0,:]]))
        fm.write(', ' + names[i] + '\n')
        fw.write(', '.join([str(x) for x in shared.wipp_results[i,0,:]]))
        fw.write(', ' + names[i] + '\n')

fw.close()
fm.close()
```


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8.2.8. Python script `krig_remove_two_steel.py`

The following Python script is analogous to that in Section 8.2.6, except a list of most-likely-to-be-removed steel-cased wells are first removed before removing a second steel-cased wells and re-kriging the results. The main functionality of this routine is imported from the Python script `krig_plus_one.py` (see Section 8.2.1).

```
import sys
import numpy as np

# most of the functionality is defined in krig_plus_one; import to re-use code
sys.path.append(r'..\kriging_add_well')
import krig_plus_one as k
import shared_data as shared

# this python script removes an observation point, each time calling
#  KT3D.exe to krig the remaining network

fh = open(r'..\common_data\2007_well_names.dat','r')
names = [line.rstrip() for line in fh]
fh.close()

# fourth column is casing type (1=steel, 0=fiberglass)
fh = open(r'..\common_data\2007_well_data.dat','r')
wells = [line.rstrip().split() for line in fh]
fh.close()

# perform the "remove one well" analysis for the networks modulo the
# following "likely to not be replaced" wells
firstWell = ['WIPP-25','WIPP-13','H-12','H-7b1']

shared.mod_results = np.zeros((len(wells)+1,1,5))
shared.wipp_results = np.zeros((len(wells)+1,1,5))

# same base-case used throughout to allow comparison
shared.data = '\n'.join('\t'.join(w) for w in wells)
print 'base case',
k.krig(len(wells),0,0.0,0.0,k.knx,k.kny,k.kx0,k.ky0,k.dx,k.dy,base=True,addone=False)

fm = open('model_results_two.dat','w')
fw = open('wipp_results_two.dat','w')

stnames = []

# remove one of the first steel cased wells
for first in firstWell:
    # find index in list
    ifirst = names.index(first)

    # make a local copy of well list
    cwells = list(wells)

    # remove first steel well
    del cwells[ifirst]

    # cycle through remaining steel wells
    for i,well in enumerate(wells):
        if int(well[4]) == 1:
            if ifirst != i:

                stnames.append(names[i])

                # make another copy of list, removing second well
                ccwells = list(cwells)
                del ccwells[i]

                # collapse back into string
                shared.data = '\n'.join('\t'.join(w) for w in ccwells)

                print names[ifirst],names[i],
                k.krig(i,0,0.0,0.0,k.knx,k.kny,k.kx0,k.ky0,k.dx,k.dy,base=False,addone=False)
                fm.write(', '.join([str(x) for x in shared.mod_results[i,0,:]])+',')
                fm.write(', '.join((names[ifirst],names[i])) + '\n')
                fw.write(', '.join([str(x) for x in shared.wipp_results[i,0,:]])+',')
```

```
                fw.write(', '.join((names[ifirst],names[i])) + '\n')

fw.close()
fm.close()
```

8.3. Triangle Metric Maximization Scripts

The following scripts were used in the local gradient estimation or triangle metric maximization portion of the analysis (see Section 3.0).

8.3.1. MATLAB script `triangles_add_one.m`

The following MATLAB script computes and plots figures related to the triangle interior angle ratio metric. Each location in the model domain is added to the current network and the statistics are re-computed.

```
clear
% this Matlab script asses the benefit of adding a new well, where
% locations on the MODFLOW model grid are used as potential locations.
% This approach is geometry-based only;

% the ratio min(angle)/max(angle) is used as a metric for the "quality" of
% a triangle.  More equilateral (ratio=1) triangles would be better.

addpath '..\common_programs\'
wells = load('..\common_data\2007_well_data_for_triangles.dat');
margin = load('..\common_data\composite_23_margin.dat');
noflow = load('..\common_data\no_flow_boundary.dat');
totalbdry = load('..\common_data\total_boundary.dat');
WIPP = load('..\common_data\wipp_boundary.dat');

% default qhull options, except QbB, which scales domain to unit box (since
% UTM coordinates are numerically large and can lead to significant
% roundoff error)
triopts = {'Qt','QbB','Qc','Qz'};

xt=wells(:,1);
yt=wells(:,2);
nw = size(xt,1);

% model grid
grid = load('..\common_data\model_domain_specs.dat');
nx = grid(1,1);    ny = grid(1,2);
xmin = grid(2,1);  ymin = grid(2,2);
dx = grid(4,1);    dy = grid(4,2);
clear grid;

[X,Y] = meshgrid(linspace(xmin,xmin+nx*dx,nx), ...
    linspace(ymin,ymin+ny*dy,ny));
D = numel(X);

INSIDE = reshape(inpolygon(X,Y,totalbdry(:,1),totalbdry(:,2)),D,1);
INSIDE(D+1) = 1;

% observation points in a long x,y vector
Z(1:D,1:2) = [reshape(X,D,1),reshape(Y,D,1)];

Q = zeros(D,5);
numt = zeros(D,1);

for jj=1:D+1

    % only points between no-flow and h2/h3 halite boundaries are
    % candidate sites, skip the others
    if INSIDE(jj)

        if jj==D+1
            x=xt;
            y=yt;
        else
            x = [xt; Z(jj,1)];
            y = [yt; Z(jj,2)];
        end

```


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```
        tri = delaunay(x,y,triopts);

        nt = size(tri,1);
        geom = zeros(size(tri,1),7);  % 3 sides, 3 angles, area, # pts inside

        % calculate geometric things related to triangles
        % lengths from Pythagorean theorem
        % angles from cosine law
        % area from Matlab built-in fcn

        % length of side a (2->3)
        geom(1:nt,1) = sqrt((x(tri(:,3)) - x(tri(:,2))).^2 + ...
            (y(tri(:,3)) - y(tri(:,2))).^2);
        % length of side b (3->1)
        geom(1:nt,2) = sqrt((x(tri(:,1)) - x(tri(:,3))).^2 + ...
            (y(tri(:,1)) - y(tri(:,3))).^2);
        % length of side c (1->2)
        geom(1:nt,3) = sqrt((x(tri(:,2)) - x(tri(:,1))).^2 + ...
            (y(tri(:,2)) - y(tri(:,1))).^2);

        % angle 1 between sides b & c in radians
        geom(1:nt,4) = acos((sum(geom(:,2:3).^2,2) - geom(:,1).^2)./ ...
            (2.0*prod(geom(:,2:3),2)));
        % angle 2 between sides a & c in radians
        geom(1:nt,5) = acos((sum(geom(:,1:2:3).^2,2) - geom(:,2).^2)./ ...
            (2.0*prod(geom(:,1:2:3),2)));
        % angle 3 between sides b & a in radians
        geom(1:nt,6) = acos((sum(geom(:,1:2).^2,2) - geom(:,3).^2)./ ...
            (2.0*prod(geom(:,1:2),2)));

        % area of triangle - use MATLAB built-in function
        geom(1:nt,7) = polyarea(x(tri(:,1:3)),y(tri(:,1:3)),2);

        % compute triangle comparison criterias
        ang_ratio = min(geom(:,4:6),[],2)./max(geom(:,4:6),[],2);

        % area-weighted angle ratio
        Q(jj,1) = sum(ang_ratio(:).*geom(:,7))/(nt*sum(geom(1:nt,7)));

        % non-weighted angle ratio average
        Q(jj,2) = sum(ang_ratio(:))/nt;

        % area-weighted angle ratio median
        Q(jj,3) = median(ang_ratio(:).*geom(:,7))/sum(geom(1:nt,7));
        numt(jj) = nt;

        % mean triangle area
        Q(jj,4) = sum(geom(:,7))/nt;

        % median triangle area
        Q(jj,5) = median(geom(:,7));
    end
end

% reset values outside area of interest to not-a-number
% so they are not plotted.

% save results for use in final 3-way combination of results
out = reshape(squeeze((Q(1:end-1,1)-Q(D+1,1))./Q(D+1,1)),ny,nx);
out(~INSIDE(1:end-1)) = -999;
save('triangles_add_one_mean.dat','out','-ASCII');
out = reshape(squeeze((Q(1:end-1,3)-Q(D+1,3))./Q(D+1,3)),ny,nx);
out(~INSIDE(1:end-1)) = -999;
save('triangles_add_one_median.dat','out','-ASCII');
clear out;

Q(~INSIDE(1:end-1),1:end) = NaN;
numt(~INSIDE(1:end-1)) = NaN;

scrnsz = get(0,'ScreenSize');

%% plot results
figure()
ceil(max(numt)-min(numt))
contourf(X,Y,reshape(numt(1:D),ny,nx),3);
colorbar;
daspect([1,1,1]);
hold on
tri = delaunay(xt,yt,triopts);
triplot(tri,xt,yt,'g','LineWidth',0.5);
plot(xt,yt,'or','LineWidth',2)
```

```
plot(margin(:,1),margin(:,2),'-m','LineWidth',2)
plot(noflow(:,1),noflow(:,2),'--k','LineWidth',2)
plot(WIPP(:,1),WIPP(:,2),'-k','LineWidth',1.5)
xlabel('NAD27 UTM x Zone 13 [m]','FontSize',14)
ylabel('NAD27 UTM y Zone 13 [m]','FontSize',14)
title('Total number of triangles in network')
% measured from inside of figure window (no borders or toolbars included)
% position -> [left, bottom, width, height]
set(gcf,'Position',[10,50,(scrnsz(4)-120)*0.95,scrnsz(4)-120])
% make file printed at screen size, rather than bad default
set(gcf, 'PaperPositionMode', 'auto');
print('-dmeta','triangles_add1_total_number.emf')

type2 = {'scaled_mean_angle','unscaled_mean_angle','median_angle','mean_area','median_area'};
cblab = {'%\Delta area-weighted mean angle ratio', ...
         '%\Delta mean angle ratio', ...
         '%\Delta area-weighted median angle ratio', ...
         '%\Delta mean triangle area', '%\Delta median triangle area'};
txt = {'a','','b','','',''};
white = 0.0;
for ii=1:5
    clf;
    data = squeeze((Q(1:D,ii) - Q(D+1,ii))./Q(D+1,ii));
    contourf(X,Y,reshape(data,ny,nx),20);
    colormap(redwhitemap(data,white));
    cb = colorbar;
    set(get(cb,'ylabel'),'string',cblab{ii},'FontSize',14);
    daspect([1,1,1]);
    hold on
    tri = delaunay(xt,yt,triopts);
    triplot(tri,xt,yt,'g','LineWidth',2)
    plot(xt,yt,'or','LineWidth',2)
    plot(margin(:,1),margin(:,2),'-m','LineWidth',2)
    plot(noflow(:,1),noflow(:,2),'--k','LineWidth',2)
    plot(WIPP(:,1),WIPP(:,2),'-k','LineWidth',1.5)
    xlabel('NAD27 UTM X Zone 13 [m]','FontSize',14)
    ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',14)
    set(gcf,'Position',[10,50,(scrnsz(4)-120)*0.85,scrnsz(4)-120])
    set(gcf, 'PaperPositionMode', 'auto');
    text(6.05E5,3.594E6,txt{ii},'FontSize',24,'FontWeight','bold');
    brighten(0.5);
    print('-dmeta', ['triangles_add1_',type2{ii},'.emf'])
end
```

8.3.2. MATLAB function `redwhitemap.m`

The following MATLAB script is a function for computing the red-white-blue color maps used in the plotting of figures in this section; see line 161 of `triangles_add_one.m` in section 8.3.1.

```
function [ map ] = redwhitemap( data, white )
%REDWHITEMAP create a specific color map from
% blue = min to red=max with wite at a specific number

mindata = min(min(data));
maxdata = max(max(data));

nlevels = 64;

map = zeros(nlevels,3);

if mindata >= white
    % ** all data will be colored red (no blue or white)

    mindata = white;

    % compute color at midpoint of each bin, rather than at max or min
    xn = mindata + (0.5:1.0:(nlevels-0.5))*(maxdata - mindata)/nlevels;

    % white -> red
    map(xn >= white,1) = 1;    % red
    map(xn >= white,2) = (maxdata - xn(xn >= white))/(maxdata - white);  % green
    map(xn >= white,3) = map(xn >= white,2);  % blue


elseif maxdata <= white
```


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```
    % ** all data will be colored blue (no red or white)

    maxdata = white;

    % compute color at midpoint of each bin, rather than at max or min
    xn = mindata + (0.5:1.0:(nlevels-0.5))*(maxdata - mindata)/nlevels;

    % blue -> white
    map(xn < white,1) = (xn(xn < white) - mindata)/(white - mindata);  % red channel
    map(xn < white,2) = map(xn < white,1);  % green
    map(xn < white,3) = 1;          % blue

else
    % ** data will be blue, red, and white

    % compute color at midpoint of each bin, rather than at max or min
    xn = mindata + (0.5:1.0:(nlevels-0.5))*(maxdata - mindata)/nlevels;

    % blue -> white
    map(xn < white,1) = (xn(xn < white) - mindata)/(white - mindata);  % red channel
    map(xn < white,2) = map(xn < white,1);  % green
    map(xn < white,3) = 1;          % blue

    % white -> red
    map(xn >= white,1) = 1;     % red
    map(xn >= white,2) = (maxdata - xn(xn >= white))/(maxdata - white);  % green
    map(xn >= white,3) = map(xn >= white,2);  % blue

end
end
```

8.3.3. MATLAB script `triangles_remove_one.m`

The following MATLAB script computes and plots the triangle interior angle ratio metric after individually removing each of the steel-cased wells from the network.

```
clear
% This matlab script looks at the effects that removing one of the
% steel-cased (without replacement) would have on the estimation of the
% gradient, using linear interpolation across Delauny triangles as the
% estimator.

% Load data
addpath '..\common_programs\';

% well datat (x,y,fwh,res,casing type)
wells = load('..\common_data\2007_well_data_for_triangles.dat');
names = textread('..\common_data\2007_well_names_for_triangles.dat','%s');

% the majority of this analysis should be done without SNL-6 and SNL-15,
% but some figures in text use them for comparison
RHmask = wells(:,4) > -990; % exclude SNL-6 and SNL-15
wells = wells(RHmask,:);
names = names(RHmask,:);
% RHmask = ones(size(wells,1),1);

margin = load('..\common_data\composite_23_margin.dat');
noflow = load('..\common_data\no_flow_boundary.dat');
totalbdry = load('..\common_data\total_boundary.dat');
wipp = load('..\common_data\wipp_boundary.dat');

nearwipp = [min(wipp(:,1))-750.0,max(wipp(:,1))+750.0, ...
            min(wipp(:,2))-750.0,max(wipp(:,2))+750.0];

% wells that make a convex hull around the dataset of all wells
hull = convhull(wells(:,1),wells(:,2));

steelwells = wells(wells(:,5)==1,1:3);  % fifth column indicates casing type
fiberwells = wells(wells(:,5)==0,1:3);
stnames =   {names{wells(:,5)==1}};

% wells on the hull that are also steel-cased
j=1;
for i=1:size(steelwells,1)
    for k=1:size(hull,1)
```

```
        if sqrt((steelwells(i,1) - wells(hull(k),1))^2 + ...
                (steelwells(i,2) - wells(hull(k),2))^2) < 1
            sthull(j) = i;
            j=j+1;
        end
    end
end

xt=wells(:,1);
yt=wells(:,2);
ht=wells(:,3);
nw = size(xt,1);
nst = size(steelwells,1);
Q = zeros(nst+1,3);

% calculation grid (not MODFLOW grid) is minimal grid which includes
% convex hull around data
xmin = min(xt);  ymin = min(yt);
xmax = max(xt);  ymax = max(yt);
dx = 100.0;       dy = 100.0;  % note: using 100x100 is slow.

[X,Y] = meshgrid(xmin:dx:xmax, ymin:dy:ymax);
nx = size(X,2);
ny = size(X,1);

INSIDE = inpolygon(X,Y,totalbdry(:,1),totalbdry(:,2));

npts = numel(X);

% direction and magnitude of gradient in each cell, for
% scenario of removing each steel-casing well + base case

GRAD = zeros(npts,nst+1,2);

% effects of removing one steel-casing well + base case for comparison
for jj=1:nst+1

    if jj < nst+1
        % set of x,y,h without steel casing well jj
        x = [fiberwells(:,1);steelwells(1:jj-1,1);steelwells(jj+1:nst,1)];
        y = [fiberwells(:,2);steelwells(1:jj-1,2);steelwells(jj+1:nst,2)];
        h = [fiberwells(:,3);steelwells(1:jj-1,3);steelwells(jj+1:nst,3)];
    else
        x= xt;
        y=yt;
        h=ht;
    end

    tri = delaunay(x,y);
    nt = size(tri,1);

    D = zeros(size(tri,1),1);
    coeff = zeros(size(tri,1),4);
    grad =  zeros(size(tri,1),2); % angle and magnitide of hydraulic gradient
    geom =  zeros(size(tri,1),8);  % 3 sides, 3 angles, area, # pts inside

    % compute equation for line through 3 points
    % value of determinant used in denominator of Cramer's rule
    D(1:nt) = x(tri(:,1)).*y(tri(:,2)) + x(tri(:,2)).*y(tri(:,3)) + ...
        y(tri(:,1)).*x(tri(:,3)) - x(tri(:,3)).*y(tri(:,2)) - ...
        x(tri(:,1)).*y(tri(:,3)) - x(tri(:,2)).*y(tri(:,1));

    % a (coefficient on x)
    coeff(1:nt,1) = (h(tri(:,1)).*y(tri(:,2)) + y(tri(:,1)).*h(tri(:,3)) + ...
        h(tri(:,2)).*y(tri(:,3)) - h(tri(:,3)).*y(tri(:,2)) - ...
        h(tri(:,2)).*y(tri(:,1)) - h(tri(:,1)).*y(tri(:,3)))./D;

    % b (coefficient on y)
    coeff(1:nt,2) = (x(tri(:,1)).*h(tri(:,2)) + h(tri(:,1)).*x(tri(:,3)) + ...
        x(tri(:,2)).*h(tri(:,3)) - x(tri(:,3)).*h(tri(:,2)) - ...
        x(tri(:,2)).*h(tri(:,1)) - x(tri(:,1)).*h(tri(:,3)))./D;

    % c (constant coefficient)
    coeff(1:nt,3) = (x(tri(:,1)).*y(tri(:,2)).*h(tri(:,3)) + ...
        y(tri(:,1)).*h(tri(:,2)).*x(tri(:,3)) + ...
        x(tri(:,2)).*y(tri(:,3)).*h(tri(:,1)) - ...
        x(tri(:,3)).*y(tri(:,2)).*h(tri(:,1)) - ...
        x(tri(:,2)).*y(tri(:,1)).*h(tri(:,3)) - ...
        x(tri(:,1)).*y(tri(:,3)).*h(tri(:,2)))./D;

    % compute angle and magnitude of hydraulic gradient
```


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```
        grad(1:nt,1) = atan2(coeff(:,2),coeff(:,1));
122     grad(1:nt,2) = sqrt(sum(coeff(:,1:2).^2,2));

124     % map results from "vector" triangles to "raster" grid
        for kk=1:nt
126         % result is a logical vector, indicating if the cell is in (T) or
            % out (F) side this current triangle
128         IN = reshape(inpolygon(X,Y,x(tri(kk,1:3)),y(tri(kk,1:3))),npts,1);

130         % sum(IN) = number of cells inside the triangle
            % ones(sum(IN))*kk = column vector of the counter kk
132         % coeff(...,1:2) = x & y gradient repeated for every cell inside
            %                  that triangle, copied to correct locations in GRAD
134
            GRAD(IN,jj,1:2) = coeff(ones(sum(IN),1)*kk,1:2);
136     end

138     % calculate geometric things related to triangles
        % lengths from Pythagorean theorem
140     % angles from cosine law
        % area from Matlab built-in fcn
142
        % length of side a (2->3)
144     geom(1:nt,1) = sqrt((x(tri(:,3)) - x(tri(:,2))).^2 + ...
            (y(tri(:,3)) - y(tri(:,2))).^2);
146     % length of side b (3->1)
        geom(1:nt,2) = sqrt((x(tri(:,1)) - x(tri(:,3))).^2 + ...
148         (y(tri(:,1)) - y(tri(:,3))).^2);
        % length of side c (1->2)
150     geom(1:nt,3) = sqrt((x(tri(:,2)) - x(tri(:,1))).^2 + ...
            (y(tri(:,2)) - y(tri(:,1))).^2);
152
        % angle 1 between sides b & c in radians
154     geom(1:nt,4) = acos((sum(geom(:,2:3).^2,2) - geom(:,1).^2)./ ...
            (2.0*prod(geom(:,2:3),2)));
156     % angle 2 between sides a & c in radians
        geom(1:nt,5) = acos((sum(geom(:,1:2:3).^2,2) - geom(:,2).^2)./ ...
158         (2.0*prod(geom(:,1:2:3),2)));
        % angle 3 between sides b & a in radians
160     geom(1:nt,6) = acos((sum(geom(:,1:2).^2,2) - geom(:,3).^2)./ ...
            (2.0*prod(geom(:,1:2),2)));
162
        % area of triangle - use MATLAB built-in function
164     geom(1:nt,7) = polyarea(x(tri(:,1:3)),y(tri(:,1:3)),2);

166     % compute goodness triangle criteria
        ang_ratio = min(geom(:,4:6),[],2)./max(geom(:,4:6),[],2);
168
        % area-weighted mean angle ratio
170     Q(jj,1) = sum(ang_ratio(:).*geom(:,7))/(nt*sum(geom(1:nt,7)));

172     % area-weighted median angle ratio
        Q(jj,2) = median(ang_ratio(:).*geom(:,7))/sum(geom(1:nt,7));
174
        % median triangle area
176     Q(jj,3) = median(geom(:,7));

178 end

180 if sum(RHmask) == 44
        % plot figures showing distribution of metrics for 2007 Culebra network
182     figure();
        trisurf(tri,x,y,ones(size(x),1),log10(geom(:,7)));
184     view(2)
        axis('image')
186     xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
        ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
188     cb = colorbar;
        set(get(cb,'ylabel'),'string','log_{10}(triangle area [m^2])','FontSize',12);
190     text(6.06E5,3.593E6,'a','FontSize',20,'FontWeight','bold')
        brighten(0.25);
192     print('-dmeta','triangles_2007_network_log10_area.emf')

194     trisurf(tri,x,y,ones(size(x),1),ang_ratio);
        view(2)
196     axis('image')
        xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
198     ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
        cb = colorbar;
200     set(get(cb,'ylabel'),'string','interior angle ratio','FontSize',12);
        text(6.06E5,3.593E6,'b','FontSize',20,'FontWeight','bold')
```

```
202         brighten(0.25);
            print('-dmeta','triangles_2007_network_angratio_area.emf')
204
            trisurf(tri,x,y,ones(size(x),1),log10(grad(:,2)));
206         view(2)
            axis('image')
208         xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
            ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
210         cb = colorbar;
            set(get(cb,'ylabel'),'string','log_{10}(gradient magnitude)','FontSize',12);
212         text(6.06E5,3.593E6,'c','FontSize',20,'FontWeight','bold')
            brighten(0.25);
214         print('-dmeta','triangles_2007_network_gradmag_area.emf')

216         figure()
            subplot(131)
218         plot(log10(geom(:,7)),ang_ratio,'o')
            xlabel('log_{10}(triangle area [m^2])')
220         ylabel('interior angle ratio')
            axis([5,8,0,1])
222         text(7.5,0.9,'a','FontSize',22,'FontWeight','bold')
            subplot(132)
224         plot(log10(grad(:,2)),ang_ratio,'+')
            xlabel('log_{10}(gradient magnitude)')
226         ylabel('interior angle ratio')
            axis([-5,0,0,1])
228         text(-0.6,0.9,'b','FontSize',22,'FontWeight','bold')
            subplot(133)
230         plot(log10(grad(:,2)),log10(geom(:,7)),'*')
            ylabel('log_{10}(triangle area [m^2])')
232         xlabel('log_{10}(gradient magnitude)')
            axis([-5,0,5,8])
234         text(-0.6,7.7,'c','FontSize',22,'FontWeight','bold')
            print('-dmeta','scatter_plots_2007_network_metrics.emf')
236
            figure()
238         triplot(tri,x,y)
            axis('image')
240         hold on
            plot(fiberwells(:,1),fiberwells(:,2),'bs', ...
242             'MarkerSize',6,'MarkerFaceColor','b');
            plot([steelwells(1:i-1,1);steelwells(i+1:nst,1)], ...
244              [steelwells(1:i-1,2);steelwells(i+1:nst,2)],'ro', ...
                'MarkerSize',6,'MarkerFaceColor','r');
246         plot(margin(:,1),margin(:,2),'-m','LineWidth',2);
            plot(noflow(:,1),noflow(:,2),'--k','LineWidth',2);
248         plot(wipp(:,1),wipp(:,2),'-k','LineWidth',2);
            midx = sum(x(tri(:,1:3)),2)/3.0;
250         midy = sum(y(tri(:,1:3)),2)/3.0;
            quiver(midx,midy,-coeff(:,1),-coeff(:,2),2.5,'k','LineWidth',2)
252         xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
            ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
254         text(6.06E5,3.594E6,'a','FontSize',22,'FontWeight','bold')
            print('-dmeta','vector_plots_2007_network.emf')
256     else
            % plot figures showing distribution of metrics for 2007 Culebra network (no SNL-6 or SNL-15)
258         figure();
            trisurf(tri,x,y,ones(size(x),1),log10(geom(:,7)));
260         view(2)
            axis('image')
262         xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
            ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
264         cb = colorbar;
            set(get(cb,'ylabel'),'string','log_{10}(triangle area [m^2])','FontSize',12);
266         text(6.06E5,3.593E6,'a','FontSize',20,'FontWeight','bold')
            brighten(0.25);
268         print('-dmeta','triangles_noSNL15-6_network_log10_area.emf')

270         trisurf(tri,x,y,ones(size(x),1),ang_ratio);
            view(2)
272         axis('image')
            xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
274         ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
            cb = colorbar;
276         set(get(cb,'ylabel'),'string','interior angle ratio','FontSize',12);
            text(6.06E5,3.593E6,'b','FontSize',20,'FontWeight','bold')
278         brighten(0.25);
            print('-dmeta','triangles_noSNL15-6_network_angratio_area.emf')
280
            trisurf(tri,x,y,ones(size(x),1),log10(grad(:,2)));
282         view(2)
```


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```
        axis('image')
        xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
        ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
        cb = colorbar;
        set(get(cb,'ylabel'),'string','log_{10}(gradient magnitude)','FontSize',12);
        text(6.06E5,3.593E6,'c','FontSize',20,'FontWeight','bold')
        brighten(0.25);
        print('-dmeta','triangles_noSNL15-6_network_gradmag_area.emf')

        figure()
        subplot(131)
        plot(log10(geom(:,7)),ang_ratio,'o')
        xlabel('log_{10}(triangle area [m^2])')
        ylabel('interior angle ratio')
        axis([5,8,0,1])
        text(7.5,0.9,'a','FontSize',22,'FontWeight','bold')
        subplot(132)
        plot(log10(grad(:,2)),ang_ratio,'+')
        xlabel('log_{10}(gradient magnitude)')
        ylabel('interior angle ratio')
        axis([-5,0,0,1])
        text(-0.6,0.9,'b','FontSize',22,'FontWeight','bold')
        subplot(133)
        plot(log10(grad(:,2)),log10(geom(:,7)),'*')
        ylabel('log_{10}(triangle area [m^2])')
        xlabel('log_{10}(gradient magnitude)')
        axis([-5,0,5,8])
        text(-0.6,7.7,'c','FontSize',22,'FontWeight','bold')
        print('-dmeta','scatter_plots_noSNL15-6_network_metrics.emf')

        figure()
        triplot(tri,x,y)
        axis('image')
        hold on
        plot(fiberwells(:,1),fiberwells(:,2),'bs', ...
            'MarkerSize',6,'MarkerFaceColor','b');
        plot([steelwells(1:i-1,1);steelwells(i+1:nst,1)],...
             [steelwells(1:i-1,2);steelwells(i+1:nst,2)],'ro', ...
            'MarkerSize',6,'MarkerFaceColor','r');
        plot(margin(:,1),margin(:,2),'-m','LineWidth',2);
        plot(noflow(:,1),noflow(:,2),'--k','LineWidth',2);
        plot(wipp(:,1),wipp(:,2),'-k','LineWidth',2);
        midx = sum(x(tri(:,1:3)),2)/3.0;
        midy = sum(y(tri(:,1:3)),2)/3.0;
        quiver(midx,midy,-coeff(:,1),-coeff(:,2),0.5,'k','LineWidth',2)
        xlabel('NAD27 UTM X Zone 13 [m]','FontSize',12)
        ylabel('NAD27 UTM Y Zone 13 [m]','FontSize',12)
        text(6.06E5,3.594E6,'b','FontSize',22,'FontWeight','bold')
        print('-dmeta','vector_plots_noSNL15-6_network.emf')
    end

    % save results to file for making tables
    stnames
    out = abs(100.0*(Q(1:nst,1:3)-Q(ones(nst,1)*(nst+1),1:3))./Q(ones(nst,1)*(nst+1),1:3));
    save('triangles_remove_one_well.dat','out','-ASCII');

    figure()
    scrnsz = get(0,'ScreenSize');

    % change in mean interior angle-ratio of network
    figure()
    ylab = {'%\Delta in area-weighted mean angle ratio', ...
            '%\Delta in area-weighted median angle ratio', ...
            '%\Delta in median triangle area'};

    fname = {'mean_angle','median_angle','median_area'};

    for i=1:3
        clf
        tmp=abs(100.0*(Q(1:nst,i)-Q(nst+1,i))./Q(nst+1,i));
        bar(1:nst,tmp,'r');
        hold on;
        tmp(sthull(:)) = 0.0;
        bar(1:nst,tmp,'b');
        xlabel('removal of steel-cased well');
        ylabel(ylab{i},'fontsize',13);
        set(gcf,'PaperType','tabloid')
        set(gca,'XTickMode','manual');
        set(gca,'XTick',1:nst);
        set(gca,'XTickLabel',stnames);
        set(gcf,'PaperPositionMode','auto')
```

```
364         set(gcf,'Position',[10,50,0.85*scrnsz(3),0.33*scrnsz(4)])
            print('-dmeta',['triangles_remove1_',fname{i},'_compare.emf'])
366     end

368     % relative difference between gradient without steel well and base case
        BASE = GRAD(1:npts,ones(nst,1)*(nst+1),1:2);
370     DIFF = (GRAD(1:npts,1:nst,1:2) - BASE)./BASE;
        mag = sqrt(sum((GRAD(:,1:nst,1:2) - GRAD(:,ones(nst,1)*(nst+1),1:2)).^2,3));
372
        % area "effected" by removal of well (square meters)
374     clf;
        subplot(211)
376     tol = 1.0E-3;
        mask = mag > tol;
378     mask(~INSIDE) = false;
        count = zeros(nst,1);
380     for j=1:nst
            count(j) = sum(mag(:,j) > tol);
382     end
        tmp = dx*dy*(count);
384     bar(1:nst,log10(tmp),'r');
        hold on;
386     tmp(sthull(:)) = 0.0;
        bar(1:nst,log10(tmp),'b');
388     xlabel('removal of steel-cased well');
        title('log_{10}(area) effected (0.001) by removal [m^2]','fontsize',13);
390     axis([0,nst+1,4,8]);
        set(gcf,'PaperType','tabloid')
392     set(gca,'XTickMode','manual');
        set(gca,'XTick',1:nst);
394     set(gca,'XTickLabel',stnames);
        subplot(212)
396     tol = 1.0E-2;
        mask = mag > tol;
398     mask(~INSIDE) = false;
        count = zeros(nst,1);
400     for j=1:nst
            count(j) = sum(mag(:,j) > tol);
402     end
        tmp = dx*dy*(count);
404     bar(1:nst,log10(tmp),'r');
        hold on;
406     tmp(sthull(:)) = 0.0;
        bar(1:nst,log10(tmp),'b');
408     xlabel('removal of steel-cased well');
        title('log_{10}(area) effected (0.01) by removal [m^2]','fontsize',13);
410     axis([0,nst+1,4,8]);
        set(gcf,'PaperType','tabloid')
412     set(gca,'XTickMode','manual');
        set(gca,'XTick',1:nst);
414     set(gca,'XTickLabel',stnames);

416     set(gcf,'PaperPositionMode','auto')
        set(gcf,'Position',[10,50,0.85*scrnsz(3),0.5*scrnsz(4)])
418     print('-dmeta','triangles_remove1_effected_logarea_compare.emf')

420     DIFF(~INSIDE,:,:) = NaN;

422     % change in gradient magnitude upon removal of steel well
        clf;
424     DIFF2 = GRAD(1:npts,1:nst,1:2) - BASE;  % not normalized
        LEN = sqrt(DIFF2(1:npts,1:nst,1).^2 + DIFF2(1:npts,1:nst,2).^2);
426     tmp = sum(LEN(mask),1)./count;
        bar(1:nst,tmp,'r');
428     tmp(sthull(:)) = 1.0;
        bar(1:nst,tmp,'b');
430     set(gca,'YScale','log')
        hold on;
432     xlabel('removal of steel-cased well');
        ylabel('\Delta in gradient magnitude from well removal','fontsize',13);
434     set(gcf,'PaperType','tabloid')
        set(gca,'XTickMode','manual');
436     set(gca,'XTick',1:nst);
        set(gca,'XTickLabel',stnames);
438     set(gcf,'PaperPositionMode','auto')
        set(gcf,'Position',[10,50,0.85*scrnsz(3),0.33*scrnsz(4)])
440     print('-dmeta','triangles_remove1_gradmag_compare.emf')

442     % change in mean gradient angle upon removal of steel well
        clf;
444     angle = abs(atan2(DIFF2(1:npts,1:nst,2), DIFF2(1:npts,1:nst,1)));
```


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```
tmp = sum(angle(mask),1)./count;
bar(1:nst,tmp,'r');
hold on;
tmp(sthull(:))=0.0;
bar(1:nst,tmp,'b');
xlabel('removal of steel-cased well');
ylabel('|\Delta in gradient direction| from well removal','fontsize',13);
v=axis();
axis([v(1:2),0,pi])
set(gca,'YTick',0:pi/4:pi);
set(gca,'YTickLabel','0|45|90|135|180');
set(gcf,'PaperType','tabloid')
set(gca,'XTickMode','manual');
set(gca,'XTick',1:nst);
set(gca,'XTickLabel',stnames);
set(gcf,'PaperPositionMode','auto')
set(gcf,'Position',[10,50,0.85*scrnsz(3),0.33*scrnsz(4)])
print('-dmeta','triangles_remove1_gradang_compare.emf')

gradHSVimage = zeros(ny,nx,3);

% largest magnitude change seen in any figure (for consistent scaling)
maxmag = max(max(log10(sqrt(DIFF(:,:,1).^2 + DIFF(:,:,2).^2))));

figure();
for i=1:nst

    % easier to re-compute than save
    x = [fiberwells(:,1);steelwells(1:i-1,1);steelwells(i+1:nst,1)];
    y = [fiberwells(:,2);steelwells(1:i-1,2);steelwells(i+1:nst,2)];

    % wells that make a convex hull for the dataset less one well
    localhull = convhull(x(:),y(:));
    LOCINSIDE = inpolygon(X,Y,x(localhull),y(localhull));

    clf()
    mag = sqrt(reshape(DIFF(:,i,1).^2,ny,nx) + reshape(DIFF(:,i,2).^2,ny,nx));
    rex = reshape(DIFF(:,i,1),ny,nx);
    rey = reshape(DIFF(:,i,2),ny,nx);
    angle = abs(atan2(rey,rex));

    % clear results outside the convex hull of the reduced dataset.
    mag(~LOCINSIDE) = NaN;
    angle(~LOCINSIDE) = NaN;

    % map angle onto hue and log10(magnitude) onto brightness (assume full
    % saturation)

    % data range: 0 <= theta <= +pi
    blue = 0.6534;  % red is 1.0; scale range from blue to red
    gradHSVimage(:,:,1) = (1.0 - blue)*angle./pi + blue;
    gradHSVimage(:,:,2:3) = 1.0;  % full saturation / brightness

    logmag = log10(mag);
    minmag = log10(tol);

    % reset values lower than tolerance to tolerance
    logmag(logmag < minmag) = minmag;
    gradALPHA = (logmag - minmag)./(maxmag - minmag);

    h = image(hsv2rgb(gradHSVimage));
    set(h,'XData',X(1,:)); % assign coorinates to pixels to allow
    set(h,'YData',Y(:,1)); % overlays to be plotted over image
    set(h,'AlphaData',gradALPHA);  % make "no-change" areas clear
    axis xy   % flip y-axis from image convention to plot convention

    daspect([1,1,1]);
    hold on;
    title(stnames{i},'fontsize',15);
    xlabel('NAD27 UTM x Zone 13 [m]');
    ylabel('NAD27 UTM y Zone 13 [m]');

    tri = delaunay(x,y);
    triplot(tri,x,y,'-g','LineWidth',1/3);

    hold on
    plot(fiberwells(:,1),fiberwells(:,2),'bs', ...
        'MarkerSize',9,'MarkerFaceColor','b');
    plot([steelwells(1:i-1,1);steelwells(i+1:nst,1)], ...
        [steelwells(1:i-1,2);steelwells(i+1:nst,2)],'ro', ...
        'MarkerSize',9,'MarkerFaceColor','r');
```

```
526         plot(steelwells(i,1),steelwells(i,2),'ko', ...
                'LineWidth',2.5,'MarkerEdgeColor','r', ...
528             'MarkerSize',14,'MarkerFaceColor','k');

530         plot(margin(:,1),margin(:,2),'-m','LineWidth',2);
            plot(noflow(:,1),noflow(:,2),'--k','LineWidth',2);
532         plot(wipp(:,1),wipp(:,2),'-k','LineWidth',2);

534         if strcmp(stnames{i},'H-2b2') || strcmp(stnames{i},'ERDA-9') || ...
                    strcmp(stnames{i},'H-3b2') || strcmp(stnames{i},'WIPP-19')
536             % for on-site wells, zoom in to WIPP LWB area
                axis(nearwipp);
538         else
                axis([xmin,xmax,ymin,ymax]);
540         end
            set(gcf,'PaperPositionMode','auto')
542         set(gcf,'PaperType','usletter')
            set(gcf,'Position',[10,50,(scrnsz(4)-120)*0.85,scrnsz(4)-120])
544         print('-dmeta',['triangles_grad_change_',stnames{i},'.emf']);
    end
546
```

8.3.4. MATLAB script `triangles_remove_two.m`

The following MATLAB script computes and plots the triangle interior angle metric upon removal of two steel wells from the well network.

```
    clear
2   % This matlab script looks at the effects that removing one of the
    % steel-cased (without replacement) would have on the estimation of the
4   % gradient, using linear interpolation across Delauny triangles as the
    % estimator.
6
    firstWell = {'WIPP-25','WIPP-13','H-12','H-7b1'};
8   nfst = size(firstWell,2);

10  % Load data
    addpath '..\common_programs\';
12
    % well datat (x,y,fwh,res,casing type)
14  wells = load('..\common_data\2007_well_data_for_triangles.dat');
    names = textread('..\common_data\2007_well_names_for_triangles.dat','%s');
16
    RHmask = wells(:,4) > -990; % exclude SNL-6 and SNL-15
18  wells = wells(RHmask,:);
    names = names(RHmask,:);
20
    margin = load('..\common_data\composite_23_margin.dat');
22  noflow = load('..\common_data\no_flow_boundary.dat');
    totalbdry = load('..\common_data\total_boundary.dat');
24
    % wells that make a convex hull around the dataset of all wells
26  hull = convhull(wells(:,1),wells(:,2));

28  steelwells = wells(wells(:,5)==1,1:3);  % fifth column indicates casing type
    fiberwells = wells(wells(:,5)==0,1:3);
30  stnames =   {names{wells(:,5)==1}};

32  % wells on the hull that are also steel-cased
    j=1;
34  for i=1:size(steelwells,1)
        for k=1:size(hull,1)
36          if sqrt((steelwells(i,1) - wells(hull(k),1))^2 + ...
                    (steelwells(i,2) - wells(hull(k),2))^2) < 1
38              sthull(j) = i;
                j=j+1;
40          end
        end
42  end

44  xt=wells(:,1);
    yt=wells(:,2);
46  ht=wells(:,3);
    nw = size(xt,1);
```


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```
nst = size(steelwells,1);
Q = zeros(nst+1,nfst,2);
Q = NaN;

stnames{nst+1} = 'BASE-CASE';

% calculation grid (not MODFLOW grid) is minimal grid which includes
% convex hull around data
xmin = min(xt);  ymin = min(yt);
xmax = max(xt);  ymax = max(yt);
dx = 100.0;       dy = 100.0;  % note: using 100x100 is slow.

[X,Y] = meshgrid(xmin:dx:xmax, ymin:dy:ymax);
nx = size(X,2);
ny = size(X,1);

INSIDE = inpolygon(X,Y,totalbdry(:,1),totalbdry(:,2));

npts = numel(X);

% direction and magnitude of gradient in each cell, for
% scenario of removing each steel-casing well + base case

GRAD = ones(npts,nst+1,2);

% effects of removing one steel-casing well + base case for comparison
for mm=1:nfst
    for jj=1:nst+1

        % two steel wells must be different
        if ~strcmp(firstWell{mm},stnames{jj})

            if jj < nst+1
                % set of x,y,h without steel casing well jj or mm
                x = [fiberwells(:,1);steelwells(~strcmp(stnames(1:nst),stnames{jj}) & ...
                                                ~strcmp(stnames(1:nst),firstWell{mm}),1)];
                y = [fiberwells(:,2);steelwells(~strcmp(stnames(1:nst),stnames{jj}) & ...
                                                ~strcmp(stnames(1:nst),firstWell{mm}),2)];
                h = [fiberwells(:,3);steelwells(~strcmp(stnames(1:nst),stnames{jj}) & ...
                                                ~strcmp(stnames(1:nst),firstWell{mm}),3)];
            else
                x = xt;
                y = yt;
                h = ht;
            end

            tri = delaunay(x,y);
            nt = size(tri,1);

            D = zeros(size(tri,1),1);
            coeff = zeros(size(tri,1),4);
            grad = zeros(size(tri,1),2); % angle and magnitide of hydraulic gradient
            geom = zeros(size(tri,1),8);  % 3 sides, 3 angles, area, # pts inside

            %% compute equation for line through 3 points
            % value of determinant used in denominator of Cramer's rule
            D(1:nt) = x(tri(:,1)).*y(tri(:,2)) + x(tri(:,2)).*y(tri(:,3)) + ...
                y(tri(:,1)).*x(tri(:,3)) - x(tri(:,3)).*y(tri(:,2)) - ...
                x(tri(:,1)).*y(tri(:,3)) - x(tri(:,2)).*y(tri(:,1));

            % a (coefficient on x)
            coeff(1:nt,1) = (h(tri(:,1)).*y(tri(:,2)) + y(tri(:,1)).*h(tri(:,3)) + ...
                h(tri(:,2)).*y(tri(:,3)) - h(tri(:,3)).*y(tri(:,2)) - ...
                h(tri(:,2)).*y(tri(:,1)) - h(tri(:,1)).*y(tri(:,3)))./D;

            % b (coefficient on y)
            coeff(1:nt,2) = (x(tri(:,1)).*h(tri(:,2)) + h(tri(:,1)).*x(tri(:,3)) + ...
                x(tri(:,2)).*h(tri(:,3)) - x(tri(:,3)).*h(tri(:,2)) - ...
                x(tri(:,2)).*h(tri(:,1)) - x(tri(:,1)).*h(tri(:,3)))./D;

            % c (constant coefficient)
            coeff(1:nt,3) = (x(tri(:,1)).*y(tri(:,2)).*h(tri(:,3)) + ...
                y(tri(:,1)).*h(tri(:,2)).*x(tri(:,3)) + ...
                x(tri(:,2)).*y(tri(:,3)).*h(tri(:,1)) - ...
                x(tri(:,3)).*y(tri(:,2)).*h(tri(:,1)) - ...
                x(tri(:,2)).*y(tri(:,1)).*h(tri(:,3)) - ...
                x(tri(:,1)).*y(tri(:,3)).*h(tri(:,2)))./D;

            % compute angle and magnitude of hydraulic gradient
            grad(1:nt,1) = atan2(coeff(:,2),coeff(:,1));
            grad(1:nt,2) = sqrt(sum(coeff(:,1:2).^2,2));
```

```
            grad(1:nt,3) = max(h(tri(:,1:3)),[],2) - min(h(tri(:,1:3)),[],2);

            % map results from "vector" triangles to "raster" grid
            for kk=1:nt
                % result is a logical vector, indicating if the cell is in (T) or
                % out (F) side this current triangle
                IN = reshape(inpolygon(X,Y,x(tri(kk,1:3)),y(tri(kk,1:3))),npts,1);

                % sum(IN) = number of cells inside the triangle
                % ones(sum(IN))*kk = column vector of the counter kk
                % coeff(...,1:2) = x & y gradient repeated for every cell inside
                %                  that triangle, copied to correct locations in GRAD

                GRAD(IN,jj,1:2) = coeff(ones(sum(IN),1)*kk,1:2);
            end
            %% calculate geometric things related to triangles
            % lengths from Pythagorean theorem
            % angles from cosine law
            % area from Matlab built-in fcn

            % length of side a (2->3)
            geom(1:nt,1) = sqrt((x(tri(:,3)) - x(tri(:,2))).^2 + ...
                (y(tri(:,3)) - y(tri(:,2))).^2);
            % length of side b (3->1)
            geom(1:nt,2) = sqrt((x(tri(:,1)) - x(tri(:,3))).^2 + ...
                (y(tri(:,1)) - y(tri(:,3))).^2);
            % length of side c (1->2)
            geom(1:nt,3) = sqrt((x(tri(:,2)) - x(tri(:,1))).^2 + ...
                (y(tri(:,2)) - y(tri(:,1))).^2);


            % angle 1 between sides b & c in radians
            geom(1:nt,4) = acos((sum(geom(:,2:3).^2,2) - geom(:,1).^2)./ ...
                (2.0*prod(geom(:,2:3),2)));
            % angle 2 between sides a & c in radians
            geom(1:nt,5) = acos((sum(geom(:,1:2:3).^2,2) - geom(:,2).^2)./ ...
                (2.0*prod(geom(:,1:2:3),2)));
            % angle 3 between sides b & a in radians
            geom(1:nt,6) = acos((sum(geom(:,1:2).^2,2) - geom(:,3).^2)./ ...
                (2.0*prod(geom(:,1:2),2)));

            % area of triangle - use MATLAB built-in function
            geom(1:nt,7) = polyarea(x(tri(:,1:3)),y(tri(:,1:3)),2);

            % compute goodness triangle criteria
            ang_ratio = min(geom(:,4:6),[],2)./max(geom(:,4:6),[],2);

            % area-weighted angle ratio
            Q(jj,mm,1) = sum(ang_ratio(:).*geom(:,7))/sum(geom(1:nt,7));

            % median triangle area
            Q(jj,mm,2) = median(geom(1:nt,7));
        else
            Q(jj,mm,1:2) = NaN;
        end
    end
end

scrnsz = get(0,'ScreenSize');

BASE = Q(ones(1,nst)*(nst+1),:,1:2);
plt = (Q(1:nst,:,1:2) - BASE)./BASE;

figure()
h1 = imagesc(plt(1:nst,:,1));
axis('image')
%colormap(redwhitemap(reshape(plt(:,:,1),numel(plt(:,:,1)))));
colorbar()
figure()
h2 = imagesc(plt(1:nst,:,2));
axis('image')
%colormap(redwhitemap(reshape(plt(:,:,2),numel(plt(:,:,2)))));
colorbar()
```

8.4. Model Parameter Correlation Maximization Scripts

Information Only

The first two scripts are run in Linux, then the following Python and R scripts are run in Windows and are used to compute the correlation and partial correlation results used in the analysis.

8.4.1. Bash shell script `checkout_model_data.sh`

The following Linux Bash shell script is run to check the Culebra MODFLOW model inputs and results needed out from CVS, convert the binary head output files to ASCII, perform directory manipulations and zip the results into a single file for transfer to Windows XP.

```
#!/bin/bash

# this Bash script is run in Linux and checks out the model files
# required to perform the model correlation analysis.

repo=/nfs/data/CVSLIB

# check out the list of the final 100 fields used from AP-144
cvs -d ${repo}/MiningMod checkout Inputs/keepers

# move it into the current directory
mv Inputs/keepers .
rm -rf Inputs

# checkout model inputs from Tfields repository in CVS (AP-114 Task 7)
for d in `cat keepers`; do
  # checkout transmissivity and anisotropy fields
  cvs -d ${repo}/Tfields checkout Outputs/${d}/modeled_{K,A}_field.mod
done

# modify the path of "updated" T-fields, so they are all at the
# same level in the directory structure (to make these agree w/ mining mod repository)

if [ -a keepers_short ]; then
    # delete any pre-existing files here,
    # since file is concatenated to in next loop
    rm keepers_short
fi

for d in `cat keepers`; do
  bn=`basename ${d}`
  # test whether it is a compound path
  if [ ${d} != ${bn} ]; then
      dn=`dirname ${d}`
      mv ./Outputs/${d}/ ./Outputs/

      # put an empty file in the directory to indicate
      # what the directory was previously named
      touch ./Outputs/${bn}/${dn}
  fi

  # create a keepers list without directories
  echo ${bn} >> keepers_short
done

# get output files from MiningMod CVS repository
for d in `cat keepers_short`; do
    # checkout particle tracking results (R0 is no mining replicate)
    cvs -d ${repo}/MiningMod checkout Outputs/R0/${d}/dtrk.out
    # checkout binary heads
    cvs -d ${repo}/MiningMod checkout Outputs/R0/${d}/modeled_head.bin

    # move files into existing directories
    mv Outputs/R0/${d}/{dtrk.out,modeled_head.bin} Outputs/${d}/
done

# remove intermediate directories
rm -rf Outputs/R0
rm -rf Outputs/Update
rm -rf Outputs/Update2

# convert binary MODFLOW head output to ascii for use in AP-111 analysis
for d in `cat keepers_short`; do
```

```
    cd Outputs/${d}
    ln -sf ../../head_bin2ascii.py .
    python head_bin2ascii.py
    rm ./head_bin2ascii.py
    rm ./modeled_head.bin
    cd ../..
done

# zip results up for transfer to windowz
cd Outputs
zip -r model_files.zip r???
mv model_files.zip ../
```

8.4.2. Python script `head_bin2ascii.py`

The following Python script is run in Linux to convert the binary MODFLOW head output files to ASCII format, for transfer to Windows XP for further analysis. This script is called by the Bash shell script `checkout_model_data.sh` that checks the data out of CVS and does the looping over the directories.

```
import struct
from sys import argv,exit

class FortranFile(file):
    """ modified from May 2007 Enthought-dev mailing list post by Neil Martinsen-Burrell"""

    def __init__(self,fname, mode='r', buf=0):
    file.__init__(self, fname, mode, buf)
    self.ENDIAN = '<'  # little endian
        self.di = 4  # default integer (could be 8 on 64-bit platforms)

    def readReals(self, prec='f'):
        """Read in an array of reals (default single precision) with error checking"""
        # read header (length of record)
    l = struct.unpack(self.ENDIAN+'i',self.read(self.di))[0]
    data_str = self.read(l)
    len_real = struct.calcsize(prec)
    if l % len_real != 0:
        raise IOError('Error reading array of reals from data file')
    num = l/len_real
    reals = struct.unpack(self.ENDIAN+str(num)+prec,data_str)
        # check footer
    if struct.unpack(self.ENDIAN+'i',self.read(self.di))[0] != l:
        raise IOError('Error reading array of reals from data file')
    return list(reals)

    def readInts(self):
        """Read in an array of integers with error checking"""
    l = struct.unpack('i',self.read(self.di))[0]
    data_str = self.read(l)
    len_int = struct.calcsize('i')
    if l % len_int != 0:
        raise IOError('Error reading array of integers from data file')
    num = l/len_int
    ints = struct.unpack(str(num)+'i',data_str)
    if struct.unpack(self.ENDIAN+'i',self.read(self.di))[0] != l:
        raise IOError('Error reading array of integers from data file')
    return list(ints)

    def readRecord(self):
        """Read a single fortran record (potentially mixed reals and ints)"""
        dat = self.read(self.di)
        if len(dat) == 0:
            raise IOError('Empy record header')
    l = struct.unpack(self.ENDIAN+'i',dat)[0]
    data_str = self.read(l)
        if len(data_str) != l:
            raise IOError('Didn''t read enough data')
        check = self.read(self.di)
        if len(check) != 4:
            raise IOError('Didn''t read enough data')
    if struct.unpack(self.ENDIAN+'i',check)[0] != l:
        raise IOError('Error reading record from data file')
    return data_str
```


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```
def reshapev2m(v,nx,ny):
    """Reshape a vector that was previously reshaped in C-major order from a matrix,
    back into a C-major order matrix (here a list of lists)."""
    m = [None]*ny
    n = nx*ny
    for i,(lo,hi) in enumerate(zip(xrange(0, n-nx+1, nx), xrange(nx, n+1, nx))):
        m[i] = v[lo:hi]
    return m

def floatmatsave(filehandle,m):
    """Writes array to open filehandle.
    Outer list is rows, inner lists are columns."""

    for row in m:
        f.write(''.join([' %9.4f' % col for col in row]) + '\n')

# open file and set endian-ness
try:
    infn,outfn = argv[1:3]
except:
    print '2 command-line arguments not given, using default in/out filenames'
    infn = 'modeled_head.bin'
    outfn = 'modeled_head.hed'

ff = FortranFile(infn)

# currently this assumes a single-layer MODFLOW model (or at least only one layer of output)

# format of MODFLOW header in binary layer array
fmt = '<2i2f16s3i'
# little endian, 2 integers, 2 floats,
#    16-character string (4 element array of 4-byte strings), 3 integers

while True:
    try:
        # read in header
        h = ff.readRecord()

    except IOError:
        # exit while loop
        break

    else:
        # unpack header
        kstp,kper,pertim,totim,text,ncol,nrow,ilay = struct.unpack(fmt,h)

        # print status/confirmation to terminal
        print kstp,kper,pertim,totim,text,ncol,nrow,ilay

        h = ff.readReals()

ff.close()

f = open(outfn,'w')

floatmatsave(f,reshapev2m(h,ncol,nrow)[::-1])
f.close()
```

8.4.3. Python script `load_model_data.py`

The following Python script is not called by itself, but instead is used as a library in two other Python scripts. This script loads the model input (transmissivity and anisotropy fields) and model output (head) from each of the 100 calibrated MODFLOW realizations.

```
import numpy as np
from os.path import join
from glob import glob

datadir = '../../../common_data/'
fh = open(datadir + 'model_domain_specs.dat','r')
nx,ny =     [int(x) for x in fh.readline().strip().split()]
xmin,ymin = [float(x) for x in fh.readline().strip().split()]
xmax,ymax = [float(x) for x in fh.readline().strip().split()]
fh.close()
```

```
dt = np.float64  # "double precision"

# number of fields and elements in each
numf = 100
numel = nx*ny
ndata = 3
tcorr = np.zeros((ndata+1,numel),dtype=dt)
hcorr = np.zeros((ndata,numel),dtype=dt)
trav = np.zeros((numf,),dtype=dt)

dpi = 160
figsize = (14,6)

kdat = np.zeros((numf,numel),dtype=dt)
adat = np.zeros((numf,numel),dtype=dt)
hdat = np.zeros((numf,numel),dtype=dt)

# loop over all the directories, read input
for i,d in enumerate(glob('r???')):
    print i,d
    # x (row) log10 hydraulic conductivity
    kdat[i,:] = np.loadtxt(join(d,'modeled_K_field.mod'),dtype=dt)
    # log10 ratio y/x (col/row) for conductivity
    adat[i,:] = np.loadtxt(join(d,'modeled_A_field.mod'),dtype=dt)

    # log10 travel time to LWB is first column, last row
    fn = open(join(d,'dtrk.out'),'r')
    trav[i] = float(fn.readlines()[-1].split()[0])
    fn.close()

    # read in modflow head (saved in file as a matrix already)
    hdat[i,:] = np.loadtxt(join(d,'modeled_head.hed'),dtype=dt)[::-1,:].reshape((numel,))

kdat = np.log10(kdat)
adat = np.log10(adat)
trav = np.log10(trav)

hdat[hdat == -999] = np.NaN

tflat = trav.flatten()
kdat[kdat < -15] = np.NaN
keff = kdat + 0.5*adat

print 'min log effective k:',np.nanmin(keff)
print 'max log effective k:',np.nanmax(keff)

# define a mask that selects the WIPP LWB area + a buffer of cells around it
wippmask = np.zeros((307,284),dtype='bool') # false boolean array
buffer = 15
wippmask[121-buffer:185+buffer,88-buffer:152+buffer] = True
wippmask.shape = (307*284,)

print 'successfully loaded model data'
```

8.4.4. Python script `export_pcor_inputs.py`

The following Python script calls the library `load_model_data.py` to read in the model data, then exports the K_{eff} and head data for an area surrounding the WIPP LWB for use in the following R script that does the partial correlation analysis.

```
import numpy as np
from load_model_data import *

# save large matrix: nrows = 100
# ncols = # elements (here (64 + (buffer * 2))**2 + 1 for travel time)

# save imported data for use in R
# for partial correlation analysis

# perform outer difference, then only use upper triangle of tensor

np.savetxt('keff_trav.dat',
           np.concatenate((keff[:,wippmask],trav[:,None]),axis=1),
           fmt='%.7f')
```


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```
np.savetxt('head_trav.dat',
           np.concatenate((hdat[:,wippmask],trav[:,None]),axis=1),
           fmt='%.7f')

print 'saved data for partial correlation analysis in R'
```

8.4.5. R script `compute_partial_correlations.R`

The following R script loads in the data exported by `export_pcor_inputs.py`, computes the partial correlation of K_{eff} and head in each cell to travel times and head to travel times, accounting for the effects K_{eff} or head in all other cells.

```
# read in the matrix that has realizations as rows (100) and parameters as columns
# (k or h at model cells and travel time as last column)

k <- read.table('keff_trav.dat')
library(corpcor)

# this takes a lot of RAM (> 2GB)
pc <- pcor.shrink(k)

# write all rows, last column to file (partial correlation of each k  to travel time
# holding effects of all other k values constant)
write.table(pc[,dim(pc)[1]],'kpc.out',row.names=FALSE,col.names=FALSE)

h <- read.table('head_trav.dat')
pc <- pcor.shrink(h)

# write all rows, last column to file (partial correlation of each k  to travel time
# holding effects of all other k values constant)
write.table(pc[,dim(pc)[1]],'hpc.out',row.names=FALSE,col.names=FALSE)
```

8.4.6. Python script `spearman_rank_coefficient.py`

The following Python script computes correlation statistics between the results of the Culebra model calibration (particle tracking times to the WIPP LWB) and the Culebra model input files, creating plots of the results for the report.

```
import numpy as np
from os.path import join
from glob import glob
import matplotlib
matplotlib.use('Agg') # to improve memory usage
import matplotlib.pyplot as plt
import matplotlib.colors as colors

# save code for loading data in separate module
from load_model_data import *

def finish_fig(extents):
    '''Add common things to figures'''
    plt.hold = True
    plt.xlabel('UTM NAD27 X [km]')
    plt.axis(extents)
    locs,labels = plt.xticks()
    plt.xticks(locs,(locs/1000.0).astype('|S3'))
    plt.ylabel('UTM NAD27 Y [km]')
    locs,labels = plt.yticks()
    plt.yticks(locs,(locs/1000.0).astype('|S4'),rotation=90)
    plt.plot(wipp[:,0],wipp[:,1],'k-',linewidth=1)
    plt.plot(h2[:,0],h2[:,1],'g--',linewidth=2)
    plt.plot(h3[:,0],h3[:,1],'r:',linewidth=2)
    plt.plot(salado[:,0],salado[:,1],'k:',linewidth=2)
    plt.plot(wells[fiberg,0],wells[fiberg,1],'gs',markersize=4)
    plt.plot(wells[~fiberg,0],wells[~fiberg,1],'ro',markersize=4)
    plt.axis('image')
    plt.axis(extents)

# load in partial-correlation data exported from R
pck = np.zeros((307*284,),dtype=dt)
```


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```
    pch = np.zeros((307*284,),dtype=dt)

    pch[wippmask] = np.loadtxt('hpc.out',dtype=dt)
    pck[wippmask] = np.loadtxt('kpc.out',dtype=dt)

    pck.shape = (307,284)
    pch.shape = (307,284)

    print 'successfully loaded partial correlation data'

    for n in xrange(numel):
        if n % 10000 == 0:
            print n

        # A = travel time from C-2737 to WIPP LWB (global)
        # B = head at same cell as property (local)
        # Tx vs A/B
        # Ty vs A/B
        # Teff vs A/B
        # A vs B

        data1 = [kdat[:,n],  kdat[:,n] + adat[:,n], kdat[:,n] + 0.5*adat[:,n]]
        hflat = hdat[:,n].flatten()

        for i,d in enumerate(data1):
            dflat = d.flatten()
            tcorr[i,n] = np.corrcoef(dflat,tflat)[0,1]
            hcorr[i,n] = np.corrcoef(dflat,hflat)[0,1]

        tcorr[ndata,n] = np.corrcoef(hflat,tflat)[0,1]

    # blank out no-flow area
    tcorr[np.isnan(kdat[0,:])[None,:]] = np.NaN
    hcorr[np.isnan(kdat[0,:])[None,:]] = np.NaN

    # clean up some temporary things
    del data1
    del hflat
    del dflat

    wipp = np.loadtxt(datadir+'wipp_boundary.dat')
    h2 = np.loadtxt(join(datadir,'h2_200711.dat'),delimiter=',')
    h3 = np.loadtxt(join(datadir,'h3_200711.dat'),delimiter=',')
    salado = np.loadtxt(join(datadir,'mrgn_dissolution.dat'),skiprows=5)
    wells = np.loadtxt(datadir+'2007_well_data.dat')
    fiberg = wells[:,4] == 0.0

    # regional left,right,bottom,top
    regext = (xmin,xmax,ymin,ymax)

    # wipp area left,right,bottom,top
    wippext = (wipp[:,0].min() - 1500.0, wipp[:,0].max() + 1500.0,
               wipp[:,1].min() - 1500.0, wipp[:,1].max() + 1500.0)

    cmap = colors.LinearSegmentedColormap.from_list('bwr',('blue','white','red'))
    norm1 = colors.Normalize(vmin=-1,vmax=+1)
    norm2 = colors.Normalize(vmin=-0.5,vmax=+0.5)
    normsm1 = colors.Normalize(vmin=-0.015,vmax=+0.015)
    normsm2 = colors.Normalize(vmin=-0.005,vmax=+0.005)

    plt.figure(1)
    plt.semilogy(10.0**trav,'k*')
    plt.xlabel('realization')
    plt.ylabel('years travel time to WIPP LWB')
    plt.savefig('travel_times.png')
    plt.close(1)

    fmt = '%.5e'
    fn = ['_kx_','_ky_','_keff_']
    nn = ['K_x', 'K_y','K_{eff}']

    # plot comparisons of partial and regular Keff correlation inside WIPP
    plt.figure(1,figsize=figsize,dpi=dpi)
    plt.subplot(121)
    plt.imshow(tcorr[2,:].reshape((ny,nx)),interpolation='nearest',
               cmap=cmap,norm=norm2,extent=regext)
    plt.colorbar(shrink=0.8)
    finish_fig(wippext)
    plt.title('corr. $K_{eff}$ w/ travel time')
    plt.subplot(122)
    plt.imshow(pck.reshape((ny,nx)),interpolation='nearest',
```


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```
            cmap=cmap,norm=normsm2,extent=regext)
plt.colorbar(shrink=0.8)
finish_fig(wippext)
plt.title('partial corr. $K_{eff}$ w/ travel time')
plt.savefig('Keff_partial_travel_time_corr.png')
plt.close(1)

# plot comparisons of partial and regular head correlation inside WIPP
plt.figure(1,figsize=figsize,dpi=dpi)
plt.subplot(121)
plt.imshow(tcorr[ndata,:].reshape((ny,nx)),interpolation='nearest',
            cmap=cmap,norm=norm2,extent=regext)
plt.colorbar(shrink=0.8)
finish_fig(wippext)
plt.title('corr. $h$ w/ travel time')
plt.subplot(122)
plt.imshow(pch.reshape((ny,nx)),interpolation='nearest',
            cmap=cmap,norm=normsm1,extent=regext)
plt.colorbar(shrink=0.8)
finish_fig(wippext)
plt.title('partial corr. $h$ w/ travel time')
plt.savefig('h_partial_travel_time_corr.png')
plt.close(1)

# write results (reshaped into matrix form)
for j,f in enumerate(fn):
    np.savetxt('corr'+f+'vs_time.dat', tcorr[j,:].reshape((ny,nx)),fmt=fmt)

    plt.figure(1,figsize=figsize,dpi=dpi)
    plt.subplot(121)
    plt.imshow(tcorr[j,:].reshape((ny,nx)),interpolation='nearest',
                cmap=cmap,norm=norm2,extent=regext)
    finish_fig(regext)
    plt.title('regional corr. $' + nn[j] + '$ w/ travel time')
    plt.subplot(122)
    plt.imshow(tcorr[j,:].reshape((ny,nx)),interpolation='nearest',
                cmap=cmap,norm=norm2,extent=regext)
    plt.colorbar(shrink=0.8)
    finish_fig(wippext)
    plt.title('WIPP corr. $' + nn[j] + '$ w/ travel time')
    plt.savefig(f[1:] + 'travel_time_corr.png')
    plt.close(1)

    np.savetxt('corr'+f+'vs_head.dat', hcorr[j,:].reshape((ny,nx)),fmt=fmt)

    plt.figure(2,figsize=figsize,dpi=dpi)
    plt.subplot(121)
    plt.imshow(hcorr[j,:].reshape((ny,nx)),interpolation='nearest',
                cmap=cmap,norm=norm1,extent=regext)
    finish_fig(regext)
    plt.title('regional corr. $' + nn[j] + '$ w/ head')
    plt.subplot(122)
    plt.imshow(hcorr[j,:].reshape((ny,nx)),interpolation='nearest',
                cmap=cmap,norm=norm1,extent=regext)
    plt.colorbar(shrink=0.8)
    finish_fig(wippext)
    plt.title('WIPP corr. $' + nn[j] + '$ w/ head')
    plt.savefig(f[1:] + 'heads_corr.png')
    plt.close(2)

np.savetxt('corr_head_vs_time.dat', tcorr[ndata,:].reshape((ny,nx)),fmt=fmt)

plt.figure(4,figsize=figsize,dpi=dpi)
plt.subplot(121)
plt.imshow(tcorr[ndata,:].reshape((ny,nx)),interpolation='nearest',
            cmap=cmap,norm=norm2,extent=regext)
finish_fig(regext)
plt.title('regional corr. head w/ time')
plt.subplot(122)
plt.imshow(tcorr[ndata,:].reshape((ny,nx)),interpolation='nearest',
            cmap=cmap,norm=norm2,extent=regext)
plt.colorbar(shrink=0.8)
finish_fig(wippext)
plt.title('WIPP corr. head w/ time')
plt.savefig('heads_vs_travel_time_corr.png')
plt.close(4)

# compute variance across all realizations for output and each parameter
print 'travel time to WIPP LWB:\tmean:%.8e\tstd:%.8e\n' % \
    (trav.sum()/100.0,np.sqrt(np.var(trav)))
```


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```
data = [kdat, kdat+adat, kdat+0.5*adat]
dnam = ['kx_', 'ky_', 'keff_']
dnnm = ['$\\log_{10}(K_x', '$\\log_{10}(K_y', '$\\log_{10}(K_{eff}']

for j,(dat,nam) in enumerate(zip(data,dnam)):
    std = np.sqrt(np.var(dat,axis=0).reshape((ny,nx)))
    std[std < 1.0E-10] = 0.0
    mean = (dat.sum(axis=0)/100.0).reshape((ny,nx))
    np.savetxt(nam+'var.out',std,fmt=fmt)
    np.savetxt(nam+'mean.out',mean,fmt=fmt)
    plt.figure(3,figsize=figsize,dpi=dpi)
    plt.subplot(121)
    plt.imshow(mean,interpolation='nearest',extent=regext)
    plt.colorbar(shrink=0.8)
    finish_fig(regext)
    plt.title('mean ' + dnnm[j] + ')$')
    plt.subplot(122)
    plt.imshow(std,interpolation='nearest',extent=regext, norm=colors.Normalize(vmin=0.0))
    plt.colorbar(shrink=0.8)
    finish_fig(regext)
    plt.title('$\\log_{10}$ standard deviation ' + dnnm[j] + ')$')
    plt.savefig(nam + 'avg_std.png')
    plt.close(3)
```

8.5. Combination of Three Methods Scripts

8.5.1. Python script `combine_plot_methods.py`

The following Python script combines the results of the three individual methods, plots the figures in the text, and samples the results at steel-cased well locations to create the table in the text.

```
import numpy as np
import matplotlib
matplotlib.use('Agg')
import matplotlib.pyplot as plt
import matplotlib.colors as colors
from os.path import join
from itertools import chain

# weights used for recombination
w = (0.5,1.0,1.0)

def normalize_field(f):
    """pass a field with NaN in places outside active modflow region"""
    fmin = np.nanmin(f)
    fmax = np.nanmax(f)
    return (f-fmin)/(fmax-fmin)

def normalize_triangle(f):
    fmin = np.nanmin(f)
    fmax = np.nanmax(f)
    return f/(fmax-fmin)

def spread_field(fsm,factor=2):
    """map a field that is a subset of the 307x284 field onto the large field"""
    flarge = np.empty((fsm.shape[0]*factor,fsm.shape[1]*factor),dtype=fsm.dtype)
    for j,row in enumerate(fsm):
        drow = list(chain(*[(x,x) for x in row]))
        flarge[2*j,:] = drow
        flarge[2*j+1,:] = drow
    return flarge[0:-1,:]

def finish_fig(extents):
    '''Add common things to figures'''
    plt.hold = True
    plt.xlabel('UTM NAD27 X [km]')
    plt.axis(extents)
    locs,labels = plt.xticks()
    plt.xticks(locs,(locs/1000.0).astype('|S3'))
    plt.ylabel('UTM NAD27 Y [km]')
    locs,labels = plt.yticks()
    plt.yticks(locs,(locs/1000.0).astype('|S4'),rotation=90)
    plt.plot(wipp[:,0],wipp[:,1],'k-',linewidth=1)
    plt.plot(h2[:,0],h2[:,1],'g--',linewidth=2)
    plt.plot(h3[:,0],h3[:,1],'r:',linewidth=2)
    plt.plot(salado[:,0],salado[:,1],'b:',linewidth=2)
```


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```
        plt.plot(wells[fiberg,0],wells[fiberg,1],'gs',markersize=4)
        plt.plot(wells[steel,0],wells[steel,1],'ro',markersize=4)
        plt.axis('image')
        plt.axis(extents)

    datadir = join('..','common_data')

    fh = open(join(datadir,'model_domain_specs.dat'),'r')
    nx,ny =     [int(x) for x in fh.readline().strip().split()]
    xmin,ymin = [float(x) for x in fh.readline().strip().split()]
    xmax,ymax = [float(x) for x in fh.readline().strip().split()]
    fh.close()

    wipp = np.loadtxt(join(datadir,'wipp_boundary.dat'))
    h2 = np.loadtxt(join(datadir,'h2_200711.dat'),delimiter=',')
    h3 = np.loadtxt(join(datadir,'h3_200711.dat'),delimiter=',')
    salado = np.loadtxt(join(datadir,'mrgn_dissolution.dat'),skiprows=5)
    wells = np.loadtxt(join(datadir,'2007_well_data.dat'))

    fhwn = open(join(datadir,'2007_well_data_with_names.dat'),'r')
    # names are last column of each row, but not including 2 wells in CH region
    steel_well_names = [x.rstrip().split()[-1] for x in fhwn if x.split()[-2] == '1']
    fhwn.close()

    fiberg = wells[:,4] == 0.0
    steel = wells[:,4] == 1.0

    wellij = np.zeros((steel.sum(),2),'int')
    wellij[:,0] = np.floor((wells[steel,0] - xmin)/100.0)
    wellij[:,1] = np.floor((ymin - wells[steel,1])/100.0)

    # regional left,right,bottom,top
    regext = (xmin,xmax,ymin,ymax)

    # wipp area left,right,bottom,top
    wippext = (wipp[:,0].min() - 1500.0, wipp[:,0].max() + 1500.0,
               wipp[:,1].min() - 1500.0, wipp[:,1].max() + 1500.0)

    fs = (18,9)

    # read in mean/medain kriging + 1 results
    # these are on a mesh with 1/4 as many elements (1/2 as many in each direction)
    # and therefore must be mapped onto the MODFLOW grid

    kmean = np.loadtxt(join('..','kriging_add_well','addone_mod_results_mean.dat'))
    kmedian = np.loadtxt(join('..','kriging_add_well','addone_mod_results_median.dat'))

    kmean[kmean==1] = np.NaN     # blank out areas outside MODFLOW active areas
    kmedian[kmedian==1] = np.NaN

    nkmean = normalize_field(kmean)
    nkmedian = normalize_field(kmedian)

    kmean = spread_field(kmean)[::-1,:]
    kmedian = spread_field(kmedian)[::-1,:]

    nkmean = spread_field(nkmean)[::-1,:]  # flip wrt y
    nkmedian = spread_field(nkmedian)[::-1,:]

    # read in the results of the add-one analysis for triangles
    tmean = np.loadtxt(join('..','triangle_add_well','triangles_add_one_mean.dat'))
    tmedian = np.loadtxt(join('..','triangle_add_well','triangles_add_one_median.dat'))

    tmean[tmean==-999] = np.NaN     # blank out areas outside MODFLOW active areas
    tmedian[tmedian==-999] = np.NaN

    ntmean = normalize_triangle(tmean)[::-1,:]
    ntmedian = normalize_triangle(tmedian)[::-1,:]

    # read in correlation results (handling the NaN in the file)
    fhk = open(join('..','model_correlation','CRA2009_model',
                            'final_100_fields','corr_keff_vs_time.dat'),'r')
    kl = []
    for line in fhk:
        kl.append([float(x) for x in
                   line.strip().replace('1.#QNANe+00','-999').split()])
    fhk.close()
    kcorr = np.array(kl)
    del kl

    fhh = open(join('..','model_correlation','CRA2009_model',
```


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```
                                'final_100_fields','corr_head_vs_time.dat'),'r')
hl = []
for line in fhh:
    hl.append([float(x) for x in
               line.strip().replace('1.#QNANe+00','-999').replace('-1.#IND0e+00','1.0E-
16').split()])
fhh.close()
hcorr = np.array(hl)
del hl

# set -999 substituted above back to NaN
kcorr[kcorr==-999]=np.NaN
kcorr[np.isnan(tmean[::-1,:])]=np.NaN
hcorr[hcorr==-999]=np.NaN
hcorr[np.isnan(tmean[::-1,:])]=np.NaN

nkcorr = normalize_field(np.abs(kcorr))  # should already be flipped
nhcorr = normalize_field(np.abs(hcorr))

# ######################
# compute the remove-one analysis for correlation results from sampling-based correlation
analysis
fh = open('corr_remove_one_steel.dat','w')

fh.write('\t'.join(steel_well_names) + '\n')
np.savetxt(fh,kcorr[wellij[:,1],wellij[:,0]][None,:],fmt='%.6e',delimiter='\t')
np.savetxt(fh,hcorr[wellij[:,1],wellij[:,0]][None,:],fmt='%.6e',delimiter='\t')
fh.close()

# plot up histograms of distribution in each field
plt.figure(1,figsize=(12.5,10))
bins = 150

plt.subplot(321)
plt.hist(nkmean[~np.isnan(nkmean)].flatten(),bins=bins)
plt.ylabel('frequency')
plt.xlabel(r'scaled mean $\Delta$ kriging var.')
plt.axis('tight')

plt.subplot(322)
plt.hist(nkmedian[~np.isnan(nkmedian)].flatten(),bins=bins)
plt.xlabel(r'scaled median $\Delta$ kriging var.')
plt.axis('tight')

plt.subplot(323)
plt.hist(ntmean[~np.isnan(ntmean)].flatten(),bins=bins)
plt.ylabel('frequency')
plt.xlabel(r'scaled mean $\Delta$ triangle angle raio')
plt.axis('tight')

plt.subplot(324)
plt.hist(ntmedian[~np.isnan(ntmedian)].flatten(),bins=bins)
plt.xlabel(r'scaled median $\Delta$ triangle angle raio')
plt.axis('tight')

plt.subplot(325)
plt.hist(nkcorr[~np.isnan(nkcorr)].flatten(),bins=bins)
plt.ylabel('frequency')
plt.xlabel(r'scaled $\rho$ $K_{eff}$ vs. $t$')
plt.axis('tight')

plt.subplot(326)
plt.hist(nhcorr[~np.isnan(nhcorr)].flatten(),bins=bins)
plt.xlabel(r'scaled $\rho$ head vs. $t$')
plt.axis('tight')

plt.subplots_adjust(hspace=0.3)
plt.savefig('histograms_of_distributions.png')
plt.close(1)

# plot up histograms of original (unscaled) distribution in each field
plt.figure(1,figsize=(12.5,10))
bins = 150

plt.subplot(321)
plt.hist(kmean[~np.isnan(kmean)].flatten(),bins=bins)
plt.axis('tight')
plt.ylabel('frequency')
plt.xlabel(r'unscaled mean $\Delta$ kriging var.')

plt.subplot(322)
```


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```
208  plt.hist(kmedian[~np.isnan(kmedian)].flatten(),bins=bins)
     plt.axis('tight')
210  plt.xlabel(r'unscaled median $\Delta$ kriging var.')

212  plt.subplot(323)
     plt.hist(tmean[~np.isnan(tmean)].flatten(),bins=bins)
214  plt.axis('tight')
     plt.ylabel('frequency')
216  plt.xlabel(r'unscaled mean $\Delta$ triangle angle raio')

218  plt.subplot(324)
     plt.hist(tmedian[~np.isnan(tmedian)].flatten(),bins=bins)
220  plt.axis('tight')
     plt.xlabel(r'unscaled median $\Delta$ triangle angle raio')
222
     plt.subplot(325)
224  plt.hist(kcorr[~np.isnan(kcorr)].flatten(),bins=bins)
     plt.axis('tight')
226  plt.ylabel('frequency')
     plt.xlabel(r'unscaled $\rho$ $K_{eff}$ vs. $t$')
228
     plt.subplot(326)
230  plt.hist(hcorr[~np.isnan(hcorr)].flatten(),bins=bins)
     plt.axis('tight')
232  plt.xlabel(r'unscaled $\rho$ head vs. $t$')

234  plt.subplots_adjust(hspace=0.3)
     plt.savefig('histograms_of_original_distributions.png')
236  plt.close(1)

238  cmap = colors.LinearSegmentedColormap.from_list('rwg',('red','orange','white','blue','purple'))
     nrm = colors.Normalize(vmin=-2.4,vmax=2.4)
240  #cmap = 'jet'
     out = np.zeros((307,284,4))
242
     ## combine results linearly with multipliers
244  # mean and median + keff and head = 4 results
     plt.figure(1)
246  #out[:,:,0] = np.sqrt((w[0]*nkcorr)**2 + (w[1]*nkmean)**2 + (w[2]*ntmean)**2)
     out[:,:,0] = w[0]*nkcorr + w[1]*nkmean + w[2]*ntmean
248  plt.imshow(out[:,:,0],interpolation='nearest',extent=regext,cmap=cmap,norm=nrm)
     cb = plt.colorbar(shrink=0.8)
250  cb.set_label('$S_c$')
     plt.title('$K_{eff} +$ mean')
252  finish_fig(regext)
     plt.savefig('combined_results_map_Keff_mean.png')
254  plt.close(1)

256  plt.figure(1)
     #out[:,:,1] = np.sqrt((w[0]*nhcorr)**2 + (w[1]*nkmean)**2 + (w[2]*ntmean)**2)
258  out[:,:,1] = w[0]*nhcorr + w[1]*nkmean + w[2]*ntmean
     plt.imshow(out[:,:,1],interpolation='nearest',extent=regext,cmap=cmap,norm=nrm)
260  cb = plt.colorbar(shrink=0.8)
     cb.set_label('$S_c$')
262  plt.title('$h +$ mean' )
     finish_fig(regext)
264  plt.savefig('combined_results_map_h_mean.png')
     plt.close(1)
266
     plt.figure(1)
268  #out[:,:,2] = np.sqrt((w[0]*nkcorr)**2 + (w[1]*nkmedian)**2 + (w[2]*ntmedian)**2)
     out[:,:,2] = w[0]*nkcorr + w[1]*nkmedian + w[2]*ntmedian
270  plt.imshow(out[:,:,2],interpolation='nearest',extent=regext,cmap=cmap,norm=nrm)
     cb = plt.colorbar(shrink=0.8)
272  cb.set_label('$S_c$')
     plt.title('$K_{eff} +$ median' )
274  finish_fig(regext)
     plt.savefig('combined_results_map_Keff_median.png')
276  plt.close(1)

278  plt.figure(1)
     #out[:,:,3] = np.sqrt((w[0]*nhcorr)**2 + (w[1]*nkmedian)**2 + (w[2]*ntmedian)**2)
280  out[:,:,3] = w[0]*nhcorr + w[1]*nkmedian + w[2]*ntmedian
     plt.imshow(out[:,:,3],interpolation='nearest',extent=regext,cmap=cmap,norm=nrm)
282  cb = plt.colorbar(shrink=0.8)
     cb.set_label('$S_c$')
284  plt.title('$h +$ median' )
     finish_fig(regext)
286  plt.savefig('combined_results_map_h_median.png')
     plt.close()
288
```


: 00494

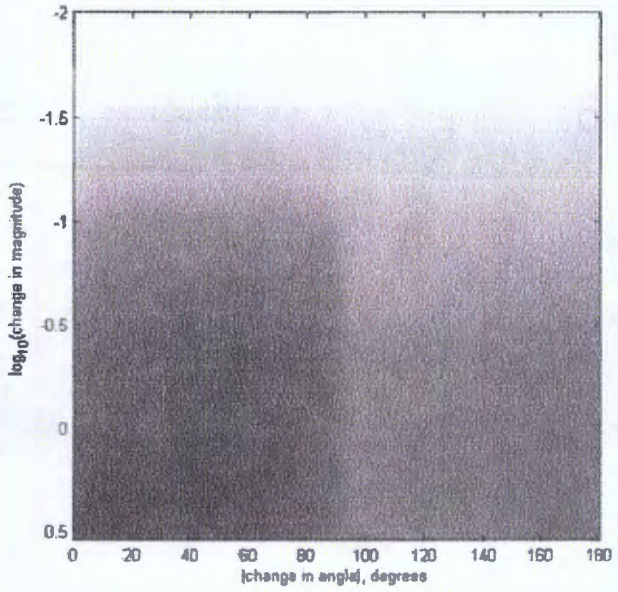
```
    # ########################################
290 # save table of results at steel-cased wells
    fh = open('composite_remove_one_steel.dat','w')
292
    fh.write('\t'.join(steel_well_names) + '\n')
294 for j in [0,1,2,3]:
        np.savetxt(fh,out[wellij[:,1],wellij[:,0],j][None,:],fmt='%.6e',delimiter='\t')
296 fh.close()
```


Information Only

9.0 Remove One Steel Well Figures

The following set of 18 figures (1 colormap and 17 map plots) shows the computed impact on the estimated local gradient from removal of a single steel-cased well from the Culebra monitoring network. Two different types of changes are being illustrated; changes in both gradient and magnitude are represented by the hue and saturation of the color, respectively. White areas in the figures correspond to areas where the change in the predicted gradient is less than the threshold value (0.01), while the deeply colored areas indicate a large change in the magnitude of the gradient. Hot (red) colors indicate the magnitude of the change in angle, with cool colors (blue) indicating no change in direction (both factors are illustrated in the 2D color map below).

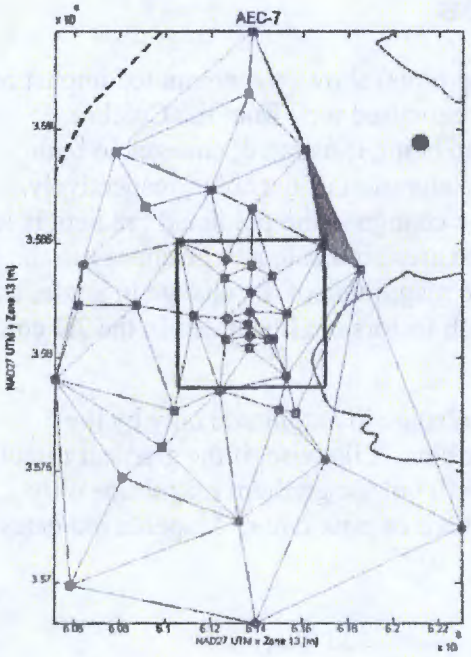
For example, if removing a well causes the gradient to change in magnitude only by the maximum amount, the region would be filled with dark blue. Likewise, if the gradient direction change completely (180 degrees) upon removing the well, but the gradient magnitude only changed slightly, the region would be filled with a faint red or pink color. Magenta indicates a change of 90 degrees, halfway between red and blue.

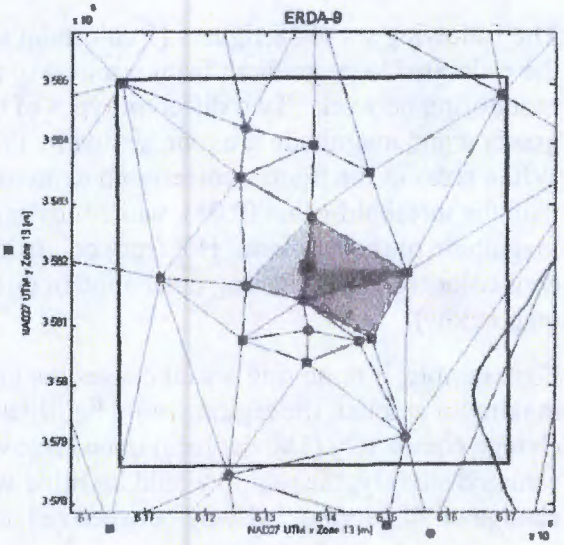


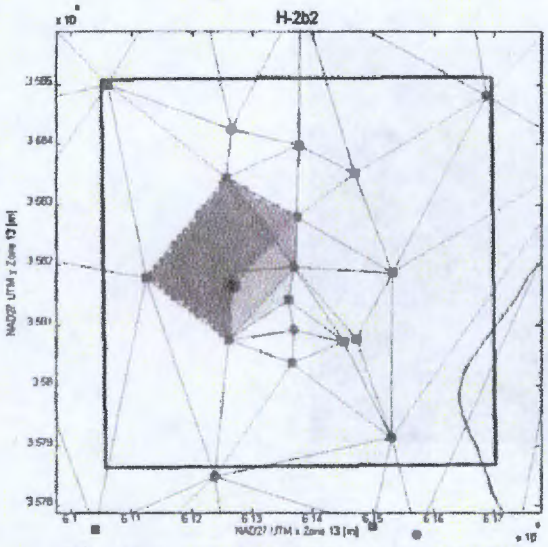
Each figure shows the localized effects on the gradient magnitude estimate, due to removing a steel-cased well from the network. The colors (representing changes above the threshold) are only found in the triangles directly connected to the removed point.

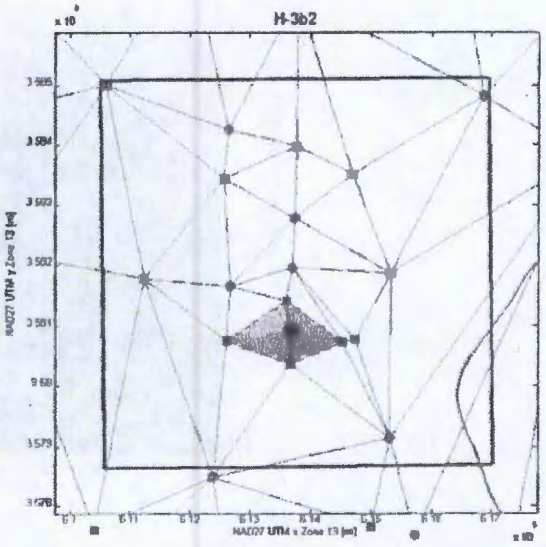
For wells that have no effect outside the WIPP LWB, the plot area is reduced to this smaller area. The Delaunay triangles corresponding to the reduced monitoring network are plotted on the figure; the original triangles are not shown.

Information Only









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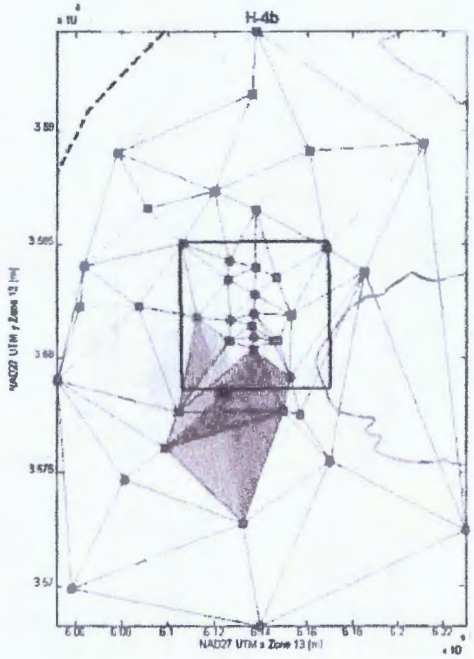

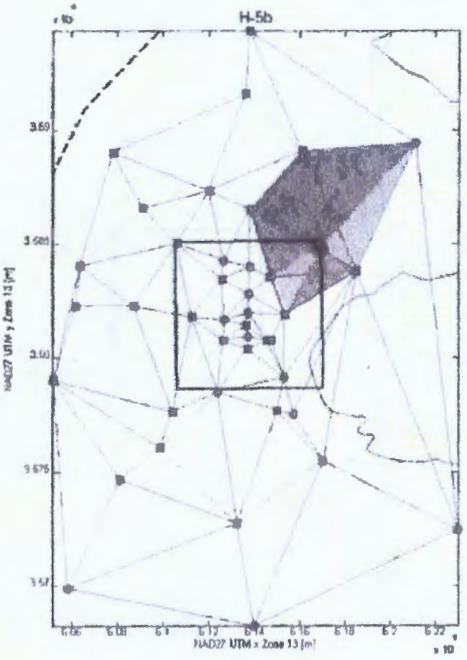

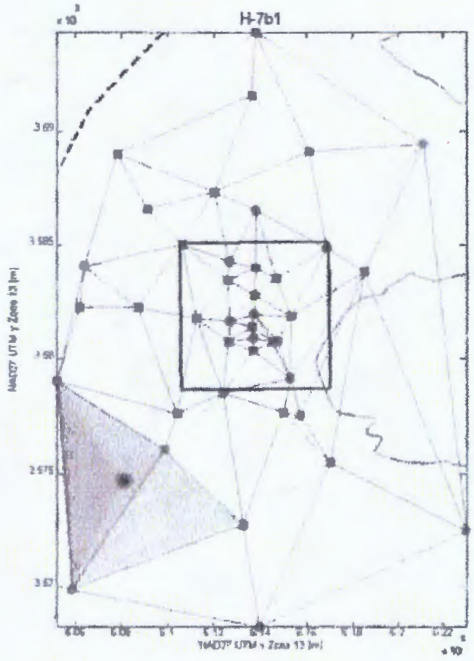

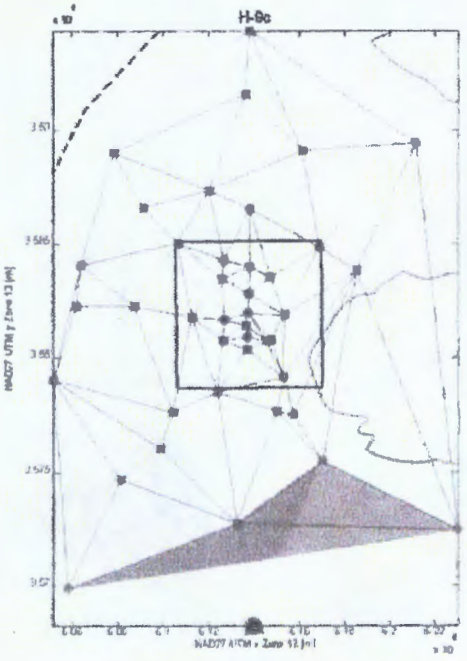

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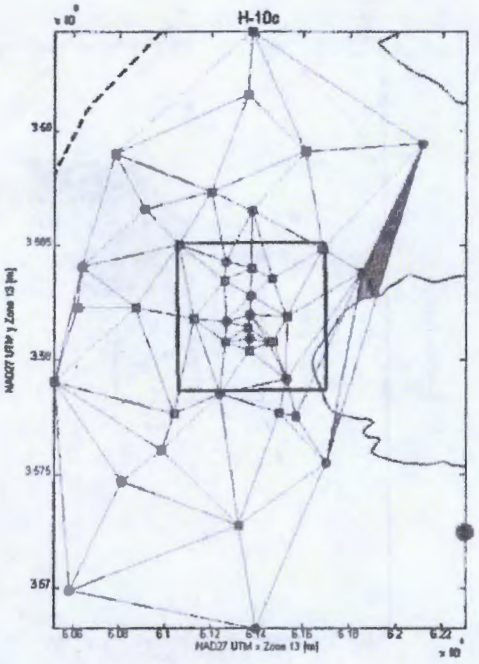

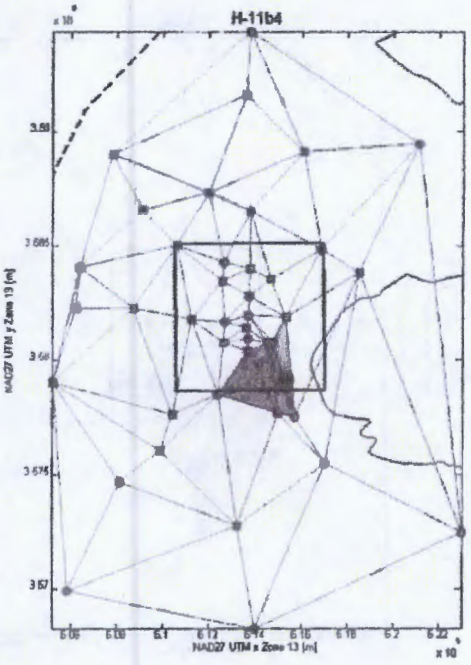

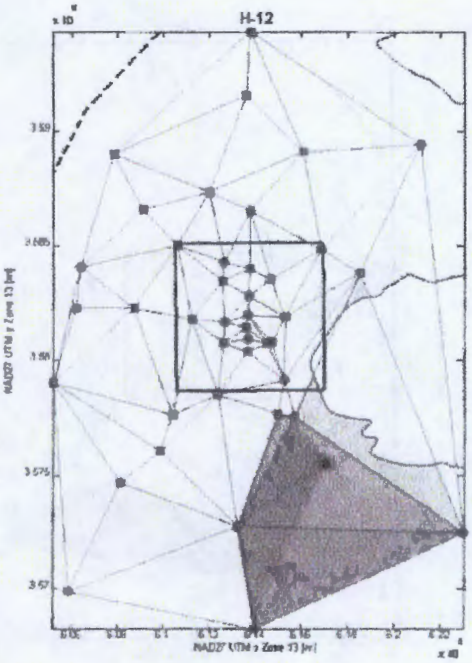

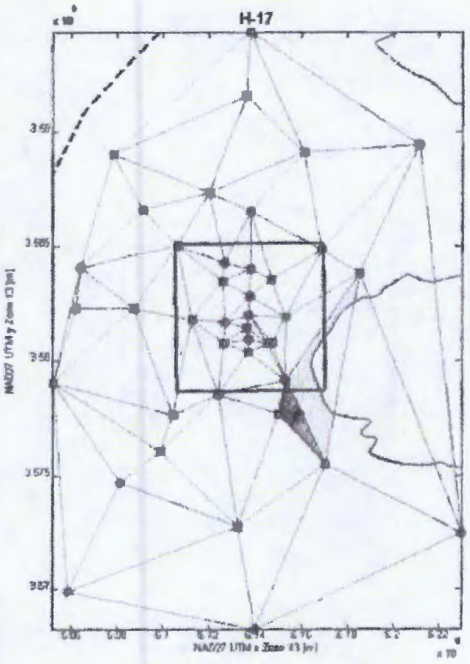

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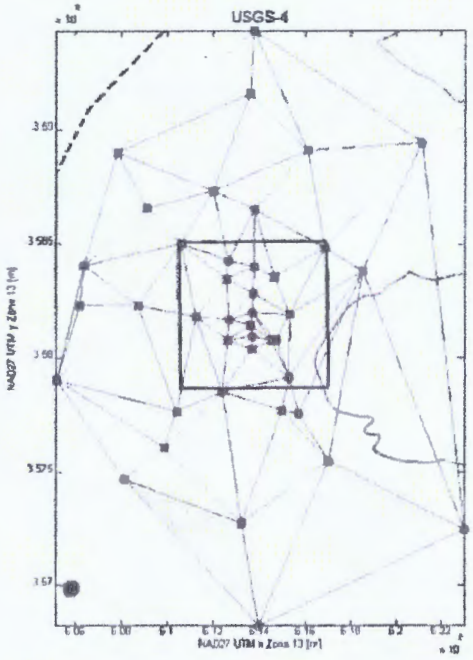

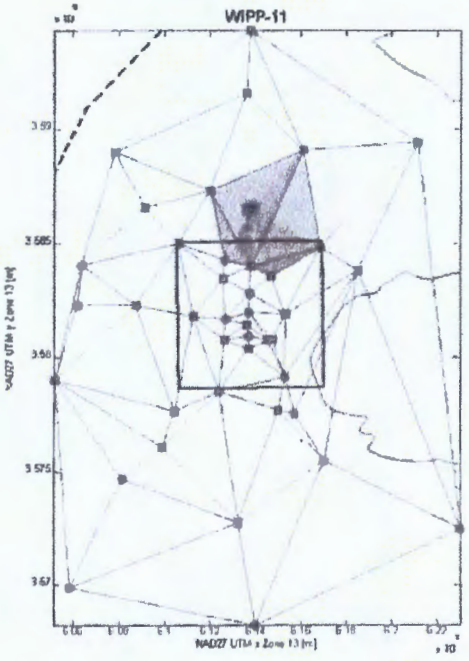

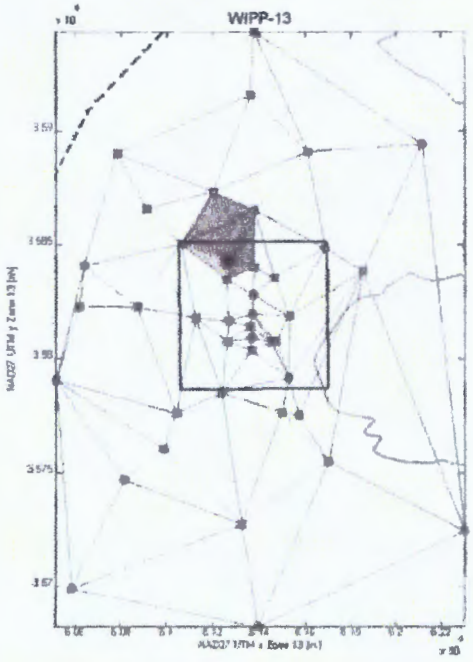

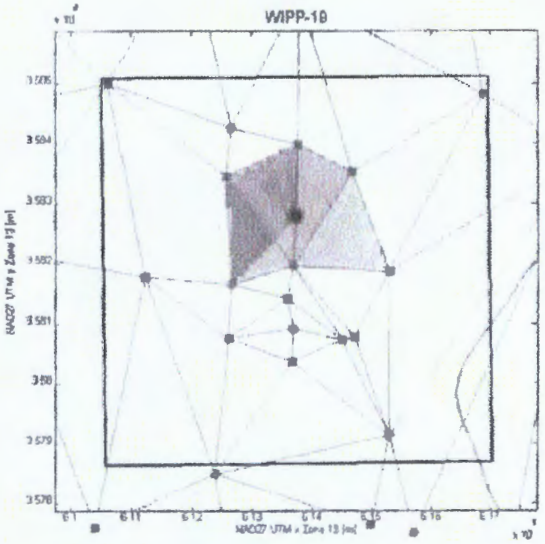

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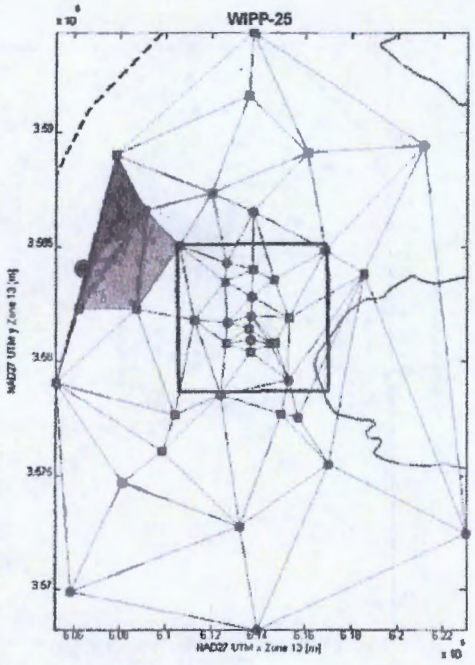


Information Only

DOE/WIPP-95-2154

BASIC DATA REPORT

DOE/WIPP--95-2154

For

WQSP 1

WQSP 2

WQSP 3

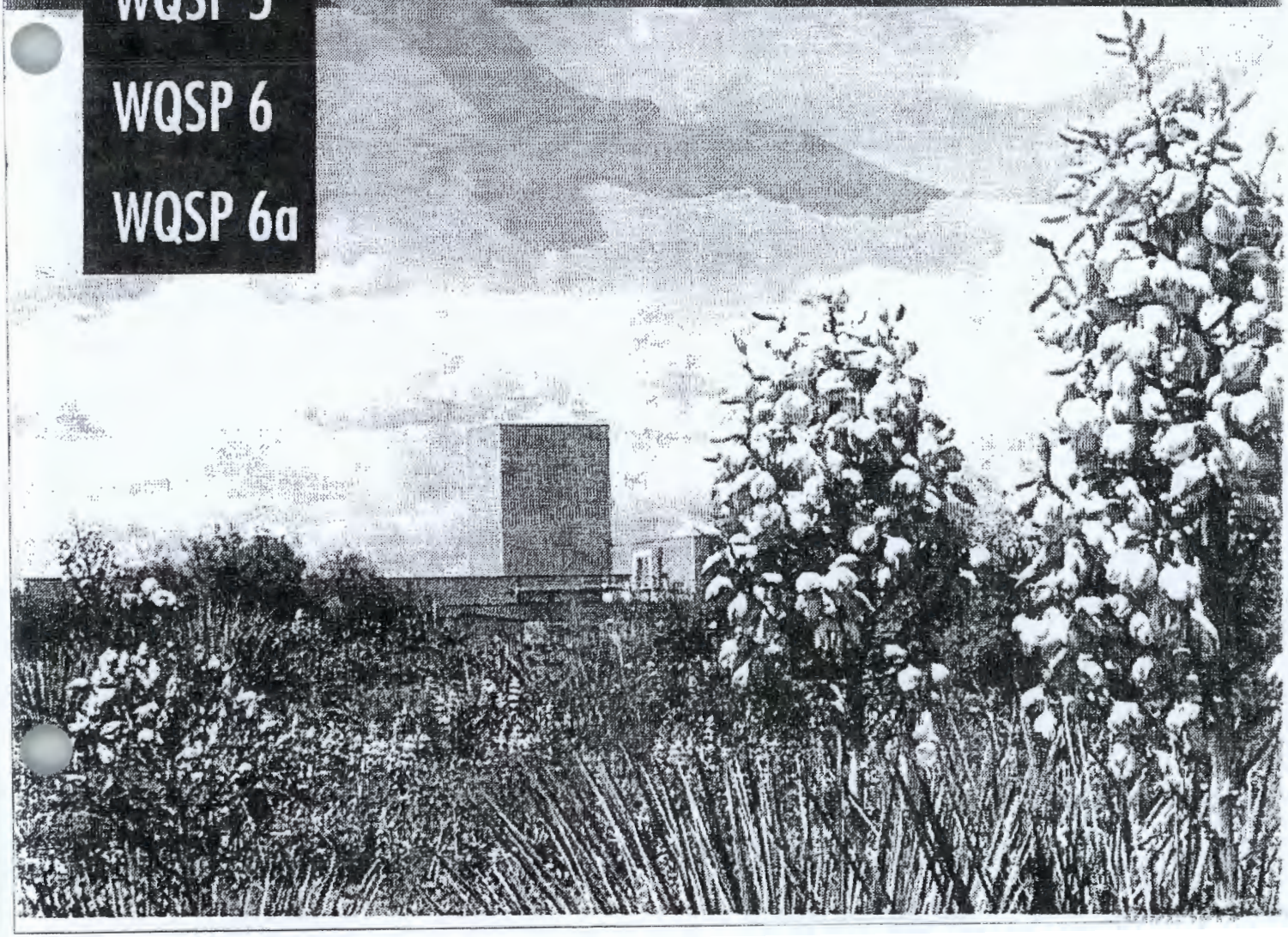
WQSP 4

WQSP 5

WQSP 6

WQSP 6a

MASTER



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Processing and final preparation of this report was performed by the Waste Isolation Pilot Plant Management and Operating Contractor for the U.S. Department of Energy under Contract No. DE-AC04-86AL31950.

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WQSP#6a
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- Stratigraphic Summary
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- Dewey Lake Core Description
- Hole History
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1.0 Introduction

The Waste Isolation Pilot Plant (WIPP) is located in southeastern New Mexico about 30 miles east of Carlsbad, New Mexico. The WIPP was authorized by Congress in 1979 (Public Law 96-194) and given the mission to provide "...a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." The WIPP is intended to receive, handle, and permanently dispose of transuranic waste. To fulfill this mission, the U.S. Department of Energy is constructing a full scale facility to demonstrate both technical and operational principles of the permanent storage/disposal of transuranic waste. Technical aspects are those concerned with the design, construction, and performance of subsurface structures. Operational aspects refer to the receiving, handling, and emplacement of transuranic waste in salt. The facility is also designed for in situ studies and experiments in salt. The Water Quality Sampling Program (WQSP) evaluates the physical and chemical properties of the groundwater above the repository horizon that are part of the technical performance aspects.

2.0 Purpose of the Water Quality Sampling Program Wells

The objective of the WQSP is to collect representative groundwater samples from water-bearing zones in the area of the WIPP site. These data assist in meeting the requirements of site characterization. The WQSP wells drilled in 1994 are intended to provide representative, reproducible, and defendable quality data that are free of well construction bias. These seven wells were drilled along the boundary of the Off Limits Area under an U.S. Environmental Protection Agency (EPA) directive and enhance the current groundwater monitoring network.

3.0 Description of Drilling Program

Wells WQSP#1 through WQSP#6a are located (Figure 3-1) in east-central Eddy County, New Mexico in the T22S, R31E (Table 3-1). This drilling program was initiated by Westinghouse Electric Corporation and involved a number of subcontractors. Each of their contributions to the program are provided below.

An archeological survey was performed at the locations of the new monitoring wells by Pecos Archeological Consultants. This survey was conducted on May 26 and June 16, 1994 for the six drill pads and new access roads constructed for this program. One archeological site was recorded with significant cultural remains within the impact zone. This site was avoided by rerouting one of the access roads to a drill pad. The description is intentionally vague to protect

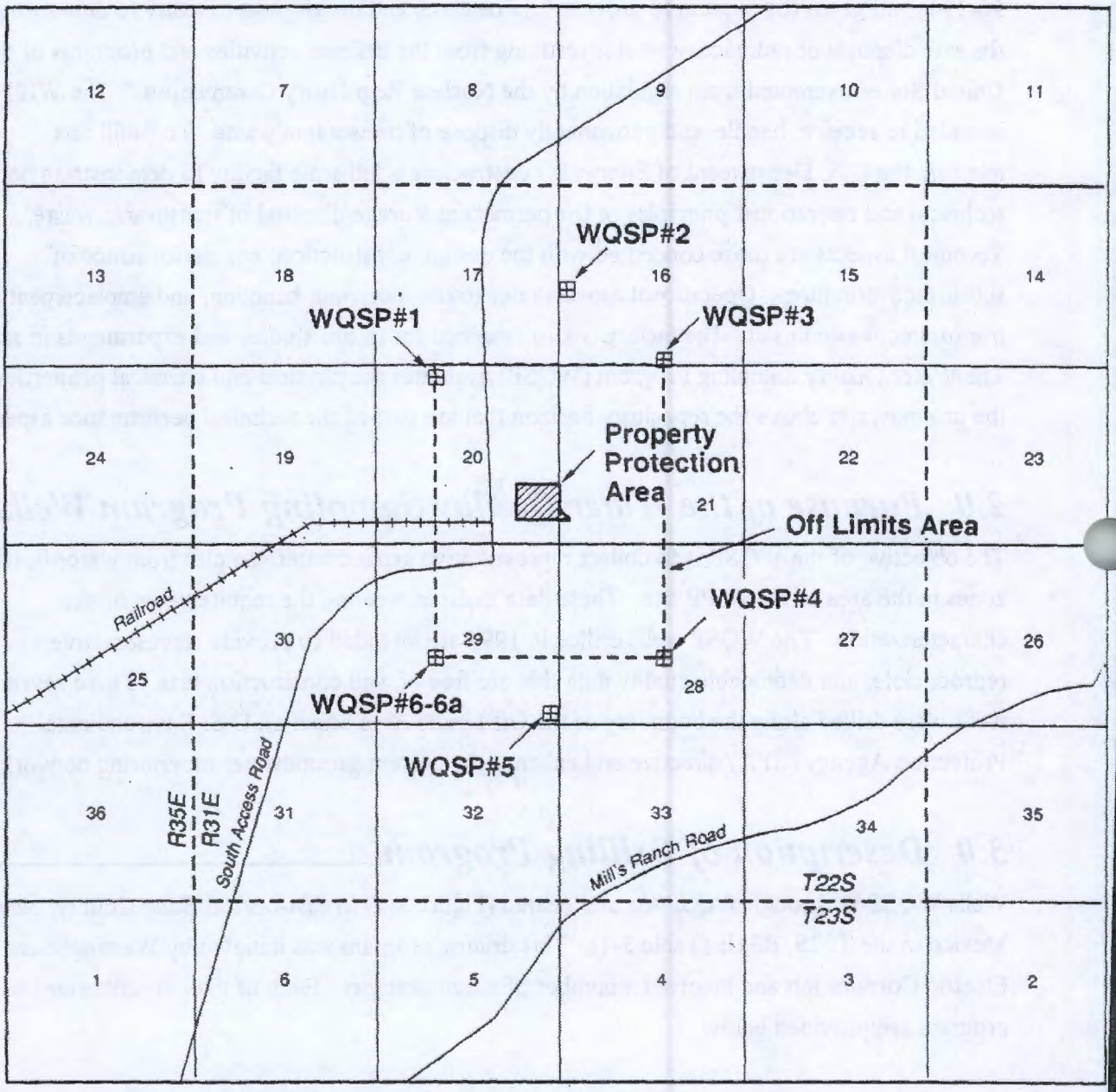

Figure 3-1
Location of WQSP Wells 1 to 6a

Table 3-1
Location Information for the
1994 Water Quality Sampling Program (WQSP) Boreholes

Borehole ID	State Plane Coordinate		Elevation amsl	Location T22S R31E	Coordinates (feet)	
	East	North				
WQSP#1	663600	503774	3416.6	Section 20	101 FNL	1422 FWL
WQSP#2	667598	505542	3461.4	Section 16	1646 FSL	142 FWL
WQSP#3	670576	504030	3477.5	Section 16	96 FSL	2162 FEL
WQSP#4	670658	495000	3430.5	Section 28	1632 FSL	2136 FEL
WQSP#5	667170	493666	3381.6	Section 29	330 FSL	340 FEL
WQSP#6	663691	494942	3361.8	Section 29	1626 FSL	1461 FWL
WQSP#6a	663625	494969	3361.2	Section 29	1653 FSL	1395 FWL

- FNL - feet from north line
- FSL - feet from south line
- FWL - feet from west line
- FEL - feet from east line
- amsl - above mean sea level

the location of this site. Unauthorized collection, vandalism, or excavation of cultural remains is prohibited under the Archeological Resources Protection Act (ARPA) (16 USC §470aa et seq).

The access roads to the drill locations, the drill pads, and the pits were constructed by MMP Construction. The drill pads are 100 ft by 100 ft, topped with construction grade caliche, and occupy approximately 2.29 acres. At each location, two pits were constructed approximately 30 ft by 15 ft and approximately 10 ft deep and lined with high density polyethylene plastic. One pit contained the discharged cuttings and fluids from the drilling; the other pit was divided into two sections, with one side containing the drilling mud, and the other side containing non-potable water. WQSP#6 and WQSP#6a occupy the same drill pad; however, four discharge pits were constructed at this location. After drilling and well development, these pits were filled with soil.

The wells were drilled by West Texas Water Well Service from September to November of 1994 (Table 3-2). Grab samples of the cuttings were taken by IT Corporation every 20 ft to track formations penetrated and to stop open-hole drilling in time to core the Culebra Member of the Rustler Formation. The core was described by INTERA. A condensed well summary, stratigraphic summary, cuttings description, Culebra core description (Dewey Lake core description for WQSP#6a), hole history, and geophysical logs (Century Geophysical Corporation) are presented as appendices in this report.

The drilling plan for the six new monitoring wells provided an option for additional wells to be drilled should water be encountered in the Dewey Lake Formation. Water in the Dewey Lake Formation was encountered in only one well, WQSP#6. WQSP#6a, located approximately 100 ft west of WQSP#6, was terminated within the upper portion of the Dewey Lake Formation for further investigation.

3.1 WQSP#1

WQSP #1 is located 101 ft from the north line and 1422 ft from the west line in Section 20, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 13 through 16, 1994, and encountered 40 ft of Santa Rosa Formation, 482 ft of Dewey Lake Formation, and 174 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 696 ft to 737 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs

Table 3-2
Drilling Information for the
1994 Water Quality Sampling Program (WQSP) Boreholes

Borehole ID	Drill Dates	Total depth (feet)	Cored Interval (feet)	Unit
WQSP#1	September 13-16, 1994	737	696-737	Culebra
WQSP#2	September 6-10, 1994	846	800-846	Culebra
WQSP#3	October 20-26, 1994	879	833-879	Culebra
WQSP#4	October 5-7, 1994	800	740-798	Culebra
WQSP#5	October 12-13, 1994	681	648-676	Culebra
WQSP#6	September 22-30, 1994	617	568-617	Culebra
WQSP#6a	October 28-31, 1994	225	160-220	Dewey Lake

- SPC_NAD27 - State plane coordinates _ North American Datum Model 27

were run in the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity. The geophysical logs were run in this hole before it was reamed, therefore, approximately 40 ft of slough prevented the logging tool from reaching the bottom of the hole. The rest of the wells were reamed before they were logged.

3.2 WQSP#2

WQSP #2 is located 1646 ft from the south line and 142 ft from the west line in Section 16, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 6 through 10, 1994, and encountered 147 ft of Santa Rosa Formation, 486 ft of Dewey Lake Formation, and 215 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 800 ft to 846 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.3 WQSP#3

WQSP #3 is located 96 ft from the south line and 2162 ft from the east line in Section 16, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 20 through 26, 1994, and encountered 155 ft of Santa Rosa Formation, 513 ft of Dewey Lake Formation, and 212 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 833 ft to 879 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.4 WQSP#4

WQSP #4 is located 1632 ft from the south line and 2136 ft from the east line in Section 28, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 5 through 7, 1994, and encountered 78 ft of Santa Rosa Formation, 510 ft of Dewey Lake Formation, and 212 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 740 ft to 798 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.5 WQSP#5

WQSP #5 is located 330 ft from the south line and 340 ft from the east line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 12 through 13, 1994, and encountered 25 ft of Santa Rosa Formation, 450 ft of Dewey Lake Formation, and 206 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 648 ft to 676 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: spontaneous potential resistivity, natural gamma, density, and neutron porosity.

3.6 WQSP#6

WQSP #6 is located 1626 ft from the south line and 1461 ft from the west line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from September 22, through October 4, 1994, and encountered 68 ft of Santa Rosa Formation, 341 ft of Dewey Lake Formation, and 208 ft of Rustler Formation. Cuttings were collected every 20 ft and the well was cored from 568 ft to 617 ft for detailed description of the Culebra Member of the Rustler Formation. Geophysical logs were run the entire length of the hole and include: deviation, caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

3.7 WQSP#6a

WQSP #6a is located 1653 ft from the south line and 1395 ft from the west line in Section 29, T22S, R31E in Eddy County, New Mexico. The well was drilled from October 28, through November 1, 1994, and encountered 35 ft of Santa Rosa Formation and 185 ft of Dewey Lake Formation. Cuttings were collected every 20 ft and the well was cored from 160 ft to 220 ft for detailed description of the Dewey Lake Formation. Geophysical logs were run the entire length of the hole and include: caliper, spontaneous potential, resistivity, natural gamma, and neutron porosity.

WQSP#1

Section 20, T22S, R31E

Location of WQSP #1

WQSP #1
Condensed Well Summary

Location:	Section 20, T22S, R31E 101 ft from the north line 1422 ft from the west line	
Elevation: (Top of Casing)	3419.2 ft above mean sea level	
Cuttings Description:	D.S. Belski	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 13 to 16, 1994 737 ft below land surface 696 to 737 ft every 20 ft

WQSP #1
Stratigraphic Summary

Stratigraphic Unit	*Depth Interval Natural Gamma Log (feet)	Core Description
Surficial Deposits/Santa Rosa	0-40	
Dewey Lake Redbeds	40-522	
Rustler Formation	522-689 partial	
• Forty Niner Member	522-591	
• Magenta Member	591-612	
• Tamarisk Member	612-689?	695.6-699 partial
• Culebra Member	NA	699-722
• Partial lower unnamed member	NA	722-737 partial
Maximum Recorded Depth	689	

* Geophysical logs were run before the hole was reamed. Sloughing in the hole prevented the loggers from reaching bottom.

WQSP #1
CUTTINGS DESCRIPTION

WQSP #1
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
08/31/94	1120	1**	6	Surficial deposits
	1125	2**	25	Surficial deposits
09/13/94	1309	1	45	Mudstone, clay, siltstone and sandstone
	1324	2	65	Siltstone and sandstone
	1353	3	85	Sandstone, siltstone, and mudstone
	1423	4	105	Siltstone and mudstone
	1433	5	125	Sandstone, siltstone, and mudstone
	1520	6	145	Siltstone, mudstone, and clay
	1546	7	165	Sandstone, siltstone, and gypsum
	1610	8	185	Siltstone, mudstone, sandstone, and gypsum
	1638	9	205	Siltstone, mudstone, and gypsum
	1707	10	225	Mudstone, siltstone, and gypsum
	1718	11	245	Siltstone, mudstone, and gypsum
09/14/94	0746	12	265	Sandstone, siltstone, and gypsum
	0759	13	285	Sandstone, siltstone, and gypsum
	0825	14	305	Sandstone, mudstone, and gypsum
	0845	15	325	Sandstone, trace gypsum
	0904	16	345	Siltstone, gypsum, and sand
	0919	17	365	Siltstone and gypsum
	0945	18	385	Sandstone, siltstone, and mudstone
	1009	19	405	Siltstone, mudstone, and sandstone
	1021	20	425	Siltstone, mudstone, and gypsum
	1040	21	445	Siltstone and mudstone
	1102	22	465	Siltstone with selenite, claystone with green reduction spots
	1112	23	485	Siltstone with selenite, claystone with green reduction spots

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #1
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1131	24	505	Siltstone with selenite and fibrous gypsum
	1154	25	525	Anhydrite and gypsum
09/14/94	1219	26	545	Anhydrite and gypsum
	1235	27	565	Mud
	1306	28	585	Anhydrite and siltstone
	1318	29	605	Anhydrite
	1351	30	625	Anhydrite, selenite, and siltstone
	1413	31	645	Anhydrite
	1502	32	665	Anhydrite
	1536	33	685	Anhydrite with mud

* Cuttings description is for stratigraphic control not geologic description.
** Auger drilling

WQSP #1
CULEBRA CORE DESCRIPTION

PAGE 1 OF 3

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94
DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		695.0					
		695.6					
09/15 11:25	1	696.0	8 7			695.6 - 699.0 ft: upper 0.2 ft of unit: red-brown mudstone with numerous subrounded-subangular pebble-sized anhydrite clasts underlain by light to dark gray mottled anhydrite with 2-3 mm gypsum laminae. Lower 0.2 ft of unit: light-brown and black interbedded clays. Sharp contact between anhydrite, clay, and underlying Culebra Member.	Tamarisk Member of Rustler Formation
		697.0					
		698.0					
		699.0		VO		699.0 - 700.6 ft: reddish gray-brown microcrystalline dolomite with numerous open vugs (1 mm - 0.25 cm). Fractures occurring along horizontal, thin (< 1 mm) clay seams.	Culebra Member of Rustler Formation
		700.0		VO	CF		
		701.0		VO			

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

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COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15	1	701.0 702.0 703.0 704.0 705.0 706.0 707.0	8 7	OV OV OV OV OV OV	GF CF	700.6 - 706.0 ft: light olive-gray microcrystalline dolomite. Upper 2 ft of unit contains infrequent open vugs up to 1.5 cm. Vugs decrease in size and increase in frequency toward base of unit (~1 mm). In lower 2.5 ft open vugs form in bands 0.1 to 0.3 ft in width. Horizontal fractures occur toward base of unit along thin (<1 mm) clay seams. In upper 2 ft of unit horizontal fractures occur along gypsum seams. Unit contains infrequent high-angle gypsum veins (2-3 mm).	Culebra Member of Rustler Formation

PAGE 3 OF 3

WIPP CORE-LOG INVENTORY

INTERA

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LOG BY: JBD

DATE: 09/15/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15 11:30	1	707.0	8 7	OV OV		706.0 - 710.5 ft: same dolomite as previous unit. Upper 1.5 ft highly fractured and clayey. Small (1-2 mm) vugs, open, and of moderate intensity. Vugs decrease in frequency and increase in size (0.5 - 3 cm) toward base of unit. Lower 3 ft of unit highly fractured with thin (<1 mm) clay seams and small blebs of clay.	Culebra Member of Rustler Formation ~1.5 feet of core loss
		708.0		OV			
		709.0		OV			
		710.0		---	CF		
		711.0					
		712.0					
		713.0					

PAGE 1 OF 1

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

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DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/15/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		710.0					
		710.5					
09/15 14:31	2	712.0	2 7	OV OV OV	GF	710.5 - 722.0 ft: light olive-gray microcrystalline dolomite, highly fractured. Numerous moderately-sized (5-10 mm) open vugs toward top of unit decreasing in frequency and size with depth. Toward base of unit vugs are sparse and gypsum filled. Evidence of infrequent gypsum filled fractures throughout unit. Contact between the Culebra Member and underlying unnamed member not visible.	Culebra Member of Rustler Formation 8.5 feet of core loss
		714.0		OV			
		716.0			GF		
		718.0					
		720.0					
		722.0					

PAGE 1 OF 3

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

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LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/16/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15 17:04	3	722.0 723.0 724.0 725.0 726.0 727.0 728.0	100			722.0 - 724.5 ft: black, plastic clay with infrequent 1-2 mm gypsum stringers. 724.5 - 726.5 ft: very dark red-brown clay with 0.1 - 0.2 ft white to pinkish white gypsum bands. Infrequent gypsum stringers up to 2 mm in width.	Unnamed Member of Rustler Formation

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#1 DIA.: 4"

LOCATION: NE1/4 NW1/4 Section 20 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 101' FSL 1422' FWL

ELEVATION: 3419.2 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/16/94

DRILL DATE: 09/15/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/15	3	728.0 729.0 730.0 731.0 732.0 733.0 734.0	100			726.5 - 732.0 ft: lighter red-brown clay with numerous gypsum veins up to 0.3 ft in width. White to pinkish-white crystalline (lath-like interlocking crystals) gypsum fill. Veins are horizontal to high angle and increase in frequency toward base of unit as clay grades into anhydrite. 732.0 - 737.0 ft: light to dark gray mottled anhydrite with abundant 1-2 mm gypsum laminae.	Unnamed Member of Rustler Formation

PAGE 3 OF 3

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

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ELEVATION: 3419.2 feet amsl
DRILL METHOD(S): Air Rotary

LOG BY: JBD
DATE: 09/16/94
DRILL DATE: 09/15/94
DRILLER: Ronnie Keith
DRILL: Gardner Denver 1500
DRILL CO.: West Texas Water Well Service

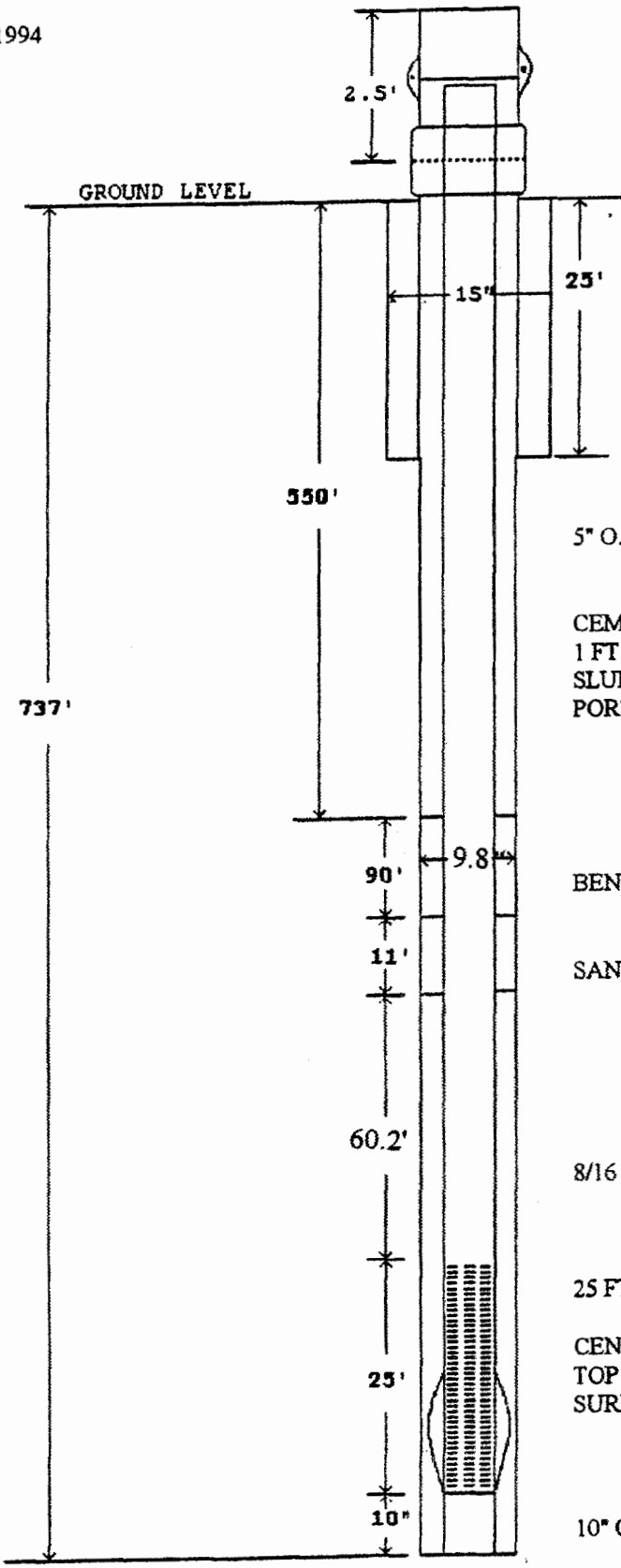
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		734.0					
09/15 17:40	3	735.0	100			732.0 - 737.0 ft: light to dark gray mottled anhydrite with abundant 1-2 mm gypsum laminae.	Unnamed Member of Rustler Formation
		736.0					
		737.0					
		738.0					
		739.0					
		740.0					

WQSP #1
HOLE HISTORY

WIPP Project
QSP #1
Eddy County, New Mexico

September 13-16, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 550 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 640 TO 550 FT

SAND PACK FROM 651 TO 640 FT

8/16 BRADY GRAVEL FROM 651 TO 712 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 13, 1994

WQSP # 1

6:30 AM - 8:00 AM - Rig down on WQSP # 2 and move to WQSP # 1
8:00 AM - 11:30 AM - Rigging up on WQSP # 1
11:30 AM - 5:00 PM - Drilling 9 7/8" hole from 25′ - 245′
5:00 PM - 5:20 PM - Come out of hole & secure rig for day

September 14, 1994

WQSP # 1

6:00 AM - 6:35 AM - Carlsbad to WQSP # 1
6:35 AM - 6:45 AM - Check fluid levels
6:45 AM - 7:25 AM - Fix rotating head & T.I.H.
7:25 AM - 4:00 PM - Drill 9 7/8" hole from 245′ - 693′
4:00 PM - 4:15 PM - Trip pipe out of hole
4:15 PM - 4:30 PM - Shut down rig and secure for day
4:30 PM - 5:15 PM - WQSP # 1 to Carlsbad

September 15, 1995 is missing from the drillers log, see WQSP#1 core description.

WEST TEXAS WATER WELL SERVICE

September 16, 1994

WQSP # 1

6:30 AM	6:35 AM	Carlsbad to WQSP # 1
6:35 AM	6:50 AM	Check & service rig
6:50 AM	7:50 AM	Finish tripping out of hole with 3rd core run
7:50 AM	8:30 AM	Retrieve core
8:30 AM	9:00 AM	Breakdown core tools
9:00 AM	12:45 PM	Rig up logger & log well
12:45 PM	1:00 PM	Secured rig for weekend

September 20, 1994

WQSP # 1

6:00 AM	6:30 AM	Carlsbad to WQSP # 1
6:30 AM	6:40 AM	Check fluid levels in equipment
6:40 AM	7:00 AM	Run bailer in casing
7:00 AM	11:30 AM	Run 1" pipe inside 2" trimmie line to check gravel depth and remove bridge, added gravel to depth of 650' below ground surface, placed sand pack from 650'-640'
11:30 AM	12:40 PM	Pulled 1" pipe, mixed bentonite slurry to pump for bentonite seal from 640'-550' - approximately 275 gallons.
12:40 PM	1:30 PM	Rigged up to pump cement
1:30 PM	3:00 PM	Waited on cement trucks
3:00 PM	4:30 PM	Pump cement from 550' to surface, circulating out to reserve pit
4:30 PM	5:00 PM	Washout cement from lines, shut down operations for the day
5:00 PM	5:30 PM	WQSP # 1 to Carlsbad

WEST TEXAS WATER WELL SERVICE

September 21, 1994

WQSP # 1 & 2

6:10 AM - 6:40 AM - Carlsbad to WQSP # 1
6:40 AM - 6:55 AM - Service rig
6:55 AM - 8:00 AM - Clean up location & rig down

September 22, 1994

WQSP # 1

8:50 AM - 5:30 PM - Bailed well to develop and clean up

September 28, 1994

WQSP # 1

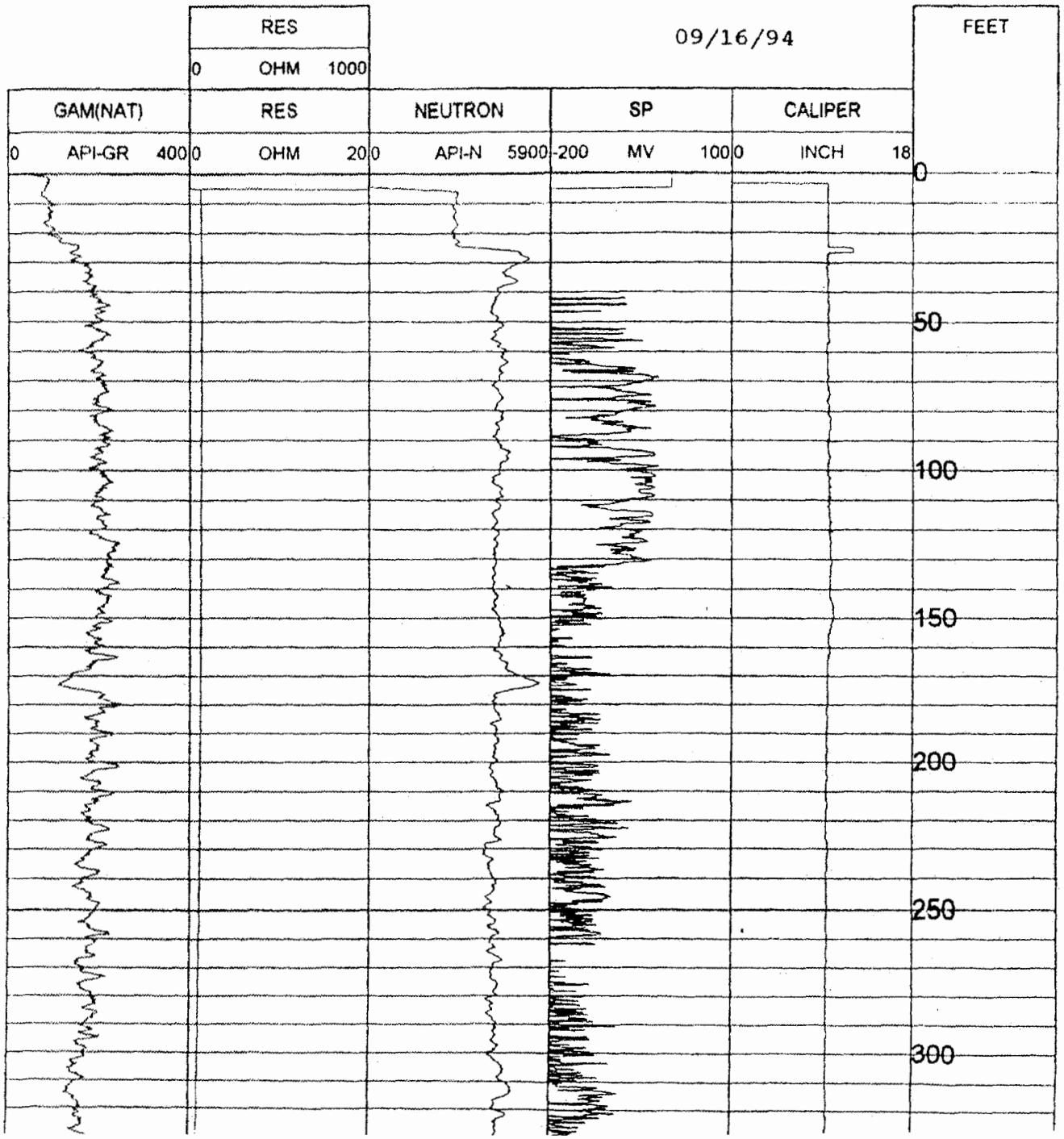
7:25 AM - 9:30 AM - Make 24 trips with bailer, rig down, & go to get pipe trailer & pump
9:30 AM - 10:00 AM - Getting pipe trailer & pump
10:00 AM - 10:45 AM - Rig up to run pump
10:45 AM - 11:15 AM - Lunch
11:15 AM - 12:30 PM - Run pump
12:30 PM - 12:40 PM - Hook up to generator & start pumping - pump rate 13 GPM
12:40 PM - 3:30 PM - Pump well - average 10.9 GPM
Pump was set on 714' 1" gal. pipe
3:30 PM - 4:00 PM - Rig down & go to WQSP # 6

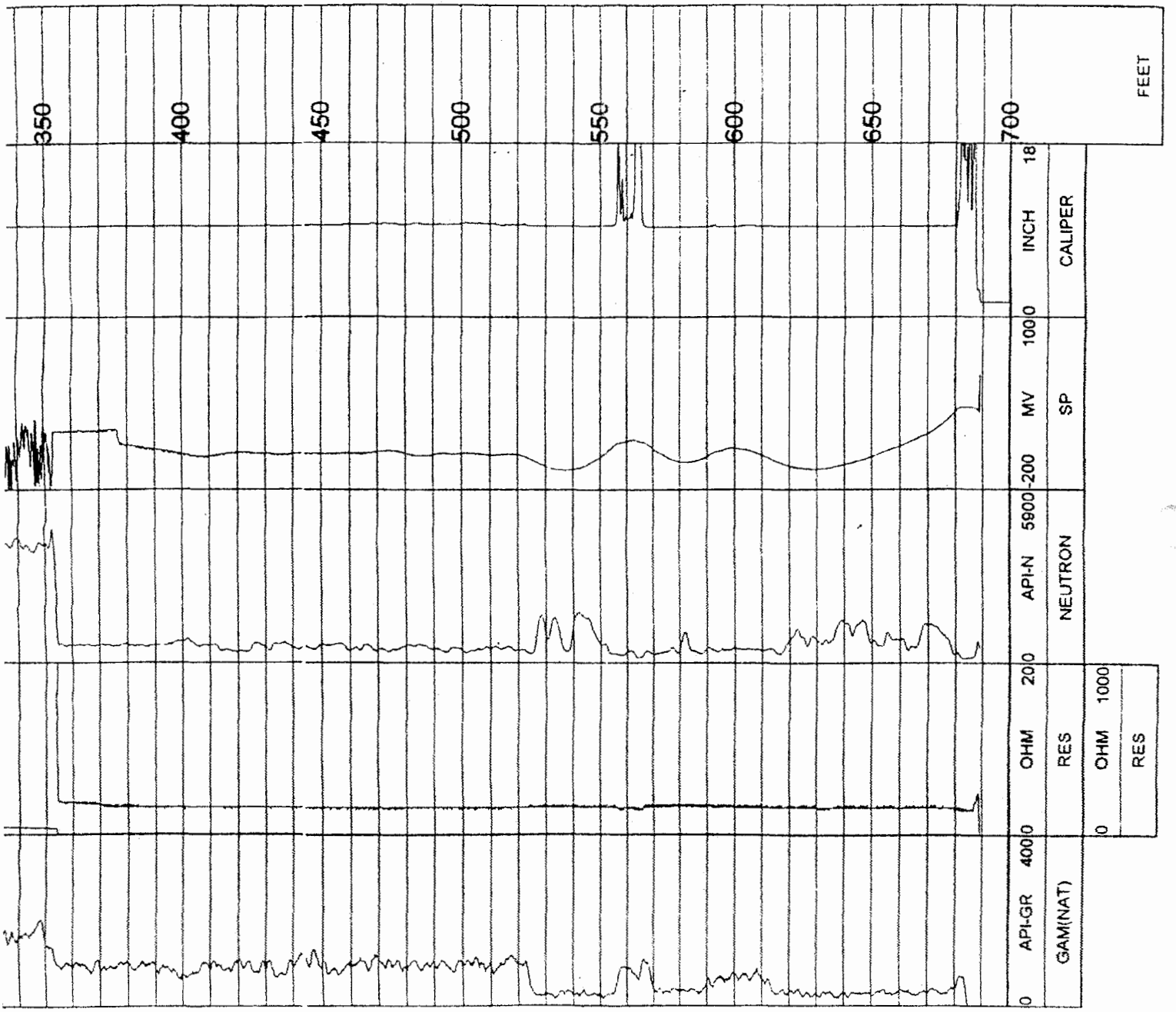
September 29, 1994

WQSP # 1

6:30 AM - 6:45 AM - Rig up to pull pump
6:45 AM - 8:00 AM - Pulled pump & rigged down
8:00 AM - 9:45 AM - Load up, straighten sand line
9:45 AM - 10:00 AM - WQSP # 1 to WQSP # 6

WQSP #1
GEOPHYSICAL LOGS

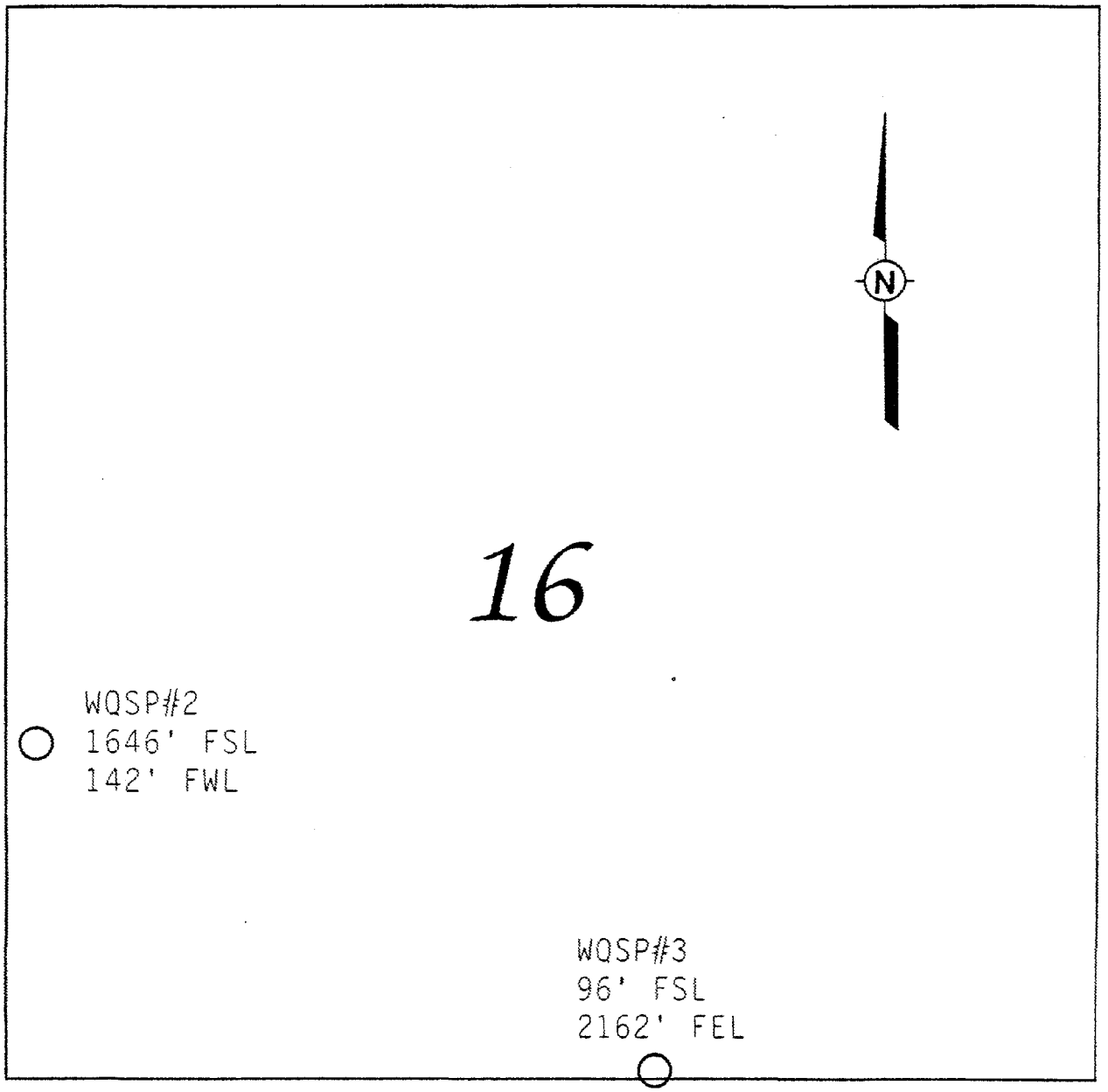

RES
0 OHM 1000
09/16/94
FEET
GAM(NAT)
RES
NEUTRON
SP
CALIPER
0 API-GR 400
0 OHM 20
0 API-N 5900
-200 MV 100
0 INCH 18
0
50
100
150
200
250
300



WQSP #1
Geophysical Logs

WQSP#2

Section 16, T22S, R31E



Location of WQSP #2

WQSP #2
Condensed Well Summary

Location:	Section 16, T22S, R31E 1646 ft from the south line 142 ft from the west line	
Elevation: (Top of Casing)	3463.9 ft above mean sea level	
Cuttings Description:	D.S. Belski	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 6 to 10, 1994 848 ft below land surface 800 to 846 ft every 20 ft

WQSP #2
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-143	
Dewey Lake Redbeds	143-629	
Rustler Formation	629-844 partial	
• Forty Niner Member	629-692	
• Magenta Member	692-714	
• Tamarisk Member	714-811	800-810 partial
• Culebra Member	811-833	810-834
• Partial lower unnamed member	833-844	834-846
Maximum Recorded Depth	844	

WQSP #2
CUTTINGS DESCRIPTION

WQSP #2
Cuttings Description*

Date	Time	Sample Number	Depth (feet)	Description
08/31/94	0920	1**	6	Surficial deposits
	0928	2**	25	Surficial deposits
09/06/94	0845	1	45	Sandstone, clay, and sand
	0900	2	65	Clay, sandy siltstone, and mudstone
	0927	3	85	Clay
	1035	4	105	Sandy mudstone, clay, and sandstone
	1102	5	125	Sandstone, clay, and interbedded siltstone and sandstone
09/07/94	0824	6	145	Sandstone with minor gypsum
	1101	7	165	Mudstone
	1239	8	185	Mudstone, trace sandstone
	1259	9	205	Sandstone, clay, minor gypsum
	1323	10	215	Sandstone, clay, minor gypsum and sandstone
	1330	11	225	Sandstone
	1341	12	245	Claystone and gypsum
	1407	13	265	Sandstone and minor fibrous gypsum
	1423	14	285	Sandstone with green reduction spots
	1447	15	305	Sandstone
	1523	16	325	Sandstone
	1550	17	345	Siltstone and sandstone
	1610	18	365	Sandstone, minor fibrous gypsum
	1643	19	385	Siltstone with interbedded sandstone
	1715	20	405	Siltstone with green reduction spots, minor fibrous gypsum and clay
	1729	21	425	Siltstone with interbedded mudstone and sandstone
	1749	22	445	Sandstone, trace gypsum
09/08/94	0833	23	465	Siltstone, trace gypsum

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #2
Cuttings Description (Continued)*

Date	Time	Sample Number	Depth (feet)	Description
	0854	24	485	Siltstone, sandstone, trace gypsum
	0922	25	505	Siltstone, clay, trace gypsum
	0946	26	525	Mudstone, siltstone, sand, and clay
	1003	27	545	Mudstone, siltstone, sand, and clay
	1030	28	565	Sandy siltstone
	1048	29	585	Siltstone with minor gypsum
	1103	30	605	Sandy siltstone with mudstone
	1152	31	625	Siltstone, mudstone, and sand
	1154	32	630	Sandstone
09/08/94	1216	33	645	Anhydrite and clay
	1243	34	665	Siltstone, mudstone, and sand
	1313	35	685	Anhydrite with gypsum
	1326	36	705	Dolomite, damp
	1350	37	725	Anhydrite with gypsum
	1431	38	745	Gypsum and anhydrite
	1450	39	765	Gypsum and anhydrite
	1530	40	785	Gypsum
	1538	41	798	Mudstone, minor gypsum and anhydrite

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling

WQSP #2
CULEBRA CORE DESCRIPTION

PAGE 1 OF 3

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#2 DIA.: 4"

LOCATION: NW1/4 SW1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1646'FSL 142'FWL

ELEVATION: 3463.9 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/09/94

DRILL DATE: 09/09/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09 11:29	1	800.0 801.0 802.0 803.0 804.0 805.0 806.0	9 1			800.0 - 810.1 ft: light to dark gray mottled anhydrite with gypsum laminae (1-2 mm). Upper 0.2 ft of unit is red-brown mudstone with subrounded to subangular pebble-sized anhydrite clasts. Lens of similar material from 804.3 - 804.5 ft with bladed selenite crystals.	Tamarisk Member of Rustler Formation

PAGE 2 OF 3

WIPP CORE-LOG INVENTORY

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DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09	1	806.0 807.0 808.0 809.0 810.0 811.0 812.0	9 1			800.0 - 810.1 ft: light to dark gray mottled anhydrite with gypsum laminae (1-2 mm). Upper 0.2 ft of unit is red-brown mudstone with subrounded to subangular pebble-sized anhydrite clasts. Lens of similar material from 804.3 - 804.5 ft with bladed selenite crystals. Contact with underlying dolomite unclear.	Tamarisk Member of Rustler Formation
						810.1 - 816.0 ft: highly fractured light olive gray microcrystalline dolomite, appears clayey. Small open vugs increasing in size and decreasing in frequency with depth. Toward base gypsum-filled vugs (~ 4 cm).	Culebra Member of Rustler Formation

PAGE 3 OF 3

WIPP CORE-LOG INVENTORY

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DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/09	1	812.0	9 1	OV		810.1 - 816.0 ft: highly fractured light olive gray microcrystalline dolomite. Small open vugs increasing in size and decreasing in frequency with depth. Toward base of unit vugs are sparse (5 mm - 4.5 cm) and gypsum filled. Fractures toward base appear to have been gypsum filled.	Culebra Member of Rustler Formation 1.5 feet of core loss
		813.0					
		814.0		ΦV			
				Φv			
12:30		815.0			GF		
		816.0					

PAGE 1 OF 1

WIPP CORE-LOG INVENTORY

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DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		816.0					
09/10 16:42	2		7 5	ØV ØV	F	816.0 - 830.0 ft: light olive gray dolomite, highly fractured. Upper portion of unit contains numerous small, open vugs and infrequent gypsum filled fractures. Vugs increase in size and decrease in frequency with depth. Some vugs up to 3 cm in size, many are gypsum filled. Clay lined fractures are present toward base of unit.	Culebra Member of Rustler Formation 3.5 feet of core loss
		819.0			GF		
				ØV	F		
		822.0		ØV ØV			
		825.0					
				ØV	F		
				ØV			
		828.0			CF		
17:15				ØV			
		830.0					
		831.0					

PAGE 1 OF 2

WIPP CORE-LOG INVENTORY

INTERA

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DATE: 09/10/94

DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/10 9:55	3	830.0				830.0 - 833.7 ft: light olive gray microcrystalline dolomite with numerous small vugs (open) with gypsum lined fractures. Vugs decrease in frequency toward base of unit.	Culebra Member of Rustler Formation
			75	OY	GF		
		832.0		OY			
					GF		
				OY			
		834.0				833.7 - 837.6 ft: transition between Culebra Member and underlying unnamed member . Upper 1.0 ft very rubbly clayey dolomite and claystone with numerous gypsum crystals. Lower portion dark black plastic clay.	Unnamed Member of Rustler Formation
		836.0					
		838.0				837.6 - 846.0 ft: dark black rubbly claystone in upper portion turning to red-brown clay with white, pinkish-white gypsum bands. Gypsum and anhydrite percent increases toward base of unit.	
		840.0					
		842.0					

PAGE 2 OF 2	WIPP CORE-LOG INVENTORY	INTERA FORM 1400

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LOG BY: JBD

DATE: 09/10/94

DRILL DATE: 09/10/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

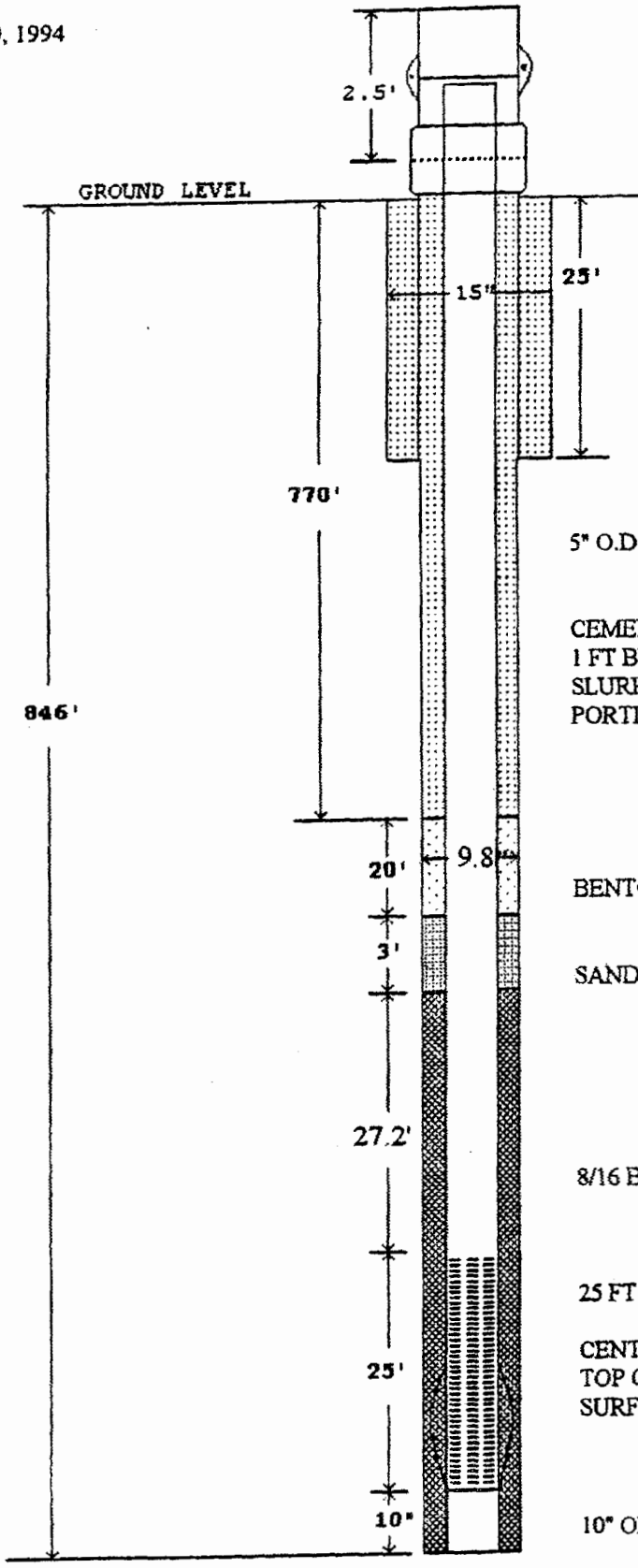
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
09/10 10:35	3	842.0 844.0 846.0	75			837.6 - 846.0 ft: dark black rubbly claystone in upper portion turning to red-brown clay with white-pink gypsum bands. Gypsum and anhydrite percentages increase toward base of unit.	Unnamed Member of Rustler Formation 4 ft of core lost

WQSP #2
HOLE HISTORY

WIPP Project
WQSP #2
Eddy County, New Mexico

September 6-10, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 770 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 770 TO 790 FT

SAND PACK FROM 790 TO 793 FT

8/16 BRADY GRAVEL FROM 846 TO 793 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 6, 1994

WQSP # 2

7:30 AM - 8:15 AM - Put rotating head back together and serviced rig
8:15 AM -11:15 AM - Drilled 9 7/8" hole from 25'-125', tripped out of hole
11:30 AM - 1:10 PM - Worked on rotating head
1:10 PM - 1:30 PM - Trip drill collars, remove rotating head, & take in to machine shop
1:30 PM - 2:00 PM - Service rig and secure for the day

September 7, 1994

WQSP # 2

7:20 AM - 8:00 AM Put on rotating head & trip in hole
8:00 AM - 8:40 AM Drill 9 7/8" hole from 125' - 147'
8:40 AM - 10:10 AM Work on rotating head
10:10 AM - 7:00 PM Drill 9 7/8" hole from 147' - 461'
7:00 PM - 7:15 PM T.O.O.H. 150' shut down, secure rig for the day

September 8, 1994

WQSP # 2

6:20 AM - 6:50 AM - Carlsbad to WQSP # 2
6:50 AM - 7:15 AM - Service rig & auxiliary air compressor
7:15 AM - 8:10 AM - Work on air compressor
8:10 AM - 8:15 AM - T.I.H.
8:30 AM - 11:15 AM - Drilling 9 7/8" hole from 461'-616'
11:15 AM - 11:35 AM - Change out batteries & alternator on air compressor
11:35 AM - 4:00 PM - Drilling 9 7/8" hole from 616'-800'. Stopped drilling at this point to come out of hole & prepare for coring 9-9-94
4:00 PM - 5:30 PM - Finished blowing on well to remove cuttings, had several tight spots due to anhydrite chunks falling in hole & catching bit on trip out
5:30 PM - 6:30 PM - Serviced rig and secured for the day. Talked with company man providing core tools for job

WEST TEXAS WATER WELL SERVICE

September 9, 1994

WQSP # 2

5:40 AM	6:15 AM	Carlsbad to WQSP # 2
6:15 AM	6:30 AM	Check fluid levels on equipment
6:30 AM	8:40 AM	Trip in the hole, had two feet of fill in overnight. Had t mist with foam to clean out hole
8:40 AM	10:30 AM	Rig up core barrel
10:30 AM	11:20 AM	Going in the hole
11:20 AM	11:35 AM	Coring 15′
11:35 AM	11:55 AM	Cleaning out hole
11:55 AM	12:15 PM	Waiting on orders to core deeper
12:15 PM	12:35 PM	Coring 1′
12:35 PM	3:15 PM	Coming out of hole with 1st core, recovered 15′, laid core barrel, broke it down, & pump into core troughs
3:15 PM	3:45 PM	Make up core barrel & start back in hole for second run
3:45 PM	4:40 PM	Tripping in the hole
4:40 PM	5:15 PM	Coring 2nd run 14′ - Depth 830′
5:15 PM	6:20 PM	Come out of the hole, lay down core barrel
6:20 PM	7:05 PM	Push out core
7:05 PM	7:30 PM	Secure rig for day, leave location
7:30 PM	8:10 PM	WSQP @ 2 to Carlsbad

September 10, 1994

WQSP # 2

7:00 AM	7:40 AM	Carlsbad to WQSP # 2
7:40 AM	7:55 AM	Service rig
7:55 AM	8:40 AM	Trip in the hole for 3rd core run, had 55′ of fill in, plug bit
8:40 AM	9:00 AM	Come out of hole 150′ & try to unload hole
9:00 AM	9:10 AM	Run 2 jts. back in well and unload hole. Possible bridge @ 55′ off bottom, back to bottom @ 10:00 AM
10:00 AM	10:35 AM	Coring 3rd run, cut 16′
10:35 AM	11:35 AM	Coming out of the hole w/3rd core
11:35 AM	12:35 PM	Lay down core barrel and pump out
12:35 PM	1:30 PM	Break down tool joints on core barrel & load on trailer
1:30 PM	2:00 PM	Shut down rig and secure rig for week end

WEST TEXAS WATER WELL SERVICE

September 12, 1994

WQSP # 2

5:45 AM	7:35 AM	Odessa to WIPP WQSP # 2
7:35 AM	9:00 AM	Line pits for brine water
9:00 AM	10:10 AM	Trip pipe in hole
10:10 AM	11:00 AM	Mix 30 sacks sw gel to sweep hole with and remove cuttings
11:00 AM	11:45 AM	Circulate and condition
11:45 AM	1:05 PM	Ream 8 1/2" core hole to 9 7/8"
1:05 PM	3:55 PM	TD 846' circulating
3:55 PM	4:40 PM	Trip out of hole
4:40 PM	4:55 PM	Rig up to log well
4:45 PM	6:45 PM	Log hole

September 21, 1994

WQSP # 1 & 2

6:10 AM	6:40 AM	Carlsbad to WQSP # 1
6:40 AM	6:55 AM	Service rig
6:55 AM	8:00 AM	Clean up location & rig down
8:00 AM	10:10 AM	Replace cable on blocks
10:10 AM	11:30 AM	Picked up well casing for WQSP # 2 and filled pits at WQSP # 2
11:30 AM	12:00 PM	Rigged up drilling rig on WQSP # 2
12:00 PM	1:30 PM	Trip in the hole and tag fill in
1:30 PM	2:10 PM	Mix mud to circulate down hole
2:10 PM	3:00 PM	Clean out bottom of hole
3:00 PM	3:30 PM	Circulate
3:30 PM	4:00 PM	Trip out of hole 200' and shut down rig
3:00 PM	4:30 PM	Spot surface hole on WQSP #'s 5 & 6
4:30 PM	5:00 PM	Back to Carlsbad

WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 2

6:00 AM	6:35 AM	Carlsbad to WQSP # 2
6:35 AM	6:45 AM	Check fluid level in equipment
6:45 AM	7:05 AM	Trip pipe in hole to check TD
7:05 AM	7:30 AM	Circulate
7:30 AM	8:30 AM	Trip pipe out of hole
8:30 AM	9:10 AM	Water meter locked up - waiting on key
9:10 AM	10:20 AM	Run 2" trimmie line
10:20 AM	12:35 PM	Run 5" fiberglass casing, screen, & centralizers
12:35 PM	1:00 PM	Rig up gravel hopper to gravel pack well
1:00 PM	3:00 PM	Gravel pack well
3:00 PM	4:00 PM	Mix bentonite slurry and spot above gravel for seal
4:00 PM	5:30 PM	Pump cement grout to surface
5:30 PM	6:00 PM	Pull trimmie pipe, wash up and secure rig for the day

September 23, 1994

WQSP #'s 2 & 6

6:00 AM	6:40 AM	Carlsbad to WQSP # 2
6:40 AM	8:15 AM	Rigged down on WQSP # 2, cleaned up location & moved to WQSP # 6
8:15 AM	12:00 PM	Rigged up on WQSP # 6, lined pit, put rotating head on, and shut down for weekend
12:00 PM	2:00 PM	WQSP # 6 to Odessa

September 26, 1994

WQSP # 2

8:45 AM	12:15 PM	Bail & develop well - water level @ start of day - 351'
12:15 PM	12:45 PM	Water level recovered from bail down point of 500' back to 400'
12:45 PM	3:45 PM	Continued bailing to develop well - water level @ end of day - 400'
3:45 PM	4:00 PM	Shut down unit & secured for day

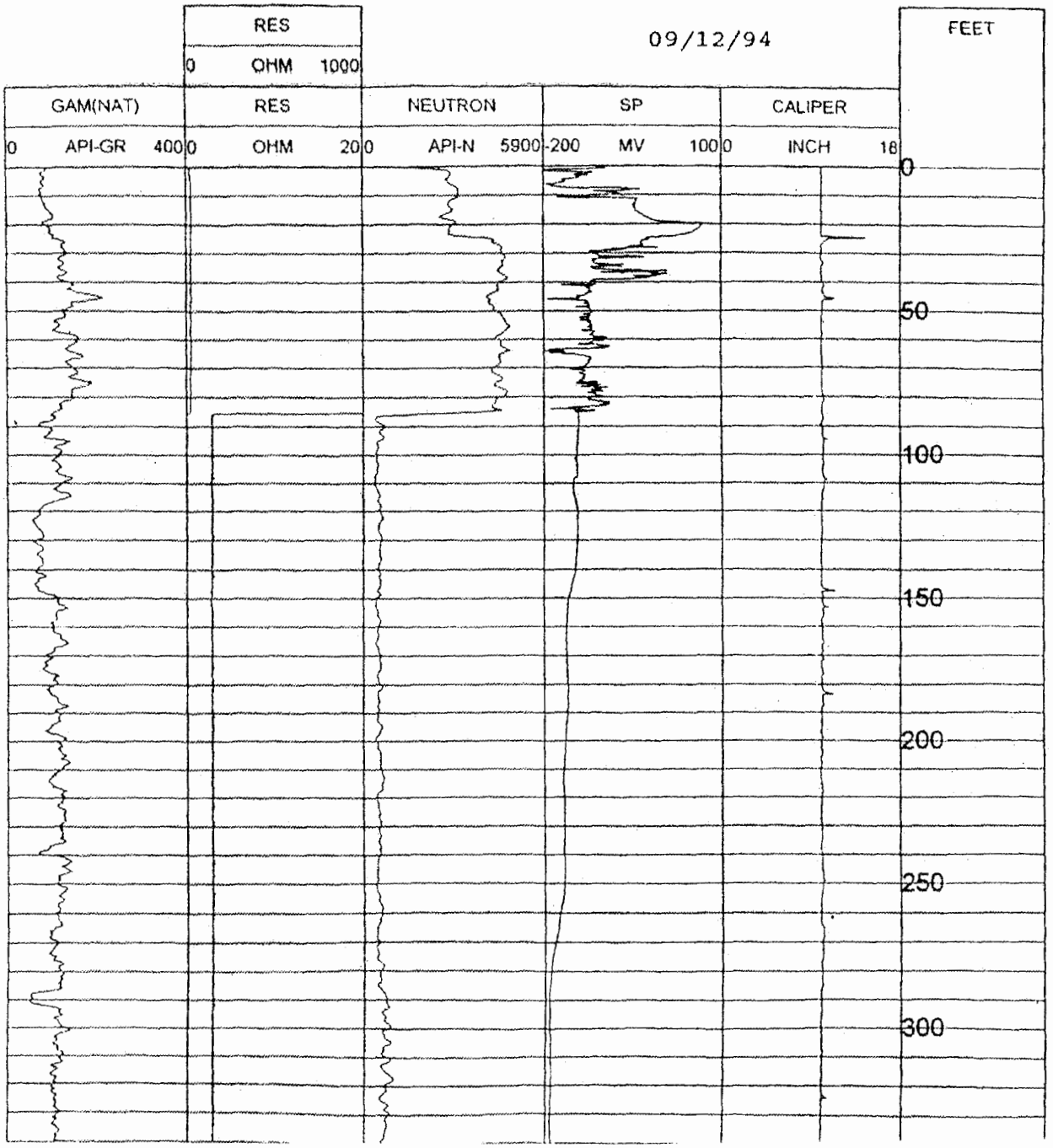
WEST TEXAS WATER WELL SERVICE

September 27, 1994

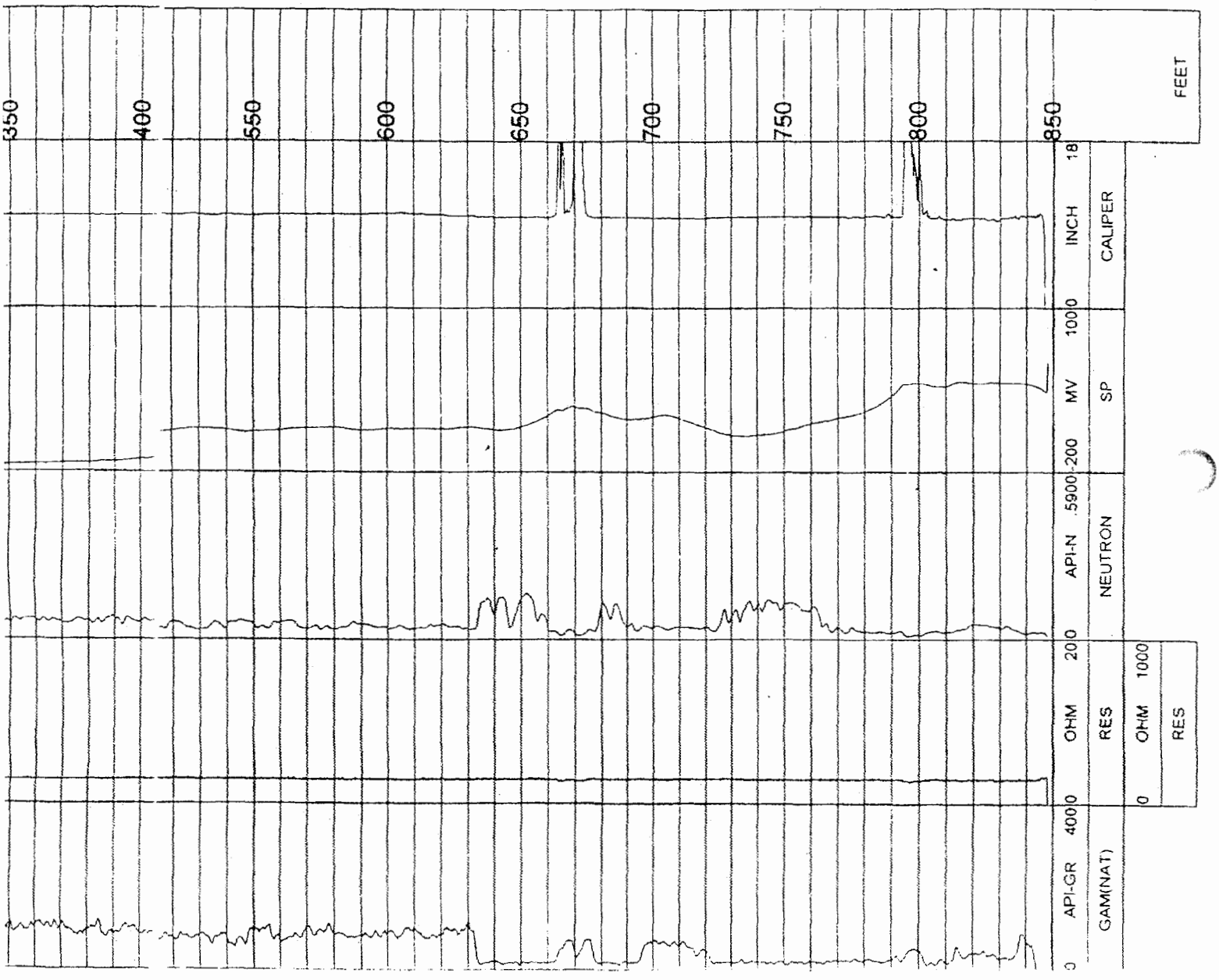
WQSP # 2

8:00 AM - 8:30 AM - Ran bailer - water level @ 400' TD 849' from top of casing
8:30 AM - 10:30 AM - Make splice on pump and ran 3 HP 230V 3 Ph 10 GPM pump in hole, start pumping @ 13 GPM
10:30 AM - 2:30 PM - Pump well to develop - avg. 10.33 gpm over 4 hours
2:30 PM - 4:00 PM - Pull pump from well
4:00 PM - 5:00 PM - WQSP # 6

WQSP #2
GEOPHYSICAL LOGS


RES
0 OHM 1000
09/12/94
FEET
GAM(NAT)
0 API-GR 400
RES
0 OHM 20
NEUTRON
0 API-N 5900
SP
-200 MV 100
CALIPER
0 INCH 18
0
50
100
150
200
250
300

Century GEOPHYSICAL CORP.



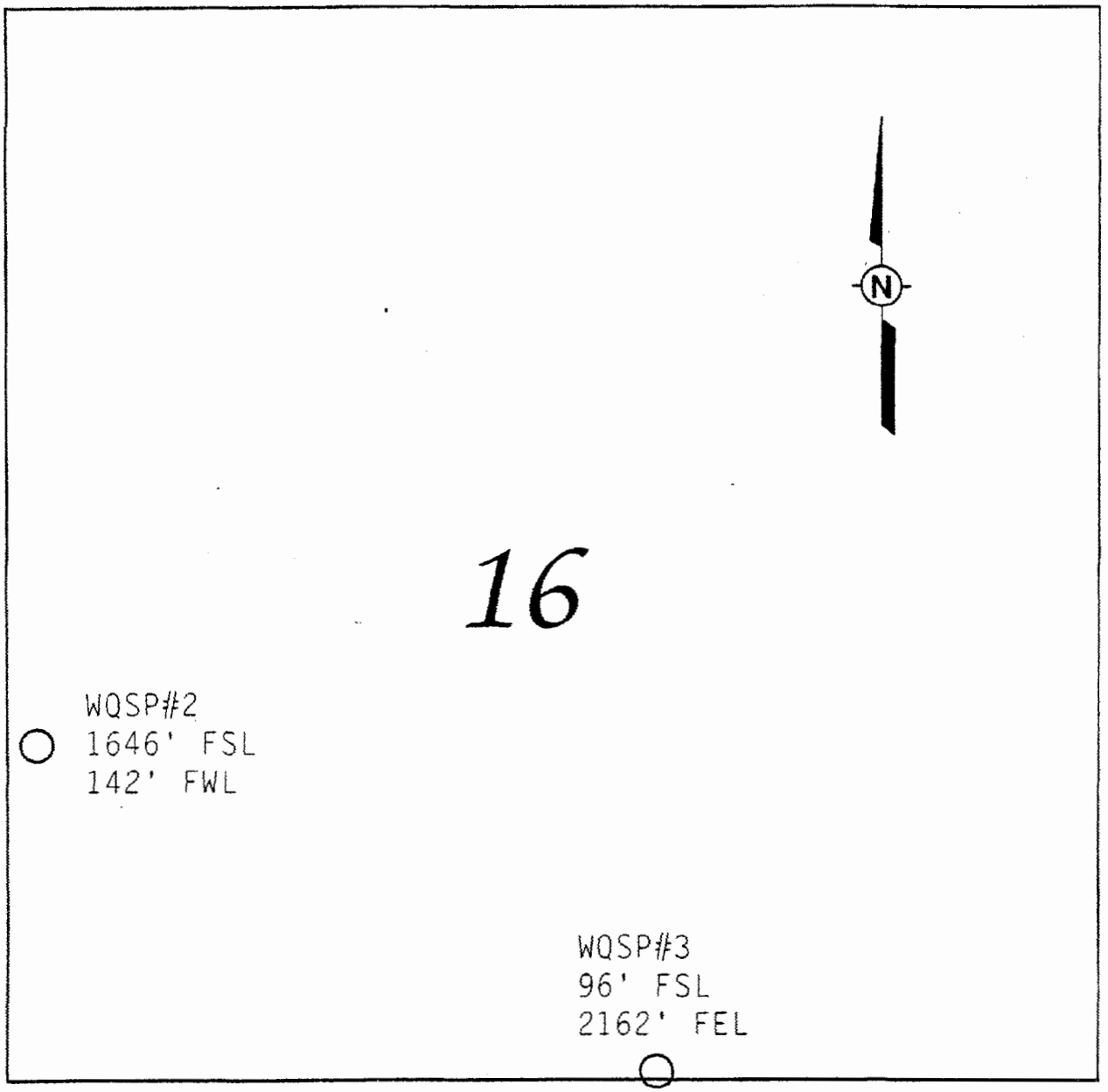
Best available data

WQSP #2
Geophysical Logs

80555

WQSP#3

Section 16, T22S, R31E



Location of WQSP #3

WQSP #3
Condensed Well Summary

Location:	Section 16, T22S, R31E 96 ft from the south line 2162 ft from the east line	
Elevation: (Top of Casing)	3480.3 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 20 to 26, 1994 880 ft below land surface 833 to 879 ft every 20 ft

WQSP #3
Stratigraphic Summary

Stratigraphic Unit	Depth Interval Natural Gamma Log (feet)	Core Description
Surficial Deposits/Santa Rosa	0-156	
Dewey Lake Redbeds	156-669	
Rustler Formation	669-881 partial	
• Forty Niner Member	669-727	
• Magenta Member	727-749	
• Tamarisk Member	749-848	833-844 partial
• Culebra Member	848-871	844-870
• Partial lower unnamed member	871-881 partial	870-879 partial
Maximum Recorded Depth •	881	

WQSP #3
CUTTINGS DESCRIPTION

WQSP #3
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
10/03/94	1045	1**	5	Caliche
	1120	2**	25	Surficial deposits
10/20/94	0825	3	45	Sandstone
	0840	4	65	Sandstone
	0903	5	85	Sandstone
	0922	6	105	Sandstone
	0937	7	125	Mudstone
	0945	8	145	Siltstone
	1005	9	165	Siltstone and mudstone
	1020	10	185	Sandstone with minor carbonate
	1033	11	205	Mudstone interbedded with siltstone
	1055	12	225	Sandstone and siltstone
	1117	13	245	Sandstone
	1147	14	265	Mudstone, sandstone, and minor gypsum
	1242	15	285	Gypsiferous mudstone
	1255	16	305	Sandstone, carbonate, and fibrous gypsum
	1336	17	325	Mudstone interbedded with siltstone, green reduction spots, fibrous gypsum
	1414	18	345	Sandstone with carbonate
	1445	19	365	Sandstone, siltstone interbedded with mudstone, fibrous gypsum
	1515	20	385	Sandstone, mudstone, siltstone, and fibrous gypsum
10/21/94	0730	21	405	Mudstone and sandstone, limited sample, slightly damp
	0805	22	425	Sandstone, minor gypsum and mudstone, mud balls
	0839	23	445	Sandstone with minor gypsum
	0855	24	465	Siltstone and fibrous gypsum filled fractures in the sandstone

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #3
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	0915	25	485	Sandstone, trace carbonate and gypsum
	0935	26	505	Mudstone, selenite gypsum and siltstone interbedded with mudstone
10/21/94	0952	27	525	Mudstone and selenite
	1007	28	545	Gypsiferous sand, sandstone, and selenite
	1021	29	565	Sandstone and mudstone with green reduction spots, trace gypsum,
	1034	30	585	Gypsiferous mudstone with green reduction spots, trace selenite
	1048	31	605	Mudstone, sandstone, and fibrous gypsum
	1110	32	625	Siltstone, sandstone, and selenite
	1120	33	645	Siltstone, sandstone, and gypsum
	1142	34	665	Siltstone and sandstone
10/24/94	1031	35	705	Anhydrite, mudstone, and selenite
	1113	36	725	Anhydrite with minor gypsum and mudstone
	1120	37	745	Anhydrite, minor selenite, trace mudstone
	1210	38	765	Anhydrite, minor selenite, trace claystone
	1255	39	785	Anhydrite, trace claystone
	1335	40	805	Anhydrite, limited sample
	1350	41	825	Anhydrite

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #3
CULEBRA CORE DESCRIPTION

PAGE 1 OF 4

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94

DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		832.0					
10/25 09:35	1	834.0	9 7		GF	833.0 - 844.0 ft: light to dark gray mottled anhydrite with wavy (1-3 mm) gypsum laminae. Gypsum filled fracture 0.5 cm wide from 841.2 - 844.0 ft with minor displacement.	Tamarisk Member of Rustler Formation
		836.0					
		838.0					
		840.0					
		842.0					
		844.0					

PAGE 2 OF 4

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"
LOCATION: NW1/4 NE1/4 Section 16 T22S R31E
ORIENTATION: Vertical Down
COORDINATES: 96' FSL 2162' FEL
ELEVATION: 3480.3 feet amsl
DRILL METHOD(S): Air Rotary

LOG BY: JBD
DATE: 10/25/94
DRILL DATE: 10/25/94
DRILLER: Ronnie Keith
DRILL: Gardner Denver 1500
DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		844.0					
10/25	1	846.0	9 7		GF	844.0 - 855.6 ft: light olive gray microcrystalline dolomite. Upper 0.2 ft red-gray dolomite with small (1-2 mm) elongate gypsum filled vugs grading to gray dolomite. Wavy discontinuous clay filled fractures (0.5 - 1 mm). Vugs increase in size, variety, and intensity with depth becoming large (up to 2 cm), gypsum filled, small (1 - 2 mm), and open. 853 - 855.6 ft: vugs decrease in intensity, are mainly large and some gypsum filled. Few thin, wavy discontinuous gypsum filled fractures. 853.9 - 854.5 ft: broken, rubbly, silty interval.	Culebra Member of Rustler Formation
		848.0					
		850.0					
		852.0			GF		
		857.0					

WIPP CORE-LOG INVENTORY

INTERA

FORM 140

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94

DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		856.0					
10/25 10:40	1		9 7			855.6 - 861.3 ft: light olive gray microcrystalline dolomite interbedded with brown/tan silty dolomite (laminated) with moderate open vugs some gypsum filled. Moderate gypsum filled fractures with minor displacement. Base of unit is transition to extremely vuggy non-silty dolomite.	Culebra Member of Rustler Formation
		858.0			GF		
		860.0			GF		
						861.3 - 864.0 ft: extremely vuggy light olive gray microcrystalline dolomite. 2-3 mm open vugs, some ≥ 2 cm, minor gypsum filled vugs. Rare thin horizontal gypsum filled fractures.	1' core loss
		862.0					
					GF		
13:40		864.0				864.0 - 870.4 ft: same dolomite as above, majority of vugs gypsum filled. Vugs increase in size and decrease in frequency with depth becoming rare to nonexistent at base of unit. Large, opaque, gypsum-filled inclusions from 867-870.4 ft. (continued on next page)	1' core loss
		866.0					
		868.0					

PAGE 4 OF 4

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#3 DIA.: 4"

LOCATION: NW1/4 NE1/4 Section 16 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 96' FSL 2162' FEL

ELEVATION: 3480.3 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/25/94

DRILL DATE: 10/25/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

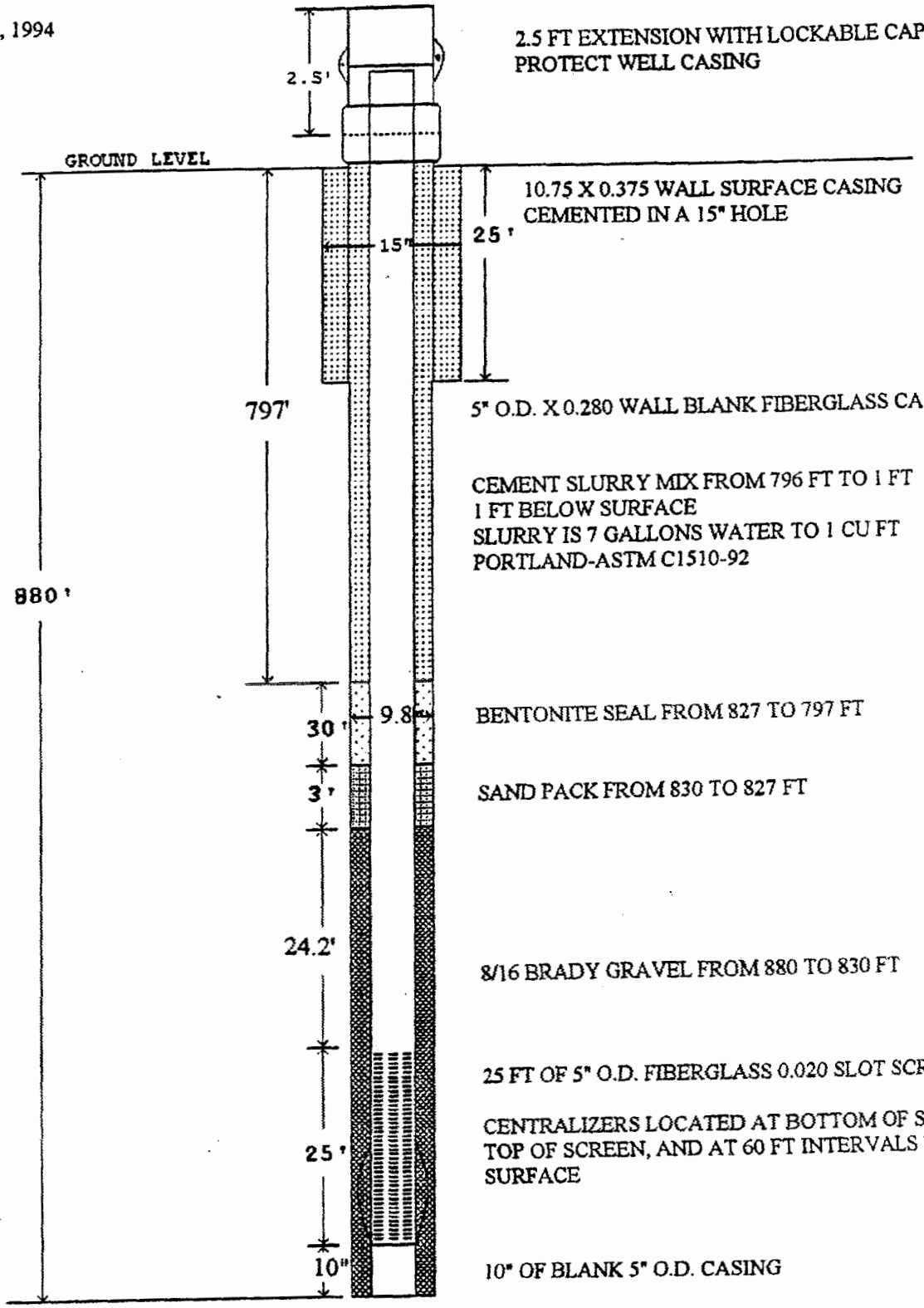
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/25 14:40	2	868.0	9 7			Wavy, discontinuous, vertical gypsum-filled fractures (1-2 mm) contact between Culebra and underlying unnamed member is sharp. ~1 ft of core loss.	Culebra Member of Rustler Formation
		870.0				870.4 - 873.0 ft: upper 0.9 ft black plastic clay with minor gypsum stringers grading to dark red/brown clay with minor red-pink/gray anhydrite beds.	Unnamed member of Rustler Formation
		872.0					
		874.0				873.0 - 877.4 ft: red/light brown mud-clay with frequent light-gray/pink anhydrite beds and high angle veins and stringers. Anhydrite decreases in frequency with depth. Rare light gray clay inclusions. Base of unit contains subrounded anhydrite pebbles (0.25 - 1 cm) and thin (5 - 6 mm) anhydrite beds.	
		876.0					
		878.0				877.4 - 879.0 ft: dark-light gray microcrystalline anhydrite with thin (2-4 mm) wavy gypsum laminae.	
		880.0					

WQSP #3
HOLE HISTORY

WIPP Project
WQSP #3
Eddy County, New Mexico

October 20-26, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 796 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 827 TO 797 FT

SAND PACK FROM 830 TO 827 FT

8/16 BRADY GRAVEL FROM 880 TO 830 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

October 20, 1994

WQSP # 3

6:00 AM	6:35 AM	Carlsbad to WQSP # 3
6:35 AM	6:45 AM	Check fluid levels
6:45 AM	7:50 AM	Finish rigging up and line pits
7:50 AM	12:00 PM	Started drilling 9 7/8" hole from 25'. 10.75" .375W surface in place
12:00 PM	12:30 PM	Work on air compressor
12:30 PM	3:30 PM	Continued drilling
3:30 PM	4:15 PM	Pulled 60' of drill pipe, service air filters on rig
4:15 PM	5:15 PM	Secure rig & go to Carlsbad

October 21, 1994

WQSP # 3

5:50 AM	6:30 AM	Carlsbad to WQSP # 3
6:30 AM	6:45 AM	Check fluid levels
6:45 AM	7:10 AM	Work on air compressor
7:10 AM	12:30 PM	Drilling 9 7/8" from 400' on air
12:30 PM	12:45 PM	Trip out 200' of drill pipe
12:45 PM	3:00 PM	Replace cable on blocks
3:00 PM	5:00 PM	Carlsbad to Odessa

October 24, 1994

WQSP # 3

6:00 AM	8:40 AM	Odessa to WQSP # 3 (had flat in route)
8:40 AM	8:50 AM	Check fluid levels
8:50 AM	9:30 AM	Trip pipe in the hole
9:30 AM	2:00 PM	Drill 9 7/8" hole from 680' to 833' on mist pump
2:00 PM	2:30 PM	Clean out hole
2:30 PM	3:30 PM	Trip drill pipe and collars out of hole, prepare to core
3:30 PM	4:45 PM	Get load of water, secure rig
4:45 PM	5:30 PM	WQSP # 3 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 25, 1994

WQSP # 3

6:00 AM	6:30 AM	Carlsbad to WQSP # 3
6:30 AM	6:40 AM	Check fluid levels
6:40 AM	7:10 AM	Wait on Weatherford
7:10 AM	8:10 AM	Rig up core tools
8:10 AM	9:20 AM	Trip in hole for 1st core run
9:20 AM	10:40 AM	Coring from 833' - 864', top of Culebra @ 844'
10:40 AM	10:50 AM	Clean out hole
10:50 AM	11:50 AM	Trip out of the hole
11:50 AM	12:30 PM	Breakout core barrel and lay down inner barrel
12:30 PM	1:00 PM	Pick up inner barrel & go back in hole
1:00 PM	2:00 PM	Tripping in hole
2:00 PM	2:30 PM	Coring from 844' - 859'
2:30 PM	2:40 PM	Clean out hole
2:40 PM	3:45 PM	Tripping out of the hole, pull inner barrel & lay out on ground
3:45 PM	4:30 PM	Pump out core, load core tools & secure rig
4:30 PM	5:15 PM	WQSP # 3 to Carlsbad

October 26, 1994

WQSP # 3

6:00 AM	6:40 AM	Carlsbad to WQSP # 3
6:40 AM	6:55 AM	Check fluid levels
6:55 AM	8:35 AM	Trip pipe in the hole
8:35 AM	10:30 AM	Ream hole from 8 1/2" to 9 7/8" to receive logging tools - hole reamed from 833' - 880'
10:30 AM	11:00 AM	Clean out hole with foaming agents
11:00 AM	12:05 PM	Trip out of the hole
12:05 PM	2:30 PM	Wait on logging unit
2:30 PM	5:00 PM	Run logs
5:00 PM	5:35 PM	WQSP # 3 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 27, 1994

WQSP # 3

6:00 AM	6:40 AM	Carlsbad to WQSP # 3
6:40 AM	6:50 AM	Check fluid levels
6:50 AM	7:35 AM	Run bailer to check if hole is open, had 40′ of fill
7:35 AM	8:40 AM	Trip pipe in the hole
8:40 AM	9:45 AM	Clean out hole, hit bridge at 840′. Hole was bridged over from 840′ - 860′, open from 860′ - 880′
9:45 AM	10:35 AM	Trip out of the hole
10:35 AM	11:15 AM	Prepare to run 2" trimmie line
11:15 AM	12:00 PM	Run 2" trimmie line
12:00 PM	12:15 PM	Prepare to run fiberglass screen & casing - 29 jts blank, 1 - 10′ blank bottom, 1 jt screen
12:15 PM	2:10 PM	Running casing
2:10 PM	2:45 PM	Rig up to gravel pack (work on mud pump)
2:45 PM	3:45 PM	Gravel packing well with 8/16 Brady gravel from 880′
3:45 PM	4:15 PM	Mix bentonite slurry for plug above gravel pack
4:15 PM	4:40 PM	Rig up to cement (wait on truck)
4:40 PM	5:20 PM	Cementing from 800′
5:20 PM	6:10 PM	Pull 2: trimmie line
6:10 PM	6:20 PM	Secure rig
6:20 PM	7:00 PM	WQSP # 3 to Carlsbad

October 31, 1994

WQSP # 3

Unit # 2

7:55 AM	9:10 AM	Arrive on location, pour 4 gallons of bleach into well, check & service unit, rig up & prepare to bail well, surge well with bailer to allow solution to work through screened interval
9:10 AM	12:25 PM	Start bailing, water level @ 448′, TD from top of casing 803′. Made 20 trips
12:25 PM	1:25 PM	Made 10 more trips with bailer
1:25 PM	3:10 PM	Run test pump in well, pump set on 1" pipe @ 866′
3:10 PM		Start pump - 7.5 GPM
3:30 PM		Pumping 6.2 gpm
3:55 PM		Well pumped off, shut down for the day
4:00 PM		Left location

WEST TEXAS WATER WELL SERVICE

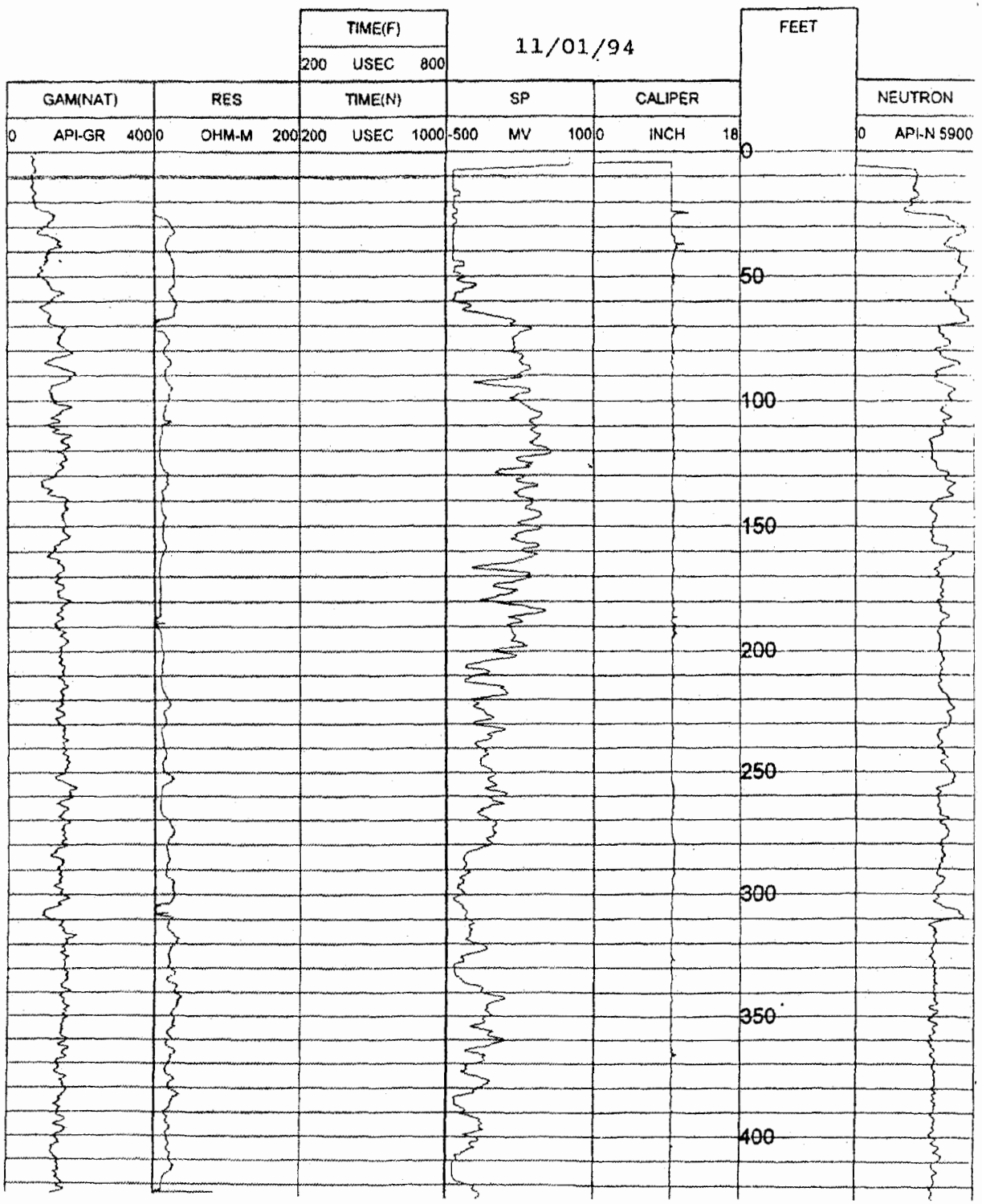
November 1, 1994

WQSP # 3

Unit # 2

6:40 AM -	7:00 AM -	Arrive on location, check unit
7:00 AM -	8:40 AM -	Start surging well, pumping 9 GPM
8:40 AM -	-	Start continuous test w/2 GPM choke in line, 65# backpressure
9:20 AM -	-	Change to 3 GPM choke, 40# backpressure
9:25 AM -	-	Pumped off well, change back to 2 GPM choke
9:35 AM -	-	1.2 GPM @ 60# backpressure
9:55 AM -	-	.75 GPM @ 60# backpressure
10:15 AM -	-	.8 GPM @ 60# backpressure
10:30 AM -	-	.8 GPM @ 60# backpressure
10:45 AM -	-	.8 GPM @ 60# backpressure
11:00 AM -	-	.8 GPM @ 60# backpressure
11:15 AM -	-	.8 GPM @ 60# backpressure
11:30 AM -	-	.8 GPM @ 60# backpressure
11:45 AM -	-	.8 GPM @ 60# backpressure
12:00 PM -	-	.8 GPM @ 60# backpressure - shut down test
12:05 PM -	1:30 PM -	Rig up, pull pump
1:30 PM -	2:55 PM -	Set up to log
2:55 PM -	4:10 PM -	Finish logging and wait on cement truck
4:10 PM -	4:35 PM -	Cement from 147' to surface
4:35 PM -	4:45 PM -	Clean up & leave location

WQSP #3
GEOPHYSICAL LOGS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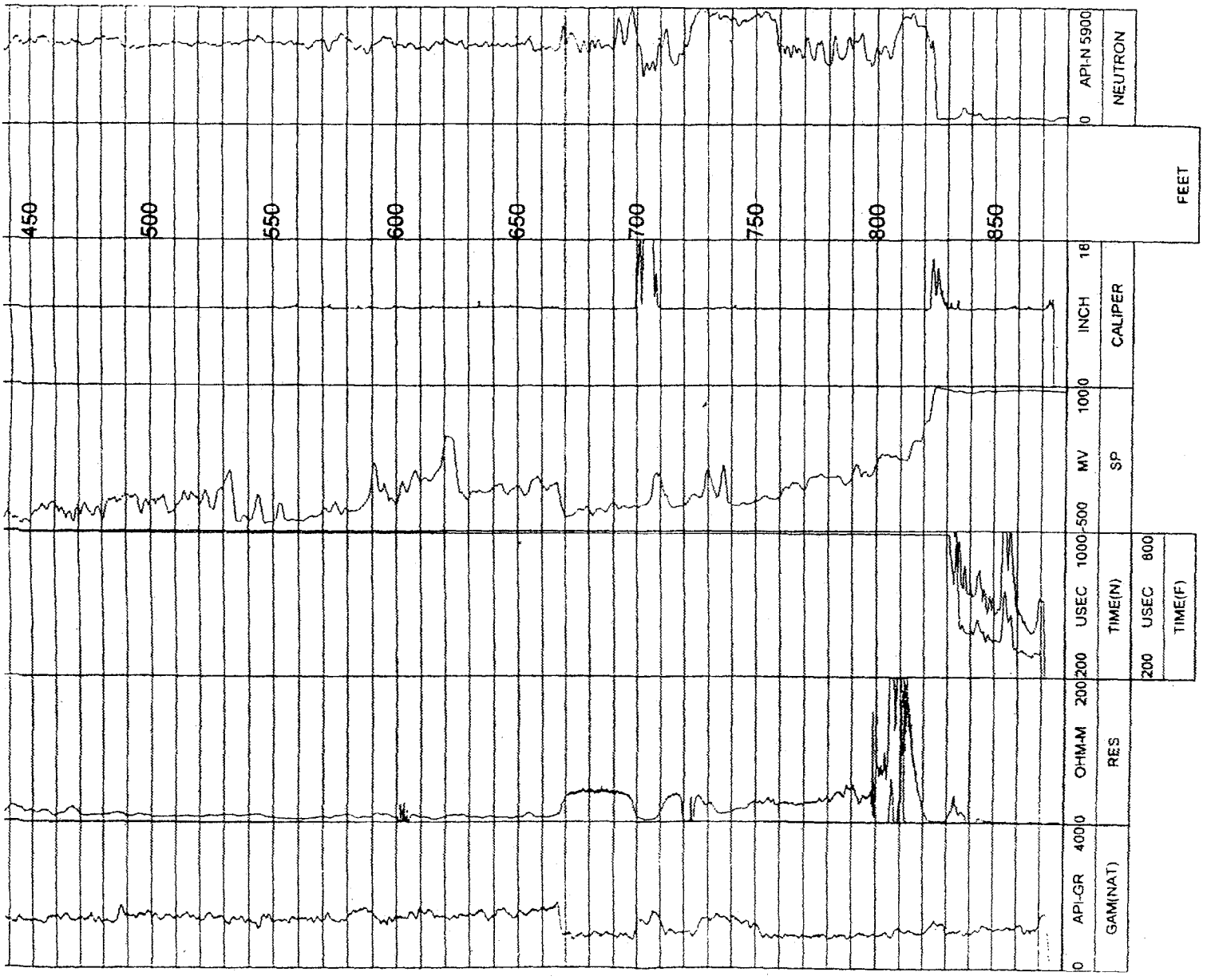


WQSP #3
Geophysical Logs

WQSP#4

WQSP #4
CUTTINGS DESCRIPTION

WQSP #4
Cuttings Description*

Date	Time	Sample Number	Depth (feet)	Description
10/03/94	0930	1**	5	Caliche
	0955	2**	25	Surficial deposits
10/05/94	0820	1	45	Siltstone, mudstone, and clay
	0834	2	65	Sandstone, siltstone, mudstone, and mud
	0903	3	85	Siltstone and mudstone
	0923	4	105	Mudstone and siltstone
	0939	5	125	Mudstone and Siltstone
	1003	6	145	Sandstone and mudstone
	1025	7	165	Siltstone, mudstone, trace gypsum
	1043	8	185	Siltstone and sandstone
	1104	9	205	Mudstone, trace fibrous gypsum and sandstone
	1130	10	225	Sandstone and fibrous gypsum
	1157	11	245	Siltstone and sandstone with green reduction spots, fibrous gypsum
	1225	12	265	Sandstone with green reduction spots, minor carbonate
	1258	13	285	Siltstone, sandstone, trace gypsum
	1327	14	305	Siltstone, sandstone, trace gypsum
	1402	15	325	Siltstone and sandstone
	1432	16	345	Mudstone and sandstone with green reduction spots
	1451	17	365	Mudstone and sandstone with green reduction spots, minor carbonate, and trace gypsum
	1510	18	385	Silt and sandstone with green reduction spots, minor fibrous gypsum
	1538	19	405	Sandstone, mudstone, minor gypsum, and silt, damp
	1547	20	425	Silt with gypsum, mudstone, and sandstone
10/06/64	0735	21	445	Silt, sand, and gypsum
	0804	22	465	Silt and sandstone with gypsum filled fractures

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07 09:30	1	740.0	100			740.47 - 746.0 ft: red-brown muddy clay with angular anhydrite clasts (≤ 0.25 cm), isolated gypsum crystals (~ 4-5 mm), and light gray clay inclusions. Some rare fibrous gypsum fragments (~ 0.25 cm).	Tamarisk Member of Rustler Formation
		742.0					
		744.0					
		746.0				746.0 - 765.4 ft: light-dark gray mottled microcrystalline anhydrite with thin (~1 mm) wavy gypsum laminae grading to coarsely crystalline light-dark gray mottled anhydrite at 749.0 ft. Anhydrite is coarsely crystalline from 749.0 - 752.3 ft. (continued on next page)	
		748.0					
		750.0					
		752.0					

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07	1	752.0 754.0 756.0 758.0 760.0 762.0 764.0	100			Dark band of gray microcrystalline anhydrite with thin lenses of gypsum, some fibrous from 752.3 - 753.0 ft. Dark brown clay seam (~ 0.10 ft thick) interbedded at 752.5 ft. Remainder of unit light with dark gray mottled microcrystalline anhydrite.	Tamarisk Member of Rustler Formation

PAGE 3 OF 5

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/7 11:00	1	764.0	100				Tamarisk Member of Rustler Formation
						765.4 - 765.6 ft: gray-brown clay.	
		766.0				765.6 - 771.5 ft: upper 0.5 ft red-gray microcrystalline dolomite, laminated with numerous open vugs (< 1 - 5 mm) grading to light olive gray dolomite. 766.1 - 767.1 ft: decrease in frequency of vugs, numerous thin (1-2 mm) vertical gypsum filled fractures, gypsum vein (1-3 cm) from 766.6 - 767.2 isolated large open vugs. Remainder of unit very vuggy (≤ 1 mm), highly fractured - some gypsum healed.	Culebra Member of Rustler Formation lower ~2 ft broken a bagged
		768.0			F GF		
		770.0					
10/7 13:55			73.6			771.47 - 775.47 ft: same dolomite as above. Upper foot is extremely vuggy (1-4 mm). Open vugs decrease in frequency with depth, increase in size and become gypsum filled. Gypsum vein (~4 cm), vertical, extends 4 ft.	
		772.0					
		774.0				See Next Page	
		776.0					

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632' FSL 2136' FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/07	2	776.0	7 3 .6			775.47 - 784.8 ft: same dolomite as above, highly fractured, clayey, with large (4 cm) lenticular, open vugs. Some fractures gypsum healed.	Culebra Member of Rustler Formation broken and bagged (sample bags #1-5) top-bottom ~7' core loss
		778.0			F		
		780.0			F		
		782.0			GF		
		784.0			F		
		786.0			CF	784.8 - 790.8 ft: same dolomite as above, thinly laminated horizontal clay lined fractures decreasing in width toward base of unit, large gypsum filled irregular vugs (4-5 cm). (continued on next page)	
		788.0					

PAGE 5 OF 5	WIPP CORE-LOG INVENTORY	INTERA FORM 1400

BOREHOLE: WQSP#4 DIA.: 4"

LOCATION: NE1/4 SE1/4 Section 28 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1632'FSL 2136'FEL

ELEVATION: 3433.0 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/07/94

DRILL DATE: 10/07/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

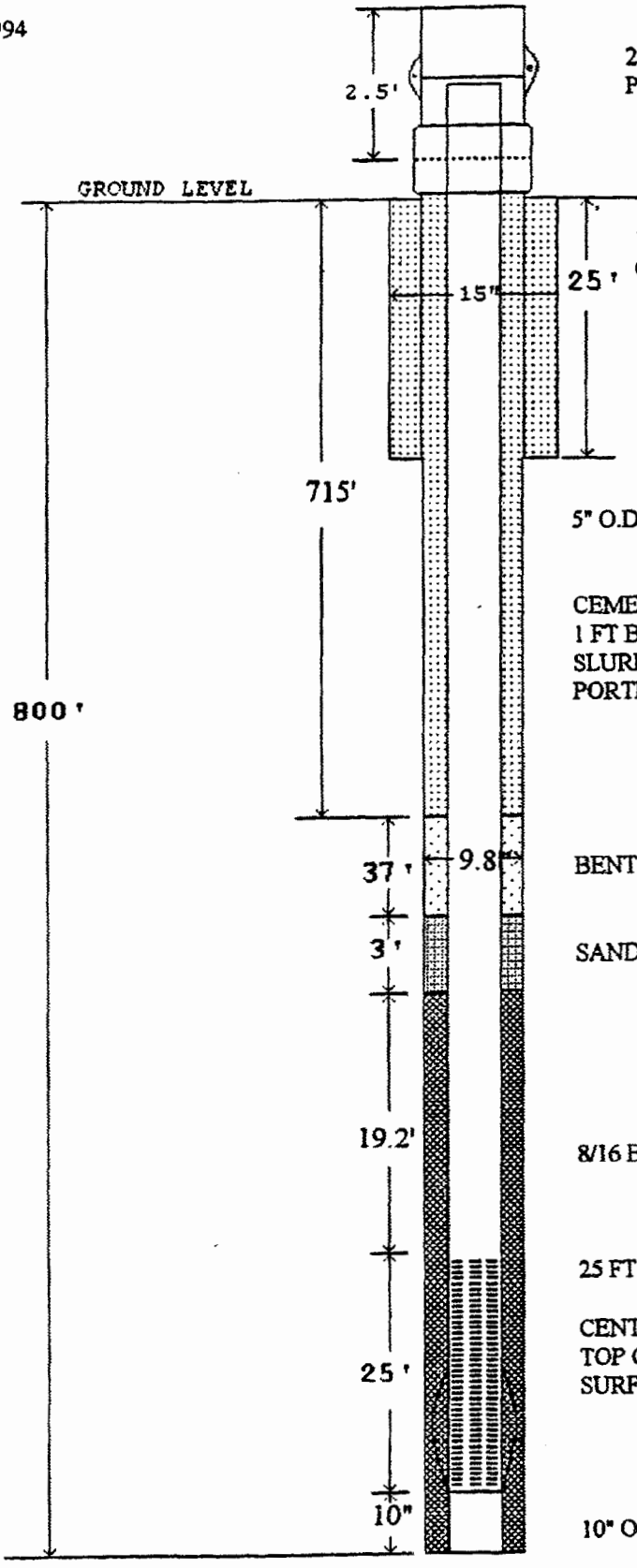
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/7 15:30	2	788.0	73.6			~2 - 4 cm band of intraformational conglomerate at very base of unit. Sharp contact between Culebra Member and unnamed member.	Culebra Member of Rustler Formation
		790.0				790.8 - 795.6 ft: black, plastic clay with thin (1-2 mm) white gypsum stringers (vertical) and isolated lenticular gypsum inclusion. Black clay grades to red-brown muddy clay with minor anhydrite interbeds.	Unnamed Member of Rustler Formation
		792.0					
		794.0					
		796.0				795.6 - 798.0 ft: dark to light gray mottled microcrystalline anhydrite grading to white-pink at depth with red/brown mud-clay interbeds.	
		798.0					

WQSP #4
HOLE HISTORY

WIPP Project
WQSP #4
Eddy County, New Mexico

October 5-7, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 715 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 752 TO 715 FT

SAND PACK FROM 755 TO 752 FT

8/16 BRADY GRAVEL FROM 800 TO 755 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREE
TOP OF SCREEN, AND AT 60 FT INTERVALS TO
SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

October 5, 1994

WQSP # 4

5:55 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	7:40 AM -	Work on rotating head
7:40 AM -		Start drilling operations running 9 7/8" mill tooth bit, 10.75" surface, set & cemented to 25'

October 6, 1994

WQSP # 4

5:55 AM -	6:30 AM -	Carlsbad to WQSP # 4
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	6:50 AM -	Trip pipe back to bottom
6:50 AM -	7:20 AM -	Wait on Ron
7:20 AM -	3:30 PM -	Drilling 9 7/8" hole from 428' to 740'
3:30 PM -	4:00 PM -	Circulate to clean up hole
4:00 PM -	4:50 PM -	Trip out of hole & prepare to core
4:50 PM -	5:30 PM -	WQSP # 4 to Carlsbad

Had to go on mist pump & adding foam @ 648'

WEST TEXAS WATER WELL SERVICE

October 7, 1994

WQSP # 4

5:55 AM	6:30 AM	Carlsbad to WQSP # 4
6:30 AM	6:40 AM	Check fluid levels
6:40 AM	7:30 AM	Rig up core barrel
7:30 AM	8:30 AM	Trip core barrel in for 1st run
8:30 AM	9:15 AM	Clean out hole of fill in
9:15 AM	10:40 AM	Core from 740.47 - 772
10:40 AM	10:50 AM	Clean out hole
10:50 AM	11:35 AM	Tripping out of hole
11:35 AM	12:00 PM	Breakout inner barrel and lay on ground
12:00 PM	12:30 PM	Pick up inner barrel
12:30 PM	12:45 PM	Pump out core
12:45 PM	1:30 PM	Start back hole for 2nd run
1:30 PM	1:40 PM	Clean out hole
1:40 PM	3:30 PM	Coring
3:30 PM	4:15 PM	Tripping out of hole
4:15 PM	4:50 PM	Break off jars and pull inner barrel to lay down
4:50 PM	5:15 PM	Pump out core
5:15 PM	6:00 PM	Load core tools and secure rig
6:00 PM	8:00 PM	WQSP # 4 to Odessa

October 10, 1994

WQSP # 4

5:30 AM	7:30 AM	Odessa to WQSP # 4
7:30 AM	8:00 AM	Service rig
8:00 AM	9:30 AM	Trip pipe in the hole
9:30 AM	12:00 PM	Ream hole from 8 1/2" to 9 7/8" from 740' - 800'
12:00 PM	12:10 PM	Clean out hole
12:10 PM	1:10 PM	Trip out of hole
1:10 PM	1:30 PM	Rig up logging unit
1:30 PM	3:15 PM	Log well
3:15 PM	4:20 PM	Work on rig & load casing
4:20 PM	5:00 PM	WQSP # 4 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 11, 1994

WQSP # 4

5:30 AM	6:30 AM	Carlsbad to WQSP # 4
6:30 AM	6:40 AM	Check fluid levels
6:40 AM	6:55 AM	Measure hole depth to check for fill in - TD 800′
6:55 AM	8:55 AM	Run 2" trimmie line in hole
8:55 AM	10:40 AM	Run 5" fiberglass casing 1 - 10" x 5" bottom 1 - 25′ x 5″ .020 screen 767′ x 5" blank casing Bottom cap, slip cap, centralizers
10:40 AM	12:00 PM	Gravel pack w/ 8-16 gravel from 800′ - 755′
12:00 PM	12:15 PM	Mix bentonite plug and spot above gravel pack
12:15 PM	1:35 PM	Wait on cement
1:35 PM	2:30 PM	Pump cement
2:30 PM	3:00 PM	Pull 2" trimmie line
3:00 PM	3:20 PM	Rig down
3:20 PM	4:40 PM	Move and rig up on WQSP # 5
4:40 PM	5:25 PM	WQSP # 5 to Carlsbad

October 12, 1994

WQSP # 4

Unit @ 2

8:30 AM		Arrived on WQSP # 6, rig up pulling unit to pull test pump
9:00 AM	11:00 AM	Pulled test pump and moved to WQSP # 4
11:00 AM	1:30 PM	Rigged up and waited on cement
1:30 PM	4:00 PM	Bailed on well to develop and clean up any fines left by gravel pack TD 800′

WEST TEXAS WATER WELL SERVICE

October 13, 1994

WQSP # 4

Unit # 2

6:45 AM		- Arrive on location, check & service unit
7:35 AM	7:50 AM	- Make 5 runs with bailer
7:50 AM	9:00 AM	- Make splice on test pump, get ready to run
9:00 AM	10:50 AM	- Run 3 HP 20 GPM test pump
10:50 AM	11:35 Am	- Make electrical hook up and put on wellhead
11:35 AM		- Start pump open ended - 12 GPM
11:40 AM		- 12 GPM
11:45 AM		- 11.75 GPM
11:50 AM		- 11.5 GPM
11:55 AM		- 11 GPM
12:00 PM		- 9.75 GPM
12:20 PM		- 9.25 GPM
12.35 PM		- 8.75 GPM
1:05 PM		- 8 GPM
1:35 PM		- 8 GPM
2:05 PM		- 8 GPM
2:35 PM		- 8 GPM
3:05 PM		- 7.75 GPM
3:35 PM		- 7.75 GPM Stopped pumping
3:35 PM	4:15 PM	- Surged well and shut down operations for the day
4:15 PM	4:25 PM	- Back to WQSP # 5
4:25 PM	5:15 PM	- Help Ronny come out of hole

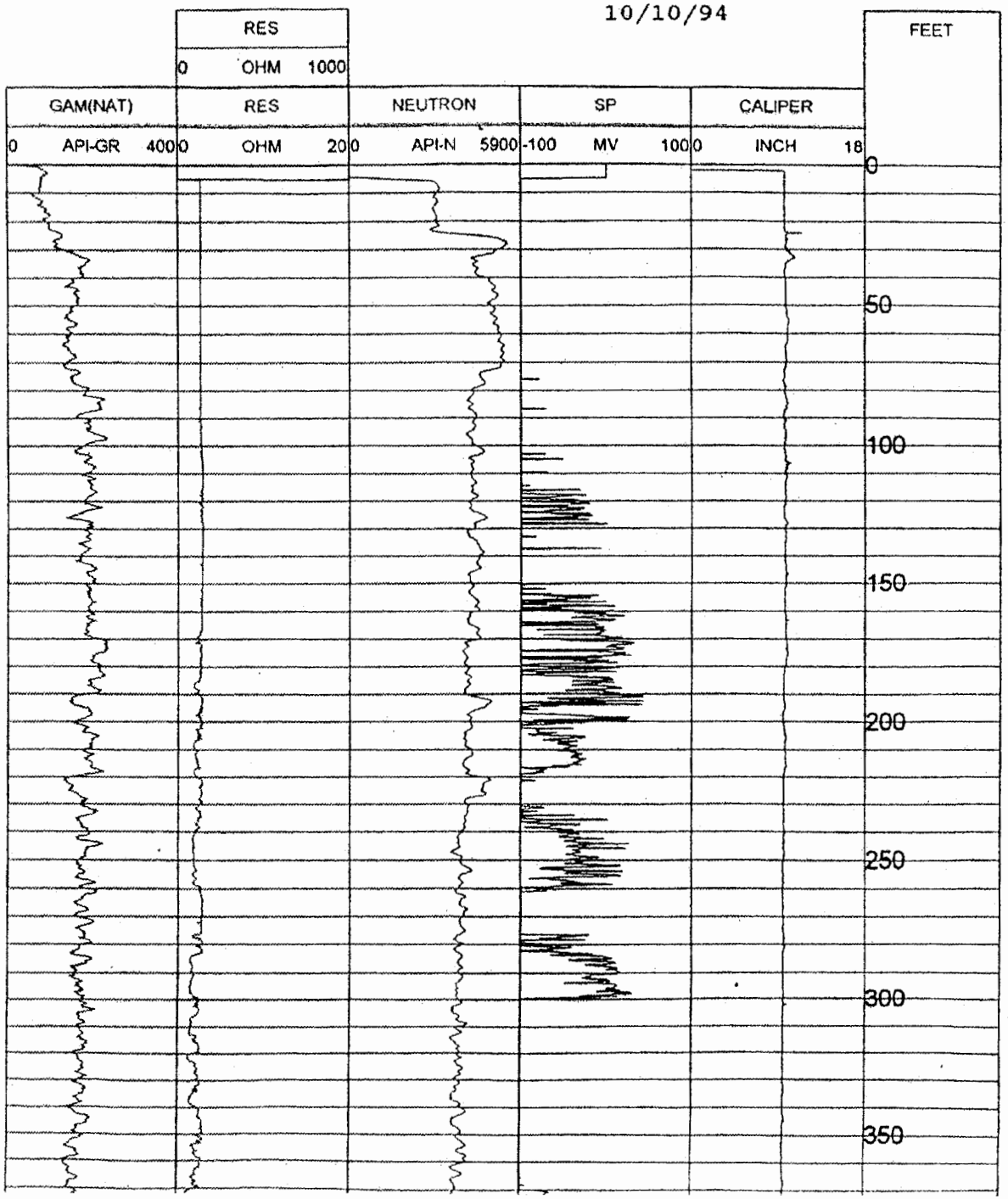
October 14, 1994

WQSP # 4

Unit # 2

7:15 AM		- Surged well 20 times in effort to try and dirty up fluid being pumped
8:15 AM		- Stopped surging well and began pumping constant, open ended discharge
8:20 AM		- Pumping 12 GPM, clear discharge
8:25 AM		- Pumping 11.5 GPM, clear discharge
8:30 AM		- Pumping 10.5 GPM, clear discharge
8:35 AM		- Pumping 10 GPM, clear discharge
8:40 AM		- Pumping 9.75 GPM, clear discharge
8:45 AM		- Pumping 9.5 GPM, clear discharge
8:50 AM		- Pumping 9.25 GPM, clear discharge
8:55 AM		- Pumping 9.25 GPM, clear discharge
9:00 AM		- Pumping 9 GPM, clear discharge
1:00 PM		- Shut down operations for weekend
1:00 PM	3:00 PM	- Returned to Odessa

WQSP 4#
GEOPHYSICAL LOGS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FEET
GAM(NAT)
0 API-GR 400
RES
0 OHM 200
NEUTRON
0 API-N 5900
SP
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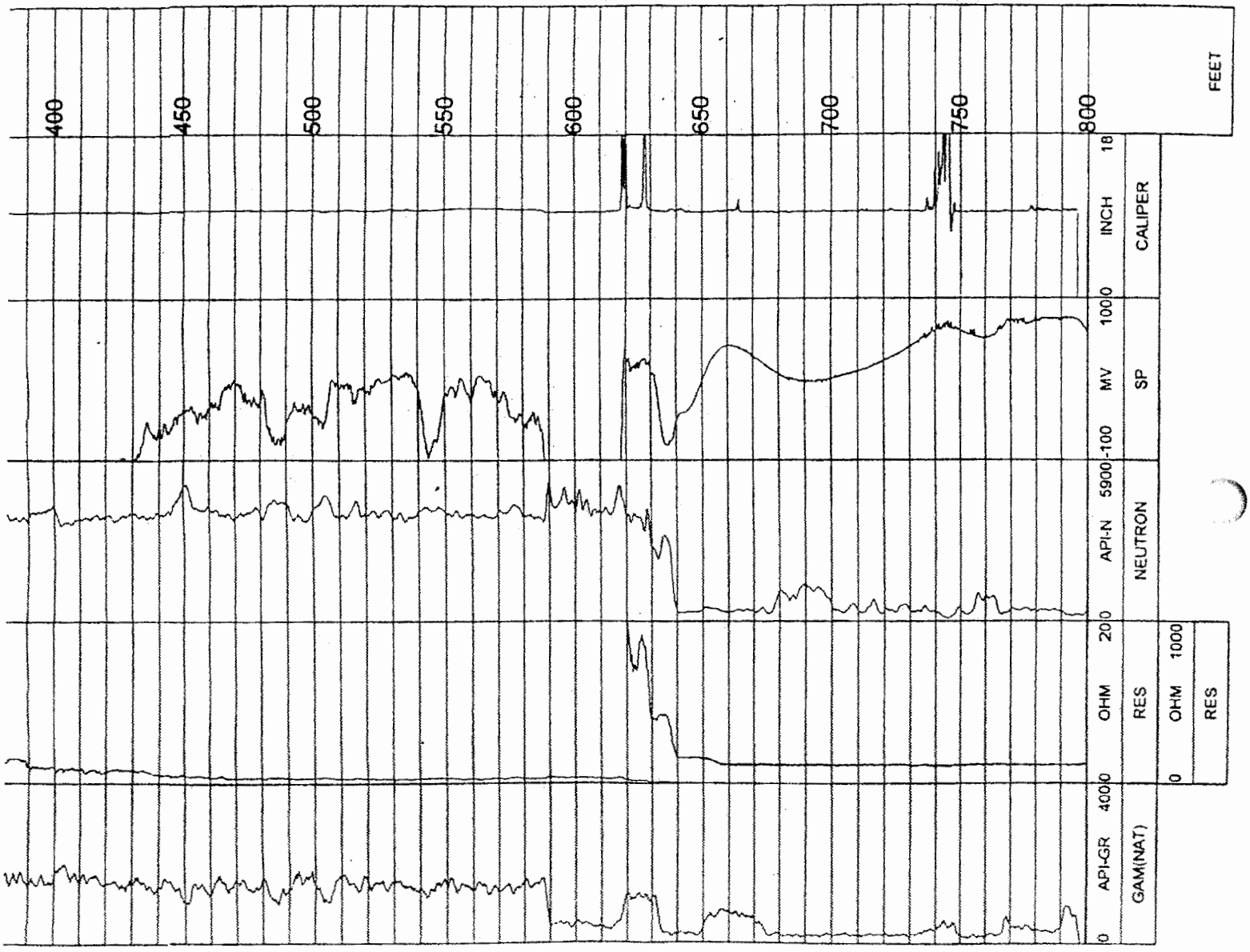
CALIPER
0 INCH 18
0
50
100
150
200
250
300
350

Century GEOPHYSICAL CORP.



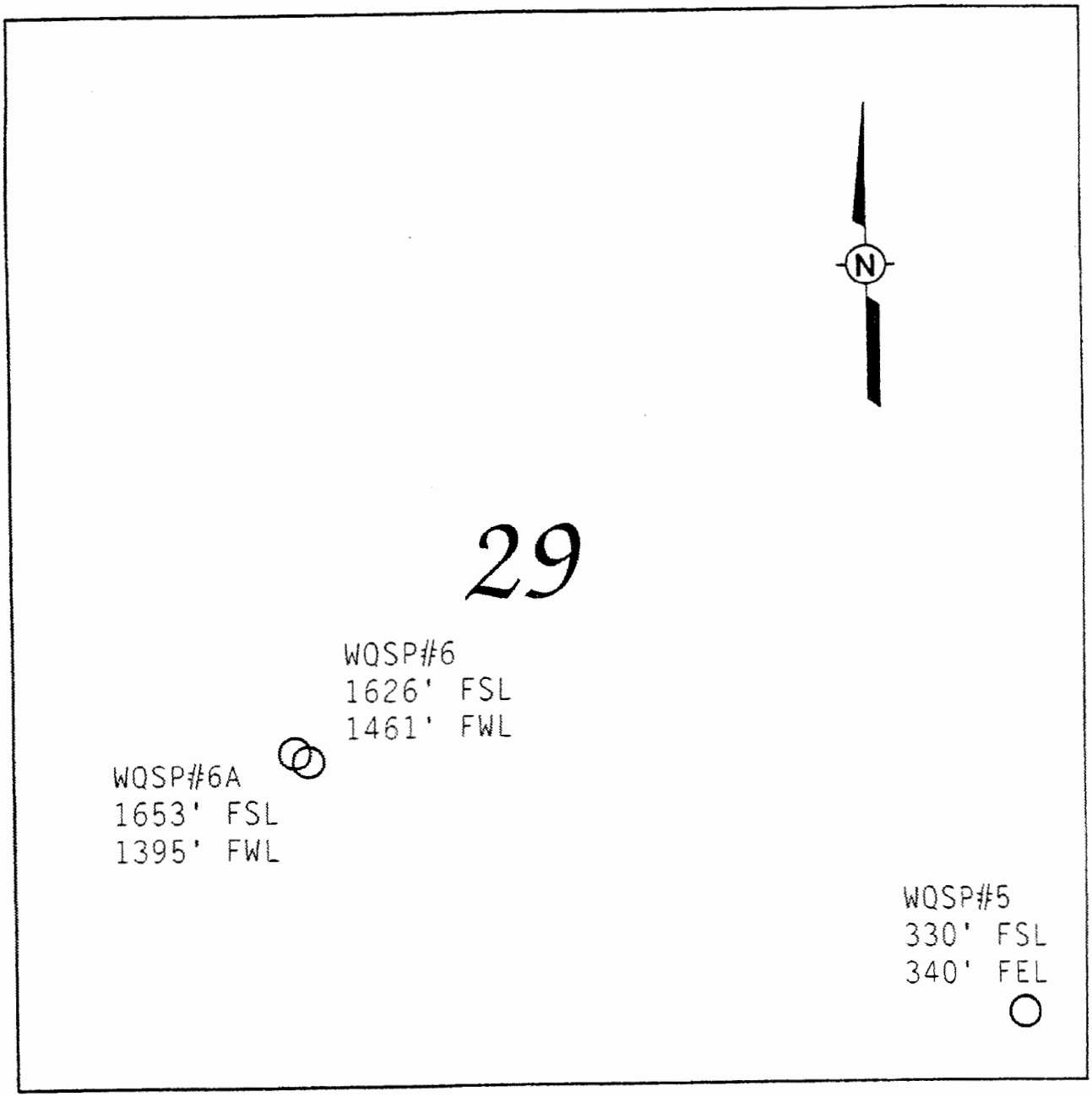
WQSP #4
Geophysical Logs

301683 002 01 000 B4

02621

WQSP#5

Section 29, T22S, R31E



Location of WQSP #5

WQSP #5
Condensed Well Summary

Location:	Section 29, T22S, R31E 330 ft from the south line 340 ft from the east line	
Elevation: (Top of Casing)	3384.4 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 12 to 13, 1994 683 ft below land surface 648 to 676 ft every 20 ft

WQSP #5
Stratigraphic Summary

Stratigraphic Unit	Depth Interval Natural Gamma Log (feet)	Core Description
Surficial Deposits/Santa Rosa	0-25	
Dewey Lake Redbeds	25-475	
Rustler Formation	475-683 partial	
• Forty Niner Member	475-530	
• Magenta Member	530-554	
• Tamarisk Member	554-648	
• Culebra Member	648-669	648-674
• Partial lower unnamed member	669-683	674-676 partial
Maximum Recorded Depth	683	

WQSP #5
CUTTINGS DESCRIPTION

WQSP #5
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
09/22/94	0935	1**	4	Caliche
	0940	2**	25	Mudstone
10/12/94	0825	3	45	Sandstone and mudstone
	0833	4	65	Mudstone and sandstone
	0855	5	85	Sandstone
	0910	6	105	Mudstone with green reduction spots, damp
	0925	7	125	Mudstone, damp
	0936	8	145	Sandy siltstone with gypsum
	0950	9	165	Mudstone, fibrous gypsum
	1014	10	185	Mudstone and sandstone with green reduction spots, minor gypsum
	1025	11	205	Sandstone
	1045	12	225	Sandstone and mudstone with green reduction spots, damp
	1110	13	245	Mudstone and sandstone
	1120	14	265	Mudstone laminated with fibrous gypsum, sandstone, minor gypsum
	1140	15	285	Sandy mudstone, sandstone with minor gypsum
	1153	16	305	Mudstone and sandstone with green reduction spots, fibrous gypsum
	1210	17	325	Mudstone with green reduction spots, minor gypsum
	1233	18	345	Sandstone interbedded with fibrous gypsum
	1245	19	365	Sandstone, trace gypsum
	1308	20	385	Sandy mudstone interbedded with gypsum, trace carbonate
	1335	21	405	Sandstone with green reduction spots and gypsiferous siltstone
10/12/94	1353	22	425	Sandstone with green reduction spots, laminated with fibrous gypsum
	1416	23	445	Gypsiferous mudstone laminated with fibrous gypsum, damp
	1440	24	465	Mudstone with green reduction spots, minor gypsum
	1504	25	485	Anhydrite, minor gypsum, sandstone and carbonate

* Cuttings description is for stratigraphic control not geologic description.
** Auger drilling.

WQSP #5
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1535	26	505	Gypsiferous siltstone, carbonate
10/13/94	0810	27	545	Anhydrite, mudstone, trace carbonate
10/13/94	0847	28	565	Anhydrite
	0920	29	585	Anhydrite, mudstone, trace dolomite
	1005	30	605	Anhydrite, mudstone, trace dolomite
	1050	31	625	Anhydrite and claystone
	1115	32	645	Anhydrite

* Cuttings description is for stratigraphic control not geologic description.
** Auger drilling.

WQSP #5
CULEBRA CORE DESCRIPTION

PAGE 1 OF 3

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/13 2:20	1	649.0	68		GF	648.0 - 657.0 ft: light olive gray microcrystalline dolomite, thinly laminated, with 1-2 mm wide irregular gypsum healed fractures and rare, small (1-2 mm) open vugs. At 655.0 ft vugs become larger (up to 2 inches), irregular and increase in frequency, rock has a distinct "Swiss cheese" texture. Highly fractured, clayey intervals occur between 649.2-649.9 and 652.6-652.7 ft. Rubbly, clayey, but competent interval occurs between 653.4 - 655.0 ft with rare (≤ 0.25 cm) vugs. Contact between Culebra Member and overlying Tamarisk Member not observed.	Culebra Member of Rustler Formation
		650.0			F		
					GF		
		652.0			F		
		654.0					
		656.0					
		658.0				657.0 - 666.0 ft: core loss.	9 feet of core loss
		660.0					

PAGE 2 OF 3

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/13	1	660.0	68			657.0 - 666.0 ft: core loss.	Culebra Member of Rustler Formation 9 feet of core loss
		662.0					
		664.0					
		666.0			GF	666.0 - 674.4 ft: same dolomite as above, extremely vuggy, most vugs are small and rock has a "sponge-like" texture. Some vugs are interconnected by dissolution and are highly irregular in shape. Vugs tend to form horizontal bands (~0.10 ft thick). Some dissolution pockets are gypsum filled. Vugs decrease in frequency with depth. Short, irregular gypsum-healed fractures and clay lens toward top of units. (continued on next page)	
		668.0					
		670.0					
		672.0					

PAGE 3 OF 3

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#5 DIA.: 4"

LOCATION: SE1/4 SE1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 330' FSL 340' FEL

ELEVATION: 3384.4 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/13/94

DRILL DATE: 10/13/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

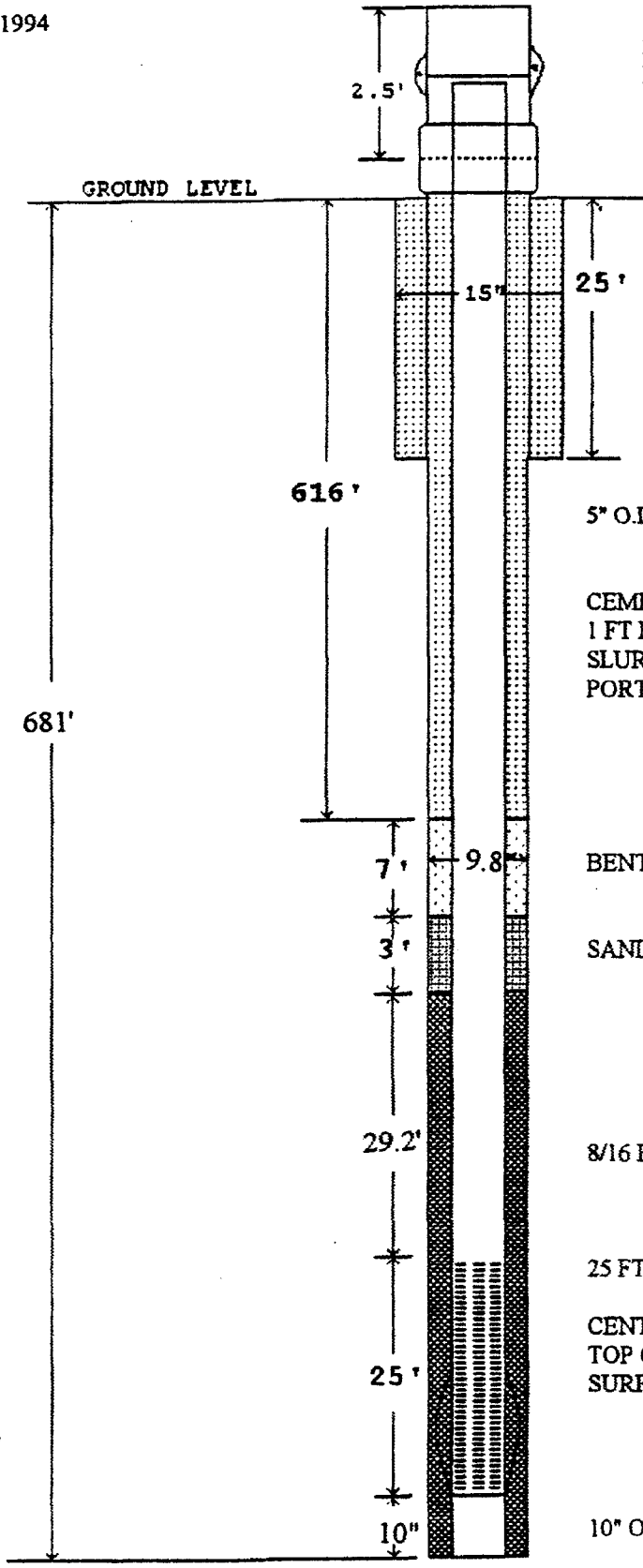
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		672.0					
10/13	1	674.0	68		F	highly fractured interval at 673.5 ft grading to more competent rock at 674.4 ft. Contact between Culebra Member and unnamed member is gradational.	Culebra Member of Rustler Formation
4:15		676.0				674.4 - 676.0 ft: compact, gypsiferous, black clay grading to red-brown clay with gypsum interbeds and stringers.	Unnamed Member o. Rustler Formation
		678.0					
		680.0					
		682.0					
		684.0					

WQSP #5
HOLE HISTORY

WIPP Project
WQSP #5
Eddy County, New Mexico

October 12-13, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 613 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 623 TO 613 FT

SAND PACK FROM 626 TO 623 FT

8/16 BRADY GRAVEL FROM 681 TO 626 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREE
TOP OF SCREEN, AND AT 60 FT INTERVALS TO
SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 5 & WQSP # 6

9:00 AM - 12:00 PM - Drilled, set 10.75" surface casing, cemented

October 12, 1994

WQSP # 5

6:00 AM - 6:35 AM - Carlsbad to WQSP # 5
6:35 AM - 6:50 AM - Check fluid levels
6:50 AM - 8:00 AM - Finish rigging up
8:00 AM - 12:30 PM - Start drilling from 25'. 10.75" .375W surface nipple pre-set to 25' & cemented to surface
12:30 PM - 3:45 PM - Drilling 9 7/8" hole, started to get wet at 505', shut down for the day
3:45 PM - 4:00 PM - Pull out of hole 3 stands & shut down
4:00 PM - 4:35 PM - WQSP # 5 to Carlsbad

October 13, 1994

WQSP # 5

5:50 AM - 6:30 AM - Carlsbad to WQSP # 5
6:30 AM - 6:45 AM - Check fluid levels
6:45 AM - 8:05 AM - Trip back in hole to start drilling
8:05 AM - 11:15 AM - Drilling 9 7/8" hole from 505' to 648' on mist pump using foam
11:15 AM - 11:30 AM - Circulate hole to clean up
11:30 AM - 12:15 PM - Trip out of hole to set up coring operation.
12:15 PM - 1:45 PM - Pick up core barrel assembly and go in hole to core
1:45 PM - 2:15 PM - Pull up and put on 5' pup joint.
2:15 PM - 4:15 PM - Coring 1st run 8 1/2" bit cutting 4" core
4:15 PM - 4:25 PM - Circulate foam, clean up before T.O.O.H.
4:25 PM - 5:25 PM - T.O.O.H.
5:25 PM - 5:45 PM - Breakout core barrel, lay down inner barrel
5:45 PM - 6:30 PM - Pump out core, recovered 22'10"
6:30 PM - 7:00 PM - Load core tools
7:00 PM - 7:40 PM - WQSP # 5 to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 18, 1994

WQSP # 5

5:50 AM -	7:40 AM -	Odessa to WQSP # 5
7:40 AM -	7:50 AM -	Move and spot logging trailer
7:50 AM -	8:10 AM -	Wait on logger
8:10 AM -	11:00 AM -	Run camera in WQSP # 5
11:00 AM -	12:50 PM -	Trip pipe back in well
12:50 PM -	2:00 PM -	Ream hole from 8 1/2" to 9 7/8" from 648' - 683'
2:00 PM -	2:30 PM -	Clean out hole
2:30 PM -	3:05 PM -	Pull 8 jts of drill pipe and secure rig for the day
3:05 PM -	4:00 PM -	Get load of water & pump diesel
4:00 PM -	4:30 PM -	WQSP @ 5 to Carlsbad

11:00 AM - 1:00 PM - Barrett pulled pump out of WQSP # 4

October 19, 1994

WQSP # 5

5:30 AM -	6:30 AM -	Carlsbad to WQSP # 5
6:30 AM -	6:40 AM -	Check fluid levels
6:40 AM -	8:00 AM -	Trip pipe back to bottom & clean out hole
8:00 AM -	8:50 AM -	Trip pipe out of hole
8:50 AM -	9:50 AM -	Run 2" trimmie line
9:50 AM -	11:20 AM -	Run 5" fiberglass casing, screen
11:20 AM -	12:30 PM -	Gravel pack well w/8-16 gravel
12:30 PM -	1:00 PM -	Mix bentonite seal & pumped
1:00 PM -	1:45 PM -	Wait on cement trucks
1:45 PM -	2:30 PM -	Started cementing operations
2:30 PM -	3:00 PM -	Pull 2" trimmie line
3:00 PM -	3:30 PM -	Rig down
3:30 PM -	4:00 PM -	Move to WQSP # 3, start rigging up & get load of water
4:00 PM -	4:30 PM -	Secure rig and equipment
4:30 PM -	5:10 PM -	WQSP # 3 to Carlsbad

October 20, 1994

WQSP # 5

1:30 PM -	5:15 PM -	Rigged up on WQSP # 5, started developing well with bailer, made 9 trips. TD of well 683', static water level 394'

WEST TEXAS WATER WELL SERVICE

October 21, 1994

WQSP # 5

Unit # 2

6:35 AM -	7:20 AM -	Arrive on location, check & service unit, prepare to run test pump
7:20 AM -	8:55 AM -	Run 3 HP test pump on 32 joints of 1" galvanized pipe, pump set 672'
8:55 AM -		- Start pumping well @ 13.25 GPM
9:00 AM -		- 12.75 GPM
9:05 AM -		- 11.75 GPM
9:10 AM -		- 11 GPM
9:15 AM -		- 10.25 GPM
9:20 AM -		- 2.50 GPM with 150# backpressure
9:25 AM -		- 2.75 GPM
9:30 AM -		- 2.50 GPM
9:40 AM -		- 3 GPM
9:45 AM -		- 3 GPM shut down & allow to recover
10:10 AM -		- Start surging well to further develop
10:55 AM -		- Start pumping, set rate @ 3:00 PM, 150# backpressure
3:00 PM -		- Pump was shut off, making .8 GPM

October 24, 1994

WQSP # 5

Unit # 2

9:35 AM -	- Start surging
11:35 AM -	- Start test 225 GPM @ 150# back pressure
12:50 PM -	- 1.75 GPM @ 170# back pressure
2:20 PM -	- 2.5 GPM @ 150# back pressure
2:30 PM -	- 2.75 GPM @ 150# back pressure
2:40 PM -	- 1.75 GPM @ 150# back pressure
3:15 PM -	- 1.75 GPM @ 0# back pressure
3:25 PM -	- 1.75 GPM
3:45 PM -	- 1.9 GPM
3:50 PM -	- 1.9 GPM Shut down for the day

WEST TEXAS WATER WELL SERVICE

October 25, 1994

WQSP # 5

Unit # 2

6:55 AM -	9:00 AM -	Surge well to further develop, and pump well at intermittent times
9:00 AM -	10:50 AM -	Pump well @ 2.1 GPM down to 1.9 GPM. Shut pump down and add 5 gallons of Clorox bleach to break down any existing polymer left in well between gravel pack & wellbore
10:50 AM -	12:00 PM -	Surge well to help break down and further develop formation
12:00 PM -	4:00 PM -	Install 2 GPM choke and begin pumping well at 2.6 GPM with 170# back pressure
1:00 PM -		- 1.85 GPM @ 70 #
4:00 PM -		- 1.8 GPM @ 50#
		Shut down unit for the day

October 26, 1994

WQSP # 5

Unit # 2

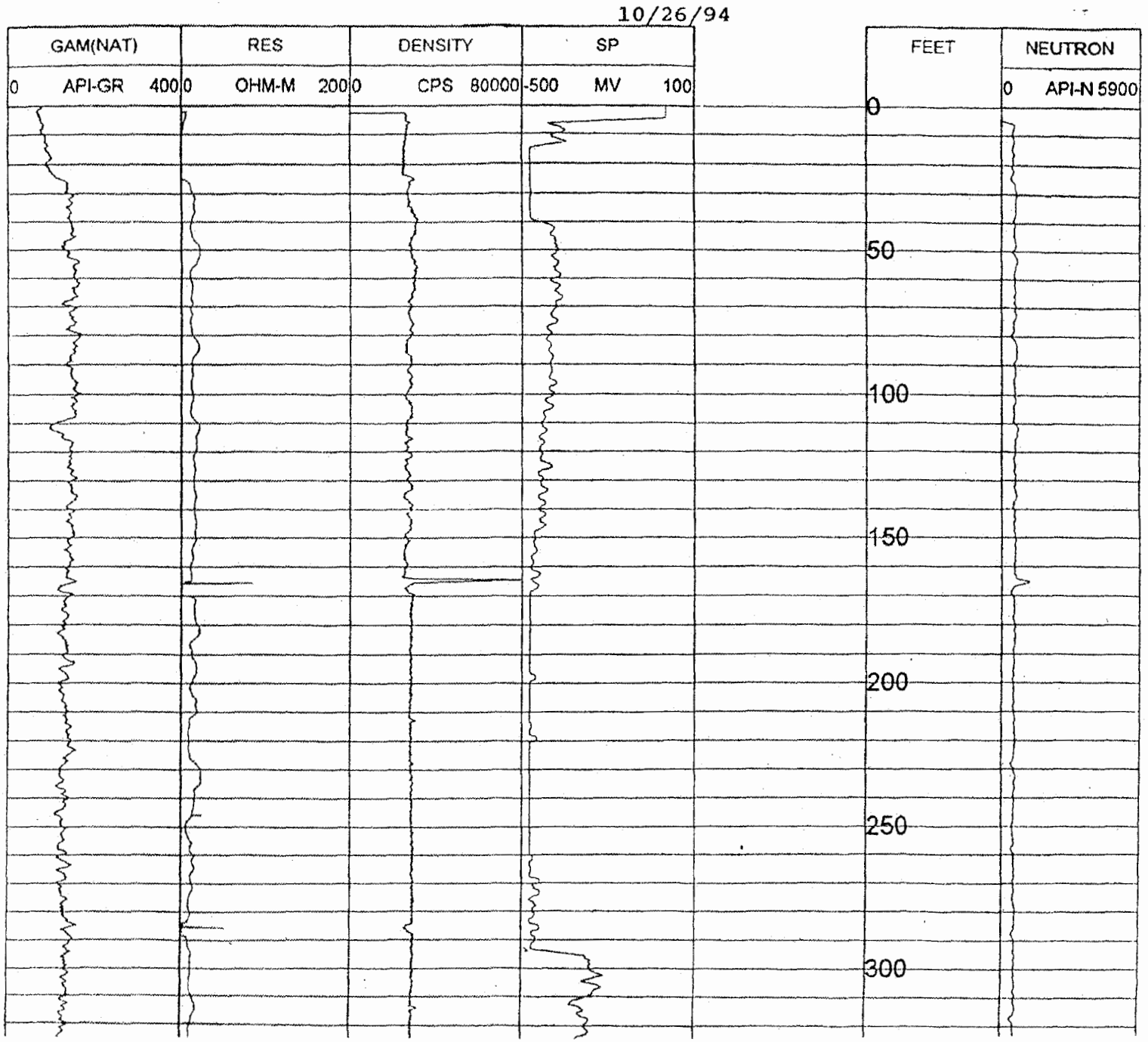
7:00 AM -	7:20 AM -	Arrive on location, service & check unit, rig up and prepare to pull pump
7:20 AM -	9:15 AM -	Pull test pump
9:15 AM -	10:30 AM -	Remain rigged up, load & secure trailer, wait on logging unit
10:30 AM -	2:10 PM -	Run logs on WQSP # 5, rig down, go to WQSP # 3 to log

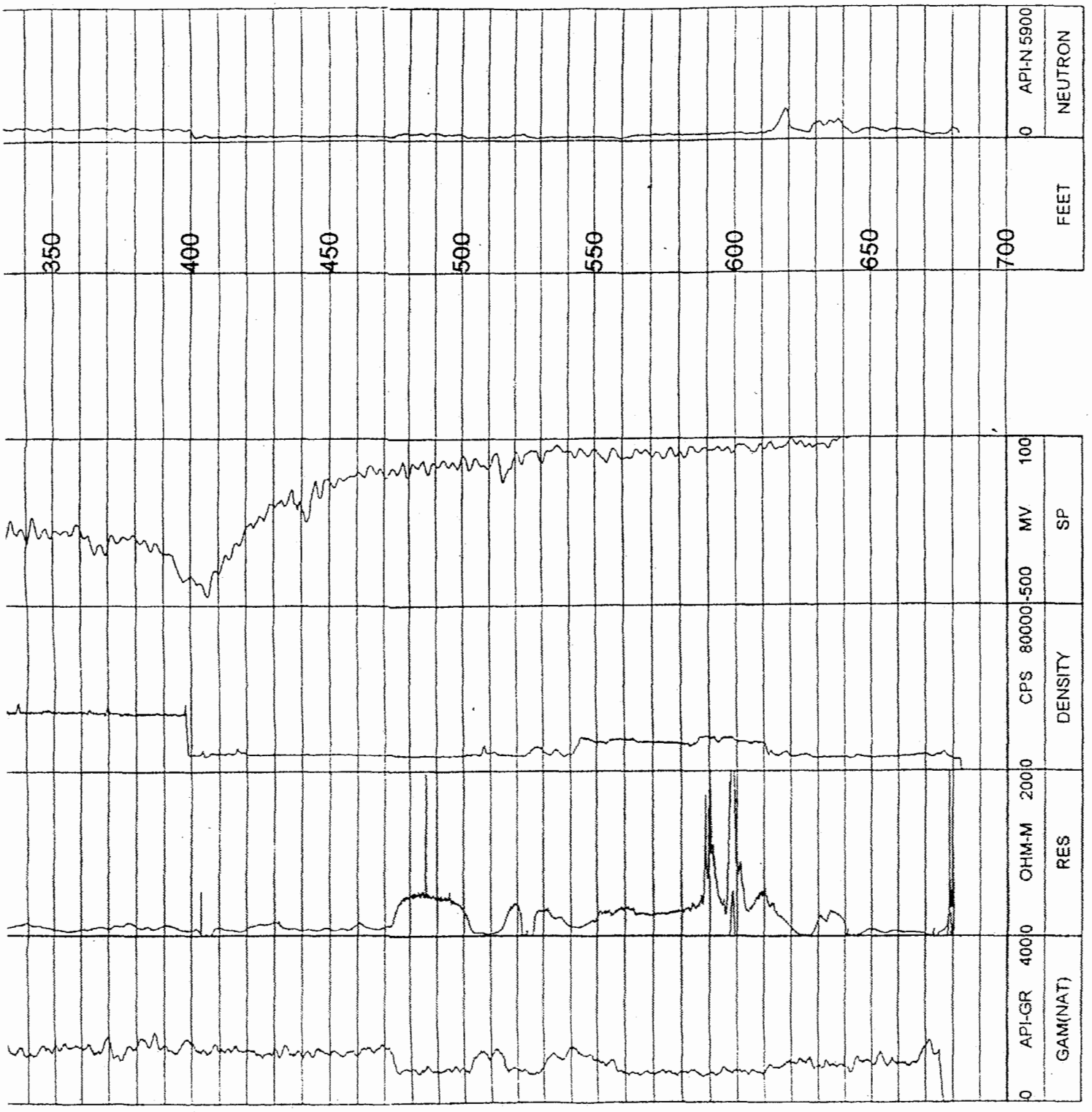
WQSP # 5

Unit # 2

7:00 AM -		- Arrive on location ,service & check unit, rig up and prepare to pull test pump
7:20 AM -	9:15 AM -	Pull test pump
9:15 AM -	10:00 AM -	Load and secure trailer to move to WQSP # 3
10:00 AM -	10:30 AM -	Wait on logging unit
10:30 AM -	2:10 PM -	Run logs and move to WQSP # 3

WQSP #5
GEOPHYSICAL LOGS

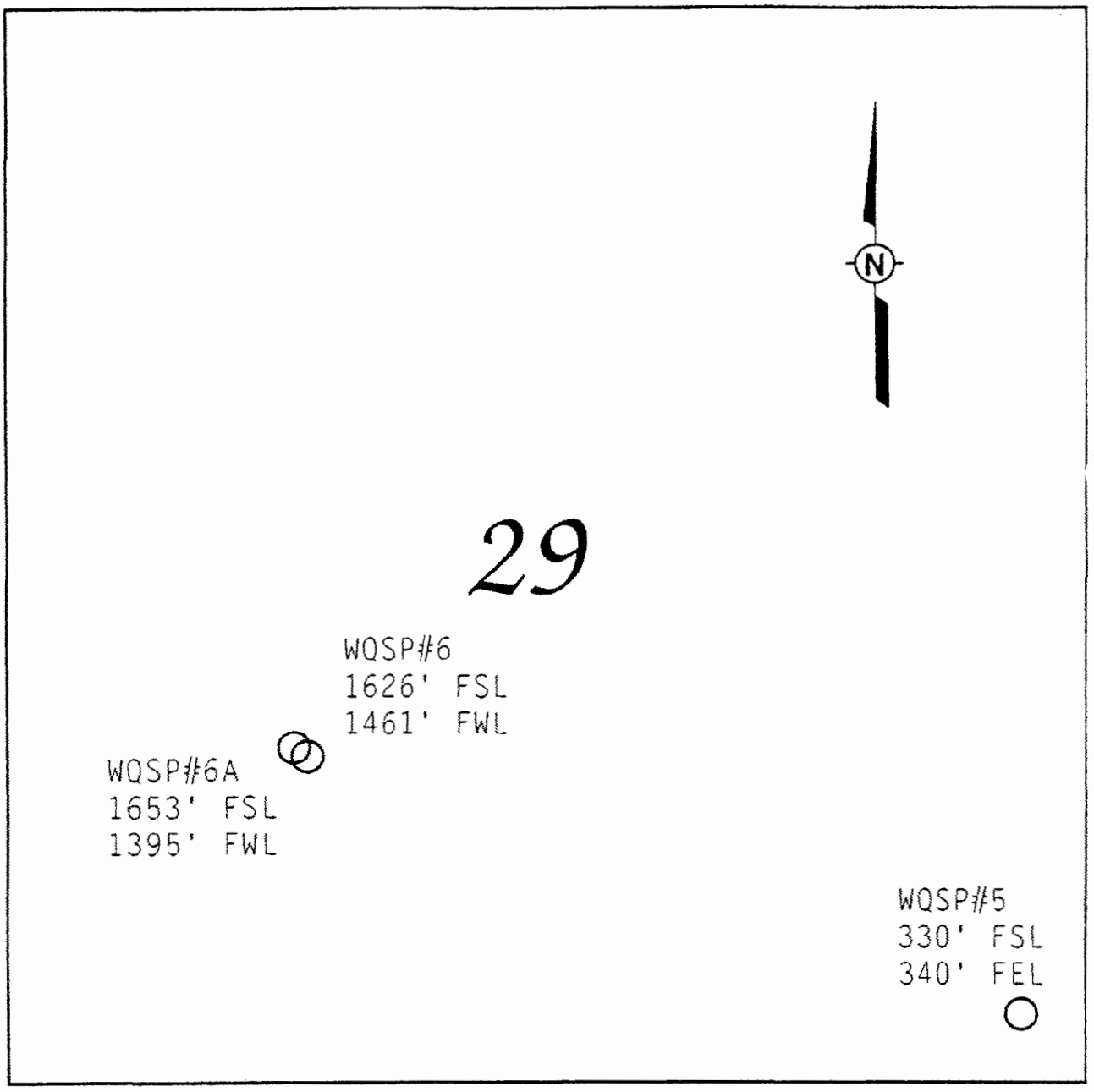

10/26/94
GAM(NAT)
0 API-GR 400
RES
0 OHM-M 200
DENSITY
0 CPS 80000
SP
-500 MV 100
FEET
0
50
100
150
200
250
300
NEUTRON
0 API-N 5900



WQSP #5
Geophysical Logs

WQSP#6

Section 29, T22S, R31E



Location of WQSP #6

WQSP #6
Condensed Well Summary

Location:	Section 29, T22S, R31E 1626 ft from the south line 1461 ft from the west line	
Elevation: (Top of Casing)	3363.8 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	September 22, to October 4, 1994 617 ft below land surface 568 to 617 ft every 20 ft

WQSP #6
Stratigraphic Summary

Stratigraphic Unit	Depth Interval Natural Gamma Log (feet)	Core Description
Surficial Deposits/Santa Rosa	0-68	
Dewey Lake Redbeds	68-409	
Rustler Formation	409-620	
• Forty Niner Member	409-474	
• Magenta Member	474-497	
• Tamarisk Member	497-588	568-582 partial
• Culebra Member	588-606	582-607
• Partial lower unnamed member	606-620	607-617 partial
Maximum Recorded Depth	620	617

WQSP #6
CUTTINGS DESCRIPTION

WQSP #6
Cuttings Description *

Date	Time	Sample Number	Depth (feet)	Description
09/22/94	1050	1**	5	Surficial deposits
	1110	2**	25	Mudstone, sandstone, and clay
09/26/94	0903	3	45	Mudstone with green reduction spots
	0914	4	65	Sandstone with green reduction spots
	1015	5	85	Sandstone with green reduction spots
	1030	6	105	Siltstone, trace gypsum
	1043	7	125	Siltstone, damp
	1055	8	145	Siltstone and sand, damp
	1112	9	165	Sandy siltstone, damp
	1147	10	185	Mudstone and sand
	1203	11	205	Mudstone and sandstone
	1245	12	225	Sandstone, mudstone with green reduction spots, gypsum
	1325	13	245	Sandstone, siltstone, and selenite
	1340	14	265	Sandstone, selenite, and siltstone, limited sample
	1410	15	285	Sandstone and sandy siltstone with green reduction spots, selenite
	1435	16	305	Sandstone and gypsum
	1515	17	325	Sandy siltstone, sandstone, selenite
	1540	18	345	Sandy siltstone, sandstone, minor gypsum
	1550	19	365	Sandstone and siltstone with green reduction spots
09/27/94	1010	20	385	Sandy siltstone and sandstone with green reduction spots, minor gypsum
	1045	21	405	Gypsum, sandstone, and sandy siltstone
09/28/94	1035	22	425	Anhydrite, gypsum, and sandstone with green reduction spots
	1155	23	445	Anhydrite and gypsum
	1235	24	465	Anhydrite and gypsum

* Cuttings description is for stratigraphic control not geologic description.

** Auger drilling.

WQSP #6
Cuttings Description (Continued) *

Date	Time	Sample Number	Depth (feet)	Description
	1325	25	485	Anhydrite, gypsum, dolomite
	1410	26	505	Anhydrite, trace dolomite
	1520	27	525	Anhydrite
09/28/94	1645	28	545	Anhydrite and gypsum
	1810	29	565	Mud, minor anhydrite and gypsum, limited sample
	1835	30	568	Anhydrite and mud

* Cuttings description is for stratigraphic control not geologic description.
** Auger drilling.

WQSP #6
CULEBRA CORE DESCRIPTION

PAGE 1 OF 5

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29 10:10	1	568.0 570.0 572.0 574.0 576.0 578.0 580.0	93		F	568.0 - 582.0 ft: light to dark gray mottled microcrystalline anhydrite with 1-2 mm wavy gypsum laminae. Horizontal fracture at 569.7 ft overlain by ~0.75 cm thick gypsum band. Interval of sparsely laminated anhydrite from 570.0 - 571.2 ft with numerous 1-2 mm isolated euhedral gypsum crystals. A prominent 2-4 cm thick continuous gypsum vein (vertical) occurs from 576.0 - 580.0 ft. Gradational contact between Tamarisk Member and underlying Culebra Member.	Tamarisk Member of Rustler Formation

PAGE 2 OF 5

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94
DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29		580.0				See previous page.	Tamarisk Member of Rustler Formation
		582.0		OV		582.0 - 585.0 ft: brown-gray microcrystalline dolomite with (0.25-1 cm) open vugs and moderate horizontal fractures ~2 cm wide band of dolomite with rounded anhydrite clasts (~0.5 cm) at 582.2 ft.	Culebra Member of Rustler Formation
	1	584.0	93	OV			
		586.0		OV		585.0 - 596.6 ft: light olive gray, thinly laminated microcrystalline dolomite with numerous small open vugs (1-2 mm) and moderate horizontal fracturing. Vugs increase in size, decrease in frequency and are sparse and fibrous gypsum filled at 589.9 ft. A continuous 1-2 mm gypsum-filled fracture occurs from 590.3 - 591.1 ft. Highly fractured clayey intervals with bladed gypsum crystals and numerous open vugs from 589.9 - 590.3 ft and 591.1 - 591.2 ft. (continued on next page)	
		588.0		OV			
		590.0		OV	GF CF		
		592.0					

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"
LOCATION: NE1/4 SW1/4 Section 29 T22S R31E
ORIENTATION: Vertical Down
COORDINATES: 1626' FSL 1461' FWL
ELEVATION: 3363.8 feet amsl
DRILL METHOD(S): Air Rotary

LOG BY: JBD
DATE: 09/29/94
DRILL DATE: 09/29/94
DRILLER: Ronnie Keith
DRILL: Gardner Denver 1500
DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/29		592.0					
	1	594.0	95	OV	LF GF	Toward base of unit vugs decrease in size and increase in frequency. Clay filled fractures and thin (0.5-1 mm) gypsum healed fractures increase in frequency with depth. Fractures are thin, wavy, and discontinuous.	Culebra Member of Rustler Formation 2 feet of core loss
1:38		596.0					
9/30						596.6 - 606.85 ft: same dolomite as above. Upper foot interbedded with vuggy (up to 0.25 cm) dolomite rubble in a red-brown mud/clay matrix. 597.6 - 600.2 ft: dolomite is clayey, highly fractured with numerous (1-2 mm) open vugs. Remainder of unit is competent with numerous small vugs, some connected by dissolution to form vertical and horizontal bands up to 3 cm in length. Thin, discontinuous gypsum-healed fractures (1-2 mm) increase in frequency with depth. (continued on next page)	2.5 feet of core loss
	2	598.0	87.5	OV	CF		
		600.0		OV	GF		
		602.0		OV			
		604.0					

PAGE 4 OF 5

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"
LOCATION: NE1/4 SW1/4 Section 29 T22S R31E
ORIENTATION: Vertical Down
COORDINATES: 1626' FSL 1461' FWL
ELEVATION: 3363.8 feet amsl
DRILL METHOD(S): Air Rotary

LOG BY: JBD
DATE: 09/29/94
DRILL DATE: 09/29/94
DRILLER: Ronnie Keith
DRILL: Gardner Denver 1500
DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/30	2	604.0	87.5	OV	GF	Toward base of unit, vugs decrease with some becoming gypsum filled. Contact between Culebra Member and underlying unnamed member is sharp.	Culebra Member of Rustler Formation
		606.0		OV		606.85 - 608.1 ft: black plastic clay with rare isolated gypsum crystals (1-2 mm).	Unnamed Member of Rustler Formation
		608.0				608.1 - 615.2 ft: upper 2 ft black-brown clay interbedded with light gray anhydrite grading to red-brown mudstone with numerous light gray-pinkish anhydrite interbeds, high angle veins, and stringers.	
		610.0					
		612.0					
		614.0					
		616.0				615.2 - 616.6 ft: light-dark gray mottled anhydrite with thin (1-2 mm) wavy gypsum laminae.	

PAGE 5 OF 5

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#6 DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1626' FSL 1461' FWL

ELEVATION: 3363.8 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 09/29/94

DRILL DATE: 09/29/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

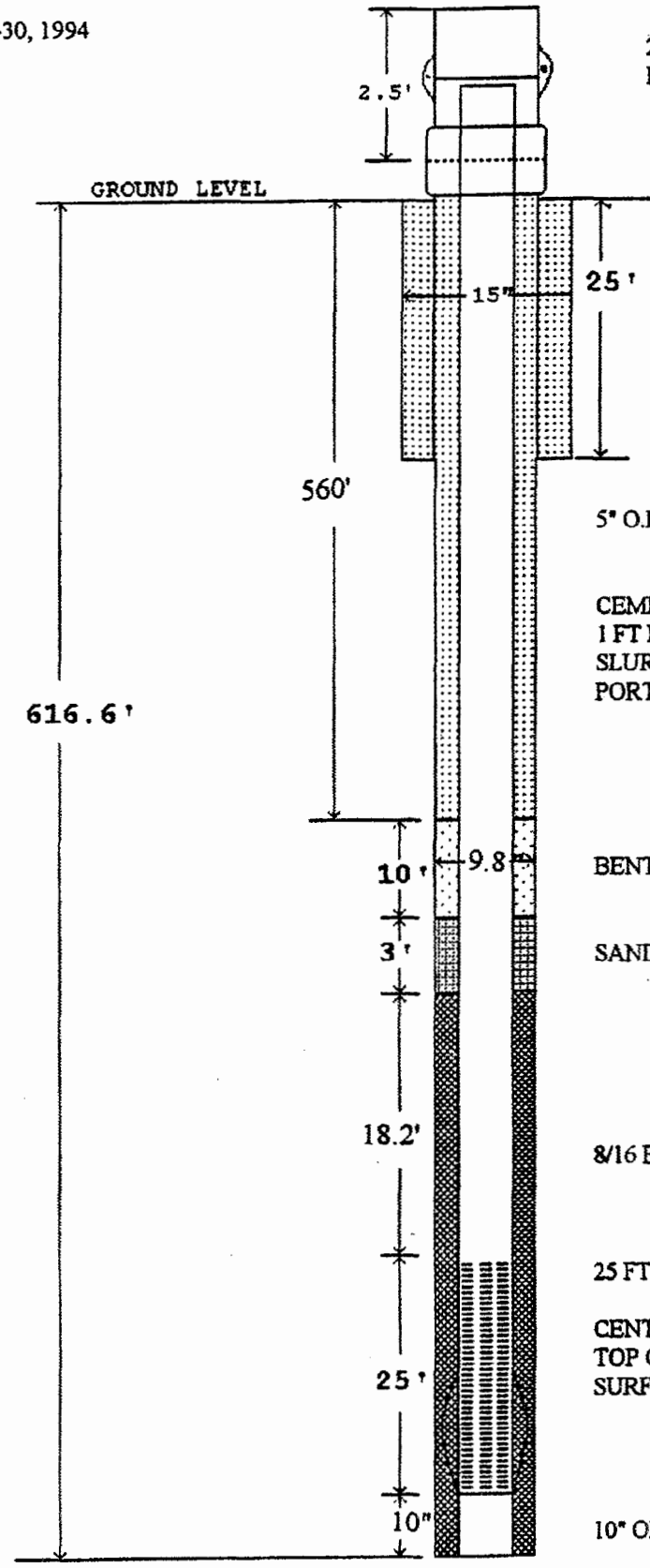
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
9/30	2	616.0	67.5			See previous page.	Unnamed Member of Rustler Formation
		618.0					
		620.0					

WQSP #6
HOLE HISTORY

WIPP Project
WQSP #6
Eddy County, New Mexico

September 22-30, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 560 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 570 TO 560 FT

SAND PACK FROM 570 TO 567 FT

8/16 BRADY GRAVEL FROM 681 TO 626 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREE
TOP OF SCREEN, AND AT 60 FT INTERVALS TO
SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

September 22, 1994

WQSP # 5 & WQSP # 6

9:00 AM - 12:00 PM - Drilled, set 10.75" surface casing, cemented

September 23, 1994

WQSP #'s 2 & 6

6:00 AM - 6:40 AM - Carlsbad to WQSP # 2
6:40 AM - 8:15 AM - Rigged down on WQSP # 2, cleaned up location & moved to WQSP # 6
8:15 AM - 12:00 PM - Rigged up on WQSP # 6, lined pit, put rotating head on, and shut down for weekend
12:00 PM - 2:00 PM - WQSP # 6 to Odessa

September 26, 1994

WQSP # 6

5:40 AM - 7:40 AM - Odessa to WQSP # 6
7:40 AM - 8:00 AM - Service rig
8:00 AM - 11:20 AM - Drilling 9 7/8" hole on air
11:20 AM - 4:00 PM - Started drilling on air/mist pump due to amount of water being made in Dewey Lake formation. Est. 40-50 GPM
4:00 PM - 4:15 PM - Trip pipe out of hole 200'. Total footage for the day 367'
4:15 PM - 4:30 PM - Secure rig for the day

September 27, 1994

WQSP # 6

6:15 AM - 6:50 AM - Carlsbad to WQSP # 6
6:50 AM - 7:00 AM - Service rig
7:00 AM - 8:10 AM - Fill pits with brine water and mix sw gel
8:10 AM - 9:30 AM - Trip in hole, had 15' of fill, cleaned out & circulated 30 minutes
9:30 AM - 11:40 AM - Drilling 9 7/8" hole on fluid from 367'-415'
11:40 AM - 12:30 PM - Take yoke off drive shaft, return to Odessa for parts
12:30 PM - 4:00 PM - Rig down waiting on parts
4:00 PM - 5:00 PM - Replace parts & ready rig for drilling Wednesday morning

WEST TEXAS WATER WELL SERVICE

September 28, 1994

WQSP # 6

6:00 AM	6:35 AM	Carlsbad to WQSP # 6
6:35 AM	6:45 AM	Check fluid levels
6:45 AM	6:50 AM	Trip pipe back to bottom
6:50 AM	7:50 AM	Drilled 4'
7:50 AM	10:10 AM	Make bit trip
10:10 AM	4:00 PM	Drilling 9 7/8" hole
4:00 PM	4:20 PM	Circulate bottoms up, look as samples
4:20 PM	6:50 PM	Continue drilling to core point. Quit drilling @ 568'
6:50 PM	7:00 PM	WQSP # 6 to Carlsbad

September 29, 1994

WQSP # 6

5:45 AM	6:20 AM	Carlsbad to WQSP # 6
6:20 AM	6:30 AM	Check fluid levels
6:30 AM	6:50 AM	Trip back to bottom
6:50 AM	7:00 AM	Circulate
7:00 AM	7:40 AM	Trip out of the hole - 568'
7:40 AM	8:45 AM	Rig up core tools
8:45 AM	10:10 AM	Trip in the 1st run with core barrel
10:10 AM	10:30 AM	Circulate
10:30 AM	2:30 PM	Coring - very slow on fluid
2:30 PM	2:50 PM	Circulating
2:50 PM	3:40 PM	Coming out of hole 28' cut 596'
3:40 PM	4:00 PM	Breakdown core barrel, lay on ground
4:00 PM	4:30 PM	Pick up core barrel T.I.H.
4:30 PM	5:00 PM	Pump core out of first barrel
5:00 PM	5:15 PM	Secure rig for day

WEST TEXAS WATER WELL SERVICE

September 30, 1994

WQSP # 6

5:50 AM - 6:20 AM - Carlsbad to WQSP # 6
6:20 AM - 6:30 AM - Check fluid levels
6:30 AM - 7:00 AM - Trip pipe and core barrel in hole for 2nd run
7:00 AM - 8:30 AM - Clean out 12' of fill before coring
8:30 AM - 11:30 AM - Core from 596' - 616.6'
11:30 AM - 11:50 AM - Circulate
11:50 AM - 1:00 PM - Trip out of hole
1:00 PM - 1:40 PM - Lay down core barrel and pump out core
1:40 PM - 2:25 PM - Breakdown core tools and load on trailer
2:25 PM - 2:50 PM - Trip collars in hole
2:50 PM - 3:00 PM - Shut down operations and secure rig for weekend
3:00 PM - 5:00 PM - WQSP # 6 to Odessa

October 3, 1994

WQSP # 6

5:30 AM - 7:30 AM - Odessa to WQSP # 6
7:00 AM - 7:40 AM - Check fluid levels
7:40 AM - 8:40 AM - Trip in hole with drill pipe
8:40 AM - 11:30 AM - Ream hole from 8 1/2" to 9 7/8"
11:30 AM - 12:30 PM - Circulate and condition hole for logging
12:30 PM - 1:30 PM - Trip out of hole for logs
1:30 PM- 3:30 PM - Log well - 616.60'
3:30 PM - 4:00 PM - Shut down operations for day

UNIT 2

5:30 AM - 7:30 AM - Odessa to WQSP # 6
7:30 AM - 9:00 AM - Unload screen storage pad south of site, and load surface casing on trailer
9:00 AM - 10:00 AM - Unload surface casing @ WQSP # 4 and WQSP # 3
10:00 AM - 1:30 PM - Set & cement surface on WQSP #'s 3 & 4
1:30 PM - 2:00 PM - Load trimmie line on trailer to take to WQSP # 6
2:00 PM - 4:00 PM - Help out at WQSP # 6 preparing to run casing 10-4-94

WEST TEXAS WATER WELL SERVICE

October 4, 1994

WQSP # 6

6:00 AM	6:35 AM	Carlsbad to WQSP # 6
6:35 AM	6:45 AM	Check fluid levels
6:45 AM	7:00 AM	Run weighted joint on sandline in well to check for fill - none found
7:00 AM	7:45 AM	Move rig and reset, prepare to run 2" trimmie line
7:45 AM	8:30 AM	Run 2" trimmie line
8:30 AM	10:00 AM	Run 5" OD fiberglass casing & screen. 10' blank, 25' of .020 slot screen, 584.10' of blank casing
10:00 AM	11:15 Am	Trimmie lined 2100# of 8/16 gravel pack into well
11:15 AM	12:00 PM	Mixed sw gel/water plug to pump on top of gravel pack for bentonite seal
12:00 PM	1:45 PM	Wait on cement
1:45 PM	3:10 PM	Circulate cement from top of bentonite seal to surface
3:10 PM	3:30 PM	Pull trimmie line
3:30 PM	4:00 PM	Rig down and move to WQSP # 4
4:00 PM	5:00 PM	Rig up and line pit on WQSP # 4
5:00 PM	5:40 PM	WQSP # 4 to Carlsbad

October 5, 1994

WQSP # 6 TD 616.6

1:00 PM		Arrived on location, set up and grease unit Change out bailers and go in the hole
1:45 PM		Fluid level @ 174' due to mud left inside casing
1:45 PM	4:00 PM	Bailed on well to develop, remove mud and fines, made 33 trips with bailer, retrieving 335 gallons of fluid. Shut down for the day, returned to Carlsbad

WEST TEXAS WATER WELL SERVICE

October 6, 1994

WQSP # 6

Unit # 2

6:45 AM	-	Arrive at location, check unit and prepare to bail
6:55 AM	-	Start bailing, water level recovered to 417' overnight
6:55 AM	- 10:00 AM -	Continued bailing well to develop. Bailed water level to 605' in 31 trips, recovering 315 gallons of fluid. Let well set for 10 minutes, fluid level recovered 5 1/2 '
10:00 AM	- 10:45 AM -	Made 5 more runs with bailer, shut down operations to go and get water truck
10:45 AM	- 11:45 AM -	WQSP # 6 to WQSP # 4 to get water truck
11:45 AM	- 12:00 PM -	Dump 20 bbls of fresh water to help break-down mud in form & further develop well
12:00 PM	- 12:10 PM -	Rig up unit to start bailing again
12:10 PM	- 3:35 PM -	Bailed on well - water level 585'
3:35 PM	- 4:45 PM -	Work on hydraulic pump on unit & shut down for the day

October 7, 1994

WQSP # 6

Unit # 2

7:30 AM	- 7:45 AM -	Arrive on location, set up unit & prepare to bail
7:45 AM	- 8:00 AM -	Started bailing well - water level @ 413' made 5 trips with bailer, laid bailer down and prepared to run pump
8:00 AM	- 9:50 AM -	Ran 1 1/2 HP 5 GPM to further develop well, ran air line provided by Ron to determine fluid level, since well is a marginal producer
9:50 AM	- 10:30 AM -	Rig up test equipment, hook up generator to run pump
10:30 AM	-	Start pumping well, meter reading 019393, pumping 7.5 GPM
10:47 AM	-	Stop pumping to let well recover
12:00 PM	-	Start pump @ 6 GPM with 23# back pressure
12:12 PM	-	Stop pump, pressure drop to 0#
1:47 PM	-	Start pump @ 6 GPM 23#
1:51 PM	-	Stop pump
3:00 PM	-	Start pump @ 6 GPM 22#
3:08 PM	-	Stop pump had 4#
3:15 PM	-	Shut down operations

WEST TEXAS WATER WELL SERVICE

October 10, 1994

Unit # 2

8:30 AM - - Arrive @ WQSP # 6, rig up on well to lower pump 10'; top of pump set @ 598'. Airline 99#, swl 364.3'

8:47 AM - - Start pump w/gate valve open - well pumping 7.5 gpm

8:52 AM - - Airline pressure 80#, back pressure 20#, 7.5 gpm, pumping level 408.2'

8:56 AM - - Increased back pressure to 60#, pumping 5.75 gpm

	Airline Pressure	Back Pressure	GPM	Draw-down	Pumping level
8:58 AM -	80#	60#	5.5	94.7'	459.1'
9:00 AM -	48#	60#	5.5	117.8'	482.1'
9:02 AM -		80#	5		
9:04 AM -	42#	80#	5	131.7'	496'
9:05 AM -	40#	80#	5	136.3'	500.6'
9:10 AM -	30#	75#	4.5	159.4'	
9:15 AM -	23#	100#	3.5	175.6'	
9:20 AM -	18#	97#	3.25	187.1'	539.9'
9:25 AM -	13#	110#	2.75	198.7'	563'
9:30 AM -	11#	120#	2	203.3'	567.6'
9:35 AM -	10#	130#	1.25	205.6'	569.9'
9:40 AM -	9#	130#	1.25	207.9'	572.2'
9:45 AM -	8#	129#	1.25	210.2'	574.5'
9:50 AM -	8#	135#	1	210.2'	574.5'
9:55 AM -	7#	135#	.75	212.5'	576.8'
10:00 AM -	6#	135#	.75	214.8'	579.1'
10:05 AM -	6#	135#	.75	214.8'	579.1'
10:10 AM -	5#	135#	.75	217.1'	581.4'
10:20 AM -	5#	135#	.75	217.1'	581.4'
10:30 AM -	5#	135#	.75	217.1'	581.4'
10:40 AM -	<5#	135#	.75	217.1'	581.4'
10:50 AM -	<5#	140#	.50	217.1'	581.4'
11:00 AM -	<5#	140#	.50	217.1'	581.4'
11:15 AM -	<5#	140#	.50+	217.1'	581.4'
11:30 AM -	5#	140#	.50+	217.1'	581.4'

Shut pump off and started recovery test of well

WEST TEXAS WATER WELL SERVICE

October 10, 1994

11:30 AM -	5#
11:31 AM -	5#
11:32 AM -	5#+
11:33 AM -	5#+
11:34 AM -	5#+
11:35 AM -	6#
11:40 AM -	6#+
11:45 AM -	7.5#
11:50 AM -	8#
11:55 AM -	10#
12:00 PM -	10#
12:10 PM -	12#
12:20 PM -	14#
12:30 PM -	17#
12:45 PM -	20#
1:00 PM -	23#
1:30 PM -	29#
2:30 PM -	38#
3:30 PM -	46#
10-11-94	
6:30 AM -	90#
7:30 AM -	92#

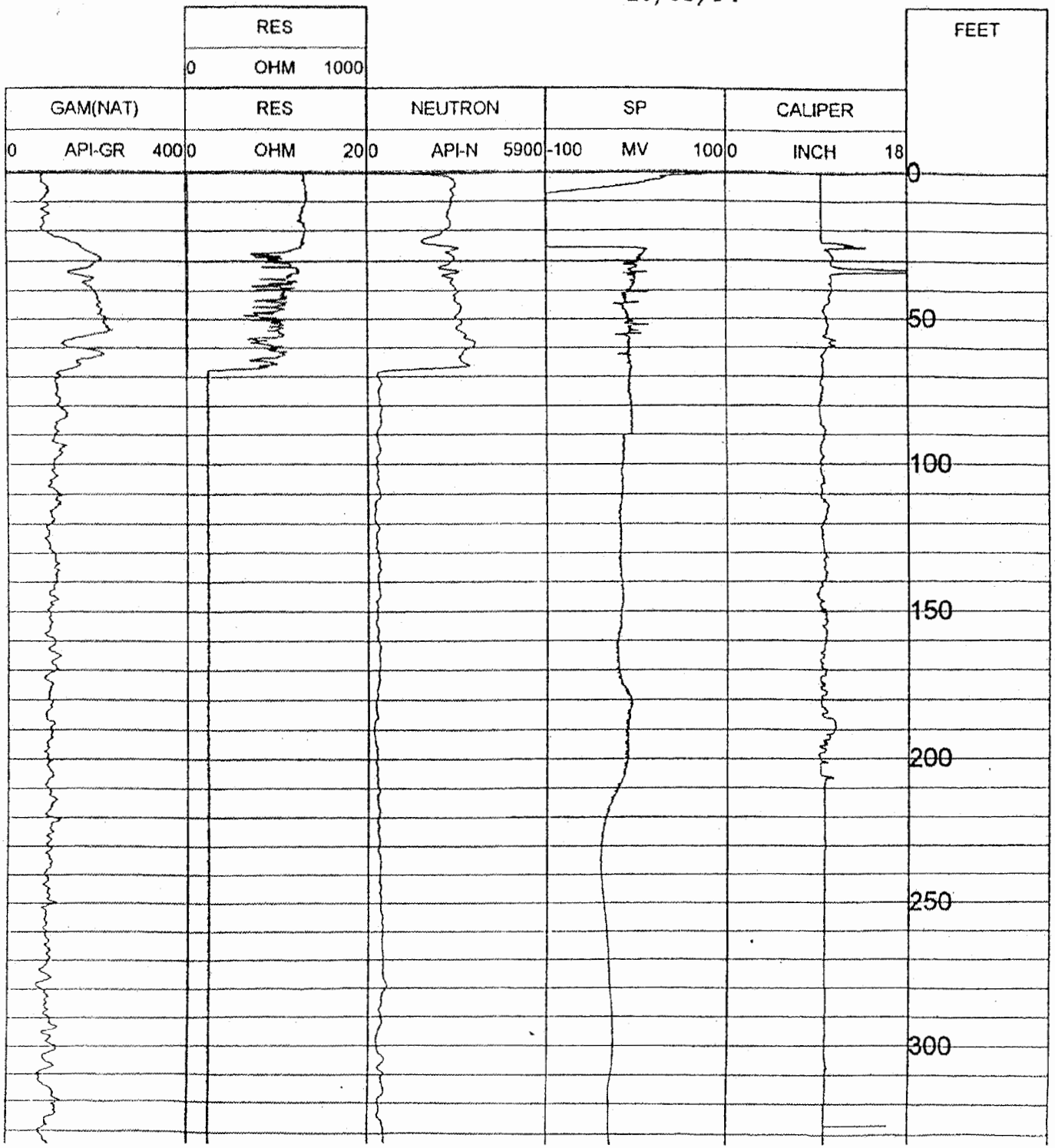
October 12, 1994

Unit @ 2

8:30 AM -		Arrived on WQSP # 6, rig up pulling unit to pull test pump
9:00 AM -	11:00 AM -	Pulled test pump and moved to WQSP # 4
11:00 AM -	1:30 PM -	Rigged up and waited on cement
1:30 PM -	4:00 PM -	Bailed on well to develop and clean up any fines left by gravel pack TD 800'

WQSP #6
GEOPHYSICAL LOGS

10/03/94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FEET
GAM(NAT)
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RES
0 OHM 20
NEUTRON
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CALIPER
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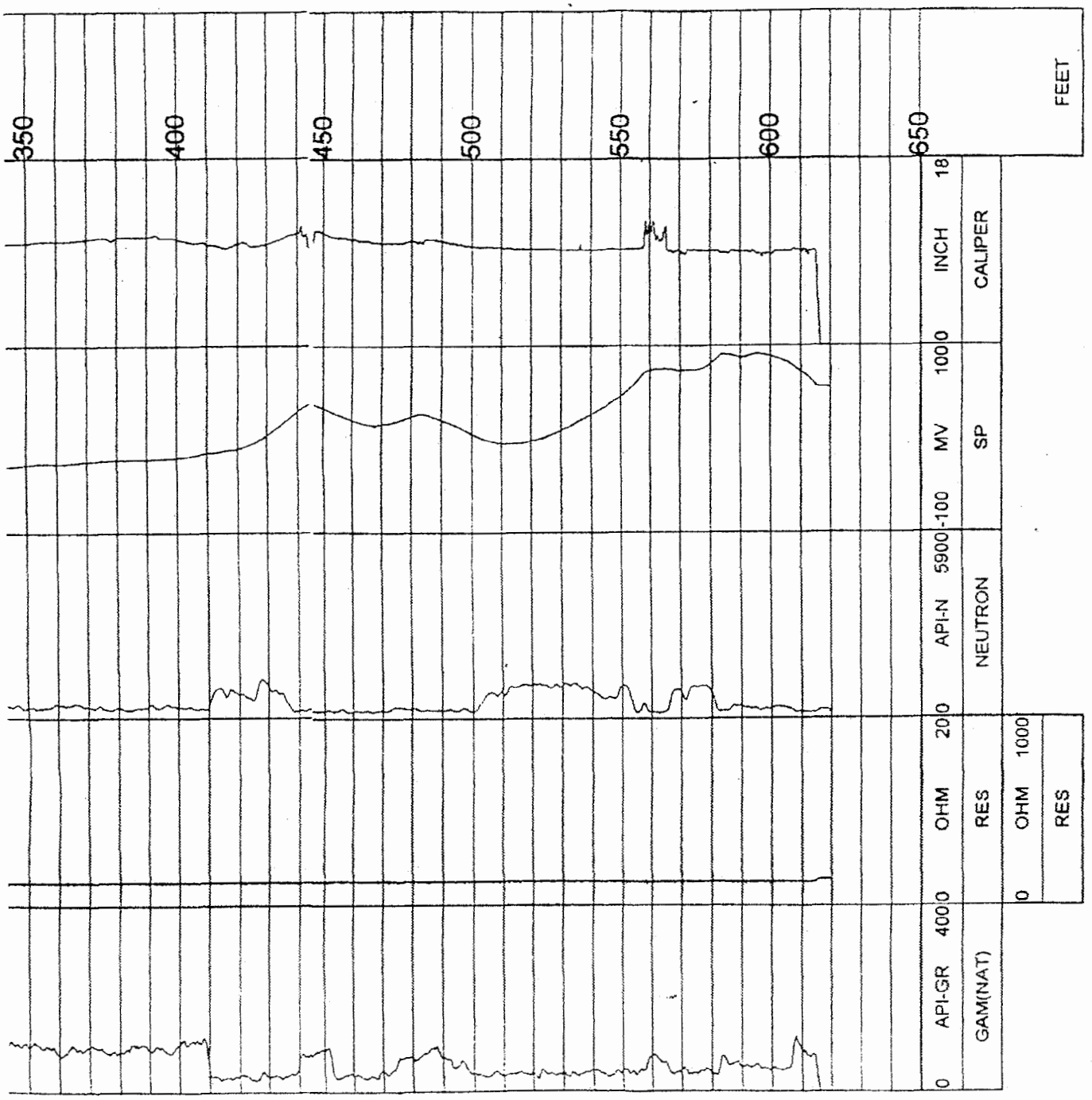
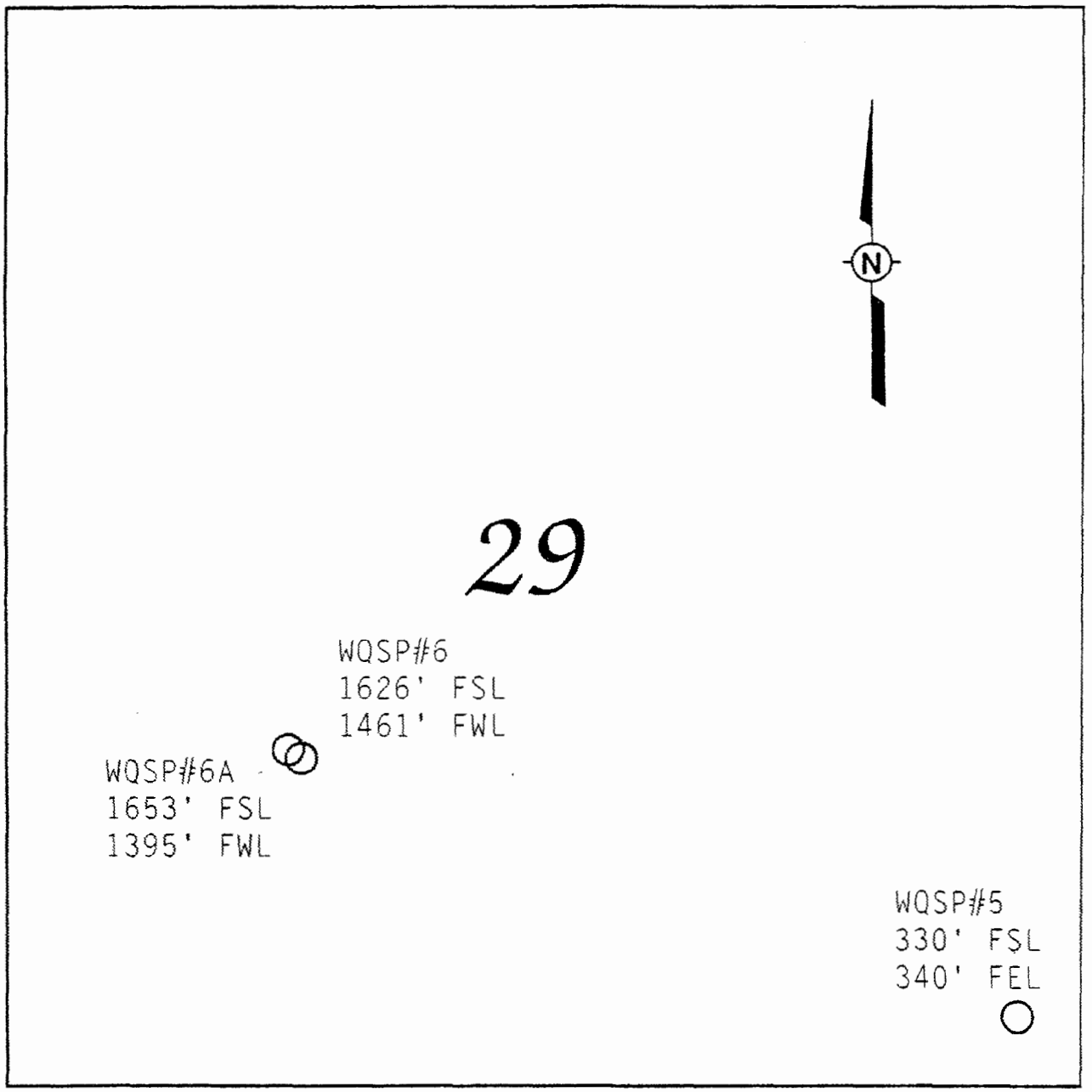
0
50
100
150
200
250
300



WQSP #6
Geophysical Logs

WQSP#6a

Section 29, T22S, R31E



Location of WQSP #6a

WQSP #6a
Condensed Well Summary

Location:	Section 29, T22S, R31E 1653 ft from the south line 1395 ft from the west line	
Elevation: (Top of Casing)	3364.7 ft above mean sea level	
Cuttings Description:	M.L. Martin	
Drilling Contractor:	West Texas Water Well Service 3432 W. University, Odessa, Texas 79764 (915) 381-2687 phone (915) 381-7853 fax	
Drilling Record	Date: Bottom of hole: Cored interval: Cuttings:	October 28, to November 1, 1994 225 ft below land surface 160 ft to 220 ft every 20 ft

WQSP #6a
Stratigraphic Summary

Stratigraphic Unit	**Depth Interval Natural Gamma Log (feet)**	**Core Description**
Surficial Deposits/Santa Rosa	0-35	
Dewey Lake Redbeds (partial)	35-220	160-220

WQSP #6a
CUTTINGS DESCRIPTION
(see WQSP 6)

WQSP #6a
DEWEY LAKE FORMATION
CORE DESCRIPTION

PAGE 1 OF 5

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/31 10:00		160.0 162.0 164.0 166.0 168.0 170.0 172.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation

PAGE 2 OF 5

WIPP CORE-LOG INVENTORY

INTERA
FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94
DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo.	FRACTURE	DESCRIPTION	REMARKS
10/31	1	172.0 174.0 176.0 178.0 180.0 182.0 184.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		184.0					
	1	186.0				160.0 - 191.0 ft: light to dark red-brown siltstone with numerous green-gray reduction spots varying in size and frequency. Spots occur randomly and in bands - the majority are 1-2 mm in diameter some form lenses up to 2 cm. In frequent, thin randomly oriented gypsum-filled fractures, clay lenses occur from 180.6-181.2 ft and some coarser grained (sandy) intervals. A broken, rubbly, silty interval occurs from 186.0-188.1 ft underlain by more competent siltstone. Unit has frequent horizontal fractures along bedding planes. At base of unit there is 2.5 ft of core loss.	Dewey Lake Formation 2.5' of core loss
		188.0					
10/31 11:00		190.0					
10/31 12:35		192.0				191.0 - 192.6 ft: crumbly, highly fractured red-brown siltstone with reduction spots (gray-green) and some gray-green clay lenses.	
	2	194.0				192.6 - 205.6 ft: see next page.	
		196.0					

WIPP CORE-LOG INVENTORY

INTERA

FORM 1400

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
		196.0				192.6 - 205.6 ft: Competent dark red-brown siltstone with coarsely crystalline anhydrite occurring in 1-2 mm horizontal bands along bedding planes. Numerous reduction spots (1-2 mm, up to 0.5 cm) in varying frequency, isolated and in bands. Thin (1-2 mm) randomly oriented gypsum-healed fractures. Siltstone is coarser grained and appears more porous along bedding planes. Clayey, rubbly intervals occur from 203.2-203.4 ft and 205-205.6 ft.	Dewey Lake Formation
		198.0					
		200.0					
		202.0					
		204.0					
		206.0				205.6 - 220.0 ft: see next page.	
		208.0					

PAGE 5 OF 5

WIPP CORE-LOG INVENTORY

INTERA

FORM 140

BOREHOLE: WQSP#6a DIA.: 4"

LOCATION: NE1/4 SW1/4 Section 29 T22S R31E

ORIENTATION: Vertical Down

COORDINATES: 1653' FSL 1395' FWL

ELEVATION: 3364.7 feet amsl

DRILL METHOD(S): Air Rotary

LOG BY: JBD

DATE: 10/31/94

DRILL DATE: 10/31/94

DRILLER: Ronnie Keith

DRILL: Gardner Denver 1500

DRILL CO.: West Texas Water Well Service

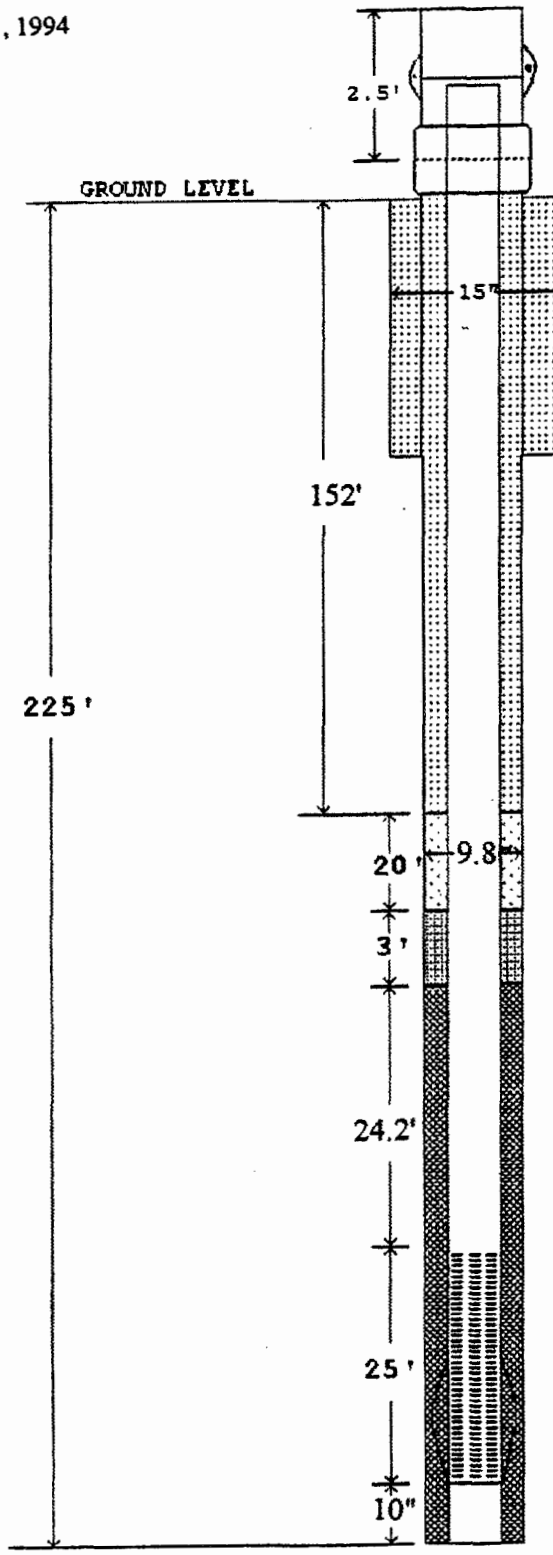
Time/ date	RUN	Depth feet	%	Geo	FRACTURE	DESCRIPTION	REMARKS
10/31	2	208.0 210.0 212.0 214.0 216.0 218.0 220.0				205.6 - 220.0 ft: competent light red-brown siltstone with very prominent, frequent, selenite bands, veins, and stringers. Prominent gray-green reduction bands and lenses. Unit has thin, wavy bedding.	Dewey Lake Formation

WQSP #6a
HOLE HISTORY

WIPP Project
WQSP #6a
Eddy County, New Mexico

October 28-31, 1994

WEST TEXAS WATER WELL SERVICE
RIG #15



2.5 FT EXTENSION WITH LOCKABLE CAP TO PROTECT WELL CASING

10.75 X 0.375 WALL SURFACE CASING CEMENTED IN A 15" HOLE

5" O.D. X 0.280 WALL BLANK FIBERGLASS CASING

CEMENT SLURRY MIX FROM 152 FT TO 1 FT
1 FT BELOW SURFACE
SLURRY IS 7 GALLONS WATER TO 1 CU FT
PORTLAND-ASTM C1510-92

BENTONITE SEAL FROM 172 TO 152 FT

SAND PACK FROM 175 TO 172 FT

8/16 BRADY GRAVEL FROM 225 TO 175 FT

25 FT OF 5" O.D. FIBERGLASS 0.020 SLOT SCREEN

CENTRALIZERS LOCATED AT BOTTOM OF SCREEN, TOP OF SCREEN, AND AT 60 FT INTERVALS TO SURFACE

10" OF BLANK 5" O.D. CASING

WEST TEXAS WATER WELL SERVICE

October 28, 1994

WQSP # 6A

6:00 AM - 6:40 AM - Carlsbad to WQSP # 3
6:40 AM - 6:50 AM - Check fluid levels
6:50 AM - 8:00 AM - Rig down on WQSP # 3
8:00 AM - 9:30 AM - Work on rig
9:30 AM - 10:10 AM - Rig up on WQSP # 6A
10:10 AM - 11:30 AM - Drill 9 7/8" hole from 25' - 130'
11:30 AM - 12:00 PM - Shut down and secure rig for weekend
12:00 AM - 2:30 PM - WQSP # 6A to Odessa

October 31, 1994

WQSP # 6A

5:40 AM - 7:35 AM - Odessa to WQSP # 6A
7:35 AM - 7:50 AM - Check fluid levels
7:50 AM - 8:00 AM - Trip pipe in hole
8:00 AM - 8:15 AM - Wait on Mary and Ray
8:15 AM - 8:40 AM - Drill 9 7/8" hole from 130' - 160'
8:40 AM - 9:00 AM - Trip pipe out of hole & prepare to core
9:00 AM - 10:15 AM - Rig up core barrel, trip in hole w/core assembly
10:15 AM - 11:10 AM - Core from 160' - 191'
11:10 AM - 11:50 AM - Pull core
11:50 AM - 12:05 PM - Pick up 2nd inner barrel
12:05 PM - 12:35 PM - Trip in hole with core barrel assembly
12:35 PM - 1:20 PM - Coring from 191' - 220'
1:20 PM - 2:00 PM - Trip out of hole and break down core barrel
2:00 PM - 2:30 PM - Pump out core
2:30 PM - 3:35 PM - Break down core barrel assembly and load on trailer
3:35 PM - 3:55 PM - Service rig and shut down for the day
3:55 PM - 4:00 PM - WQSP # 6A to Carlsbad

WEST TEXAS WATER WELL SERVICE

November 1, 1994

WQSP # 6A

5:50 AM - 6:30 AM - Carlsbad to WQSP # 6A
6:30 AM - 7:00 AM - Work on rig
7:00 AM - 8:20 AM - Wait on logging unit
8:20 AM - 9:55 AM - Run camera
9:55 AM - 10:55 AM - Run geophysical logs
10:55 AM - 12:10 PM - Trip pipe back in the hole & ream 8 1/2" to 9 7/8" hole from 160' - 225'
12:10 PM - 12:40 PM - Trip out of the hole to run casing
12:40 PM - 1:05 PM - Run trimmie line
1:05 PM - 2:00 PM - Run casing (10" x5" blank, 29.6' x5" fiberglass pipe with 25' .020 slot, 187' of 5" fiberglass blank)
2:00 PM - 2:40 PM - Start gravel packing from 225' - 175'
2:40 PM - 3:10 PM - Mix & pump bentonite seal 175' - 172'
3:10 PM - 4:00 PM - Cement through 2" trimmie line from 152' to surface
4:00 PM - 4:30 PM - Clean up grout machine, trimmie line, secure rig for the day
4:30 PM - 5:15 PM - WQSP # 6A to Carlsbad

November 2, 1994

WQSP # 6A

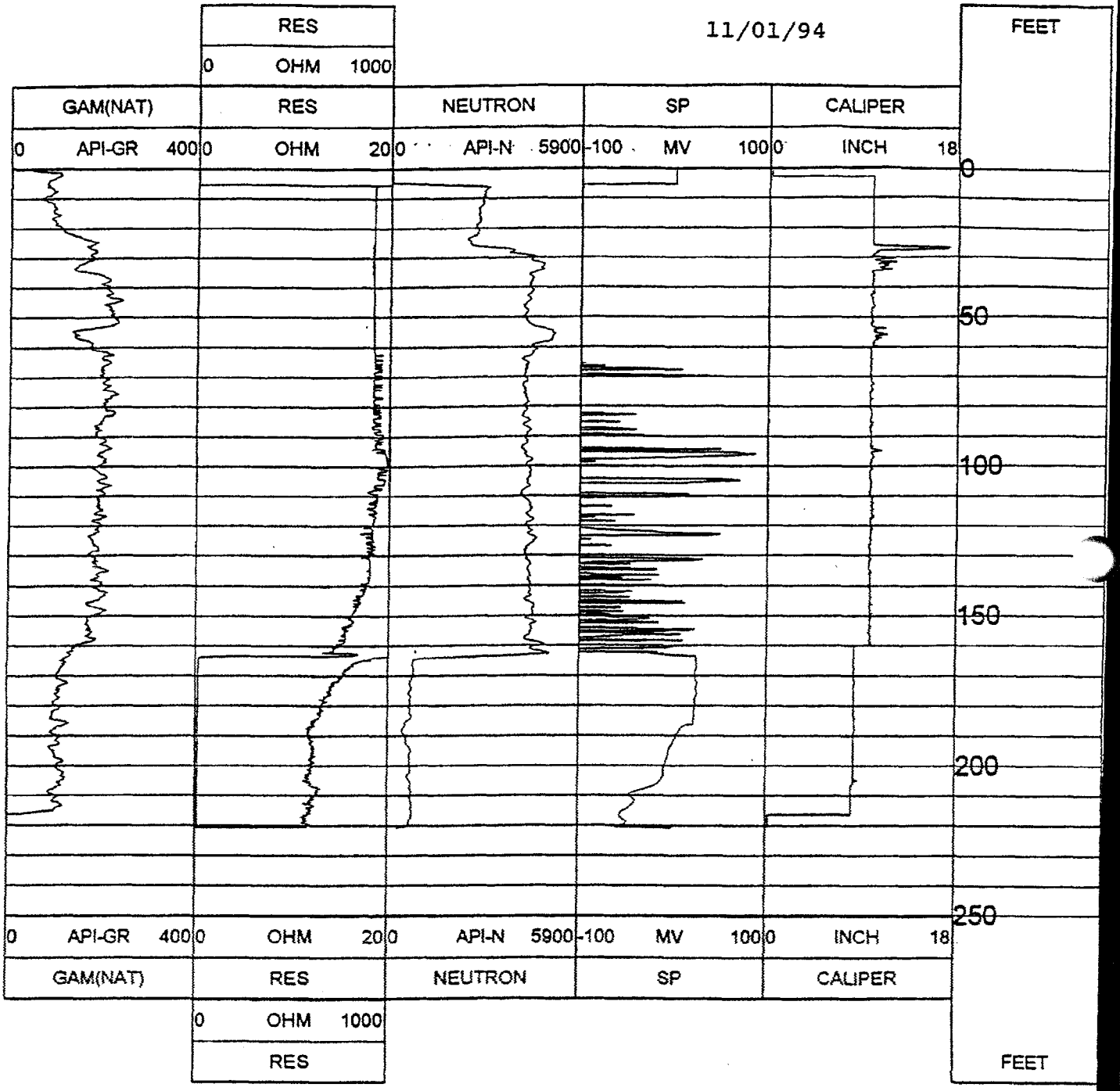
6:00 AM - 6:40 AM - Carlsbad to WQSP # 6A
6:40 AM - 11:15 Am - Rig down, pick up on location, secure load & depart for Odessa

Unit # 2

9:00 AM - 10:00 AM - Made 20 trips with bailer
10:00 AM - 10:45 AM - Run pump in well 6A to develop & test
10:45 AM - 11:15 AM - Rig up discharge and hook up to control box
11:15 AM - 12:00 PM - Wait on generator
12:10 PM - - Start pump to develop well-pumping 30 GPM
12:20 PM - - Pumping 30 GPM, clear no turbidity
12:35 PM - - Pumping 28 GPM, clear-shut off & surge 6 times
12:50 PM - - Started pumping 30 GPM, water clears up within 60 seconds
1:15 PM - - Pumping 28 GPM
1:25 PM - - Pumping 28 GPM
1:45 PM - - Pumping 28 GPM
2:15 PM - - Pumping 28 GPM

WQSP #6a
GEOPHYSICAL LOGS

Century GEOPHYSICAL CORP.



WQSP #6A
Geophysical Logs

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

NOV 1 8 2011

Mr. John Kieling, Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Comments on the September 29, 2011, Class II Permit Modification Request: "Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program Plan"

Dear Mr. Kieling:

The purpose of this letter is to provide you with comments on the Class II Permit Modification Request: "Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program Plan" submitted to the New Mexico Environment Department on September 29, 2011.

We certify under penalty of law that this document and the enclosure were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact Mrs. Susan McCauslin at 575-234-7349.

Sincerely,

George T. Basabilvazo for
Edward Ziemianski, Interim Manager
Department of Energy

M. F. Sharif, General Manager
Washington TRU Solutions LLC

Enclosures (5)

cc: w/enclosure
T. Hall, NMED * ED
CBFO M&RC
*ED denotes electronic distribution

CBFO:OESH:SEM:ANC:11-1356:UFC 5486.00

89652

Comments on the September 29, 2011, Class II Permit Modification Request

Enclosure 1

Permittees' Comments on the Class 2 PMRs, "Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program Plan" Submitted to the NMED on September 29, 2011

Update Ventilation Language

1. The Permittees wish to include a definition for a Filled Room.

   "1.5.19 Filled Room

   "Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement."

2. The Permittees seek to clarify that the language proposed in this modification establishes minimum ventilation rates for any active disposal room that is receiving CH TRU waste and any active disposal room that is adjacent to a filled room only. Ventilation rates for other rooms (active RH TRU waste disposal rooms not adjacent to a filled room) are not subject to the same minimum ventilation rates. However, such rooms are subject to the general requirements in the Permit that invoke the ventilation standards of the Mine Health and Safety Administration (MSHA). This is protective of human health because the MSHA requirements are based on the amount of air needed to accommodate the types and quantity of equipment that is operating in an area of a mine. Furthermore, RH TRU active disposal rooms are only subject to negligible quantities of hazardous emissions from containers of emplaced waste. An analysis demonstrating that these emissions are negligible was included as Supplement 3 to the 2002 RH TRU Waste Permit Modification Request.

3. The Permittees wish to include a definition for an Active Disposal Room.

   "1.5.20 Active Disposal Room

   "Active Disposal Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room."

Shielded Containers

4. In order to clarify that RH TRU waste managed in the shielded container is not subject to some of the same management conditions for RH TRU waste managed in canisters, several modifications to the text are necessary. These are in Attachment A1, Section

A1-1c(1), Page A1-9 of 80, lines 26 to 30 and Page A1-10 of 80 lines 25 to 27. The following changes are proposed as part of the shielded container modification.

RH TRU Mixed Waste

~~*The RH TRU mixed waste is handled and stored in t*~~*The RH Complex of the WHB Unit* ~~*which*~~ *comprises the following locations: RH Bay (12,552 ft² (1,166 m²)), the Cask Unloading Room (382 ft² (36 m²)), the Hot Cell (1,841 ft² (171 m²)), the Transfer Cell (1,003 ft² (93 m²)) (Figures A1-17a, b and c), and the Facility Cask Loading Room (1,625 ft² (151 m²)) (Figure A1-17d). Shielded containers are not stored in the RH Complex of the WHB. Shielded containers will be stored in the CH Bay of the WHB Unit.*

The ~~*F*~~*Following is a description of major pieces of equipment that are used to manage RH TRU mixed waste not in shielded containers in the WHB Unit. A summary of the equipment capacities, as required by 20.4.1.500 NMAC, is included in Table A1-3.*

5. A question was raised by a stakeholder regarding the overpacking of shielded containers should the container integrity be such that overpacking is necessary upon arrival at the WIPP facility. Shielded containers which require overpacking will be managed as any other CH TRU waste requiring overpacking. Overpacking of Shielded Containers is addressed in Permit Attachment A, Section A1-1d(4), Handling RH TRU Mixed Waste in Shielded Containers.

Revise the WIPP Groundwater Detection Monitoring Program Plan

6. Revised Table L-5, Page B-68, to correct table values so they match the values in the figures. Some editorial changes, such as rounding of numbers, were also made. Corrections are highlighted in yellow.

7. Editorial correction to delete the word "Suggested" from the title of Table L-6 in the Table of Contents, PMR page B-12, as it is not in the title of the associated table.

8. Editorial change to Figure L-4, *Generalized Stratigraphic Cross Section Above Bell Canyon Formation at WIPP Site*, to apply the correct color of sand and sandstone to the surficial deposits on the illustration.

9. Editorial change to Figure L-5, *Culebra Freshwater-Head Potentiometric Surface*, to add a legend item to identify the green dots on the potentiometric map as observation wells.

10. Editorial change to delete the acronym "WQSP" from the title of Figure L-6, *Detection Monitoring Well Locations*.

08665

Comments on the September 29, 2011, Class II Permit Modification Request

Enclosure 2

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 and through 16, 1994	737 (225)	15 (5)	695.63 (2124)	695.6 to 737 (2121 to 224.6)	737 (224.6)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 224.6)	699 to 722 (213 to 221)
WQSP-2 Figure L-8	September 6 and through 12, 1994	846 (257.9)	12.3 (3.7)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.4 to 834 833.7 (247 to 254)
WQSP-3 Figure L-9	October 20† and through 26, 1994	880 (268)	10 (3.1)	83380 (25 468)	833 to 879 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 and through 10, 1994;	800 (244)	9.2 (2.8)	740 (226)	740.5 to 798 (2265.7 to 243)	800 (244)	764 to 789 (233 to 241)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 791 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 and through 189, 1994;	681 (208)	6.6 7 (2)	64876 (19 6206)	648 to 676 (1968 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205.6)
WQSP-6 Figure L-12	September 26 through and October 3, 1994	616.6 617(18 7.9)	9.7 10 (3)	367 (1734 12)	367 568 to 616 617(112 173 to 188)	616.6617 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 173.7)	570 to 616.6 617(174 to 188)	582 to 607 606.9 (177 to 185)

Comments on the September 29, 2011, Class II Permit Modification Request

Enclosure 3

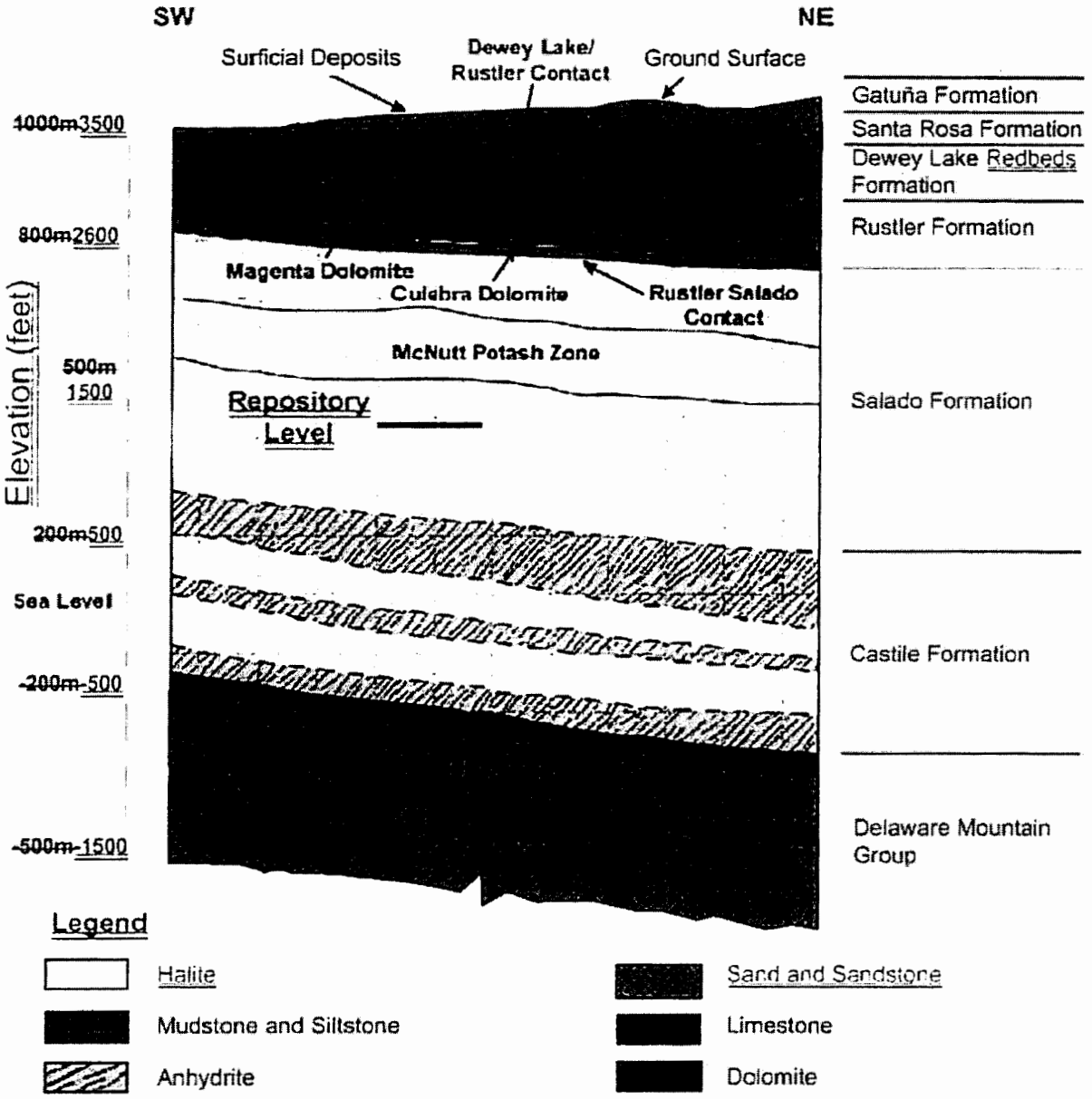


Figure I.-4

Generalized Stratigraphic Cross Section Above Bell Canyon Formation at WIPP Site

Comments on the September 29, 2011, Class II Permit Modification Request

Enclosure 4

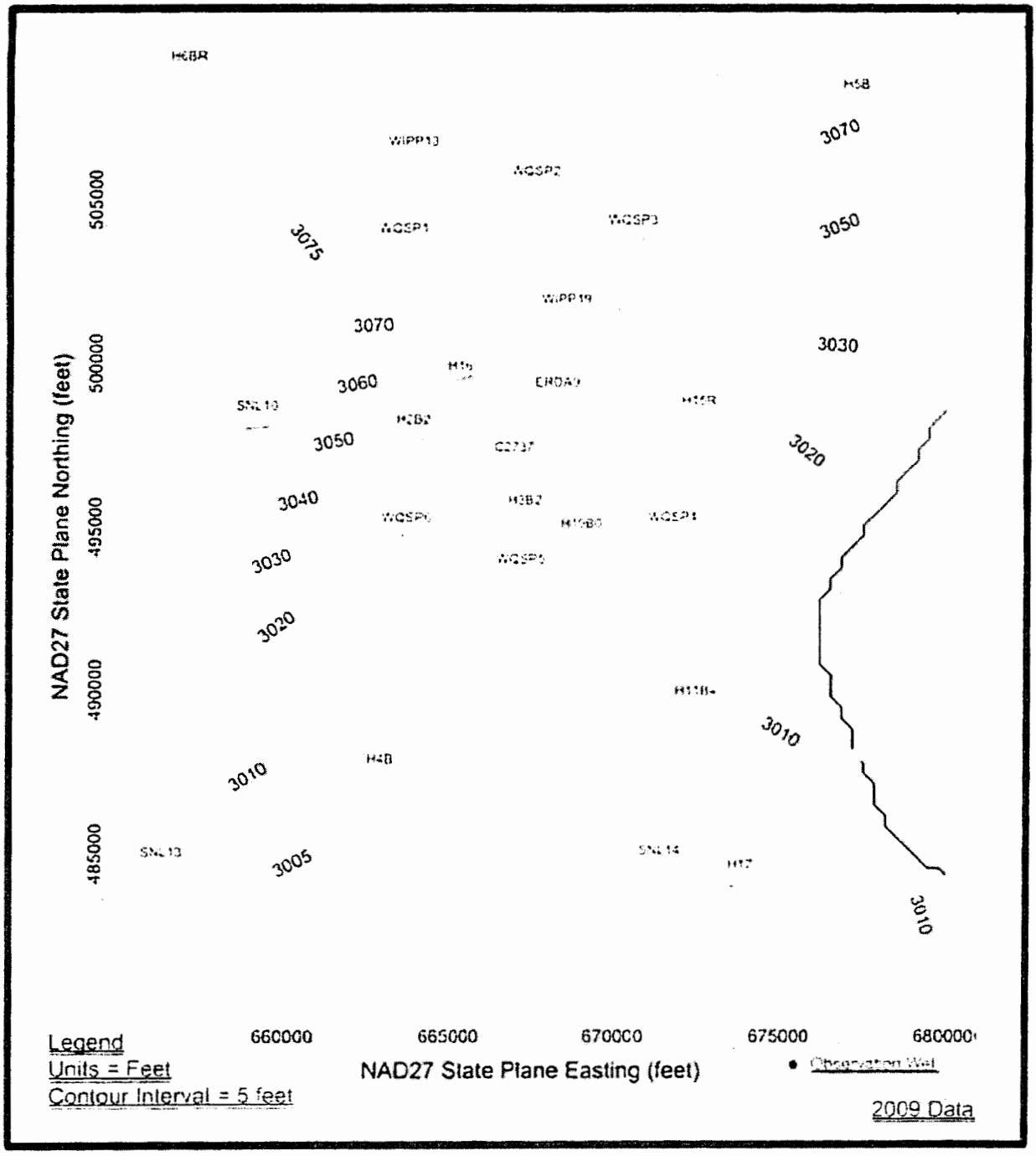
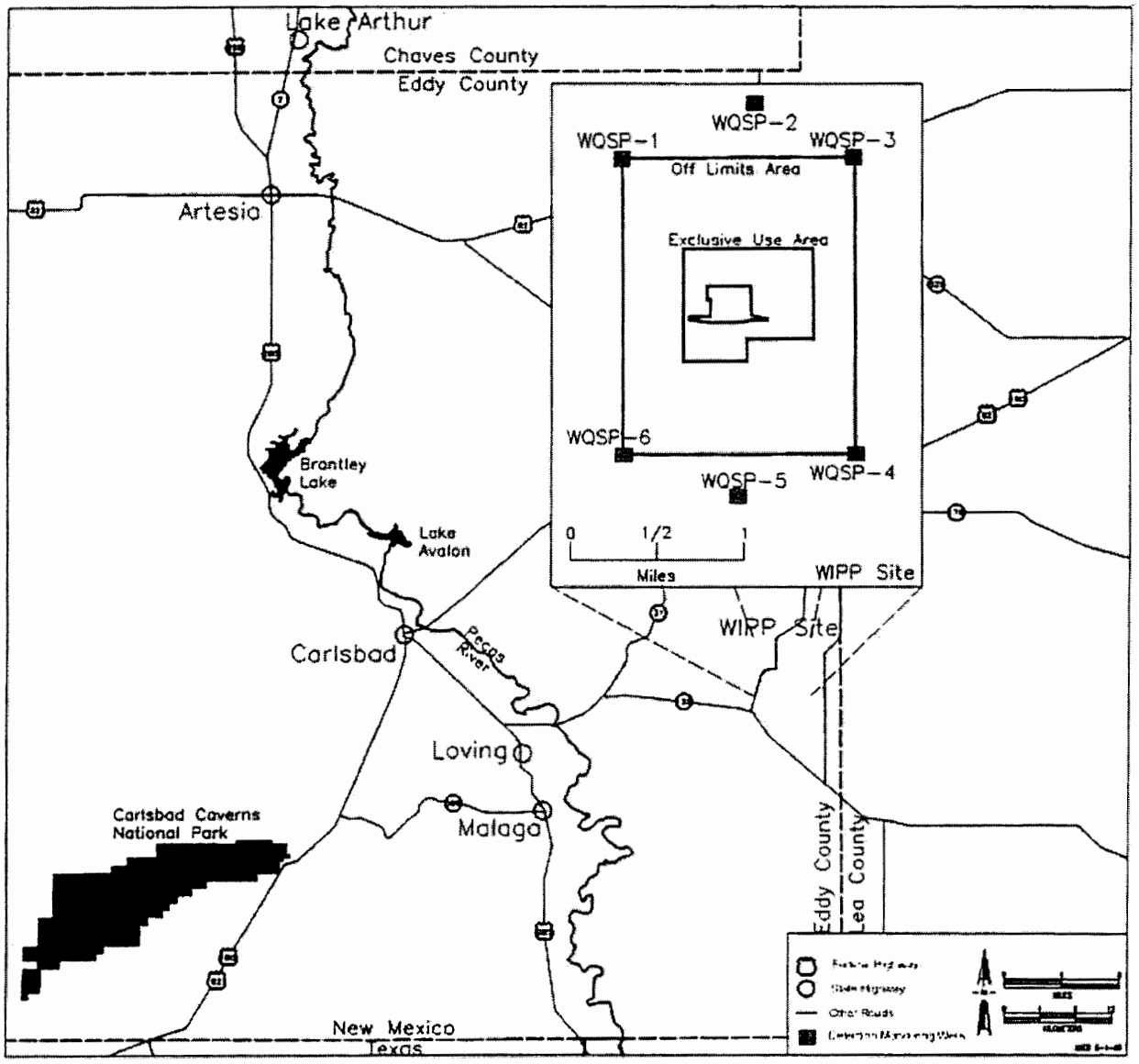


Figure L-5
Culebra Freshwater-Head Potentiometric Surface

Comments on the September 29, 2011, Class II Permit Modification Request

Enclosure 5



NOTE: Point of compliance is defined in Part 5.3.1.

Figure L-6
Detection Monitoring Well Locations

09573

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

NOV 2 1 2011

Mr. John Kieling, Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Notification of Public Notice and Fact Sheets to the Waste Isolation Pilot Plant Mailing List - Permit Number NM4890139088-TSDF

Dear Mr. Kieling:

The purpose of this letter is to provide the New Mexico Environment Department with the information identified in 20.4.1.900 New Mexico Administrative Code (NMAC) incorporating 40 CFR 270.42(b)(2) regarding the Class 2 permit modification request entitled *Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program Plan*. The information the Permittees mailed and published is included in Enclosures 1 and 2 and is summarized below:

Enclosure 1

- Public Notice for a Class 2 PMR entitled, "Public Information Meetings On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant"
- Fact Sheet for a Class 2 PMR entitled, "Department of Energy Proposes Modification to Hazardous Waste Facility Permit"

Enclosure 2 (Evidence of the mailing and publication including)

- Copy of the Public Notice from the Albuquerque Journal
- Copy of the Public Notice from the Carlsbad Current-Argus
- Copy of the receipt from Mail Service Center, indicating a mail out to the WIPP Facility Mailing List

We certify under penalty of law that this document and the enclosure were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

98574

If you have questions regarding this submittal, please contact Ms. Susan McCauslin at (575) 234-7349.

Sincerely

Edward Ziemianski, Interim Manager
Carlsbad Field Office

M.F. Sharif, General Manager
Washington TRU Solutions LLC

cc: w/enclosure
J. Davis, NMED *ED
C. Walker, Trinity Engineering ED
CBFO M&RC
*ED denotes electronic distribution

Enclosure 1

- Public Notice for a Class 2 PMR entitled, "Public Information Meetings On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant"
- Fact Sheet for a Class 2 PMR entitled, "Department of Energy Proposes Modification to Hazardous Waste Facility Permit"

PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO: U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)

WHAT: DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.

WHEN:

WHERE:

Tuesday, October 25, 2011
5 – 6 p.m.
Skeen-Whitlock Building
4021 National Parks Highway
Carlsbad, New Mexico

Thursday, October 27, 2011
2 – 4 p.m. & 6 – 8 p.m.
Courtyard by Marriott
3347 Cerrillos Road
Santa Fe, New Mexico

WHY:

On September 30, 2011, DOE submitted three Class 2 permit modification requests to the New Mexico Environment Department (NMED). The permit modification requests propose to:

1. **Revise the WIPP Groundwater Detection Monitoring Program Plan**
This modification request is being submitted in accordance with the Groundwater Permit Modification Work Plan as approved by NMED on August 5, 2011. The requested change updates the WIPP Groundwater Monitoring Plan and clarifies Permit language.

2. **Update Ventilation Language**
The proposed changes will reduce the risk to workers in the underground by allowing them to use the shortest travel path to access ventilation control points thereby minimizing the time spent in the disposal area exhaust air stream. Additionally, it proposes to change a 7-day notification to annual reporting when the Permittees fail to achieve the required ventilation rates.

3. **Add a gamma-shielded container for use at WIPP**
This request is to add an additional container to the list of approved containers for disposal at WIPP. The container will allow the Permittees to handle waste that is packaged in a gamma-shielded container.

HOW:

To obtain additional information about this permit modification request, contact Mr. Bobby St. John, WTS, at 1-800-336-9477. The permit modification is also available on the WIPP web site at http://www.wipp.energy.gov and at the WIPP Information Center, Skeen-Whitlock Building, 4021 National Parks Highway, Carlsbad, N.M. A copy of the requested permit modification also may be obtained from NMED at the address listed below.

COMMENTS:

Written comments for the record must be sent to the NMED contact person at the address below and received no later than 5 p.m. on December 5, 2011:

Mr. Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, N.M. 87505
Phone: 505-476-6049
Fax: 505-476-6060
E-mail: timothy.hall@state.nm.us

QUESTIONS:

The Permittees' compliance history during the life of the permit being modified is available from Mr. Hall at the New Mexico Environment Department.

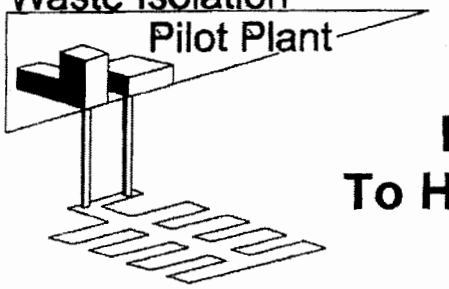
Any questions or comments to the Permitees regarding this permit modification may be sent to Mr. Bobby St. John, P.O. Box 2078, Carlsbad, N.M. 88221, no later than November 28, 2011.

WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov e-mail: communityrelations@wipp.ws toll-free: 1-866-271-9640

October 5, 2011

Waste Isolation Pilot Plant



Fact Sheet

DOE Proposes Modification To Hazardous Waste Facility Permit

Changes to the WIPP Hazardous Waste Facility Permit

Background

The U.S. Department of Energy Carlsbad Field Office (DOE) and Washington TRU Solutions LLC (WTS) submitted three Class 2 permit modification requests to the New Mexico Environment Department (NMED) to change the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit). The NMED issued the Permit (Permit Number: NM4890139088-TSDF) in November 2010.

What is Proposed?

The proposed modifications submitted to NMED on September 30, 2011, are:

1. Revise the WIPP Groundwater Detection Monitoring Program Plan
2. Update Ventilation Language
3. Addition of a Shielded Container

Revise the WIPP Groundwater Detection Monitoring Program Plan

This modification request is being submitted in accordance with the Groundwater Permit Modification Work Plan approved by NMED on August 5, 2011. The requested changes update the WIPP Groundwater Monitoring Plan and clarify Permit language.

The changes include:

- Revising specific elements of the permit to eliminate sources of confusion
- Identify wells that are used for specific types of measurements
- Clarify the need for and use of various procedures for both field and non-field work
- Remove Total Organic Halogen as a parameter for measurements
- Various editorial changes to update information
- Clarify sampling requirements
- Change frequency of groundwater sampling from semi-annual to annual
- Change frequency of reporting water level values from monthly to semi-annually
- Specify the methodology employed to generate the annual map indicating the rate and direction of groundwater flow

Update Ventilation Language

This modification increases the safety of workers when it is necessary to adjust ventilation in active disposal rooms. Adjusting ventilation allows the facility to direct air into specific areas. The ventilation adjustments ensure that adequate airflow is present where employees are conducting work. Currently, when adjusting ventilation in active disposal rooms, workers are required to travel long distances in the exhaust drift. The exhaust drift or tunnel is designated for air that has already traveled through underground openings, including over the emplaced waste containers. This modification will reduce the amount of time workers spend in the exhaust drift, by allowing them to enter the drift from an adjacent room.

Related to this, some clarification of the reporting requirement is proposed. Currently, there is a 7-day notification requirement whenever ventilation requirements are not met. The Permittees are proposing that the 7-day notification be changed such that these instances are reported annually in the Mine Ventilation Rate Monitoring Annual Report. This change will not reduce the safety or health of employees, the public or the environment.

Addition of a Shielded Container

The generator/storage sites are proposing to package a portion of the remote-handled (RH) transuranic (TRU) mixed waste inventory in gamma-shielded containers for disposal at the WIPP facility. The use of the shielded containers will enable DOE to reduce the time necessary for the packaging and management of RH TRU mixed waste. Shielded containers will be transported to the WIPP in the HalfPACT transportation package and comply with the U.S. Department of Transportation requirements for a Type 7A container. The RH TRU mixed waste that will be packaged in these containers is the same type of waste that is currently being disposed at the WIPP. This waste will continue to count against the total RH TRU waste volume allowed for disposal at the WIPP as specified in the Permit.

The gamma-shielded containers are similar to a 55-gallon drum, however they consist of approximately one-inch of lead shielding that is located between an inner and outer steel wall. A shipment will consist of a three-shielded container assembly. Once they arrive at the WIPP facility, employees will unload and process the shipment in the using existing CH-TRU mixed waste shipment equipment and procedures.

Comments

Comments for the record must be sent to Mr. Tim Hall, New Mexico Environment Department, 2905 Rodeo Park Drive, Building 1, Santa Fe, NM 87505. They also may be e-mailed: timothy.hall@state.nm.us or faxed to 505-476-6060. Only written comments

will be accepted and must be received no later than 5 p.m. (MDT) on December 5, 2011. A copy of the permit modification may be viewed or copied at the NMED offices of Mr. Hall. To be placed on the WIPP mailing list, contact Mr. Hall at the address above.

For more Information

For more information about transuranic waste shipments and procedures, call the WIPP Information Center at 1-800-336-WIPP (9477). This permit modification request is available for review in the Information Repository located on the WIPP home page at www.wipp.energy.gov. Comments to the Permittees regarding this permit modification may be sent to Mr. Bobby St. John, Washington TRU Solutions LLC, P.O. Box 2078, Carlsbad, NM 88221.

Enclosure 2

- Copy of the Public Notice from the Albuquerque Journal
- Copy of the Public Notice from the Carlsbad Current-Argus
- Copy of the receipt from Mail Service Center, indicating a mail out to the WIPP Facility Mailing List

PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO: U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)

WHAT: DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.

WHEN:

WHERE:

Tuesday, October 25, 2011	Thursday, October 27, 2011
5 – 6 p.m.	2 – 4 p.m. & 6 – 8 p.m.
Skeen-Whitlock Building	Courtyard by Marriott
4021 National Parks Highway	3347 Cerrillos Road
Carlsbad, New Mexico	Santa Fe, New Mexico

WHY:

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1. Revise the WIPP Groundwater Detection Monitoring Program Plan
This modification request is being submitted in accordance with the Groundwater Permit Modification Work Plan as approved by NMED on August 5, 2011. The requested change updates the WIPP Groundwater Monitoring Plan and clarifies Permit language.

2. Update Ventilation Language
The proposed changes will reduce the risk to workers in the underground by allowing them to use the shortest travel path to access ventilation control points thereby minimizing the time spent in the disposal area exhaust air stream. Additionally, it proposes to change a 7-day notification to annual reporting when the Permittees fail to achieve the required ventilation rates.

3. Add a gamma-shielded container for use at WIPP
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COMMENTS:

Written comments for the record must be sent to the NMED contact person at the address below and received no later than 5 p.m. on December 5, 2011:

Mr. Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, N.M. 87505
Phone: 505-476-6049
Fax: 505-476-6060
E-mail: timothy.hall@state.nm.us

QUESTIONS:

The Permittees' compliance history during the life of the permit being modified is available from Mr. Hall at the New Mexico Environment Department.

Any questions or comments to the Permittees regarding this permit modification may be sent to Mr. Bobby St. John, P.O. Box 2078, Carlsbad, N.M. 88221, no later than November 28, 2011.

WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov e-mail: communityrelations@wipp.ws toll-free: 1-866-271-9640

PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

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WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov e-mail: communityrelations@wipp.ws toll-free: 1-866-271-9640

Attn: Bobby St. John

United States Postal Service

Postage Statement—Standard Mail

Post Office: Note Mail Arrival Date & Time (Do Not Round-Stamp)

Mailer

Permit Holder's Name and Address / Email Address: MAIL SERVICE CENTER 0900
522 W. MERMOD
CARLSBAD, NM 88220

CAPS Cust. Ref. No.

CRID

Name and Address of Mailing Agent (If other than permit holder) — CRID

Telephone

Name and Address of Individual or Organization for Which Mailing is Prepared (If other than permit holder): Dept of Energy — CRID

Mailing

Post Office of Mailing: Carlsbad

Type of Postage: ☐ Permit Imprint ☐ Precanceled Stamps ☒ Metered

Processing Category: ☒ Letters ☐ Flats ☐ Parcels - Machinable ☐ Parcels - Irregular ☐ CMM ☐ NFM ☐ Catalogs

Mailer's Mailing Date: 10/05/11

Weight of a Single Piece: 0.0519 pounds

Federal Agency Cost Code

Combined Mailing: ☐ Mixed Class ☐ Single Class

Statement Seq. No.

Total # of Pieces in Mailing: 212

Of total pieces, # with simplified addresses

No. and type of Containers: ___ Sacks; ___ 1 ft. Letter Trays; 1 2 ft. Letter Trays; ___ EMM Letter Trays; ___ Flat Trays; ___ Pallets; ___ Other

Permit #

For Mail Enclosed within Another Class: ☐ Periodicals ☐ Bound Printed Matter ☐ Library Mail ☐ Media Mail ☐ Parcel Post

If Sacked, Based on: ☐ 125 pcs ☐ 15 lbs ☐ both

Total Weight: (PM)

For Automation Pieces, Enter Date of Address Matching and Coding: 10/05/2011

For Carrier Route Pieces, Enter Date of Address Matching and Coding: __/__/__

For Carrier Route Pieces, Enter Date of Carrier Route Sequencing: __/__/__

For pieces bearing a simplified address enter date of delivery statistics file or alternative method: __/__/__

Move Update Method: ☒ Ancillary Service Endorsement ☐ FASTforward ☐ NCOALink ☐ ACS ☐ Alternative Method ☐ Multiple ☐ OneCode ACS ☐ n/a Alternative Address Format

Postage

Parts Completed (Select all that apply) ☒ A ☒ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ H ☐ I ☐ J ☐ K ☐ L ☐ M ☐ S

	☐ Mailpiece is a product sample. ☐ Letter-size or flat mailpiece contains DVD/CD or other disk.	1 Subtotal Postage (Add Parts Totals)	57.64
2	Price at Which Postage Affixed (Check one) Complete if the mailing includes pieces bearing metered or precanceled stamps. ☐ Correct ☒ Lowest ☐ Neither — 212 pcs. x $ .257 Postage Affixed		54.484
3	Incentive/Fee (% or $0.00) ___ x Total Postage or Pieces as applicable ___	+/-	—
4	Incentive/Fee (% or $0.00) ___ x Total Postage or Pieces as applicable ___	+/-	—
5	Permit #	Net Postage Due (Line 1 +/- Lines 2, 3, 4)	3.16

USPS Use

Additional Postage Payment (State reason)

For postage affixed add additional payment to net postage due; for permit imprint add additional payment to total postage.

Postmaster: Report Total Postage in AIC 130 (Permit Imprint Only)

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Certification

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Signature of Mailer or Agent: [signature]

Printed Name of Mailer or Agent Signing Form: Eugene Santo

Telephone: 887-0900

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Was Verification Performed? (If required) ☐ Yes ☐ No

I CERTIFY that this mailing has been inspected for: (check items if required) (1) eligibility for postage prices claimed; (2) proper preparation (and presort where required); (3) proper completion of postage statement; (4) payment of annual fee; and (5) sufficient funds on deposit (if required).

USPS Employee's Signature

Are postage figures at left adjusted from mailer's entries? If yes, reason: ☐ Yes ☐ No

Date Mailer Notified — Contact — By (Initials) — Time AM PM

Print USPS Employee's Name

Round Stamp (Required) Payment Date

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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Thank you for fully considering and responding to my comments.

name Barbara Rose

address 3 Montoya Ct

Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

79686

X

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Thora M Dunn

address 1508 Roma NE

Albuquerque, N.M 87106

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THORA GUINN
1508 Roma Ave. NE
Albuquerque, NM 87106-4513

ALBUQUERQUE NM 870

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Sue Rowansky

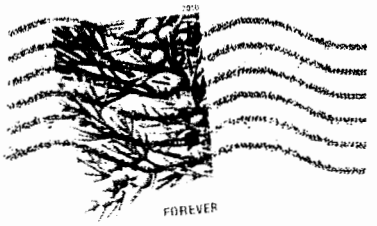
address 212 Tohatchi Trail NW

Albq NM 87104

77689

Sue Roujansky
212 Tohatchi Trl. N.W.
Albuquerque, NM 87104

ALBUQUERQUE NM 871
28 NOV 2011 PM 4 L



Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

NOV 2011

RE: *WIPP Permit Modification Request - Addition of a Shielded Containe*

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Thank you for fully considering and responding to my comments.

name DON SCHRADER & CHUCK HOSKING

address 1806 Walter S.E.
Albuquerque, N.M. 87102

06691

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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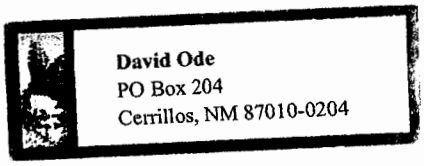
name David Z. Ook

address P.O. Box 204

Cerrillos, N.M. 87010



Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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X

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Rosamund Evans

address 1417 Adams N.E.
Albuquerque, NM 87110

: 87505

44c
Stamp

Rosamund M. Evans
1417 Adam NE
Albuquerque, NM 87110

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

X

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New Mexico Environment Department
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Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name [illegible]

address [illegible]

Albuquerque, NM 87105

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

X

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Alex Theodoron

address ALEX THEODORON
140 CHAMA ST NE
ALBUQUERQUE, NM
87108

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

NOV 2006

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Janet Greenwald

address 215 Hartline SW

Alb. NM 87105

: 20701

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87702

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Susan Shotlander Rodriguez

address 7224 Carson TRL NE

ALBUQUERQUE, NM 87120

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

087814

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name John Scrocco

address 541 Cedar St SE #3

Albuquerque, N.M. 87106

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Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Bridget Finney

address 1116 Turner Dr SE Abq NM

87102

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

: 66706

X

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Anne Adler Frais

address 1227 Columbia NE

Albuquerque, NM 87106

Fonces

1229 Columbia NE

Albuquerque, N.M. 87106

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87710

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New Mexico Environment Department
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Thank you for fully considering and responding to my comments.

name Judith Kidal Judith Kidal

address 519 Colfax Rd NE

ABQ - NM 8710 2

Please consider my concerns. Let's keep New Mexico safe!

30711

Kidd
519 Odelia Rd NE
ABQ - NM 87102

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

11/28
87112

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

Having worked at Los Alamos, I've learned NOT to trust ANY Nuke!

name Al Shipolia

address P.O. Box 134 H

Hernandez, N. Mex. 87537

111131

Al Shapolia
P.O. Box 134
Hernandez, NM 87537-0134

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

0971U

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Elizabeth Neeley

address 5520 Camino Vista, NW

Albuquerque, NM 87120-1905

715

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

Floy Barrett

name Floy Barrett

address 316 Washington N.E.

Albuquerque, N.M. 87108

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

93718

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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Ella Fenoglio

name Ella Joan Fenoglio

address 1427 Avenida del Sol NE
Albuquerque, NM 87110-6178

L 9719

Ella Fenoglio
4427 Avenida Del Sol NE
Albuquerque, NM 87110

ALBUQUERQUE NM 871

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87505+6313

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Contain*

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Thank you for fully considering and responding to my comments.

name Martin and Virginia Ramirez

address 2715 Floral Rd. N.W. #

ABQ. New Mexico 87104

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

TU722

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Madeline Aron

address 1006 Richmond DR

Albq. NM 87106

M Horan

1006 Richmond NE

Albq. NM 87106

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Cynthia Hall

address 317 Hummingbird Dr. NE

Cedar NM 87108

I am a NUCLEAR CONTRACTOR, as well

1725

[redacted]

317 Vermont St NE

ABQ, NM 87108

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

875058631 3 0069

726

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Camille Tashel

address 6 Gavilan Place

Santa Fe NM 87508

111130

Ms. Carole Tashel
6 Gavilan Pl.
Santa Fe, NM 87508

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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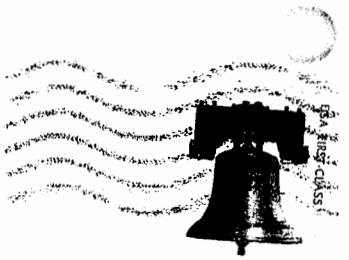
name _____

address_____

_____



44c
Stamp

Joan Zucker
3516 Campbell Ct. NW
Albuquerque, NM 87104

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

875054313

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Jennifer Beamer

address 237 Aliso Dr NE

Albuquerque, NM 87108

Jerilyn Bowen
237 Aliso Dr NE
Albuquerque, NM 87108-1002

ALBUQUERQUE NM 871
PM
28 NOV

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

11/28

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
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name [illegible]

address [illegible]

[illegible]

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

11/28

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name Jeffrey Rich

address Jeffrey Rich
1105 Los Tomases Dr NW
Albuquerque, NM 87102-1260
Animal Humane NEW MEXICO

090735

Jeffrey Rich
1105 Los Tomases Dr NW
Albuquerque, NM 87102-1260

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Animal Humane

Jeffrey Rich
1105 Los Tomases Dr NW
Albuquerque, NM 87102-1260

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Merrill Hough

address 554 Camino de la Tierra

Corrales NM 87048

96738

44c
Stamp

Ardelle Hough
554 Camino De La Tierra
Corrales, NM 87048-8558

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

0X739

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Joan Robins

addr **Ms. Joan E. Robins**
3565 Rio Grande Blvd NW
Albuquerque, NM 87107-3086

08748

of You

Ms. Joan E. Robins
3565 Rio Grande Blvd NW
Albuquerque, NM 87107-3086

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Thinking

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name DALE MONTAGUE

address 8916 6TH ST NW

ABQ NM 87114

08742

DAVE MONTAGUE

2916 6TH ST NW

ALBUQUERQUE NM 87114

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

00743

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name _____

address _____

Z Charlie Zdravesky
2109 Gun Club Road S.W.
Albequerque, NM 87105-6412

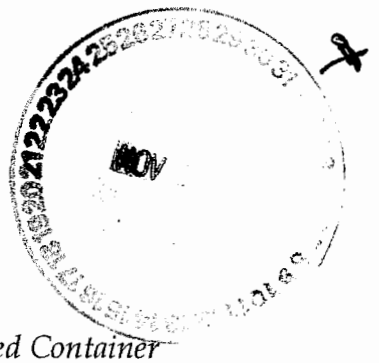
_____

: 09744

AMERICAN LUNG ASSOCIATION
SEASON'S GREETINGS 1999

INDIANAPOLIS 500

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505



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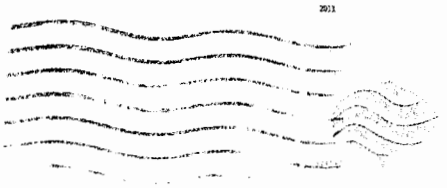
name Carol W Burton

address 1744 Vaqueros Pl NE

Albuquerque, NM 87106

60745



44c
Stamp

Carol Benson
Music & Instruction
1749 Miracerros Pl NE
Albuquerque NM 87106-1007

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87505$$5313 0069

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Lilly K. Roulet

address 11005 Morris Court NE

Albuquerque, N.M. 87112

: 88746

Mrs. Lilly K. Rendt
11005 Morris Ct NE
Albuquerque, NM 87112-4374

Forever

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Mrs. Lilly R... 11/28

ENTERED

Office of Peace, Justice & Creation Stewardship
Under the auspices of Catholic Charities of Gallup Diocese
P. O. Box 3146
Gallup, New Mexico 87305
Tel (505) 722-5272

December 1, 2011

Mr. Tim Hall, Environmental Sci & Specialist
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

DEC 2011

Dear Mr. Hall,

This letter is written on behalf of people of faith in Gallup Diocese, including McKinley and Cibola Counties, who are deeply concerned over news that the Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (TRU plutonium-contaminated) waste to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM.

Our concerns stem from the following serious issues:

- The amount of RH waste shipped to WIPP and disposed there would substantially increase. This would substantially increase risks of life-threatening radioactive exposure to populations from accidents on railways and public highways.
- Contrary to what DOE says, shielded containers cannot be handled in the same manner as Contact-handled (CH) TRU waste. Shielded containers that are damaged or leaking cannot be over-packed as CH waste has been. Moreover, the shielded containers request is not a proper class 2 permit modification.
- The amount of RH waste allowed in the Waste Handling Building would greatly increase. Because of DOE shipping and disposal practices over the past 12 years, the amount of underground space for RH waste at WIPP has been substantially reduced. DOE has not provided information about how much RH waste it has to bring to WIPP, when the waste would be ready to be shipped, whether more than the remaining capacity is needed, among other issues.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.

Given the dangers of RH waste, the need for much more information, and the complexity of the changes proposed, we request a public hearing on shielded containers, and that the containers be regarded as a class 3 modification. To safeguard human health and the environment, it is crucial that public hearings be held to insure more extensive public comment on these critical issues.

Thank you for your consideration of these serious issues impacting the future of all New Mexicans and beyond.

Sincerely,

Rose Marie Cecchini, MM

Rose Marie Cecchini, MM
Coordinator

111204

89759

ENTERED

Hall, Timothy, NMENV

From: Andrew Gold [rosemount@newmexico.com]
ent: Sunday, December 04, 2011 11:17 PM
To: Hall, Timothy, NMENV
Subject: <no subject>

Dear Mr. Hall,
I am very concerned that shielded containers at WIPP allow more remote-handled waste that is dangerous to transport, store, and dispose.
I request at public hearing on shielded containers, which should be a class 3 modification to allow additional public comment and hearing.
Thank you for your consideration.
Sincerely,
Andrew Gold ; Santa Fe,NM

111205

89751

Hall, Timothy, NMENV

From: marigayl@netzero.com
Sent: Sunday, December 04, 2011 9:26 PM
To: Hall, Timothy, NMENV
Cc: ccns@nuclearactive.org
Subject: Opposing remote-handled waste to WIPP

Tim Hall
NM Environment Department - Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, NM 87505

Dear Mr. Hall:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could not be overpacked.

The shielded containers request is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,
Marilyn Hoff
PO Box 295
El Prado, NM 87529

60-Year-Old Mom Looks 27
Mom Reveals Free Wrinkle Trick That Has Angered Doctors!
ConsumerLifestyles.org

: 98752

Hall, Timothy, NMENV

From: Jeanne Green [innerlight52@hotmail.com]
Sent: Sunday, December 04, 2011 7:51 PM
To: Hall, Timothy, NMENV
Subject: WIPP and sheilded containers

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could not be over-packed.

The shielded containers request is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Jeanne Green
11B Los Padillas Rd
El Prado, NM 87529

0753

Hall, Timothy, NMENV

From: Bonnie Korman [bkorman@newmex.com]
Sent: Sunday, December 04, 2011 7:25 PM
To: Hall, Timothy, NMENV; Kieling, John, NMENV
Subject: Re: RH waste at WIPP & use of shielded lead containers to ship and dispose

Mr. Hall and Mr. Kieling,

We are very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could not be overpacked.

The shielded containers request is not a proper class 2 permit modification. We request a public hearing, and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing. We have attended greater- than Class C waste hearings as well as CMRR- NF hearings for LANL and find they are vital for public information and the protection of citizens' rights.

Respectfully,
Bonnie Korman and Robert Bishop
Taos

: 09754

Hall, Timothy, NMENV

From: Donna Detweiler [ddetw_55@yahoo.com]
Sent: Sunday, December 04, 2011 4:05 PM
To: Hall, Timothy, NMENV
Subject: WIPP waste

Dear Mr Hall:
I hear that you are considering allowing shielded containers of "hot" remote-handled waste at WIPP. As tempting as i'm sure it must be to throw this anti-life scourge in a repository that is currently open and on a route currently traveled by other such poison, I do not want it crossing my path in this fair city of Albuquerque. At the very least i would like to see a public hearing on shielded containers, a class 3 modification. Though i'm sure it's beyond the scope of your official job description, i would like the NM Environment Dept to outlaw production in this state of materials for which we have no constructive use and which endanger the health of current and future generations. Please add that to your mandate!
Thanks for your time & care for these matters.
Donna Detweiler
Albuquerque NM

00755

Hall, Timothy, NMENV

From: mcculloch56@gmail.com on behalf of Robyn McCulloch [mydog@jps.net]
Sent: Sunday, December 04, 2011 3:38 PM
To: Hall, Timothy, NMENV
Subject: Shielded containers at WIPP

Dear People
I am very concerned that shielded containers at WIPP allow more remote-handled waste that is dangerous to transport, store, and dispose. I request at public hearing on shielded containers, which should be a class 3 modification to allow additional public comment and hearing. Thank you for considering all the ramifications.
Regards,
Robyn

--

Robyn McCulloch
Email: mydog@jps.net
Home/office: 575.758.3355
Cell: 575.770.4566
Fax: 309.413.0185

Mailing address:
P.O. Box 2556
Taos, NM 87571 USA

Shipping address:
304 Santistevan Lane,
Taos, NM 87571 USA
ground delivery ONLY

: 00756

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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The amount of RH waste in the Waste Handling Building would dramatically increase because substantial amounts of RH waste would be in the contact-handled waste portion of the building, where they currently are prohibited.

DOE also plans to use shielded containers for hotter commercial waste (Greater-Than-Class C waste), expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.

The shielded containers request is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

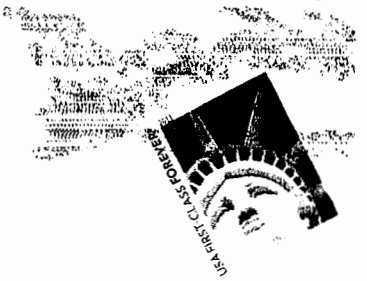
Thank you for fully considering and responding to my comments.

name Jesse D. Servis

address 93 monica RD
Los Lunas New Mexico
87031

• Unwin
• Schutz
• Toglie
• Unwir

[redacted]



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93 monica RD

Los Lunas NM
87031

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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Protective Wrap
Bitte Strato Protective
esto Protective Wrap

87505+6313

9758

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

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Thank you for fully considering and responding to my comments.

Margaret A. Spilker

name Margaret A. Spilker

address 5204 Mountain Rd NE

Albuquerque, NM 87110

759

ENTERED

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

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Thank you for fully considering and responding to my comments.

Diane Plummer, LISW

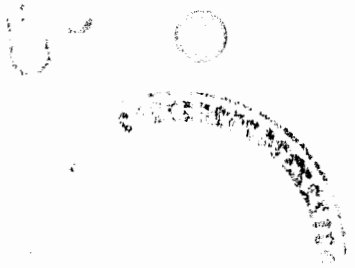
name Diane Plummer

address 432 Aliso Dr, NE

Albuquerque, NM 87108 (505 255 6430

111201

P.S. I am very concerned due to the geologic nature of the WIPP site, the faults there, and the possibilities that ground water could become contaminated by nuclear waste.



Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

36761

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Cont*

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Thank you for fully considering and responding to my comments.

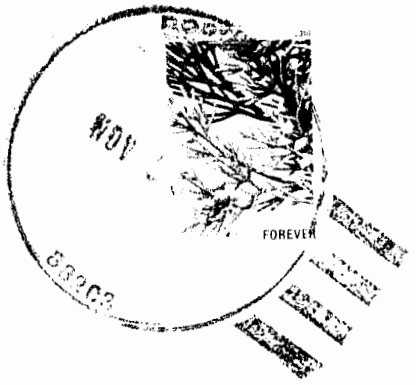
People of Carlsbad were "PROMISED" that NO HIGH Level Nuclear waste would come to WIPP!! By everyone from Pete Dominici to Louis Whitlock

name Betty Richards

address 1010 Center Ave #12

Carlsbad, NM 88220

96762



Ms. Betty Richards
Trlr. 12
1010 Center Ave.
Carlsbad, NM 88220-6171

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

8750836313 0069

763

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

11-29-11

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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Thank you for fully considering and responding to my comments.

(AMY V. BUNTING)

name Amy V. Bunting

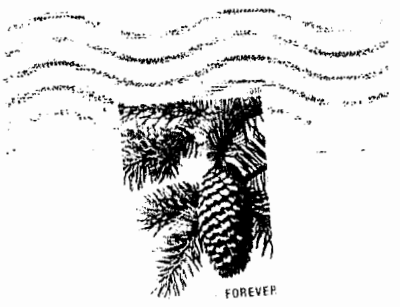
address 331 CAMINO CHICO

SANTA FE, NM 87505

P.S. This is a Form letter but it expresses my Feelings. I am 74 and was an original WIPP protester in the 1980s. We lost our fight but at least we can demand it not be made worse!

: 70764

Amy V. Bunting
Casa Ballena Del Sol
331 Camino Chico
Santa Fe, NM 87505



Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

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Thank you for fully considering and responding to my comments.

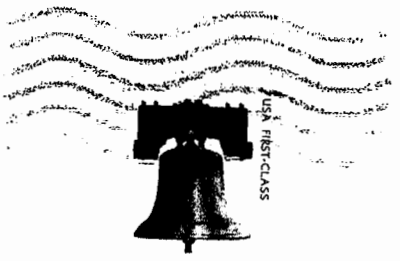
Judy Kaul

name JUDY KAUL

address 524 SYCAMORE ST. SE

ALBQ NM 87106

Ms. Judy Kaul
524 Sycamore St. SE
Albuquerque, NM 87106



Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87505+6313

0767

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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Thank you for fully considering and responding to my comments.

name E. M. Murphy and Family

address 1209 Arvilla Ave. N.W.
and 1233 Columbia NE
Albuq. N.M. 87107 and 87106

24768

FROM:
MURPHY

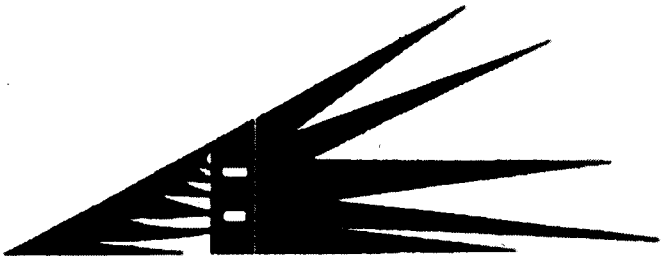
1233 COLUMBIA NE

ALBUQ. NM 87106

TO:

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

20789



SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87196 505-262-1862 FAX: 505-262-1864 www.sric.org

December 5, 2011

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive, Building 1
Santa Fe, NM 87505

RE: WIPP Class 2 Permit Modifications – Ventilation and Ground Water Monitoring

Dear Tim,

Southwest Research and Information Center (SRIC) provides the following comments on two Class 2 permit modification requests that were submitted by the permittees on September 30, 2011, according to their public notice. SRIC is commenting separately on the third request regarding shielded containers.

SRIC appreciates that the permittees provided drafts of the three proposed requests and that representatives of the permittees as well as NMED met with SRIC and other citizen group representatives on August 30, 2011. SRIC continues to believe that such pre-submittal meetings are useful and supports continuing that "standard" practice in the future. SRIC also notes that there were some changes made in the modification requests after the pre-submittal meeting.

Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR 270.42(b)(7)) and its historic practices, NMED may modify the class 2 modification requests. SRIC believes that some changes are necessary regarding both requests.

Update Ventilation Language

As an initial matter, SRIC notes that on October 7 NMED approved the permitees' September 29, 2011 request for a temporary authorization to allow entrance into a room actively managing remote-handled (RH) waste when ventilation is less than 35,000 scfm. SRIC also is aware of additional comments submitted on November 18 by the permittees that suggested changes to the request.

SRIC's primary concern is that adequate ventilation always be maintained in the Underground Hazardous Waste Disposal Units (HWDUs). The concern is reinforced by the measured levels

of volatile organic compounds (VOCs) in the Underground HWDUs during the past three years, which have exposed workers to higher levels of carbon tetrachloride than were contemplated when the permit was issued in 1999. SRIC's concerns about the request and the Temporary Authorization are that they could allow instances in which adequate ventilation is not maintained and that any such instances would not be reported to NMED. SRIC also believes that changes in permit language need to be carefully crafted so as not to be confusing or inconsistent with other provisions of the Permit. Further, based on the discussion at the pre-submittal meeting on August 30, 2011 and the information in the request, SRIC believes that there are few situations in which the existing permit language is not appropriate. Thus, any modifications to the Permit regarding ventilation should be minimal and necessary and not result in workers being allowed to emplace CH or RH waste in rooms when ventilation is less than 35,000 scfm.

Regarding the proposed new definition is Part 1.5.19 Filled Room, SRIC agrees with the language of the November 18 comments, not the proposed language in the request. The language in the comment is consistent with that of Part 1.5.16 Filled Panel. Thus, the Permit would state:

> 1.5.19. Filled Room
> "Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.

In the November 18 comments, the permittees also propose a new Part 1.5.20 Active Disposal Room that was not included in the request. SRIC believes that the practice of significantly revising a request with new language is undesireable for at least two reasons. First, it indicates that the request was not complete and accurate, which it must be. An incomplete request is grounds for denial by NMED, pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR 270.42(b)(7)(i)). Second, the permittees' comments on requests are not widely disseminated by the permittees, so they are not available to the general public that could comment on the request. In this particular instance, SRIC asked for and received the permittees' comments from NMED, so we can comment on the proposed change. SRIC also recognizes that if public comment or other factors result in the permittees recognizing the need to revise the request, the permittees may comment on their own request. In the future, SRIC requests that the permittees post their comments on modification requests in the Information Repository on the WIPP Home Page http://www.wipp.energy.gov. Such public dissemination would allow interested persons to be aware of such comments.

SRIC does not agree with all of the language of proposed Part 1.5.20 Active Disposal Room. Specifically, the word "Disposal" is unnecessary and not consistent with other language in the Permit. For example, Permit Part 4.4.1. Room-Based Limits specifies that an "open room" is "active." The request proposes new language in Part 4.5.3.2. Ventilation with the language of "active room," which the permittees do not propose to change in their comments. Thus, the comment and the request are inconsistent. Moreover, SRIC is not convinced that a further definition of "active room" is necessary and urges that NMED not include such a new provision. If NMED decides to incorporate a new definition, SRIC would support:

> 1.5.20. Active Room
> "Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.

: 98771

Regarding the specific proposed change to Part 4.5.3.2 in the request, SRIC could support the following language:

> 4.5.3.2. Ventilation
> The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft3/min and a minimum ~~active room~~ ventilation rate of 35,000 standard ft3/min when workers are present in ~~the~~ an active room adjacent to a filled room or in Room 7 of any panel, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.601(c)).

Revise WIPP Groundwater Detection Monitoring Program Plan

SRIC recognizes that the Groundwater Detection Monitoring Program Plan must be revised to address concerns about the program and that NMED approved the Groundwater Permit Modification Work Plan on August 5, 2011.

SRIC requests that the typographical error in the caption of Figure L-2 be corrected, as follows:

> Figure L-2 – WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary

Table 1 on page 16 of the request correctly states that the Land Withdrawal Area (LWA) is 16 square miles. The List of Figures on page B-12 has the correct title. Section L-1 of the request, page B-16, correctly states that the LWA is 16 square miles. Existing Permit Figure L-2 caption is 16-square-miles, so the proposed caption in the request is clearly an erroneous typographical error that NMED should correct.

Concerned Citizens for Nuclear Safety joins in these comments.

Thank you very much for your careful consideration of, and your response to, these and all other comments.

Sincerely,

Don Hancock

cc: John Kieling

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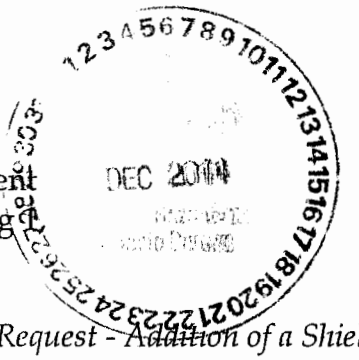

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Co*

Dear Tim Hall:

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Thank you for fully considering and responding to my comments.

name Penelope Mc Mullen, SL

address 113 Cam. Santiago

Santa Fe NM 87501

111208

7773

·e McMullen
› Santiago
M 87501

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

ENTERED

DEC 2014

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

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Thank you for fully considering and responding to my comments.

name Grace Sena

address 313 Hale Ave.

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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The shielded containers request is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Thank you for fully considering and responding to my comments.

name Charlie Sena

address_____

_____

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

02778

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name Crystal Sanchez

address 210 Rencher Ave. SE

Albuq. N.M. 87105

44c
Stamp

Tim Hall
New Mexico Environment Department
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Santa Fe, NM 87505

06780

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name G Via Jane Quintana

address 210 Renaker Ave,

Alb. N.M. 87105

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

93782

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name RYAN VIERE

address 144 HARVARD 87106

TX

44c
Stamp

Tim Hall
New Mexico Environment Department
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Santa Fe, NM 87505

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name David B. McCoy Citizen Action NM

address PO Box 4276

Albuquerque, NM 87196

44c
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New Mexico Environment Department
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Thank you for fully considering and responding to my comments.

name W. ROBINSON

address PO Box 4524

ABQ, NM 87196

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

38799

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L. Weinstock

name Lesley Weinstock

address 1712 Richmond Dr. NE

ABQ, NM 87106

C7751

44c
Stamp

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name Pat Salazar

address [illegible]

C0793

44c
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name Barbara Brandon, Paul Brandon, Cristina Bran

address 1125 Quincy St SE

Albuquerque, N.M 87108

Ms Barbara Brandon
1125 Quincy St SE
Albuquerque, NM 87108
FARMSANCTUARY.ORG

Tim Hall
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name Colette Lee Colette Lee

address 103 Camino Cabo

Santa Fe, NM 87508

44c
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name Werner L. Muller

address P.O. Box 2886

Las Vegas, NM 87701

WERNER AND HELEN MULLER
P.O. BOX 2886
LAS VEGAS, NM 87701

799

12/05 50/21

WERNER AND HELEN MULLER
P.O. BOX 2886
LAS VEGAS, NM 87701

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Stamp

Werner + Helen Muller
P.O Box 2886
Las Vegas, NM 87701

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name Ellen Cleveland

address 2000 Silver SE

Albuquerque, NM 87106

12/05 50/21

Ms. Ellen Cline
2000 Silver Ave SE
Albuquerque, NM 87106

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

36877

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name Bill Felsher

address 9215 Osuna Pl NE

ABQ NM 87111

C0703

F

Ms. Afsaneh Felsher
9215 Osuna Pl. NE
Albuquerque, NM 87111

44c
Stamp

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2905 Rodeo Park Drive East, Building 1,
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804

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name Jean McCrimmon

address 1816 Via Court SW

Albuquerque, NM 87105

44c
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name Lisa Gordon-Romero
LISA GORDON-ROMERO

address POB 3135

TAOS NM 87571

3807

44c
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name Kay Giles

address 1321 Jeanette SW

Albuquerque, NM 87105

Ms. Kay M. Giles
1321 Jeanette Ave SW
Albuquerque NM 87105-2949

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
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name Bernard Cullen (BERNARD F. CULLEN

address POB 519

EDGEWOOD, NM 87015

showbiz@lobo.net

1811

$0.44 0
US POSTAGE
FIRST-CLASS
062S0005020317
87015

C94794.24

RETURN ADDRESS:

ALLEN & MCNEILLY

POB 519

EDGEWOOD, NM 87015

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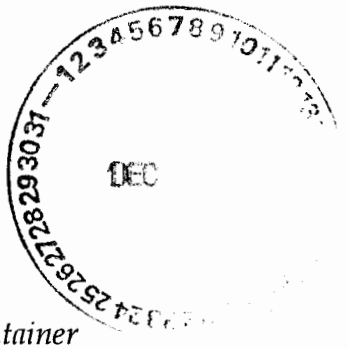
Stamp

TO:

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

01812

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505



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Thank you for fully considering and responding to my comments.

L Wainstock

name Lesley Wainstock

address 1712 Richmond Dr

ABQ, NM 87106

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

: 92814

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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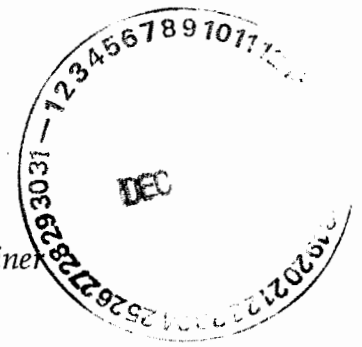
name Hildegard Adams

address 7720 Oakland Ave NE
Albq NM 87122

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505



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name Joseph Werlen

address 610 Ridge Place NE

ALB NM 87106

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

0818

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Myst. Goddard

address 411 Bethell Ave SE

Alb NM 87102

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

28823

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Jenny Beyss

address 1526 Hoopes Rd. SW

ABQ, NM 87105

02021

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

90322

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Sharon J. Miles
Sharon J. Miles
address 2700 Vista Grande NW #10
ABQ, NM 87120

71823

Senior Care Options
2700 Vista Grande NW Suite 10
Albuquerque, NM 87120

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Stephanie S. Kadrie

address 520 Foyil Dr. SW

ABQ, NM 87121-8891

CL875

Kadrie
520 Foyt Dr SW
Albuquerque, NM 87121

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
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Enrique &
name Carlota Lamadrid

address 301 Placitas Rd NW
Albq. NM 87107
&

Carlota & Enrique Lamadrid
301 Placitas Rd NW
ABQ, NM 87107

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

875068$6313

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Dominique Mazeaud

name Dominique Mazeaud

address 1352 Bishops Lodge Rd

Santa Fe, NM 87506

Ms. Dominique Mazeaud
1352 Bishops Lodge Rd
Santa Fe, NM 87506

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Enrique & Carlota Lamadrid

address 301 Placitas Rd NW
Albuq. NM 87107

831

Carlota & Enrique Lamadrid
301 Placitas Rd NW
ABQ, NM 87107

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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) Environment Department
Park Drive East, Building 1,
M 87505

IPP Permit Modification Request - Addition of a Shielded Container

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ır fully considering and responding to my comments.

Louise Arthur
1112 Baldwin Ave NE
Bug., NM 87112

Ms Denise Arthur
11112 Baldwin Ave NE
Albuquerque, NM 87112-3132

Tim Hall
New Mexico Environment D
2905 Rodeo Park Drive East,
Santa Fe, NM 87505

2834

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Randy Diner

address

Randy Diner
632 Turner Dr NE
Albuquerque, NM 87123

Randy Diner
632 Turner Dr NE
Albuquerque, NM 87123-2279

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

12/07

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name _____

address_____

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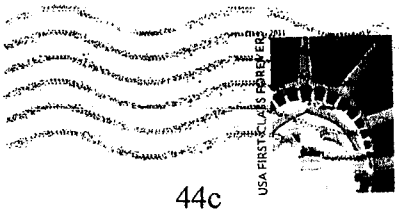

44c
Stamp

Concha Inez Villegas

1214 Missouri Ave

El Paso TX 79902

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87505$6813

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Olivia Hershey Spitzmiller

address PO Box 186

Egypt TX 77436

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Rodney D Hall

address 11 Via Si, Galisteo NM 87540

Rodney W. Hall

You must stop this modification. it is the wrong way to handle this wast. It should be incased in glass until it can be decontaminated,

Rodney Hall
11 Via Si
Galisteo, NM
87540

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

03347

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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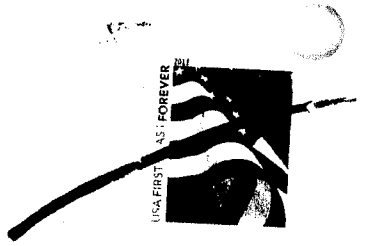
name Jim Brown

address 121 Arizona Sunset Rd NE

Rio Rancho, NM 87174



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Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Katie Stone (Katie Stone)

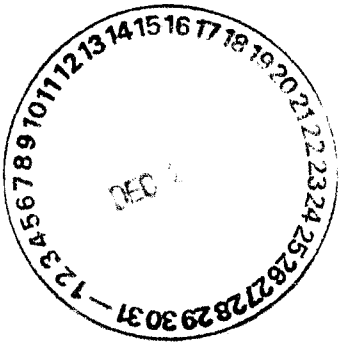
address 2425 Teodoro NW

Albuquerque NM 87107

Mr. & Mrs. Andrew Stone
2425 Teodoro Rd NW
Albuquerque NM 87107-3064

Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505



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New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
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DOE also plans to use shielded containers for hotter commercial waste (Greater-Than-Class C waste), expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.

The shielded containers request is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

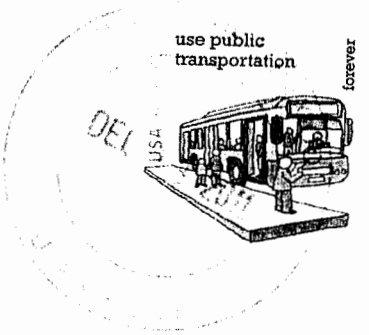
Thank you for fully considering and responding to my comments.

name KENT P. GORMLEY

address P.O. Box 295

Tijeras, NM 87059

CNT



Kent P. Gormley
P.O. Box 295
~~Tijeras, NM.~~
87059

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

RE: *WIPP Permit Modification Request - Addition of a Shielded Container*

Dear Tim Hall:

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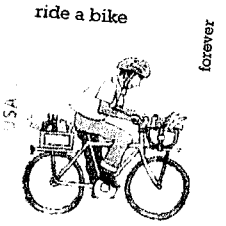
Thank you for fully considering and responding to my comments.

name FLAME Schaal

address 37 AZUL Loop
SANTA FE, NM 87508

.1849



Tim Hall
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name J-M Lee

address Box 454

Ramah, NM 87321

Box 454

Ramah NM 87321

15 DEC 2011 PM 2 L

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

87505+8313

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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name Janice Evans

address 7101 Prospect Place

Albuquerque, NM 87110

[illegible]
7101 Prospect Pl NE
ABQ NM 87110

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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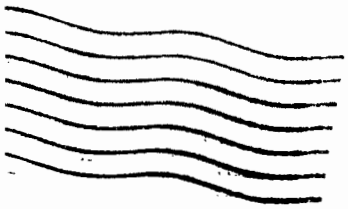
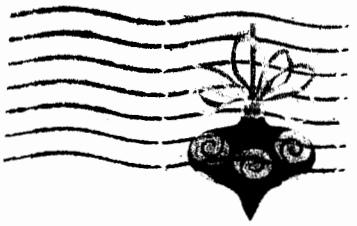
name Jennie Elizondo

address 305 49th Street NW

Alb. NM 87105

RT506





Jennie Elizondo
305 49th st nw
Alb nm. 87105
RT 506

44c
Stamp

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

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Thank you for fully considering and responding to my comments.

name Lisa Waltz Lisa Waltz

address PO Box 81112

Albuquerque NM 87198

How much of our earth will we allow to be contaminated Nuclear energy companies? No other industry is so heavily subsidized, protected & Guarenteed goverenment coverage in the event of an accident. What would New

Support Solar Energy & You Support New Mexican Jobs, New Mexico's environment and New Mexican industry.

Clean energy is the best way to protect our future.

Lisa Hatz
PO Box 81112
Albuquerque N.M.
87198

No one paid For my support

Clean Energy

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

We hope

208573

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87196 505-262-1862 FAX: 505-262-1864 www.sric.org

December 5, 2011

Tim Hall
New Mexico Environment Department
2905 Rodeo Park Drive, Building 1
Santa Fe, NM 87505

RE: WIPP Class 2 Permit Modification – Addition of a Shielded Container

Dear Tim,

Southwest Research and Information Center (SRIC) provides the following comments on the Addition of a Shielded Container Class 2 permit modification request that was submitted by the permittees on September 30, 2011, according to their public notice. SRIC is commenting separately on the other two class 2 requests regarding ventilation and groundwater monitoring.

SRIC appreciates that the permittees provided drafts of the three proposed requests and that representatives of the permittees as well as NMED met with SRIC and other citizen group representatives on August 30, 2011. SRIC continues to believe that such pre-submittal meetings are useful and supports continuing that "standard" practice in the future. SRIC also notes that there were some changes made in the modification request after the pre-submittal meeting, although several major changes suggested by SRIC at the pre-submittal meeting were not incorporated into the modification request.

1. NMED must deny the modification request
Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(7)), NMED may deny the class 2 modification request for any of three reasons. SRIC believes that denial is required because the request is deficient under each of the three criteria -- the request is not complete, the request does not meet the requirements of the Resource Conservation and Recovery Act (RCRA) and the Hazardous Waste Act (HWA), and the request does not demonstrate that the changes requested will protect human health and the environment.

A. The request is not complete. 40 CFR §270.42(b)(7)(i)
Despite the discussion at the pre-submittal meeting, the request does not include important information necessary for the public to adequately comment and for NMED to determine that the

modification would protect public health and the environment and comply with other provisions of RCRA and the HWA. For example, the modification request does not provide any limits to the amount of remote-handled (RH) waste in shielded containers that can be stored in the Parking Area Unit (PAU) or in the contact-handled (CH) Bay of the Waste Handling Building (WHB). The Permit allows no RH waste in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. Permit Part 3.1.1.2 and Table 3.1.1.

The purpose of shielded containers request is to allow RH waste to be handled in the precisely those CH areas in which RH waste is currently prohibited. Yet the request includes no changes regarding Table 3.1.1. For example, without changes to Table 3.1.1, as was discussed at the pre-submittal meeting, the entire CH Bay Storage Area could be filled only with RH waste in shielded containers. Similarly, the request also includes no changes regarding Table 3.1.2, so the entire PAU could be filled with RH waste in shielded containers. The request does not discuss those possibilities and is incomplete.

The request does not include the amounts of RH waste that would be managed at WIPP in shielded containers, nor the amount of RH waste that would be managed at WIPP in canisters. Thus, the public and NMED cannot determine, among other things, the types and amounts of RH waste that would be managed in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. The public and NMED cannot determine how much RH waste in shielded containers would be emplaced in the Underground Hazardous Waste Disposal Units (HWDUs) and how much RH waste in canisters would be in Panels 6, 7, and 8. Therefore, the request is incomplete.

The public and NMED cannot determine how much capacity would be available for CH waste in the Underground HWDUs if shielded containers were emplaced. The request Figure 3 shows some shielded containers being "randomly placed." However, the request does not describe how "random emplacement" would be accomplished or how it makes the most efficient use of Underground HWDU capacity. Nor is Figure 3 proposed for inclusion in the Permit. Apparently, some CH waste emplacement space will be displaced for RH waste in shielded containers. Whether there is adequate space for remaining CH waste in the WIPP Inventory or whether the permitted capacity for CH waste should be reduced are matters that must be discussed in the request. Therefore, the request is incomplete.

An unstated major purpose of the modification request is to address the permittees' management (or mismanagement) of WIPP over the past 13 years in such a way that there is not enough available capacity in the Underground HWDUs for some of the RH waste in the WIPP Inventory. In Panels 1-5, there are 462 RH canisters emplaced, with a volume of 411.18 cubic meters (462 x 0.89). Panels 6, 7, and 8 have a total capacity of 2,060 canisters (600+730+730), or 1,834 cubic meters, according to Table 4.1.1. Since the permittees have stated that they intend to request a permit modification for panels 9 and 10 to be the same size as panels 1-8, the presumed RH capacity of those two panels would be 1,460 canisters or 1,300 cubic meters. Thus, the total available capacity for RH waste is 3,545.18 cubic meters (411.18+1,834+1,300). That is approximately half of the RH waste legal capacity of 7,079 cubic meters and less than the amount of RH waste described in the 2011 WIPP Inventory (DOE/TRU-11-3425). That this

major purpose and the above data is not even mentioned in the request clearly shows that the request is grossly incomplete.

Page 2 of the request states:

> "RH TRU mixed waste emplaced at the WIPP facility in shielded containers will remain designated as RH TRU mixed waste in the WIPP Waste Information System (**WWIS**). The emplaced volume will be counted against the RH repository limit of 7,080 cubic meters (**m3**) and RH TRU mixed waste volume limits specified in the Permit."

Proposed revised Permit Section A1-1b(2) states that "Each 30-gallon inner container has a gross internal volume of 4.0 ft3 (0.11 m3)." Since each shipment could contain a 3-pack of shielded containers, each shipment could have 0.33 cubic meters. Each RH canister holds 0.89 cubic meters. Thus, 100 cubic meters of RH waste in canisters is handled in 113 containers and shipments, whereas 100 cubic meters of RH waste in shielded containers is handled in 304 3-packs and shipments. Therefore, use of shielded containers would substantially increase the number of packages containing RH waste being handled at WIPP, and substantially increase the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. However, those matters are not discussed in the request, and the request is inadequate and incomplete.

The request includes a new section in Attachment A1, A1-1d(4) Handling Waste in Shielded Containers, which states:

> "If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator."

At the pre-submittal meeting there was discussion regarding how overpacking would be done. One option mentioned was taking the shielded container to the RH Waste Bay for overpacking. In its November 18, 2011 comments on the class 2 requests, the permittees state (#5, page 2):

> "A question was raised by a stakeholder regarding the overpacking of shielded containers should the container integrity be such that overpacking is necessary upon arrival at the WIPP facility. Shielded containers which require overpacking will be managed as any other CH TRU waste requiring overpacking. Overpacking of Shielded Containers is addressed in Permit Attachment A, Section A1-1d(4), Handling RH TRU Mixed Waste in Shielded Containers."

An additional comment in the November 18, 2011 submittal, regarding Attachment A1, Section A1-1c(1), would add:

> "Shielded containers are not stored in the RH Complex of the WHB. Shielded containers will be stored in the CH Bay of the WHB Unit."

The Permit Section 3.1.1.9 also states:

> The Permittees shall store RH TRU mixed waste in casks, canisters, or drums in the RH Complex as described in Permit Attachment A1, Section A1-1c(1).

08351

The language in the additional comment and Permit Section 3.1.1.9 do not include shielded containers, thereby precluding the possibility of overpacking shielded containers in the RH Bay.

Permit Attachment A2-2(b), Page A2-12 of 46, lines 30-31 provides:

> If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired.

Thus, the request states that overpacking could be done, but does not describe how overpacking would be done upon arrival at WIPP or if damaged in an Underground HWDU and what overpack container would be used. While Part 3 of the Permit provides that some containers may be used to overpack "CH TRU mixed waste," there is no container specifically allowed for use to overpack shielded containers with RH waste. Thus, the request includes an overpacking provision that is erroneous and cannot be accomplished. Here again, the request is incomplete and inadequate.

Thus, regarding several different essential matters, the request is incomplete and denial of the request is appropriate.

B. The request does not meet the requirements of the HWA and RCRA. 40 CFR §270.42(b)(7)(ii)

The request includes numerous changes to the Permit in how RH waste is packaged (using the shielded container), stored in the PAU, opened in the CH Bay of the WHB, examined for contamination and damaged containers, placed on the facility pallet, and emplaced underground. As already noted above, aspects of handling of shielded containers are not completely and adequately described in the request, as required by the HWA and RCRA.

20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(1)(iii)) requires that the request explain why the modification is needed. The request fails to discuss, let alone adequately explain, that a major need is to expand the available disposal capacity for RH waste in the Underground HWDUs (see discussion on pages 2-3 above). It is clearly a violation of the HWA and RCRA to not explain the need, and the request should be denied.

Moreover, the request includes a clearly erroneous statement about the Permit. Page 2 of the request states:

> "Quantities of RH TRU waste that arrives in canisters is currently counted based on the volume of inner containers."

On the contrary, as NMED pointed out in its November 9, 2011 letter to the permittees regarding the Revised November 2, 2011 Permit, each canister is counted as 0.89 cubic meters. Thus, the request is not accurate, as required by RCRA and the HWA.

As a related matter, SRIC also would object to the volume of waste in shielded containers being counted based on the volume of the inner container, rather than on the volume of the shielded container itself. Here again, the request is incomplete, because the gross internal volume of the shielded container is not specified.

: 00662

As will be further discussed in #2 below, the request also does not meet the requirements for a class 2 modification request. Consequently, the request does not meet the requirements of RCRA and the HWA.

Thus, the request does not meet the requirements of RCRA and the HWA and denial of the request is appropriate.

C. The request does not demonstrate that use of shielded containers will protect public health and the environment. 40 CFR §270.42(b)(7)(iii); §74-4-4 NMSA.

The modification request does not discuss the characteristics of RH waste, including that it can have a surface dose rate of up to 1,000 Rem per hour and is highly dangerous to workers and the public. Because of the difficulties of safely permitting RH waste at WIPP, RH waste was not allowed until a Class 3 modification was approved on October 16, 2006, effective November 16, 2006.

As discussed on page 3 above, the use of shielded containers substantially increases the number of packages containing RH waste being handled at WIPP, substantially increases the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. In addition to significantly increasing the operations at the site, those increases pose dangers to public health and the environment that are not discussed in the request. The request does not demonstrate that such an increase in the number of packages with RH waste would not endanger public health and the environment. On the contrary, increasing the number of RH waste packages could endanger public health and the environment by requiring additional handling of RH waste, thereby increasing exposures and the likelihood of accidents and releases.

Further, SRIC believes that overpacking of a damaged or leaking shielded container must be required to protect workers and public health and the environment. That there is no overpack container available for shielded containers means that those containers should not be allowed at WIPP. Even a provision requiring that a damaged shielded container be returned to the generator may not be adequate because such return shipment might not be possible if the container is significantly damaged or leaking.

Because the request does not demonstrate that use of shielded containers will protect public health and the environment, denial of the request is appropriate.

2. If NMED does not deny the request, it must process the request as a class 3 permit modification under 40 CFR §270.42(c).

Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(6)(i)(C)), NMED may determine that the modification request must follow the procedures for a class 3 modification because there is substantial public concern about the proposed modification or the complex nature requires the more extensive procedures of class 3. Both requirements are met regarding shielded containers. There is substantial public interest in shielded containers, and there is very substantial public interest in WIPP and RH waste, as has been demonstrated over the past 15 years with the WIPP permitting process in which hundreds of people have participated as well as several organizations, in addition to SRIC, that represent hundreds of other people.

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The complex nature of using shielded containers also has been demonstrated by the above comments regarding matters that are not completely included in the request. Handling RH waste at WIPP is demonstrably complex and was subject to class 3 modification procedures in 2005 and 2006. Shielded containers would continue the complexity of the existing RH operations and add new procedures. Thus, shielded containers would multiply the complexity of managing RH waste at WIPP.

Moreover, on October 24, 2011, NMED Secretary David Martin made a determination that the Los Alamos National Laboratory (LANL) class 2 permit modification request for TA-63 Transuranic Waste Facility would be processed as a class 3 modification because of a "long history of substantial public concern regarding the management of hazardous waste at LANL." (Page 2). The NMED Secretary also determined that the modification "would require complex changes to the facility and its operations." (Page 2). There is an even longer history of substantial public concern regarding the management of hazardous waste at WIPP, dating back at least 20 years. That public concern has been manifested repeatedly in the original permitting process, including the public hearing that lasted 19 days in 1999; and in public involvement in numerous permit modification requests over the past 13 years, including the request that allowed RH waste to be managed at WIPP. As already discussed, the use of shielded containers would require complex changes to many aspects of RH management at WIPP.

Moreover, other regulations require shielded containers to be a class 3 modification. 40 CFR §270.42, Appendix I.F.1.a requires that a modification "resulting in greater than 25% increase in the facility's container storage capacity..." is a class 3 modification. Also noted above, there are no limits on the amount of RH waste that could be stored in shielded containers in the Parking Area Unit and CH Waste Bay, so the amount of RH waste allowed in those areas is certainly more than a 25% increase and the amount of RH waste in the WHB can increase by more than 25%.

40 CFR 270.42, Appendix I F.3.a requires that modifications "That require additional or different management practices than those authorized in the permit" are class 3. The purpose of shielded containers is to require additional and different management practices for RH waste than those in the Permit. Here again, shielded containers require a class 3 modification.

Thus, based on the HWA and RCRA regulations and because of current NMED practices, shielded containers must be processed as a class 3 modification, if the modification request is not denied.

3. The request includes other inadequacies.

A. The request on page 2 states:

> "No waste assemblies will be placed on top of a 3-pack assembly of shielded containers because the narrower cross section of the 3-pack assembly of shielded containers may make the stack unstable."

However, the Permit Section A2-1, Page A2-2 of 46, lines 7-8 provides:

> The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

: 08864

Since the request includes no change in that provision and states that shielded containers would be handled as CH waste, other CH waste containers could be placed on top of a 3-pack assembly or a 3-pack assembly could be placed on top of CH TRU mixed waste containers. The request does not demonstrate that such stacking would protect workers or public health and the environment, and indeed the request states that such stacking is not appropriate. SRIC objects to allowing 3-packs of shielded containers to be stacked on top of CH TRU waste containers or to CH TRU waste containers being stacked on top of shielded containers.

B. The request proposes to revise Permit Part 4, Table 4.1.1 to remove the container equivalent column. SRIC strongly objects to such a revision. The limit on the number of RH TRU canisters was supported by public comment and technical testimony in the permit modification process that added RH waste to the Permit. In the request, the permittees have provided no adequate technical basis to remove the column and the limits.

Further, Permit Part 4, Table 4.1.1 as included in the request is not consistent with the November 2, 2011 Revised Permit and must be corrected.

4. SRIC requests a public hearing on any shielded containers modification request.
RH waste and shielded containers are a matter of significant interest to SRIC and the public. As demonstrated by these comments, the use of shielded containers would be complex, and stringent measures are required to protect public health and the environment. The complexity of the matters and the incompleteness of the request require a public hearing so that the matters may be adequately examined, and the required determinations regarding protecting public health and the environment can be adequately made. Therefore, any permit modification to allow use of shielded containers is a major modification, and SRIC requests a public hearing on the current, or any other, shielded containers permit modification request.

Concerned Citizens for Nuclear Safety joins in these comments.

Thank you very much for your careful consideration of, and your response to, these and all other comments.

Sincerely,

Don Hancock

cc: John Kieling

08855

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

DEC 0 5 2011

Mr. John Kieling, Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Additional Comments on the September 29, 2011, Class II Permit Modification Request: "Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program plan"

Dear Mr. Kieling:

The purpose of this letter is to provide you with additional comments on the subject permit modification request.

We certify under penalty of law that this document and the enclosure were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact Ms. Susan McCauslin at (575) 234-7349.

Sincerely,

Edward Ziemianski, Interim Manager
Carlsbad Field Office

M. F. Sharif, General Manager
Washington TRU Solutions LLC

Enclosures (2)

cc: w/enclosure
T. Hall, NMED *ED
T. Kliphuis, NMED ED
CBFO M&RC
*ED denotes electronic distribution

CBFO:OESH:SEM:ANC:11-1361:UFC 5486.00

08865

Enclosure 1

Additional Comments on the September 29, 2011, Class 2 Permit Modification Request: "Update Ventilation Language, Addition of a Shielded Container, and Revise the WIPP Groundwater Detection Monitoring Program Plan"

Permittees' Additional Comments on the September 29, 2011, Class 2 Permit Modification Request: "Update Ventilation Language, Addition of a Shielded Container, And Revise the WIPP Groundwater Detection Monitoring Program Plan"

1. Editorial correction, PMR Item 3, *Revise the WIPP Groundwater Detection Monitoring Program Plan*, Table L-5, *Details of Construction for the Six Culebra Detection Monitoring Wells*, to provide consistency in unit conversions and rounding and to correct one value for WQSP-6 drilling depth with error. The attached Table L-5 was created to assure consistency in the manner in which the values are represented. The process is as follows: Retrieve the value from the associated Figure and convert to metric using an online converter, rounding to the nearest whole meter. This resulted in minor adjustments in the values (shown in yellow). One error was corrected in the process regarding drilling depths "With Air" for well WQSP-6. This was corrected to agree with the drilling depth value in the adjacent "Coring" column.

2. Editorial correction, PMR Item 3, *Revise the WIPP Groundwater Detection Monitoring Program Plan*, Page B-31, Line 34. Insert, "or three well bore volumes, whichever occurs first," after "...parameters stabilize...." Either stabilization of field parameters or collection of three well bore volumes attains the sample quality required for laboratory analysis. This change makes this language consistent with the proposed text in Section L-4c(2)(ii).

   ~~Ground-water~~Groundwater surface elevations will be measured in each well~~DMW~~ prior to ~~ground-water~~groundwater sample collection. ~~Ground water~~Groundwater will be extracted using serial and final sampling methods. Serial samples will be collected until ~~ground-water~~groundwater field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the ~~DMP analytical suite~~ parameters and constituents in Part 5, Tables 5-4 a and 5-4 b.

3. Editorial correction, Item 3, *Revise the WIPP Groundwater Detection Monitoring Program Plan*, Page B-53, Lines 14 and 17. In line 14 move the "and" to be in front of "temperature" and delete the comma immediately after temperature. In Line 17 delete the text "and SC to10 millivolts (mV)". The correct SC units are included earlier in the sentence and not needed here.

   ~~Precision of field measurements of water quality parameters will meet or exceed required reporting levels.~~ Specific conductance ~~SC~~, pH, and temperature ~~, and optionally Eh~~ will be measured during well purging and after sampling. SC measurements will be precise to ±10%, pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer, and ~~and~~ temperature to 0.10 degrees Celsius (°C) ~~and SCEh to 10 millivolts (mV)~~. Water-level measurement will be precise to ±0.01 ft. The precision of water density measurements, when measured in the field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than ±2 ft of error in the derived fresh-water head.

Enclosure 2

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 12 through 19 1994	737 (225)	10 (3)	696 (212)	696 to 737 (212 to 225)	737 (225)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 225)	699 to 722 (213 to 220)
WQSP-2 Figure L-8	September 6 through 12 1994	846 (258)	12 (4)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810 to 834 (247 to 254)
WQSP-3 Figure L-9	October 20 through 26 1994	880 (268)	10 (3)	833 (254)	833 to 880 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 through 10, 1994	800 (244)	9 (3)	740 (226)	740 to 798 (226 to 243)	800 (244)	764 to 789 (233 to 240)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	706 to 791 (233 to 241)
WQSP-5 Figure L-11	October 12 through 18, 1994	681 (208)	7 (2)	648 (198)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674 (198 to 205)
WQSP-6 Figure L-12	September 26 through October 3, 1994	617 (188)	10 (3)	568 (173)	568 to 617 (173 to 188)	617 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 174)	570 to 617 (174 to 188)	582 to 607 (177 to 185)

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BUTCH TONGAGE
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

December 22, 2011

Edward Ziemianski, Acting Manager
Carlsbad Field Office
Department of Energy
P. O. Box 3090
Carlsbad, New Mexico 88221-3090

Farok Sharif
Washington TRU Solutions LLC
P. O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: PERMIT MODIFICATION REQUESTS TO UPDATE VENTILATION LANGUAGE, ADD A SHIELDED CONTAINER, AND REVISE THE WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088
WIPP-11-010

Dear Messrs. Ziemianski and Sharif:

The New Mexico Environment Department (Department) has received a Permit Modification Request (PMR) to Update Ventilation Language, Add a Shielded Container, and Revise the Waste Isolation Pilot Plant (WIPP) Groundwater Detection Monitoring Program Plan, dated September 29, 2011, from the U.S. Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC (the Permittees). The Permittees seek to modify the Hazardous Waste Facility Permit for the WIPP and request that the Department process the PMR as a Class 2 permit modification under the regulations at 40 CFR § 270.42(b). For the reasons explained below, I have determined that it is appropriate for the Department to process the modification request as a Class 3 permit modification under 40 CFR § 270.42(c).

Under 40 CFR § 270.42(b)(6)(i)(C)(1), the Department Secretary may determine that the modification request must be processed as a Class 3 modification because there is substantial public concern about the requested modification. There is a long history of substantial public concern regarding the storage and disposal of remote handled (RH) waste at WIPP. Substantial public concern has also been demonstrated with respect to the current PMR proposing the

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addition of shielded containers. More than 80 people have submitted written comments for the record regarding this PRM. Many of those comments specifically addressed the proposed modification for remote handled waste. There is also a long history of substantial public concern about groundwater monitoring at WIPP. At least one of the commenters on this PRM addressed groundwater monitoring.

Further, under 40 CFR § 270.42(b)(6)(i)(C)(2), the Department Secretary may determine that the modification request must be processed as a Class 3 modification because the complex nature of the changes require the more extensive Class 3 procedures. The requested modification would require complex changes to the operation of the facility. For example, the PMR likely will necessitate additional procedures and equipment for unloading, transporting, and overpacking remote handled transuranic waste in shielded containers. As another example, the Department will need to evaluate whether the proposed modification complies with 40 CFR § 264.601(c)(6), which addresses the potential for health risks caused by human exposure to waste constituents. These issues are more properly addressed as a Class 3 modification.

Additionally, the regulations provide that a permit modification for a container unit that will "require additional or different management practices from those authorized in the permit" must be treated as a Class 3 modification. 40 CFR § 270.42, Appendix I, Item F.3.a. The Department has concluded that the requested modification will likely necessitate changes to the permit to authorize additional or different management practices for containers with remote handled waste.

In conclusion and for the reasons stated above, I have determined that the modification request must be processed as a Class 3 modification. Please be assured that the Environment Department will process the modification promptly and with as little delay as possible. Even assuming that the Department holds a public hearing on the modification, the Department will take final action on the modification request as soon as possible.

If you have any questions about this decision, please address them to John Kieling, Acting Chief of the Environment Department Hazardous Waste Bureau, at 476-6000 or john.kieling@state.nm.us.

Sincerely,

Dave Martin

Dave Martin
Cabinet Secretary

Enclosures

cc: J. Davis, NMED RPD
J. Kieling, NMED HWB
T. Kliphuis, NMED HWB
T. Hall, NMED HWB

R. Flynn, NMED OGC
C. de Saillan, NMED OGC
L. King, EPA Region 6
T. Peake, EPA ORIA
C. Walker, Trinity Engineering
File: WIPP 2011 and Reading

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

December 28, 2011

Edward Ziemianski, Acting Manager
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P. O. Box 3090
Carlsbad, New Mexico 88221-3090

Farok Sharif
Washington TRU Solutions LLC
P. O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: WITHDRAWAL OF DECEMBER 22, 2011 LETTER CONCERNING PERMIT MODIFICATION REQUESTS TO UPDATE VENTILATION LANGUAGE, ADD A SHIELDED CONTAINER, AND REVISE THE WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088
WIPP-11-010

Dear Messrs. Ziemianski and Sharif:

By means of this correspondence the New Mexico Environment Department (Department) hereby retracts the letter dated December 22, 2011 concerning Permit Modification Requests to Update Ventilation Language, add a Shielded Container, and revise the WIPP Groundwater Detection Monitoring Program Plan for the WIPP Hazardous Waste Facility Permit.

If you have any questions about this decision, please address them to John Kieling, Acting Chief of the Hazardous Waste Bureau, at 476-6000 or john.kieling@state.nm.us.

Sincerely,

Dave Martin
Cabinet Secretary

Enclosures

cc: J. Davis, NMED RPD
J. Kieling, NMED HWB
T. Kliphuis, NMED HWB
T. Hall, NMED HB
File: WIPP 2011 and Reading

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

December 28, 2011

Edward Ziemianski, Acting Manager
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M. Farok Sharif
Washington TRU Solutions LLC
P.O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: NOTICE OF EXTENSION FOR CLASS 2 PERMIT MODIFICATION DECISION
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Messrs. Ziemianski and Sharif:

On October 3, 2011, the New Mexico Environment Department (**NMED**) received a Request for Class 2 Permit Modification to the Waste Isolation Pilot Plant Hazardous Waste Facility Permit from the Department of Energy's Carlsbad Field Office and Washington TRU Solutions LLC (**Permittees**) dated September 29, 2011. This Class 2 modification included the following items:

- Update Ventilation Language
- Addition of Shielded Container
- Revise the WIPP Groundwater Detection Monitoring Program Plan

According to 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(6)), NMED must take specific action on the modification request no later than ninety (90) days after receipt of the request. In this instance, the date for a decision would be December 31, 2011. By this letter, I am notifying you as the Permittees that NMED will decide on this modification request within the next thirty (30) days, as allowed by 20.4.1.900 NMAC (incorporating §270.42(b)(6)(i)(E)).

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If you have any questions regarding this matter, please contact Trais Kliphuis of my staff at (505) 476-6051.

Sincerely,

James H. Davis, Ph.D.
Director
Resource Protection Division

cc: John Kieling, NMED HWB
Trais Kliphuis, NMED HWB
Thomas Kesterson, NMED DOE-OB/WIPP
Laurie King, EPA Region 6
Tom Peake, EPA ORIA
Connie Walker, Trinity Engineering
File: Red WIPP '11

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

January 31, 2012

Edward Ziemianski, Acting Manager
Carlsbad Field Office
Department of Energy
P. O. Box 3090
Carlsbad, New Mexico 88221-3090

M. Farok Sharif
Washington TRU Solutions LLC
P. O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: APPROVAL AND PARTIAL DENIAL OF PERMIT MODIFICATION REQUESTS TO UPDATE VENTILATION LANGUAGE, ADD A SHIELDED CONTAINER, AND REVISE THE WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088
WIPP-11-010

Dear Messrs. Ziemianski and Sharif:

The New Mexico Environment Department (Department) has received a Permit Modification Request to Update Ventilation Language, Add a Shielded Container, and Revise the Waste Isolation Pilot Plant (WIPP) Groundwater Detection Monitoring Program Plan, dated September 29, 2011, from the U.S. Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC (the Permittees). The Permittees seek to modify the Hazardous Waste Facility Permit for the WIPP and request that the Department process the request as a Class 2 permit modification under the regulations at 40 CFR § 270.42(b). For the reasons explained below, I approve with changes two items of the modification request and deny one item.

All items in the permit modification request were subject to a sixty (60) day public comment period, which ran from October 5, 2011 through December 5, 2011. The Department received written comments on the request from eighty individuals and organizations. A large majority (77) of public comments addressed item 2, the request to add provisions to the permit for shielded containers for remotely-handled radioactive waste. The Department received only a few minor public comments regarding item 1, the request to modify the ventilation requirements

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at the facility, and item 3, the request to modify the facility groundwater monitoring plan. The Department approves these modifications in accordance with 20.4.1.900 NMAC (incorporating 40 CFR § 270.42(b)). The Department has made some changes to the permit modification request. Changes include revision of the ventilation language so that the requirement for ventilation in an active remote handled waste room with workers present is not removed. This revision to the proposed language is made several section of the permit so that the requirement is consistent throughout the permit.

Under 20.4.1.900 NMAC (incorporating 40 CFR § 270.42(b)(7)), the Department may deny a Class 2 permit modification request if the modification request is incomplete; it does not comply with applicable requirements; or it fails to protect human health and the environment. During its technical review of the modification request for shielded containers, the Department noted that numerous sections in Part 3, Attachment A1, A2, C1, D, E and G must be revised to conform to the permit modification. In addition, 40 CFR 270.42(b), Appendix I, item F.3.a states changes of storage of different wastes in containers that do not require additional or different management practices from those authorized in the permit are Class 2 changes. The use of shielded containers does not fit this category as the facility will not be using different waste but will be using different containers.

Numerous public commenters identified similar issues with the modification request. Furthermore, the Department does not have sufficient information to correct the technical inadequacies in the application and approve the modifications "with changes" under 20.4.1.900 (incorporating 40 CFR § 270.42(b)(6)(i)(A)). Consequently, the Department is denying the permit modification request to add provisions for shielded containers.

Enclosed are the revised pages of the modified permit in redline-strikeout to help the reader rapidly identify each modification. Also enclosed is an electronic version of the modified permit, dated January 31, 2012. An electronic version of the modified permit has been posted for the public on the Department's WIPP Information Page at http://www.nmenv.state.nm.us/wipp/download.html

The enclosed revised permit also includes the two Class 1 permit modifications submitted since November 2011. A separate letter sent January 18, 2012 addressed the specifics of those changes.

The permit modification shall become effective thirty days after notice of the decision has been served on the Permittees pursuant to 20.4.1.901.A(10) NMAC. Thus, the effective date is March 1, 2012.

The Department will provide full response to all public comments under separate cover.

If you have any questions regarding this matter, please call Trais Kliphuis at (505) 476-6051.

Sincerely,

Dave Martin

Dave Martin
Cabinet Secretary

Enclosures:
Redline/strikeout pages showing modifications
Electronic version of modified permit dated January 31, 2012

cc: J. Davis, NMED RPD
J. Kieling, NMED HWB
T. Kliphuis, NMED HWB
R. Flynn, NMED OGC
C. de Saillan, NMED OGC
L. King, EPA Region 6
T. Peake, EPA ORIA
C. Walker, Trinity Engineering
File: WIPP 2012 and Reading

vehicle impacts. The substantial barrier incorporates the chain link and brattice cloth room closure specified in Permit Attachment A2.

1.5.14. Bulkhead

"Bulkhead" means a steel structure, with flexible flashing, that is used to block ventilation as specified in Permit Attachment A2 (Geologic Repository).

1.5.15. Explosion-Isolation Wall

"Explosion-isolation wall" means the 12-foot wall intended as an explosion isolation device that is part of the approved panel-closure system specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System).

1.5.16. Filled Panel

"Filled panel" means an Underground Hazardous Waste Disposal Unit specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.17. Internal Container

"Internal container" means a container inside the outermost container examined during radiography or visual examination (**VE**). Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not designed to hold liquid at the time of original waste packaging are not internal containers.

1.5.18. Observable Liquid

"Observable liquid" means liquid that is observable using radiography or VE as specified in Permit Attachment C (Waste Analysis Plan).

1.5.19. Filled Room

"Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.20. Active Room

"Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.

PPA, whether by personnel or vehicles, shall be through controlled gates and doors. Only properly identified and authorized persons, vehicles, and property shall be allowed entrance to and exit from the active portion of the facility. Security shall require employees to identify themselves with an identification badge when entering or leaving the premises, and shall require visitors to show proper authorization prior to allowing them to enter the active portion of the facility. Visitors shall be required to wear an approved badge and may require an authorized escort.

For the purposes of entry control to areas where wastes are managed, stored, or disposed, these areas shall be posted as Controlled Areas, and access shall be limited to trained and qualified individuals and visitors escorted by trained and qualified individuals.

2.6.4. Warning Signs

The Permittees shall post "No Trespassing" signs and "Danger: Authorized Personnel Only" signs in English and Spanish at approximately 50 ft intervals on the permanent chain-link fence surrounding the PPA. The signs shall be legible from a distance of 25 ft and shall be visible from any approach to the facility. These same signs, plus security and traffic signs, shall also be located on the controlled gates, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(c)).

2.7. GENERAL INSPECTION REQUIREMENTS

2.7.1. Inspection Schedule

The Permittees shall implement the inspection schedule specified in Permit Attachment E (Inspection Schedule, Process and Forms) to detect any malfunctions and deteriorations, operator errors, and discharges, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.2. Inspection Log Forms

The Permittees shall use the inspection logbooks and forms as specified in Permit Attachment E. Original copies of these completed forms are maintained in the Operating Record. The Permittees shall record the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

2.7.3. Inspection Frequency

The Permittees shall inspect monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment at the frequency specified in Tables E-1 and E-2 of Permit Attachment E, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

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2.7.4. Inspection Remediation

The Permittees shall remedy any deterioration or malfunction of equipment or structures which an inspection reveals, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

2.7.5. Inspection Records

Beginning with the effective date of this Permit, the Permittees shall maintain inspection logbooks and forms in the operating record until closure, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(d) and 264.73(b)(5)).

2.8. PERSONNEL TRAINING

The Permittees shall conduct personnel training, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.1. Personnel Training Content

The personnel training program shall include the requirements specified in Permit Attachment F (Personnel Training) and Permit Attachment F2 (Training Course and Qualification Card Outlines), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.2. Personnel Training Requirements

The Permittees shall train all persons involved in the management of mixed and hazardous waste in procedures relevant to the positions in which they are employed, as specified in Permit Attachment F1 (RCRA Hazardous Waste Management Job Titles and Descriptions), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.3. Personnel Training Records

The Permittees shall maintain training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d) and (e)).

2.8.4. Continuing Training

Unless otherwise specified by this Permit, continuing training required by this Permit on an annual or biennial basis shall be completed by the end of the month of the anniversary date when the training was previously completed.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room where waste disposal is taking place and ~~when~~ workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring		
Compound	**50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv**	**95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv**
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

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4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved, t~~The Permittees shall ~~notify~~ report to the Secretary in ~~writing within seven calendar days.~~ the annual report specified in Permit Section 4.6.2.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

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PART 5 - GROUND-WATER DETECTION MONITORING

5.1. DETECTION MONITORING PROGRAM

This Part specifies the requirements of the Detection Monitoring Program (**DMP**). The DMP shall establish background ground-water quality and monitor indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the ground-water, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98).

The DMP consists of six Detection Monitoring Wells (**DMWs**) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground Hazardous Waste Disposal Units (**Underground HWDUs**). The DMWs are screened in the Culebra Member of the Rustler Formation.

A DMP is necessary to demonstrate compliance with the environmental performance standard for the Underground HWDUs, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)). This environmental performance standard requires prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the ~~ground water~~ groundwater or subsurface environment.

5.2. IDENTIFICATION OF POINT OF COMPLIANCE

The point of compliance is the vertical surface located perpendicular to the groundwater flow direction at the DMWs that extends to the Culebra Member of the Rustler Formation [20.4.1.500 NMAC (incorporating 40 CFR §§264.95, 264.601, and 264.602)]. The Permittees shall conduct the DMP at DMWs specified in Table 5.3.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.98 and 264.601).

5.3. WELL LOCATION, MAINTENANCE, AND PLUGGING AND ABANDONING

The Permittees shall conduct the DMP according to the requirements of this Permit and 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) for the DMWs in the Culebra Member of the Rustler Formation.

The Permittees shall maintain the DMP in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97), and as specified below:

5.3.1. Well Locations

The Permittees shall maintain the DMWs at the locations specified on the map in Figure L-~~8~~ 6 of Permit Attachment L (WIPP Ground-water Detection Monitoring Program Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(a) and §264.98(b)), and as specified in Table 5.3.1 below:

Table 5.3.1 - Well Locations				
Well Name	**State Plane Coordinates**	**Top of Casing Elevation (ft amsl)**	**Screen Interval Depth (ft below ground surface)**	**Sampled Unit**
WQSP-1	663595E, 503784N	3419.2	702 - 727	Culebra
WQSP-2	667580E, 505537N	3463.9	811 - 836	Culebra
WQSP-3	670573E, 503991N	3480.1	844 - 869	Culebra
WQSP-4	670645E, 494986N	3433.1	764 - 789	Culebra
WQSP-5	667165E, 493665N	3384.4	646 - 671	Culebra
WQSP-6	663681E, 494948N	3364.7	581 - 606	Culebra

5.3.2. Well Maintenance

The Permittees shall maintain the DMWs specified in Table 5.3.1 and in Permit Attachment L, Section L-3b and Figures L-~~10~~7 through L-~~16~~12, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(c) and §264.98(b)).

5.3.3. Well Plugging and Abandoning

The Permittees may propose to plug and abandon a DMW by submitting a permit modification request to the Secretary in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The Permittees shall plug and abandon any DMW in a manner which eliminates physical hazards, prevents ground-water contamination, conserves hydrostatic head, and prevents intermixing of subsurface water. The Permittees shall submit a report to the Secretary which summarizes and certifies DMW plugging and abandoning methods within 90 calendar days from the date a DMW is removed from the DMP.

5.4. DETECTION MONITORING PROGRAM PARAMETERS AND CONSTITUENTS

The Permittees shall conduct the DMP at the DMWs as specified in Table 5.3.1 for the indicator parameters listed in Table 5.4.a and the hazardous constituents listed in Table 5.4.b below and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(a)):

Table 5.4.a – Indicator Parameters	
pH	Specific conductance
Total organic carbon (**TOC**)	~~Total organic halogen (**TOH**)~~
Total dissolved solids (**TDS**)	Total suspended solids (**TSS**)
~~Density~~Specific Gravity	Calcium
Magnesium	Potassium
Chloride	~~Iron (Total Fe)~~

Table 5.4.b – Hazardous Constituents	
Chloroform	1,2-dichloroethane
Carbon tetrachloride	Chlorobenzene
1,1-dichloroethylene	1,1-dichloroethane
Methylene chloride	1,1,2,2-tetrachloroethane
Toluene	1,1,1-trichloroethane
Cresols	1,4-dichlorobenzene
1,2-dichlorobenzene	trans-1,2-dichloroethylene
2,4-dinitrophenol	2,4-dinitrotoluene
Hexachloroethane	Hexachlorobenzene
Isobutanol	Methyl ethyl ketone
	Pentachlorophenol
Pyridine	Tetrachloroethylene
1,1,2-Trichloroethane	Trichloroethylene
Trichlorofluoromethane	Xylenes
Nitrobenzene	Vinyl chloride
Arsenic	Barium
Cadmium	Chromium
Lead	Mercury
Selenium	Silver
Antimony	Beryllium
Nickel	Thallium
Vanadium	

5.5. SAMPLING AND ANALYSIS PROCEDURES

Except as provided in Permit Section 5.6, the Permittees shall use the following techniques and procedures to obtain and analyze DMP samples~~, including background ground water quality samples,~~ from the DMWs specified in Table 5.3.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(d) and (e)):

5.5.1. Sample Collection Procedures

The Permittees shall collect one DMP sample and one DMP sample duplicate ~~semi~~annually from each DMW using the procedures specified in Permit Attachment L, Section L-4c, as

required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g)(2), 264.98(d), and 264.601(a)).

5.5.2. Sample Preservation and Shipment Procedures

The Permittees shall preserve and ship DMP samples using the procedures specified in Permit Attachment L, Section L-4c(2)(iv).

5.5.3. Analytical Procedures

The Permittees shall analyze DMP samples using the procedures specified in Permit Attachment L, Section L-4c(3).

5.5.4. Chain of Custody Procedures

The Permittees shall track and control DMP samples using the chain of custody procedures specified in Permit Attachment L, Section L-4c(2)(v).

5.6. BACKGROUND GROUND-WATER QUALITY

For those hazardous constituents listed in Table 5.4.b, and for all substances listed in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), the background ground-water quality values specified in Table 5.6 are established as specified in 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g) and 264.98(d)).

Table 5.6 – WQSP Well Background Values

Hazardous Constituent	WQSP-1	WQSP-2	WQSP-3	WQSP-4	WQSP-5	WQSP-6
Chloroform	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,2-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Carbon tetrachloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Chlorobenzene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Methylene chloride	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L
1,1,2,2-tetrachloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Toluene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,1-trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Cresols	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,4-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,2-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L

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Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
trans-1,2-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
2,4-dinitrophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
2,4-dinitrotoluene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachloroethane	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Isobutanol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Methyl ethyl ketone	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pentachlorophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pyridine	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Tetrachloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,2-Trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichlorofluoromethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Xylenes	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Nitrobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Vinyl chloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Arsenic	0.10 mg/L	0.06 mg/L	0.21 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L
Barium	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L
Cadmium	0.20 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.50 mg/L	0.50 mg/L	2.00 mg/L	2.00 mg/L	0.50 mg/L	0.50 mg/L
Lead	0.11 mg/L	0.17 mg/L	0.80 mg/L	0.53 mg/L	0.05 mg/L	0.15 mg/L
Mercury	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L
Selenium	0.15 mg/L	0.15 mg/L	2.00 mg/L	2.00 mg/L	0.10 mg/L	0.10 mg/L
Silver	0.50 mg/L	0.50 mg/L	0.31 mg/L	0.52 mg/L	0.50 mg/L	0.50 mg/L
Antimony	0.33 mg/L	0.50 mg/L	1.00 mg/L	0.80 mg/L	0.07 mg/L	0.14 mg/L
Beryllium	0.02 mg/L	1.00 mg/L	0.10 mg/L	0.25 mg/L	0.02 mg/L	0.02 mg/L
Nickel	0.50 mg/L	0.50 mg/L	5.00 mg/L	5.00 mg/L	0.10 mg/L	0.50 mg/L
Thallium	1.00 mg/L	1.00 mg/L	5.80 mg/L	1.00 mg/L	0.21 mg/L	0.56 mg/L
Vanadium	0.10 mg/L	0.10 mg/L	5.00 mg/L	5.00 mg/L	2.70 mg/L	0.10 mg/L

5.7. GROUND-WATER SURFACE ELEVATION DETERMINATION

5.7.1. DMP Ground-~~W~~water Surface Elevation Determination

The Permittees shall determine the ground-water surface elevation at each DMW specified in Table 5.3.1 each time the ground-water is sampled in compliance with Permit Sections 5.5.1 and 5.9.2, using the methods specified in Permit Attachment L, Section L-4c(1), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)).

5.7.2. Regional Ground-~~W~~water Surface Elevation Determination

The Permittees shall determine the ground-water surface elevation on a monthly basis for each well completed in the Culebra Member of the Rustler Formation in the WIPP Ground-~~W~~water Level Monitoring Program, as specified in Permit Attachment L, Section L-4c(1).

5.8. GROUND-WATER FLOW DETERMINATION

The Permittees shall determine the ground-water flow rate and direction in the Culebra Member of the Rustler Formation at least annually, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(e)). The Permittees shall use ground-water surface elevation data specified in Permit Section 5.7 to determine ground-water flow.

5.9. DATA EVALUATION

5.9.1. Statistical Procedures

The Permittees shall use the statistical analysis methods specified in Permit Attachment L, Section L-4e, to evaluate DMP data for each hazardous constituent as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)). These statistical analysis methods shall comply with the appropriate performance standards specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.97(i)).

5.9.2. Groundw-~~W~~ater Quality Determination

The Permittees shall sample DMWs as specified in Permit Section 5.5.1 and conduct statistical tests to determine whether there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b during the active life of the WIPP facility and post-closure care period as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90(c)).

5.9.3. Data Evaluation

The Permittees shall determine whether there is statistically significant evidence of contamination for any hazardous constituent identified in Table 5.4.b each time the DMWs are sampled as specified in Permit Section 5.9.2. In determining whether statistically significant evidence of contamination exists, the Permittees shall compare the ground-water quality at each DMW specified in Table 5.3.1 to the background ground-water quality

determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.9.4. Data Evaluation Timeframe

The Permittees shall perform the data evaluations specified in Permit Section 5.9.3 within 120 calendar days after completion of DMP sampling, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)(2)).

5.10. RECORDKEEPING AND REPORTING

5.10.1. Operating Record Requirements

The Permittees shall enter all DMP monitoring, testing, and analytical data in the operating record as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(6)). The Permittees shall enter these data, as measured and in a form appropriate for the determination of statistically significant evidence of contamination, into the operating record as specified in Permit Section 5.9.1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(c)).

5.10.2. Submittal of Results

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5.1 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, ~~in compliance with the schedule on Table 5.10.2.1 below, and~~in the Annual Culebra Groundwater Report by November 30 of each year as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)).~~:~~

~~6. Table 5.10.2.1 – Analytical Results Submittal Schedule~~	
~~7. Samples to be collected during the preceding months of:~~	~~8. Results due to the NMED Secretary by:~~
~~9. March – May~~	~~10. 120calendar days after final sample is collected~~
~~11. September – November~~	~~12. 120 calendar days after final sample is collected~~

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Analytical results of a sampling round may be included in the report specified in Permit Section 5.10.2.3 if publication of the report coincides with the 120 calendar day report submittal schedule.

~~12.1.1.1.~~5.10.2.2. Groundw~~W~~ater Surface Elevation Results

The Permittees shall submit to the Secretary ground-water surface elevation data specified in Permit Section 5.7. This submittal shall include both ground-water surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be submitted within 30 calendar days after data are collected.

~~12.1.1.2.~~5.10.2.3. Groundw~~W~~ater Flow and Radionuclide Sampling Results

The Permittees shall submit to the Secretary an evaluation of the ground-water flow data specified in Permit Section 5.8 and the results of radionuclide-specific analysis of groundwaters sampled from the DMWs in the Annual Site Environmental Report by October 1 of each calendar year.

~~12.1.2.~~5.10.3. Determination of Contamination

If the Permittees determine, pursuant to Permit Section 5.9 and 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)), that there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b, the Permittees shall comply with the following:

~~12.1.2.1.~~5.10.3.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days, indicating what hazardous constituents have shown statistically significant evidence of contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(1)).

~~12.1.2.2.~~5.10.3.2. Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the ground-water in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

~~12.1.2.3.~~5.10.3.3. Verification Sampling

As specified by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)), for any substances found in the initial analysis pursuant to Permit Section 5.10.3.2, the Permittees may resample within one month and repeat the analysis for those compounds detected. If the results of the second analysis confirm the initial analysis, these substances shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4. If the Permittees do not resample, the substances found during the initial analysis specified in Permit Section 5.10.3.2 shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4.

~~12.1.2.4.~~5.10.3.4. Submittal of Compliance Monitoring Program

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to establish a compliance monitoring program meeting the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.99). The application shall include the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(4)):

i. An identification of the concentration of any hazardous constituent specified in Table 5.4.b or any Appendix IX substance detected in the ground water at each DMW at the compliance point.

ii. Any proposed changes to the DMP necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iii. Any proposed additions or changes to the monitoring frequency, sampling and analysis procedures or methods, or statistical methods used necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iv. For each hazardous constituent detected at the compliance point, a proposed concentration limit or a notice of intent to seek an alternate concentration limit for a hazardous constituent required by 20.4.1.500 NMAC (incorporating 40 CFR §264.94).

~~12.1.2.5.~~5.10.3.5. Submittal of Additional Information

The Permittees shall, within 180 calendar days, submit to the Secretary the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(5)):

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i. All data necessary to justify an alternate concentration limit proposed in compliance with Permit Section 5.10.3.4.iv.

ii. An engineering feasibility plan for corrective action required by 20.4.1.500 NMAC (incorporating 40 CFR §264.100), if necessary.

~~12.1.3.~~5.10.4. Demonstration of Outside Contamination

If the Permittees determine, pursuant to Permit Section 5.9, that there is a statistically significant difference for hazardous constituents specified in Table 5.4.b at any DMW at the compliance point, they may demonstrate that a source other than a regulated unit caused the increase or that the detection is an artifact caused by an error in sampling, analysis, statistical evaluation, or natural variation in the ground water. In such cases, the Permittees shall comply with the following:

~~12.1.3.1.~~5.10.4.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days of determining statistically significant evidence of contamination at the compliance point that they intend to make a demonstration of outside contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(i)).

~~12.1.3.2.~~5.10.4.2. Submittal of Demonstration

The Permittees shall, within 90 calendar days, submit a report to the Secretary which demonstrates that a source other than a regulated unit caused the contamination, or that the contamination resulted from error in sampling, analysis, or evaluation, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(ii)).

~~12.1.3.3.~~5.10.4.3. Submittal of Modification Request

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to make any appropriate changes to the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iii)).

~~12.1.3.4.~~5.10.4.4. Continued Monitoring

The Permittees shall continue to monitor in compliance with the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iv)).

~~12.2.~~5.11. REQUEST FOR PERMIT MODIFICATION

If the Permittees or the Secretary determines that the DMP no longer satisfies the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) and this Permit Part, the Permittees

shall, within 90 calendar days of the determination, submit an application for a permit modification to make any appropriate changes to the program in compliance with 20.4.1.500 and .900 NMAC (incorporating 40 CFR §264.98(h) and §270.42).

PERMIT ATTACHMENTS

Permit Attachment L (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Ground-water Detection Monitoring Program Plan" - Chapter L).

ATTACHMENT A2

GEOLOGIC REPOSITORY

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The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room where waste disposal is taking place ~~when~~ and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. ~~Rubber or sheet metal~~ Flexible flashing attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. The filled rooms ~~that are filled with waste~~ will be isolated from the ventilation system, while the active rooms that are actively being filled will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

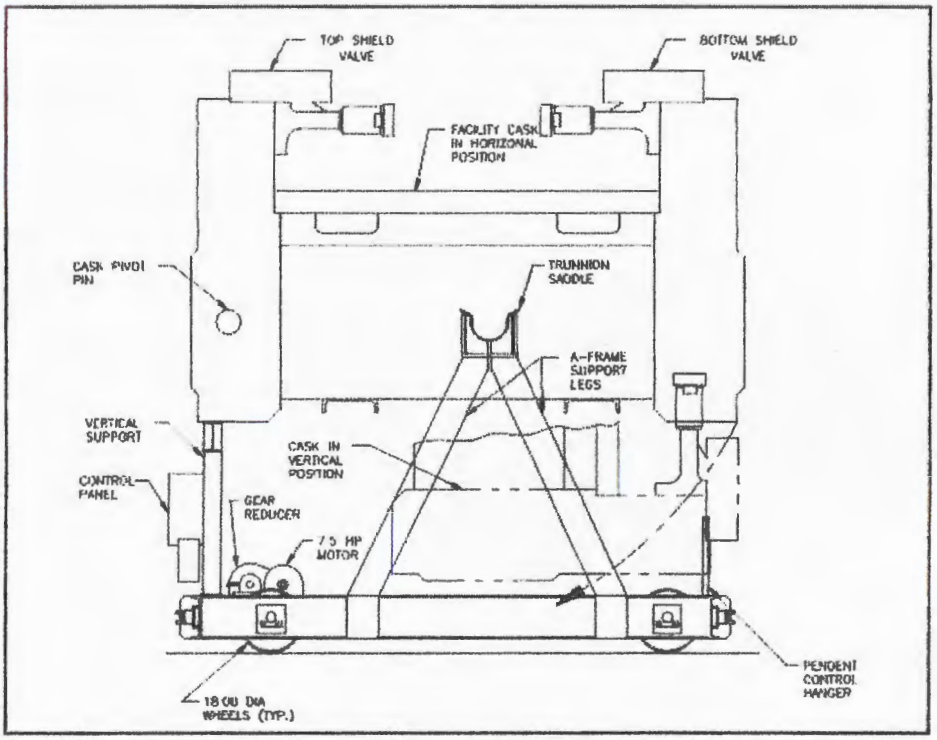

Figure A2-14
Facility Cask Transfer Car (Side View)

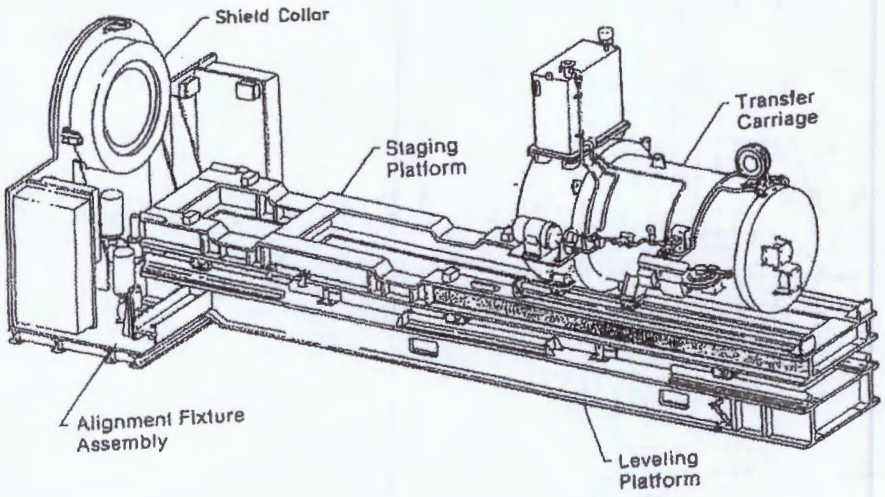

Figure A2-15
~~Horizontal~~ Typical Emplacement ~~and Retrieval~~ Equipment

1

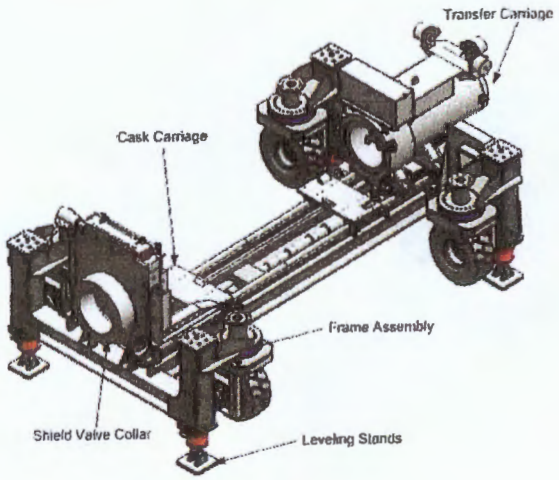

Figure A2-15a
Typical Emplacement Equipment

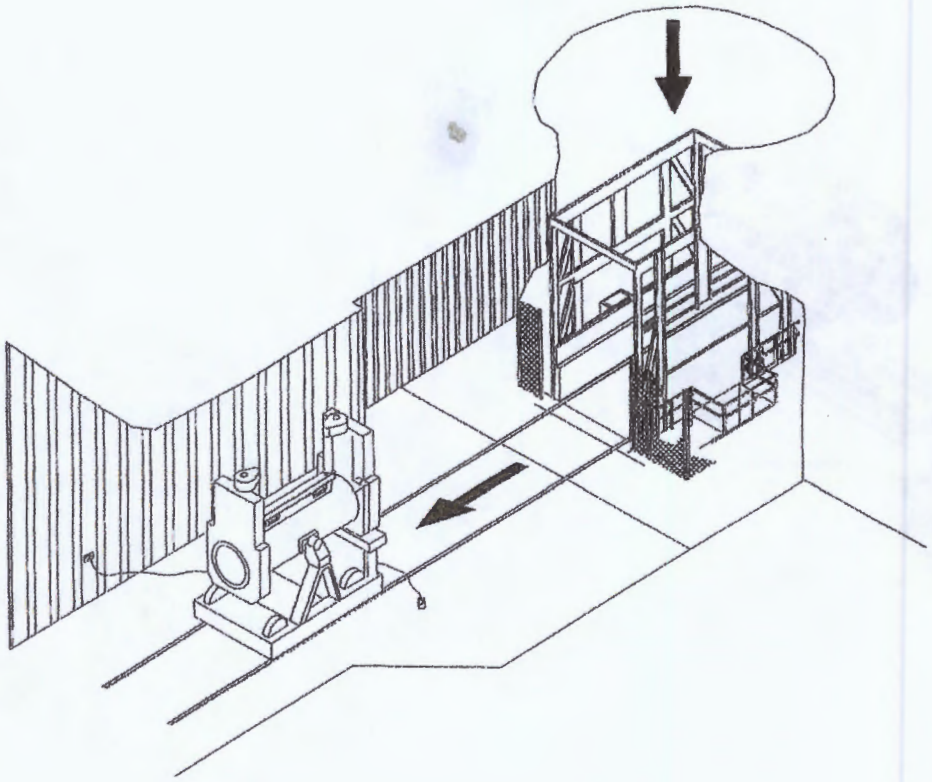

Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

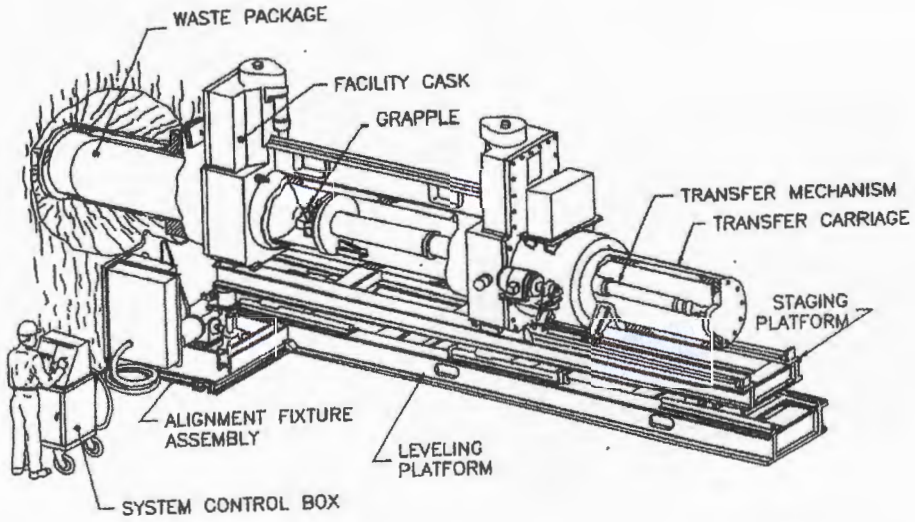

Figure A2-17
Facility Cask Installed on the ~~Horizontal~~ Typical Emplacement ~~and Retrieval~~ Equipment

FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

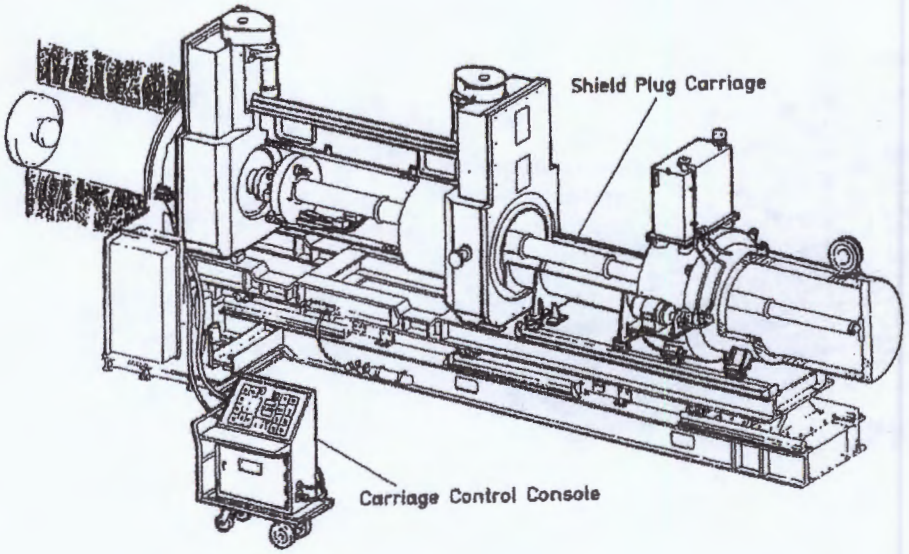

Figure A2-18
Installing Shield Plug

ATTACHMENT C3

QUALITY ASSURANCE OBJECTIVES AND DATA VALIDATION TECHNIQUES FOR WASTE CHARACTERIZATION SAMPLING AND ANALYTICAL METHODS

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A NCR shall be prepared for each nonconformance identified. Each NCR shall be initiated by the individual(s) identifying the nonconformance. The NCR shall then be processed by knowledgeable and appropriate personnel. For this purpose, a NCR including, or referencing as appropriate, results of laboratory analysis, QC tests, audit reports, internal memoranda, or letters shall be prepared. The NCR must provide the following information:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Method(s) or suggestions for correcting the nonconformance (corrective action)
- Schedule for completing the corrective action
- An indication of the potential ramifications and overall usability of the data, if applicable
- Any approval signatures specified in the site nonconformance procedures

The Permittees shall require the Site Project Manager to oversee the NCR process and be responsible for developing a plan to identify and track all nonconformances and report this information to the Permittees. The Site Project Manager is also responsible for notifying project personnel of the nonconformance and verifying completion of the corrective action for nonconformances.

Nonconformance to DQOs

For any non-administrative nonconformance related to applicable requirements specified in this WAP which are first identified at the Site Project Manager signature release level (i.e., a failure to meet a DQO), the Permittees shall receive written notification within seven calendar days of identification and shall also receive a NCR within 30 calendar days of identification of the incident. DOE shall require the generator/storage site to implement a corrective action which remedies the nonconformance prior to management, storage, or disposal of the waste at WIPP. The Permittees shall send NMED a monthly summary of nonconformances identified during the previous month, indicating the number of nonconformances received and the generator/storage sites responsible.

DOE's Corrective Action Process

DOE shall initiate a corrective action process when internal nonconformances and nonconformances at the generator/storage sites are identified. Activities and processes that do not meet requirements are documented as deficiencies.

When a deficiency is identified by the Permittees, the following process action steps are required:

The condition is documented on a Corrective Action Report (**CAR**) by the individual identifying the problem.

DOE has designated the CAR Initiator and Assessment Team Leader to review the CAR, determine validity of the finding (determine that a requirement has been violated), classify the significance of the condition, assign a response due date, and issue the CAR to the responsible party.

The responsible organization reviews the CAR, evaluates the extent and cause of the deficiency and provides a response to DOE, indicating remedial actions and actions to preclude recurrence that will be taken.

DOE reviews the response from the responsible organization and, if acceptable, communicates the acceptance to the responsible organization.

The responsible organization completes remedial actions and actions to preclude recurrence of the condition.

After all corrective actions have been completed, DOE schedules and performs a verification to ensure that corrective actions have been completed and are effective. When all actions have been completed and verified as being effective, the CAR is closed by the CAR Initiator and Assessment Team Leader on behalf of DOE.

As part of the planning process for subsequent audits and surveillances, past deficiencies are reviewed and the previous deficient activity or process is subject to reassessment.

C3-14 Special Training Requirements and Certifications

Before performing activities that affect WAP quality, all personnel are required to receive indoctrination into the applicable scope, purpose, and objectives of the WAP and the specific QAOs of the assigned task. Personnel assigned to perform activities for the WAP shall have the education, experience, and training applicable to the functions associated with the work. Evidence of personnel proficiency and demonstration of competence in the task(s) assigned must be demonstrated and documented. All personnel designated to work on specific aspects of the WAP shall maintain qualification (i.e., training and certification) throughout the duration of the work as specified in this WAP and applicable QAPjPs/procedures. Job performance shall be evaluated and documented at periodic intervals, as specified in the implementing procedures.

Personnel involved in WAP activities shall receive continuing training to ensure that job proficiency is maintained. If not specified by this WAP, the due date for required continuing training courses and requalification shall be the end of the month of the anniversary date when the training was previously completed. Training includes both education in principles and enhancement of skills. Each participating site shall include in its QAPjP a description of the procedures for implementing personnel qualification and training. All training records that specify the scope of the training, the date of completion, and documentation of job proficiency shall be maintained as QA Records in the site project file.

Analytical laboratory line management must ensure that analytical personnel are qualified to perform the analytical method(s) for which they are responsible. The minimum qualifications for certain specified positions for the WAP are summarized in Table C3-10. QAPjPs, or their implementing SOPs, shall specify the site-specific titles and minimum training and qualification requirements for personnel performing WAP activities. QAPjPs/procedures shall also contain the requirements for maintaining records of the qualification, training, and demonstrations of proficiency by these personnel.

An evaluation of personnel qualifications shall include comparing and evaluating the requirements specified in the job/position description and the skills, training, and experience included in the current resume of the person. This evaluation also must be performed for

1

Waste Analysis Plan (WAP) General Checklist for use at DOE'S Generator/Storage Sites

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Waste Stream Identification					
1	Does the generator/storage site define "waste stream" as waste materials that have common physical form, that contain similar hazardous constituents, and that are ~~-~~generated from a single process or ~~from an~~ activity ~~that is similar in material, physical form, and hazardous constituents~~? (Attachment C Section C-0a)					
2	Are procedures in place to ensure that the generator/storage site assigns one of the Summary Category Groups (S3000-homogeneous solids, S4000-soils/gravel, S5000-debris waste) to each waste stream? (Section C-1b)					
3	Are procedures in place to ensure that the generator/storage site assigns Waste Matrix Code Groups (e.g., solidified inorganics, solidified organics, salt waste, soils, combustible waste, filters, graphite, heterogeneous debris waste, inorganic nonmetal waste, lead/cadmium metal, uncategorized metal) to each waste stream? (Section C-0a)					
4	Are procedures in place to ensure that the generator/storage site assigns a Waste Stream WIPP Identifier (ID) to each waste stream? (Section C3-12b(1))					

TSDF

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
4a	Are procedures in place for generator/storage sites to submit an AK Sufficiency Determination (Determination Request) to the Permittees to meet all or part of the waste characterization requirements including: • All information specified in Permit Attachment C4, Section C4-3d • Identification of relevant hazardous constituents, and correctly identifies all toxicity characteristic and listed hazardous waste numbers • All hazardous waste number assignments must be substantiated by supporting data and, if not, whether this lack of substantiation compromises the interpretation • Resolution of data discrepancies between different AK sources must be technically correct and documented • The AK Summary includes all the identification of waste material parameter weights by percentage of the material in the waste stream, and determinations are technically correct • All prohibited items specified in the TSDF-WAC should be addressed, and conclusions drawn are technically adequate and substantiated by supporting information • If the AK record includes process control information specified in Permit Attachment C4, Section C4-3b, the information should include procedures, waste manifests, or other documentation demonstrating that the controls were adequate and sufficient. • The site must provide the supporting information necessary to substantiate technical conclusions within the Determination Request, and this information must be correctly interpreted. (Section C-0b, Section C4-3d)					
4b	If a generator/storage site does not submit a Determination Request or if the Determination Request is not approved, are procedures in place for the generator/storage site to perform radiography or VE on 100% of the containers in a waste stream and chemical sampling and analysis on a representative sample of the waste stream using headspace gas sampling and analysis (for debris waste) or solids sampling and analysis (for homogeneous solid or soil/gravel waste) as specified in Permit Attachments C1 andC2? (Section C-0b)					

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	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
31	Are procedures in place to ensure that the following Quality Assurance Objectives are adequately defined and assessed for each characterization method: • Precision as a measure of the mutual agreement among multiple measurements. • Accuracy as the degree of agreement between a measurement result and a true or known value. • Completeness is a measure of the amount of valid data obtained from a method compared to the total amount of data obtained that is expressed as a percentage. • Comparability is the degree to which one data set can be compared to another data set. • Representativeness as an expression of the degree to which data represent characteristics of a population. (Section C-4a(2))					
32	With respect to data generation, are procedures in place to ensure that the generator/storage site's waste characterization program meets the following general requirements: • Analytical data packages and batch data reports must be reported accurately in a pre-approved format, must be maintained in permanent files, and must be traceable? • All data must receive a technical review by another qualified analyst ~~or the technical supervisor, and the laboratory QA officer~~? (Section C3-10a)					
33	Are procedures in place to ensure that the generator/storage site performs validation of waste characterization data for each waste container? (Section C-4)					
34	Are procedures in place to ensure that the generator/storage site has a pre-approved format for reporting waste characterization data? (Section C-4a(4))					
35	Are procedures in place to ensure that the generator/storage site prepares analytical, testing, and sampling batch data reports to meet the requirements of their own site-specific QAPjP and/or SOPs? (Section C-4a(4))					

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	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
36	Are procedures in place to ensure that all raw data is collected and managed at the data generation level in accordance with the following criteria: • All raw data shall be signed and dated in reproducible ink by the individual collecting the data, or signed and dated using electronic signatures • All data shall be recorded clearly, legibly, and accurately in field and laboratory records and include applicable sample identification numbers • All changes to original data shall be lined out, initialed, and dated by the individual making the change. Original data may not be obliterated or otherwise be made unreadable • All data shall be transferred and reduced from field and laboratory records completely and accurately • All field and laboratory records shall be maintained as specified in Table C- 6 of Attachment C • Data shall be organized into standard reporting formats for reporting purposes. • All electronic and video data must be stored to ensure that waste container, sample and QC data are readily retrievable (Section C3-10a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
200	Do procedures adequately assign the ~~Site~~ site ~~Project~~ project ~~QA Officer~~manager with the responsibility of monitoring field QC results and initiate the nonconformance report process in the event the following acceptance criteria are not met or sample collection frequencies are not met: • Field and equipment blanks shall be less than 3 times the detection limits specified in Table C3-2 and equipment blank results determined by FTIR shall be less than the PRQL specified in Table C3-2 (Section C1-1b(1) and C1-1b(2)) • Field reference standards shall have a recovery of between 70 and 130% (Table C1-3) • Field Duplicates shall have an RPD of less than or equal to 25 (Sections C1-1b and C1-1b(4); Table C1-3)					
201	Are procedures in place to ensure that field reference standards meet the following criteria: • Field reference standards shall contain a minimum of 6 analytes listed in Table C3-2 at a range of between 10 and 100 ppmv and at concentrations greater than the MDL • Field reference standards shall be traceable to a nationally recognized standard, if available • If commercial gases are used, they shall be accompanied by a Certificate of Analysis and all field reference standards are traceable to certificates. • Commercial gases are not used past the manufacturer specified shelf life. • Field reference samples are submitted blind to the laboratory at a frequency of one per sampling batch. (Note: Field reference standards may be discontinued for direct canister method if QAO accuracy objectives are met) (Section C1-1b(3))					
202	Are procedures in place to ensure that field duplicate samples are collected sequentially and in accordance with Table C1-1. (Section C1-1b(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Equipment Testing, Inspection and Maintenance					
203	Are procedures in place to ensure that sample containers are cleaned in accordance with the following specifications: • All sampling components that contact sample gases are constructed of inert materials such as stainless steel or Teflon® • The sampling manifold and canisters are properly cleaned and leak checked prior to each sampling event in accordance to or equivalent with TO-14A or TO-15 methodology • SUMMA® canisters or equivalent are cleaned on an equipment cleaning batch basis. An equipment cleaning batch is defined as the number of canisters that can be cleaned together at one time using the same cleaning method • The cleaning system consists of an optional oven and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump • Prior to cleaning a 24 hour leak check shall be performed (+/- 2 psig) on all canisters • Canisters that shall be checked for leaks, repaired, and reprocessed • One canister per equipment cleaning batch is filled with humid zero air or humid high purity nitrogen and analyzed for VOCs • A batch is considered clean if VOC concentrations are less than 3 times the MDLs specified in Table C3-2 • Certified leak-free canisters are evacuated to 0.1 mm Hg or less for storage • Canister cleaning certification documentation is available at the cleaning facility and the cleaning facility initiates canister tags. (Section C1-1c, C1-1c(1))					
204	Are procedures in place to ensure that manifold pressure sensors and ambient air temperature sensors are certified prior to initial use and annually using NIST traceable standards. In addition OVAs if used shall be calibrated daily using known calibration gases and the balance of the OVA calibration is consistent with the manifold purge gas. (Section C1-1d)					

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Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
	Medical Resources	
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ~~hardcab~~ ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
	Fire Detection and Fire Suppression Equipment	
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and ~~horizontal~~ emplacement ~~and retrieval~~ equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (*e.g.*, malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**) or in standard large box 2s (**SLB2s**). The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

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Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	~~PM000030~~12-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	~~PM00002~~712-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[j]	Emergency Services	Monthly See List 11	~~PM00003~~612-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031~~PM00003~~1 Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	~~PM00003~~412-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	~~PM00003~~312-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035~~PM000035~~ Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-~~008~~010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029~~PM000029~~ Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[l] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030~~PM000030~~ and 12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035~~PM000035~~ Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-~~008~~010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029~~PM000029~~ Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[i] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030~~PM000030~~ and 12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

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Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
Senior Mining Technician *
Continuous Mining Specialist *
Senior Mining Specialist *
Mine OPS Supervisor *
b. Waste Hoist Operator
Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
Shaft Technician *
d. Operations Engineer
Supervisor U/G Services*
Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
Senior Safety Technician *
Safety Specialist *
Safety Engineer *
Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

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List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
   Senior Mining Technician *
   Continuous Mining Specialist *
   Senior Mining Specialist *
   Mine OPS Supervisor *
b. Waste Hoist Operator
   Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
   Shaft Technician *
d. Operations Engineer
   Supervisor U/G Services*
   Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
   Senior Safety Technician *
   Safety Specialist *
   Safety Engineer *
   Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

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Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

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System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration[b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [i] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer
Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

ATTACHMENT L

WIPP GROUND-WATER DETECTION MONITORING PROGRAM PLAN

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LIST OF ABBREVIATIONS/ACRONYMS/UNITS

~~ASER~~	~~Annual Site Environmental Report~~
~~AR/VR~~	~~Approval/Variation Request~~
Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	~~Chain~~ chain of ~~Custody~~custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
~~EM~~	~~Environmental Monitoring~~
EPA	U.S. Environmental Protection Agency
~~ES&H~~	~~Environment, Safety, and Health Department~~
~~FEIS~~	~~Final Environmental Impact Statement~~
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
~~GWSP~~	~~Groundwater Surveillance Program~~
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory ~~control samples~~
LCSD	lab control sample duplicate
~~LD~~	~~limit of detection~~
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler Formation
mg/L	milligram(s) per liter

mi	mile(s)
mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
~~PRS~~	~~Project Records Services~~
QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
~~RFA~~	~~request for analysis~~
~~RIDS~~	~~Records Inventory and Disposition Schedule~~
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
~~STLB~~	~~sample tracking logbook~~
TDS	total dissolved solids
TOC	total organic carbon
~~TOX~~	~~total organic halogens~~
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
~~TSS~~	~~total suspended solids~~
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
~~WQSP~~	~~Water Quality Sampling Program~~
µg/L	microgram(s) per liter

µm	micrometers

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ATTACHMENT L

WIPP GROUND-WATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.

~~is a geologic repository for the disposal of transuranic (TRU) waste. The disposal horizon is located 2,150 feet (ft) (655 meters (m)) below the land surface in the bedded salt of the Salado Formation (hereinafter referred to as the Salado). At WIPP, water-bearing units occur both above and below the disposal horizon. Ground-water monitoring of the uppermost aquifer below the facility is not proposed at WIPP because that water-bearing unit (the Bell Canyon Formation) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon Formation are separated by over 2000 ft (610 m) of very low-permeability evaporite sediments (Addendum L-1, Amended Renewal Application (DOE, 2009)). No natural credible pathway has been established for contaminant transport to aquifers below the repository horizon, as there is no hydrologic communication between the repository and underlying aquifer. The U.S. Environmental Protection Agency (EPA) concluded in 1990 that natural vertical communication does not exist based on their review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for ground-water monitoring through the Salado and the Castile Formation (hereinafter referred to as the Castile) into the Bell Canyon aquifer would compromise the isolation properties of the repository medium.~~

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers (km)) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses. ~~Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (HWDUs) in the underground, will be met.~~

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

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The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

Ground-water monitoring at the WIPP facility ~~in the past has focused~~ focuses on the Culebra ~~member~~ Member (**Culebra**) of the Rustler Formation (~~hereinafter referred to as the Culebra~~**Rustler**) because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. ~~basin~~Groundwater movement in the Culebra, using results from the basin-scale groundwater model~~Modeling of ground-water movement in the Culebra, based on the concept of a ground-water basin~~, is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, ~~Amended Renewal Application~~ (DOE, 2009).

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~~The WIPP site is located in Eddy County in southeastern New Mexico (Figure L-1) within the Pecos Valley section of the southern Great Plains physiographic province (Powers et al., 1978). The site is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.~~

~~The WIPP site (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (LWA), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (DOE). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.~~

This monitoring plan addresses requirements for sample collection, Culebra ground-water surface elevation monitoring, Culebra ground-water flow direction and rate determination, data management, and reporting of Culebra ground-water monitoring data. It also identifies ~~analytical~~ indicator parameters and hazardous constituents selected to assess Culebra ground-water quality~~, and establishes personnel responsibilities~~ for the WIPP ground-water detection monitoring program (**DMP**). Because quality assurance is an integral component of the ground-water sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this ~~sampling and analysis plan~~ DMP are provided in the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d))~~field operating procedures, referenced throughout this plan~~. Procedures are required for each aspect of the Culebra ground-water sampling process, including Culebra ground-water surface elevation measurement, Culebra ground-water flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection. ~~These procedures prescribe proper field sampling techniques~~. ~~Samples~~ Data required by this plan will be collected by ~~trained~~ qualified personnel ~~under the supervision and direction of qualified engineers, scientists, or other technical personnel.~~in accordance with SOPs (Table L-3).

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP ~~site~~ facility is situated within the Delaware Basin~~,~~ bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. ~~During the Permian period, which came to a close about 245 million years ago, ancient seas covered the basin. Their later evaporation resulted in the deposition of a thick sequence of evaporites. Addendum L1, Section L1-1 of the Amended Renewal Application (DOE, 2009) presents a detailed discussion of the regional geologic history.~~ Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile~~, which formed through evaporation of the Permian Sea,~~ consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation ~~(hereinafter referred to as the Rustler)~~ was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler's upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP ~~site~~facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) ~~of the Amended Renewal~~ Application (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the

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downward percolation of water into the evaporite units below.[1] The Bell Canyon ~~Formation (hereinafter referred to as the Bell Canyon)~~ is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) ~~of the Amended Renewal Application~~ (DOE, 2009)) and is confined above by the thick evaporite ~~sequences~~ deposits of the Castile ~~above~~. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is ~~more than~~approximately 2,~~000~~ 200 pounds per square inch [lb/$in.^2$] or 1~~3.8~~4.9 megapascals [MPa]) and eventually ~~moves~~ deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place ~~for millions of years~~since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-~~5~~4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) ~~of the Amended Renewal Application~~ (DOE, 2009)).

L-1a(2) Ground-water Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional ground-water aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility ~~found~~ determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-3} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and

---

[1] ~~While there may be some uncertainty over the amount of vertical recharge occurring within the Rustler, the issue is only of significance to long-term performance calculations in which releases from the repository occur through the creation of a migration pathway resulting from drilling (inadvertently) in the WIPP area. The consequences of vertical recharge are bounded in the modeling by assuming that under future climate conditions (which are assumed to be cooler and wetter), the ground-water surface elevation (water table) raises near ground surface, at which time the water table tends to mimic topography.~~

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polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy~~. As a comparison, the permeability of the Salado is roughly a thousand times less than that of a lower clay liner required of surface impoundments and landfills, assuming similar thicknesses~~.

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado ~~Salado (specifically, the Culebra Member, hereafter referred to as the Culebra)~~. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-~~5~~6). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day.~~ The Culebra is hydrologically confined.~~

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). ~~(Additional short-term pumping tests have been conducted in the Water Quality Sampling Program (WQSP) wells (see Addendum L1, Section L1-2a(3)(a)(ii) of the Amended Renewal Application (DOE, 2009)).~~ Detailed cross-hole hydraulic testing has ~~recently~~ been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

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~~The hydraulic tests are designed to yield pressure data for estimation of hydrologic characteristics.~~ Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used ~~for input to flow modeling~~in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ~~six~~ ten orders of magnitude from east to west in the vicinity of WIPP. ~~Over the site, Culebra transmissivity varies over three to four orders of magnitude. Figure D6-30 shows variation in transmissivity in the Culebra in the WIPP region.~~ Transmissivities have been calculated at 1×10^{-7} square feet per day (1×10^{-8} - ^{13} square meters per second) at well ~~P-18~~SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east. ~~Qualitative correlations have been noted between transmissivity and several geologic features possibly related to open fracture density, including (1) the distribution of overburden above the Culebra, (2) the distribution of halite in other members of the Rustler, (3) the dissolution of halite in the upper portion of the Salado, and (4) the distribution of gypsum fillings in fractures in the Culebra.~~

~~Measured matrix porosities of the Culebra vary from 0.03 to 0.30. Fracture porosity values have not been measured directly, but interpreted values from tracer tests at the H-3, H-6, and H-11 hydropads vary from 5×10^{-4} to 3×10^{-3}. Data are insufficient to determine whether the average porosity of the matrix and fractures varies significantly on a regional scale.~~

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in ground-water geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the ground-water in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

The radiogenic ages of the Culebra ground-water and the geochemical differences provide information potentially relevant to the ground-water flow directions and ground-water interaction with other units and are important constraints on conceptual models of ground-water flow. ~~Previous conceptual models of the Culebra (see Addendum L1 of the Amended Renewal Application (DOE, 2009)) have not been able to consistently relate the hydrogeochemical facies, radiogenic ages, and flow constraints (that is, transmissivity, boundary conditions, etc.) in the Culebra.~~

~~However, t~~The Permittees have proposed a ~~new~~ conceptualization of ground-water flow that ~~could~~ explains observed geochemical facies and ground-water flow patterns. The ~~new~~ conceptualization, referred to as the basin-scale ground-water ~~basin~~ model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. ~~This differs from previous interpretations, wherein no-flow was assumed between Rustler units.~~ The model assumes that the ground-water system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on ground-water flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south. ~~to a more southerly direction.~~

~~Four hydrogeochemical facies within the Culebra in the WIPP area (DOE, 1997) have been identified:~~

- ~~Zone A – saline (2-3 molal) NaCl brines, Mg/Ca ratio of 1.2 to 2;~~
- ~~Zone B – dilute (<0.1 molal) CaSO4 – rich ground water;~~
- ~~Zone C – variable composition (0.3-1.6 molal); Mg/Ca ratio 0.3 to 1.2; and~~
- ~~Zone D – high salinities (3-7 molal); K/Na weight ratios (0.2).~~

~~Facies A ground-water flow is slow, has not changed over the last 14,000 years, and probably recharged more than 600,000 years ago. Vertical leakage occurs to Facies A, and both lateral and vertical ground-water flow rates are extremely low. Facies B occurs in an area with greater vertical fracturing in the Culebra, and therefore exhibits more vertical infiltration and more rapid lateral flow in the Culebra. Flow in Facies B is currently to the south (it may mix with Facies C water to the southeast) but was more toward the west during wetter climates; vertical infiltration from the Dewey Lake to the Culebra Facies B is assumed by the Permittees to have occurred during wetter climates in an area south of the WIPP site. Facies C water was not diluted to create Facies B water. Facies C occurs "in-between" Facies A and B, and ground-water flow entered the Culebra prior to the climate change (to drier conditions) 14,000 years ago. Facies C ground-water flow is to the south at WIPP, where the Permittees theorized that it joins with a small amount of Facies A solute being transported from the east. Ground-water flow rate in Facies C is faster than in A but slower than in B, and the proposed recharge area from the Dewey Lake to the Culebra was to the northeast of the WIPP site. Facies C ground-water~~

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~~infiltrated into the Dewey Lake and then interacted with anhydrite and halite along its path to the Culebra, wherein it mixed with smaller amounts of Facies A water, the Permittees concluded that the presence of anhydrite within Rustler units does not preclude slow downward infiltration (DOE, 1997).~~

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area, Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (TDS) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6 - 5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4 - 8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP

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site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra ground-water was inconsistent with flow directions. This was based on the premise that f~~F~~acies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

Head distribution in the Culebra (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)) is consistent with basin-scale ground-water basin modeling results indicating that the generalized ground-water flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

~~Ground-water levels in the Culebra in the WIPP region have been measured for several decades. Water-level rises have been observed in the WIPP region and are possibly related to recovery from impacts caused by shaft installation, response to potash effluent discharge, or are unexplained, as discussed below. The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the potential cause of the water-level rise appears to be a primary factor.~~

~~In the vicinity of the WIPP site, water-level rises are believed to be caused by recovery from drainage into the shafts. Drainage into shafts has been reduced by a number of grouting programs over the years, most recently in 1993 around the Air Intake Shaft. Northwest of the site, in and near Nash Draw, water levels appear to fluctuate in response to effluent discharge from potash mines. Correlation of water-level fluctuation with potash mine discharge, however, cannot be proven definitively because sufficient data on the timing and volumes of discharge are not available. Water-level rises in the vicinity of the H-9 hydropad, about 6.5 miles south of the site, are thought to be caused by neither WIPP activities nor potash mining discharge. They remain unexplained. The Permittees continue to monitor ground-water levels throughout the region.~~

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

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As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying ~~unnamed lower member~~ Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta ~~member~~ Member (**Magenta**) of the Rustler ~~over~~ across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale ground-water ~~basin~~ modeling.

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~~Recent simulations to enhance the conceptual understanding of the geohydrology of the Rustler can be found in Corbet and Knupp, 1996.~~

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP ~~site~~ facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering ~~(shown, for example, as Well H-8 in Figure L-7). However, the Permittees identified the Culebra as potential aquifer in the Compliance Certification Application (DOE, 1996). Because of this, the Culebra will be the focus of future ground-water monitoring at WIPP as it is also the most transmissive continuous water-bearing zone at WIPP and is the most likely pathway for contaminant migration.~~

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the ground-water monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) ~~applies~~ apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if ground-water monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that ground-water monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP ~~Ground-water~~ Detection Monitoring Program (DMP)—Overview

L-3a Scope

~~The Permittees have established a RCRA "Ground-water Detection Monitoring Program (DMP) Plan" to define and protect ground-water resources at WIPP. One of the objectives of the WIPP DMP is to establish, by means of ground-water sampling and analysis, an accurate and representative ground-water database that is scientifically defensible and demonstrates regulatory compliance. In addition, the DMP will be used to determine background or existing~~

~~conditions of ground-water quality and quantity, including ground-water surface elevation and direction of flow, around the WIPP facility area.~~

This DMP plan governs ~~all~~ ground-water sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264 Subpart F ~~§§264.90 through 264.101~~), and ensures that ~~all~~ such data are gathered in accordance with these and other applicable requirements. ~~The ground-water quality data generated by monitoring activities will provide a comprehensive background database against which future analytical~~ Analytical results ~~can be compared~~ collected during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

~~Ground-water monitoring at WIPP has been historically conducted by several programs including the WIPP Site Characterization Program, the WIPP WQSP, and recently the WIPP Ground-water Surveillance Program (**GWSP**). Ground-water quality and ground-water surface elevation data have been collected by these programs for over 12 years at WIPP. Data from the WQSP wells (which are widely distributed across the area, see Figure L-8) will be used to continually define changes in the area's potentiometric surface and ground-water flow directions. New monitoring wells included in the WIPP GWSP (WQSP wells 1-6a) were constructed to the specifications provided in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (EPA, 1986) and constitute the RCRA ground-water monitoring network specified in this DMP as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). These wells are being used to establish background ground-water quality, ground-water surface elevations and flow directions in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(f) and (g) and 264.98(e)). Justification for the locations of these wells (3 upgradient and 4 downgradient) is presented below.~~

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

~~The WQSP wells 1 through 6 constitute the RCRA DMP for WIPP (Figure L-9 and Permit Attachment B, Figure B2-3) during detection monitoring as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). This monitoring plan is a continuation of the current WIPP GWSP, and these wells will serve as the monitoring locations during background water-quality characterization and the RCRA DMP (Figure L-9 and Permit Attachment B, Figure B2-3).~~

Wells WQSP-1, WQSP-2, and WQSP-3 ~~were~~ are located directly upgradient (north) of the WIPP shaft area. ~~The locations of the three upgradient wells were selected to be representative of the flow vectors of ground water moving downgradient onto the WIPP site. Figure 34 of~~

~~Davies, 1989, shows the simulation of direction and magnitude of ground-water flow. The upgradient wells were located based on the flow vectors resulting from this model simulation. The original WQSP observation wells, as well as those in the RCRA DMP, have been and will continue to be used as piezometer wells to support collection of ground-water surface elevation and ground-water flow modeling data to demonstrate regulatory compliance. Well location surveys for each of the seven wells were performed by the Permittees' survey personnel using the State Plane Coordinates North American Datum Model 27 method. Results of the surveys are on file with the New Mexico State Engineers Department along with the associated extraction permits for each well.~~

WQSP-4, WQSP-5, and WQSP-6 ~~were~~ are located downgradient (south) of the WIPP shaft area ~~in concert with the flow vectors shown by this model simulation~~. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra. ~~based on the greatest velocity magnitude of ground-water flow leaving the shaft area as shown on Figure 34 of Davies, 1989, and upgradient of the WIPP LWA boundary.~~ Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity ~~around wells DOE-1 and H-11,~~ which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

~~The Culebra has been selected for the focus of the DMP due to it being regionally extensive and exhibiting the most significant transmissivity of the water-bearing units at WIPP. The Culebra has been extensively studied during all past hydrologic characterization programs and found to be the most likely hydrologic pathway to the accessible environment or compliance point for any potential contamination.~~

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." ~~The RCRA ground-water monitoring network was not installed immediately downgradient of this plane. However, because the Underground HWDUs at WIPP are Subpart X units, and due to the relatively unique containment and transport aspects of the site, monitoring at the proposed locations will allow for detection of releases prior to release of these contaminants to the general public at the LWA boundary.~~ Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

~~The DMP wells were located to intercept flow vectors downgradient away from the WIPP shafts area based on current density corrected potentiometric surfaces (Figure L-9). Based on natural contours of the potentiometric surface (Figure L-9) the selected well placement locations are downgradient of the general flow direction from the shaft area.~~ Transport modeling ~~of contaminant migration throughout the Culebra to the Land Withdrawal Act boundary~~ suggest~~s~~ that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years, ~~if, under worst case conditions,~~ This assumes conditions where hazardous constituents ~~could~~ migrate from the sealed repository (post closure) to the Culebra via the

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~~sealed shafts. If contaminants were to migrate from the disposal facility, they would be detected by the DMP wells located midway between the shafts and LWA such that samples from wells could detect these contaminants long before they could reach the LWA boundary.~~

Potentiometric surfaces and ground-water flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility -area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). ~~Recent (December 1996) p~~Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

~~(Figure L-9). WQSP-4, WQSP-5, and WQSP-6 have been located downgradient of the waste emplacement areas according to present-day adjusted potentiometric surfaces.~~

~~Potentiometric surfaces that have not been corrected for density differences and that contain transient relics of previous pumping drawdown events do not reflect accurate natural ground-water flow directions and should not be used to assess the adequacy of ground-water monitoring locations. Previous potentiometric surface maps showing a potentiometric low and hydrologic gradient toward the area between WQSP-3 and WQSP-4 had not been adjusted to freshwater head equivalents, and had also been influenced by the long-term pumping at well H-19. Hence, some historic maps may not represent natural Culebra flow directions or gradients, and appropriateness of the RCRA monitoring network cannot be definitively evaluated using these data.~~

L-3b(1) ~~DMP~~ Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

~~L-3b(1)(i) WQSP-1~~

The six ~~WQSP~~ DMP Culebra wells were ~~Well WQSP-1 was~~ drilled between September 13 and October 16, 1994. The~~, to a~~ total depth of~~ each well is shown in Table L-5.737 ft (225 m) bgs~~. The wells were ~~borehole was~~ drilled through the Culebra and ~~extends 15 ft (5 m) into the unnamed lower member of the Rustler~~Los Medaños as shown in Table L-5. The wells ~~werewas~~ drilled to the top of the Culebra ~~a depth of 693 ft (211 m) bgs~~ using compressed air as the drilling fluid and~~. The interval from 693 to 737 ft (225 to 211 m) bgs (the total depth) was drilled using air mist with a foaming agent as the drilling fluid. WQSP-1 was drilled to 695.6 ft (212 m) bgs using~~ a 9⅞-in. drill bit. The wells were then ~~and was~~ cored ~~from 695.6 to 737 ft (212 to 225 m) bgs~~ using a 5¼-in. core bit to cut 4-in.~~ -~~(0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, ~~WQSP~~ DMP wells were ~~WQSP-1 was~~ reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were ~~WQSP-1 was~~ cased from the surface to total depth ~~737 ft (224.6 m) bgs~~ with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval ~~as shown in Table L-5 from 702 to 727 ft (214 to 222 m) bgs~~. The annulus between the borehole wall and the casing/screen is packed with sand ~~from 640 to 661 ft (195 to 198 m) bgs~~ and with 8/16 Brady gravel as indicated in Table L-5.~~from 661 to 737 ft (198 to 225 m) bgs. Based on core log results, the Culebra is located from 699 to 722 ft (213 to 220 m) bgs (see Figure L-10).~~

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Comment [r2]: DMP? WQSP has been deleted from the acronyms table.

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~~L-3b(1)(ii) WQSP-2~~

~~Well WQSP-2 was drilled between September 6 and 12, 1994, to a total depth of 846 ft (257.9 m) bgs. The borehole was drilled through the Culebra and extends 12.3 ft (3.7 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 800 ft (244 m) bgs with a 9⅞-in. drill bit using compressed air as the drilling fluid. The interval from 800 to 846 ft (244 to 258 m) bgs (the total depth) was drilled with a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-2 was reamed to 9⅞ in. (0.3 m) in diameter to total depth. WQSP-2 was cased from the surface to 846 ft (258 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 811 to 836 ft (247 to 255 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 790 to 793 ft (241 to 242 m) bgs and with 8/16 Brady gravel from 793 to 846 ft (242 to 258 m) bgs. Based on core log results, the Culebra is located from 810.1 to 833.7 ft (247 to 254 m) bgs (see Figure L-11).~~

~~L-3b(1)(iii) WQSP-3~~

~~Well WQSP-3 was drilled between October 21 and 26, 1994, to a total depth of 880 ft (268 m) bgs. The borehole was drilled through the Culebra and extends 10 ft (3.1 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 880 ft (268 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-3 was drilled to 833 ft (254 m) bgs using a 9⅞-in. drill bit and was cored from 833 to 870 ft (254 to 268 m) bgs using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core. After coring, WQSP-3 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 880 ft (268 m) bgs. WQSP-3 was cased from the surface to 880 ft (268 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 844 to 869 ft (257 to 265 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 827 to 830 ft (252 to 253 m) bgs and with 8/16 Brady gravel from 830 to 880 ft (253 to 268 m) bgs. Based on core log results, the Culebra is located from 844 to 870 ft (257 to 265 m) bgs (see Figure L-12).~~

~~L-3b(1)(iv) WQSP-4~~

~~Well WQSP-4 was drilled between October 5 and 10, 1994, to a total depth of 800 ft (244 m) bgs. The borehole was drilled through the Culebra and extends 9.2 ft (2.8 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 740 ft (226 m) bgs with a 9⅞-in. drill bit using compressed air as the drilling fluid. The interval from 740.5 to 798 ft (225.7 to 243 m) bgs was cored with a 5¼-in. (0.13-m) core bit to cut 4-in. (0.1-m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-4 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 800 ft (244 m) bgs. WQSP-4 was cased from the surface to 800 ft (244 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 764 to 789 ft (233 to 241 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 752 to 755 ft (229 to 230 m) bgs and with 8/16 Brady gravel from 755 to 800 ft (230 to 244 m) bgs. Based on core log results, the Culebra is located from 766 to 790.8 ft (233 to 241 m) bgs (see Figure L-13).~~

~~L-3b(1)(v) WQSP-5~~

~~Well WQSP-5 was drilled between October 12 and 19, 1994, to a total depth of 681 ft (208 m) bgs. The borehole was drilled through the Culebra and extends into the unnamed lower member of the Rustler. The well was drilled to a depth of 676 ft (206 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-5 was drilled to 648 ft (198 m) bgs using a 9⅞-in. drill bit and was cored from 648 to 676 ft (198 to 206 m) bgs using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core. After coring, WQSP-5 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 681 ft (208 m) bgs. WQSP-5 was cased from the surface to 681 ft (208 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 646 to 671 ft (197 to 205 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 623 to 626 ft (190 to 191 m) bgs and with 8/16 Brady gravel from 626 to 681 ft (191 to 208 m) bgs. Based on core log results, the Culebra is located from 648 to 674.4 ft (198 to 205.6 m) bgs (see Figure L-14).~~

~~L-3b(1)(vi) WQSP-6~~

~~Well WQSP-6 was drilled between September 26 and October 3, 1994, to a total depth of 616.6 ft (187.9 m) bgs. The borehole was drilled through the Culebra and extends 9.7 ft (3 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 367 ft (112 m) bgs using compressed air as the drilling fluid. The interval from 367 to 616 ft (112 to 188 m) bgs (the total depth) was drilled using brine as the drilling fluid. WQSP-6 was drilled to 568 ft (173 m) 4-in. (0.1-m) ft bgs using a 9⅞-in. drill bit and was cored from 568 to 616 ft (173 to 188 m) bgs using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core. After coring, WQSP-6 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 616.6 ft (188 m) bgs. WQSP-6 was cased from the surface to 616.6 ft (188 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 581 to 606 ft (177 to 185 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 567 to 570 ft (173 to 173.7 m) bgs and with 8/16 Brady gravel from 570 to 616.6 ft (174 to 188 m) bgs. Based on core log results, the Culebra is located from 582 to 606.9 ft (177 to 185 m) bgs (see Figure L-15).~~

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the ground-water monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

~~The seven RCRA monitoring wells have been sampled on a semiannual basis since their installation in 1995 to establish background ground-water quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98). This has included at least two full rounds of 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX analysis for samples from each of the proposed RCRA detection monitoring wells. In addition, ground-water samples were collected from the DMP wells (from March 1997 until waste emplacement) at a frequency of four sample replicates collected semiannually from each well for the indicator parameters of pH, specific conductance (SC), total organic carbon (TOC), and total organic halogen (TOX) to further establish background ground-water quality until detection monitoring in accordance with~~

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~~20.4.1.500 NMAC (incorporating 40 CFR §264.98) becomes applicable. A total of four rounds of Appendix IX analysis will be conducted for samples from each well for use in background ground-water quality determinations.~~

~~Detection monitoring will start when the Permittees emplace waste and continue through the post-closure phase as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90(c)). During detection monitoring, one sample and one sample duplicate will be collected semiannually from each well in the RCRA detection monitoring network. As shown in Table L-2, the DMP will continue to collect ground-water quality samples for all seven wells on a semiannual basis during the life of the DMP. 20.4.1.500 NMAC (incorporating 40 CFR §264.97(g)(2)) provides that an alternate sampling frequency to that provided in 20.4.1.500 NMAC (incorporating 40 CFR §264.98) may be proposed by the Permittees. Given the nature and rate of ground-water flow in the area surrounding WIPP, collecting and analyzing one sample semiannually will be protective of human health and the environment because any hazardous constituent leaving the underground disposal facility will not have the potential to migrate beyond the ground-water monitoring network in a one-year time frame. Ground-water flow characteristics are presented in detail in Addendum L-1, Section L-1-2a of the Amended Renewal Application (DOE, 2009).~~

Ground-water surface elevations will be monitored in each of the ~~six~~seven DMWs~~DMP wells~~ on a monthly basis. The ground-water surface elevation in each DMW ~~DMP well~~ will also be measured prior to each annual sampling event. The g~~G~~round-water surface elevation measurements in the WLMP wells~~other existing WQSP well sites~~ will also be monitored on a monthly basis when accessible ~~to supplement the area water-level database and to help define regional changes in ground-water flow directions and gradients~~. The characteristics of the DMW~~RCRA DMP~~ (sampling frequency, location) will be evaluated if significant changes are observed in the ground-water flow direction or gradient. ~~If any change occurs which could affect the ability of the DMP to fulfill the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F), the Permittees shall promptly notify NMED in writing and apply for a permit modification, if appropriate.~~

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b ~~analytes of interest are~~ ~~analytes of interest~~ measured as part of the DMP. ~~to establish background ground-water quality prior to emplacement of waste include all indicator parameters and all other parameters listed in 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX. Field measurements of pH, SC, temperature, chloride, Eh, total iron, and alkalinity are also measured during background sampling .~~

~~The DMP was initiated upon waste emplacement, at which time the semiannual samples will be analyzed for the parameters listed in Table L-3. Parameters to be analyzed by the contract laboratory such as specific conductance, total dissolved solids, total suspended solids, density, pH, total organic carbon, and total organic halogens were included as indicator parameters because of their universal commonality to ground water. Parameters such as chloride, alkalinity, calcium, magnesium, and potassium were included as matrix-specific general indicator parameters. Calcium, magnesium, potassium, chloride, and iron may be deleted during detection monitoring, with prior approval of NMED. Organic and inorganic compounds on the right hand side of Table L-3 were chosen because they will occur in the waste to be disposed at the WIPP facility.~~ Additional hazardous ~~constituents~~constituents~~parameters~~ may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP

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facility.~~the tentatively identified compound (TIC) process specified in the Waste Analysis Plan, Permit Attachment C.~~ If hazardous constituents~~compounds~~ are identified, these will be added to Part 5, Table 5.4.b~~the DMP list~~, unless the Permittees provide justification for their omission (e.g., hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

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L-4c Ground-water Surface Elevation Measurement, Sample Collection and Laboratory Analysis

Ground-water surface elevations will be measured in each DMW~~well~~ prior to ground-water sample collection. Ground-water will be extracted using serial and final sampling methods. Serial samples will be collected until ground-water field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.~~DMP analytical suite.~~

L-4c(1) Ground-water Surface Elevation Monitoring Methodology

The WIPP ground-water level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3.~~is a subprogram of the DMP. The quality assurance activities of the WLMP are in strict accordance with WP 13-1, and the quality assurance implementing procedure specific to ground-water surface elevation monitoring is WIPP Procedure WP 02-EM1014[2]. Current versions of both WP 13-1 and WP 02-EM1014 are maintained in the WIPP Operating Record.~~

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, ~~Ground-water surface elevation monitoring is in progress now and will continue through the post-closure care period specified in Permit Part 7. This section of the plan addresses the activities of the WLMP during the preoperational and operational phases of WIPP.~~

~~Collection of ground-water surface elevation data is required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). These data also provide:~~

- ~~Data collection as required by the Environmental Monitoring Plan.~~
- ~~A means to fulfill commitments made in the Final Environmental Impact Statement (FEIS).~~
- ~~A means to comply with future ground-water inventory and monitoring regulations.~~
- ~~Input for making land-use decisions, (i.e., designing long-term active and passive institutional controls for the site).~~

~~[2] WP 02-EM1014 "Groundwater Level Measurements" is a technical procedure that specifies the steps followed by Environmental Monitoring (EM) personnel for making manual ground-water level measurements in ground-water wells in the vicinity of the WIPP facility. The procedure provides general instructions including prerequisites, safety precautions, performance frequency, quality assurance, and records. Specific instructions are included for using the water level measurement electrical conductance probe and data management.~~

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~~A discussion explaining the calculation of freshwater heads from mid-formation depth at WIPP can be found in Haug, et al. (1987). Freshwater heads are useful in identifying hydraulic gradients in aquifers of variable density such as those existing at the WIPP site. Freshwater head at a given point is defined as the height of a column of freshwater that will balance the existing pressure at that point (Luszczynski, 1961).~~

Measured Culebra ~~ground~~-water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho_{\gamma g} h$$

where

p = freshwater head (length of freshwater head~~pressure~~)
$\gamma\rho$ = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)
ρg = freshwater density (mass/volume)
h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity.

Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

~~density (expressed as specific gravity).~~

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate ground-water surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. An SOP will be used when making water-level measurements for this program. The SOP will specify ~~When using an electrical conductance probe, the depth to water will be determined by reading the appropriate measurement markings on the embossed measuring tape when the alarm is activated at the surface. WIPP Procedure WP 02-EM1014 specifies~~ the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records. ~~A current revision of this procedure will be maintained in the WIPP Operating Record.~~

L-4c(1)(ii) Ground-water Surface Elevation Records and Document Control

~~All~~ incoming data will be processed in a ~~timely~~ manner ~~that~~to ~~ensures~~assure data integrity. The data management process for ground-water surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not

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~~• Assistance in understanding any changes to readings from the water pressure transducers installed in each of the shafts to monitor water conditions behind the liners.~~

~~• An understanding of whether or not the horizontal and vertical gradients of flow are changing over time.~~

~~The objective of the WLMP is to extend the documented record of ground-water surface elevation fluctuations in the Culebra and Magenta members of the Rustler in the vicinity of the WIPP facility and to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). Ground-water surface elevation data will be collected from each well of the RCRA DMP. Ground-water surface elevation data will also be collected from other Culebra wells, as well as monitoring wells completed in other water-bearing zones overlying and underlying the WIPP repository horizon (see Figure L-18) when access to these zones is possible. This includes, but is not limited to, the Bell Canyon, the Forty-niner, the contact zone between the Rustler and Salado, and the Dewey Lake.~~

groundwater~~Ground-water~~ surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, when accessible~~at least one accessible completed interval at each available well pad~~. ~~At well pads with two or more wells completed in the same interval, quarterly measurements will be taken in the redundant wells.~~ (Wwell locations are shown in Figure L-1418). ~~Ground-water surface elevation measurements will be taken monthly at each of the seven DMP wells, as well as prior to each sampling event.~~ If a cumulative ground-water surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the Annual Culebra Groundwater Report~~report~~ specified in Permit Part 5. Abnormal, unexplained changes in ground-water surface elevation will be evaluated to determine if they~~may~~ indicate changes in site recharge/discharge which could affect the assumptions regarding DMW~~DMP well~~ placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Ground-water surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual ground-water surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of ground-water surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density~~both vertically in well bores and areally from well to well~~. To monitor the hydraulic gradients of the hydrologic flow systems ~~at WIPP~~ accurately, actual ground-water surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 ~~bores~~ will be measured annually. ~~When both of these parameters are known, equivalent freshwater heads will be calculated. The concept of freshwater head is discussed in Luszczynski (1961).~~

possible (~~ie~~.~~ge~~., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to applicable SOPs (see Table L-3). ~~guidelines outlined in WIPP Procedures WP 02-EM3001[3] and WP 02-EM1014[4]. Current copies of these procedures are maintained within the WIPP Operating Record.~~ These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program ~~will~~ calculates ground-water surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet program adjusts ~~will also adjust~~ ground-water surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. ~~The data contained on the computerized work sheet will be translated into a database file. A printout will be made of the database file. The data each month will then be compiled into report format and transmitted to the appropriate agencies as requested by the Permittees.~~ Ground-water surface elevation data and equivalent freshwater heads for the~~all~~ Culebra wells in Table L-4 will be transmitted to NMED by May 31 and November 30~~one month after data are collected~~. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

~~A computerized database file will be maintained for all ground-water surface elevation data. Monthly and quarterly data will be appended into a yearly file. Upon verification that the yearly database is free of errors, it will be appended into the project database file. A printed copy of the current project database (through December of the preceding year) will be kept in the Environment, Safety and Health Department (ES&H) EM fire-resistant storage area.~~

L-4c(2) Ground-water Sampling

L-4c(2)(i) Ground-water Pumping and Sampling Systems

~~The water-bearing units at WIPP are highly variable in their ability to yield water to monitoring wells. The Culebra, the most transmissive hydrologic unit in the WIPP area, exhibits transmissivities that range many orders of magnitude across the site area and is the primary focus of the DMP.~~

~~[3] WP 02-EM3001 "Administrative Processes for Environmental Monitoring Programs" is a management control procedure to provide the administrative guidance to be used by Environmental Monitoring (EM) personnel to maintain quality control (QC) associated with EM sampling activities and to assure that data acquired under the WIPP Environmental Monitoring Program are valid. The precautions and limitations portion of this procedure assure that only qualified personnel acquire samples under the EM program, that cross contamination of sampling equipment is prevented, and that sample hold times are not exceeded. The Performance portion of the procedure provides step-by-step instructions for Quality Assurance/Quality Control (QA/QC) implementation, the use of data sheets and sample tracking logbooks, sample tasking from collection to submittal, and actions to take if sample results indicate the potential for exceeding a regulatory limit.~~

~~[4] WP 02-EM1014 "Groundwater Level Measurement", is a technical procedure which lists the equipment required and the operational checks necessary to perform groundwater level measurements. This procedure as well as WP 02-EM3001 also provides information on performing validation and verification of laboratory data.~~

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The ground-water pumping and sampling systems used to collect a ground-water sample from the ~~six~~seven ~~DMWs new DMP wells~~ will provide continuous and adequate production of water so that a representative ground-water sample can be obtained. ~~The wells used for ground-water quality sampling vary in yield, depth, and pumping lift. These factors affect the duration of pumping as well as the equipment required at each well.~~

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The DMWs are ~~DMP wells will be~~ individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down~~-~~hole submersible pumps are ~~will be~~ controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

~~The electronic flow controller allows personnel collecting samples to control the rate of discharge during well purging to minimize the potential for loss of volatiles from the sample.~~ As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged no more than~~a minimum of~~ three well bore volumes or ~~unit~~until ~~field~~ parameters have stabilized, which-ever comes first. ~~at a rate that will minimize the agitation of recharge water. This will be accomplished by monitoring formation pressure and matching the rate of discharge from the well as nearly as possible to the rate of recharge to the well. WIPP Procedure WP 02-EM1002[5] specifies the methods used for controlling flow rates and monitoring formation pressure. A current version of this document will be maintained in the WIPP Operating Record.~~ Well purging will performed in accordance with an SOP ~~requirements will be used~~ in conjunction with serial sampling to determine when the ground-water chemistry stabilizes and is therefore representative of undisturbed ground-water.

The DMWs are~~DMP wells will be~~ cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). ~~Details of well construction are presented in Section L-3b(1).~~ An electric, submersible pump installation without the use of a packer is~~will be~~ used in this instance. The largest amount of discharge from the submersible pump ~~will~~ takes place from a discharge pipe. In addition to this main discharge pipe, a dedicated ~~Teflon®~~-sample line~~,~~ running parallel to the discharge pipe~~,~~ is ~~will also be~~ used. The sampling line is manufactured from a chemically inert material. ~~Flow through the pipe will be regulated on the surface by a flow control valve and/or variable speed drive controller.~~ Cumulative flow is~~will be~~ measured using a totalizing flow meter. Flow from the discharge pipe is ~~will be~~ routed to a discharge tank for disposal.

The dedicated ~~Teflon®~~-sampling line is~~will be~~ used to collect the water sample that will undergo analysis. By using a dedicated ~~Teflon®~~-sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow

Comment [r4]: What is the difference b/w will/will not and is/is not? "is " is used throughout this paragraph

Comment [r5]: ???

~~[5]WP 02-EM1002 "Electric Submersible Pump Monitoring System Installation and Operation" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples using electric submersible pumps (ESPs). The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure the correct installation and operation. The procedure details how to install the various subsystems such as the surface discharge and pressure monitoring system and the pressure monitoring bubbler and how to start up and shut down the ESP.~~

through the sample collection line ~~is~~will be regulated by a flow-control valve. The sample line ~~is~~will be insulated at the surface to minimize temperature fluctuations.

~~Pressure Monitoring Systems~~

~~The DMP wells do not require the installation of a packer because sample biases due to well construction deficiencies are not present. However, pressures will be monitored using down hole automatic air line bubblers in the formation to maintain the water level above the pump intake. Pressure transducers may be used in line with bubblers to provide continual electronic monitoring through data acquisition systems. WIPP Procedure WP 02-EM1002 provides instructions for monitoring formation pressure using automatic airline bubblers in conjunction with pressure transducers and data acquisition systems. A current version of this document will be maintained in the WIPP Operating Record.~~

~~The mobile field laboratory provides a work place for conducting field sampling and analyses. The laboratory will be positioned near the wellhead, will be climate controlled, and will contain the necessary equipment, reagents, glassware, and deionized water for conducting the various field analyses.~~

~~Sampling Overview~~

~~Two types of water samples will be collected: serial samples and final samples. Serial samples will be taken at regular intervals and analyzed in the mobile field laboratory for various physical and chemical parameters (called field indicator parameters). The serial sample data will be used to determine whether the sample is representative of undisturbed ground water as a direct function of the stabilization of field indicator parameters and the volume of the water being pumped from the well. Interpretation of the serial sampling data will enable the Team Leader (see Section L-7) to determine when conditions representative of undisturbed ground water are attained in the pumped ground water.~~

~~Final samples will be collected when the serially sampled field indicator parameters have stabilized and are therefore representative of undisturbed ground water.~~

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the ground-water chemistry stabilizes and is therefore representative of undisturbed ground-water. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. Each DMW will be purged to no more three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed parameter are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile filed laboratory for field indicator parameters. ~~will consider a serial sample representative of undisturbed ground water when the majority of field indicator parameter measurements have stabilized within ±5 percent of the average of analytical results for the field indicator parameter from the background ground-water quality for each DMP well. Nonstabilization of one or two field indicator parameters attributable to matrix interferences, instrument drift, or other unforeseen reasons will not preclude the collection of final samples, provided the volume of purged water exceeds three well bore volumes.~~ The Permittees ~~will report, in the operating record, any final samples collected when field indicator parameters were~~

~~not stabilized, and~~ will provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the ground-water as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the Permittees, ~~Team Leader (see Section L-7),~~ but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: pH, ~~chloride, divalent cations (hardness), alkalinity, total iron, pH, Eh,~~ temperature, specific conductance, and specific gravity.

~~Protocols for collection of serial samples are specified in WIPP Procedure WP 02-EM1006[6], Analysis of serial samples are specified in WIPP Procedure WP 02-EM1005[7], Current versions of these procedures will be maintained in the WIPP Operating Record.~~

The three field indicator parameters of temperature, specific ~~conductance~~conductance ~~Eh~~, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a ~~Teflon®~~-sample line at atmospheric pressure. ~~SS~~The iron, divalent cation, chloride, alkalinity, specific conductance, and specific gravity samples will be collected from the ~~Teflon®~~-sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the ~~Teflon®~~-sample line.

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. ~~Serial sampling water collected for solute and specific conductance determinations will be filtered through a 0.45 micrometers (µm) membrane filter using a stainless-steel, in-line filter holder. Filtered water will be used to rinse the sample bottle prior to serial sample collection.~~ Unfiltered ground-water will be used when determining temperature, pH, specific conductance ~~Eh~~, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. ~~The filtered sample collected~~

~~[6] WP 02-EM1006 "Final Sample and Serial Sample Collection" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples from the WQSP wells and from privately owned wells in the vicinity of WIPP. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, and prerequisite actions which assure the data quality. The procedure addresses collection of samples from private wells, collection of serial ground-water samples, the collection of final samples for submittal to the laboratory, and data review by the monitoring task leader.~~

~~[7] WP 02-EM1005 "Groundwater Serial Sample Analysis" is a technical procedure that provides step-by-step instructions for on-site analysis of ground-water to determine ground-water stability prior to the collection of final samples for analysis. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure data quality. The procedure addresses the field measurement of Eh, pH, temperature, specific gravity, specific conductance, alkalinity, chloride, divalent cation, and total iron as indicators of ground-water stability.~~

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~~for solute analyses will be immediately analyzed for iron and alkalinity because these two solution parameters are extremely sensitive to changes in the ambient water sample pressure and temperature. A sample and duplicate of filtered water will be collected and analyzed for solute parameters (alkalinity, chloride, divalent cations, and iron).~~ Temperature, pH, and specific conductance ~~Eh~~, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

~~Samples to be analyzed for chloride and divalent cations (after preservation with nitric acid and stored at 4°C) may be stored for one week prior to analysis with confidence that the analytical results will not be altered.~~

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. Standard Operating Procedures (see Table L-3) ~~WIPP Procedure WP 02-EM1006~~ defines the protocols for the collection of final and serial samples and analysis. ~~WIPP Procedure WP 02-EM1005 defines the protocols for serial sample analysis. Current versions of these procedures will be maintained in the WIPP Operating Record.~~

~~During the first two years of DMP well serial sampling, the first sample will be analyzed as soon as possible after the pump is turned on and daily thereafter for a period of four days or until the field indicator parameters (chloride, divalent cations, alkalinity, and iron) stabilize. Eh, pH, and SC will be continually monitored by using a flow cell with ion-specific electrodes and a real-time readout. When detection monitoring begins, the serial sampling process may be modified and the decision to collect final samples would then be based on the number of well bore volumes purged and results of the analysis of chloride, temperature, specific gravity, pH, Eh, and SC. Removal of serial sampling from the DMP will be accomplished through a permit modification and a modification to this plan.~~

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-~~6~~4 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head. ~~Non-dedicated sample collection lines from the well head to the sample collection area will be discarded after each use.~~

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (DI) water and rinsed in DI water. Sample containers will be new, certified clean

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containers that will be discarded after one use. Ground~~-~~water surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed ~~with two gallons of fresh water, then rinsed~~ in accordance with SOPs ~~with five gallons of 5 percent nitric acid solution and rinsed with five gallons of DI water~~ after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a ~~blank~~ rinsate blank sample will be collected to verify cleanliness~~decontamination~~.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered ~~Teflon®~~-sampling lines ~~branching from the main sample line~~. Detailed protocols, in the form of SOPs (see Table L-3) define how ~~procedures, assure that~~ final samples will be collected in a consistent and repeatable fashion. ~~WIPP Procedure WP 02-EM1006 defines the requirements for collection of final samples~~ for analyses.

~~A current version of this procedure will be maintained in the WIPP Operating Record.~~

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-64). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory ~~Standard Operating Procedures (~~**SOPs**~~)~~). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs~~procedures~~ generated, approved, and maintained by the contract analytical laboratory.

~~Before the final sample is taken, all plastic and glass containers will be rinsed with the pumped ground water, either filtered or unfiltered, dependent upon analysis protocol. When the rinsing procedure is completed the final sample will be collected.~~

Final samples will be sent to the analytical ~~contract~~ laboratories and analyzed for parameters and hazardous constituents specified in Part 5, table 5.4a and 5.4b.

~~general chemistry, radionuclides, metals, and selected VOCs that are specific to the waste anticipated to arrive at WIPP. Table L-3 presents the specific analytes for the DMP.~~

Duplicates of the final sample will be provided to WIPP Project oversight agencies ~~when~~as requested. ~~by the Permittees or NMED.~~

W~~Resulting w~~astes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3). ~~Procedure WP 02-RC.01[3]. A current version of this procedure will be maintained in the WIPP Operating Record.~~

~~[3] WP 02-RC.01 "Site-Generated, Non-Radioactive Hazardous Waste Management Plan" is a step-by-step procedure that defines site-generate non-radioactive hazardous waste (SGNRHW) and lists responsibilities of waste management organizations including the generator, waste handlers, sampling personnel, safety personnel, and compliance personnel. In addition, the procedure defines training requirements, container marking requirements, spill response, and list prohibitions. A Section of the procedure is focused on~~

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L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated ~~with either high purity hydrochloric acid, nitric acid, or sulfuric acid (ULTREX or equivalent), depending upon the standard method of treatment required for the particular parameter suite or~~ as requested by the analytical ~~contract~~ laboratory ~~SOPs (see Table L-4)~~.

The analytical ~~contract~~ laboratory receiving the samples will ~~use procedures that~~ prescribe the type and amount of preservative, the container material type, ~~and~~ the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when~~if~~ laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses~~will use~~ uniquely numbered chain of custody/ ~~(CofC) Forms and~~ request for analysis ~~(CofC/RFA) forms(RFA) Forms~~. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes~~parameters~~ of interest. WIPP SOPs (see Table L-3) ~~Procedure WP 02-EM3001~~ provides instructions to ensure proper sample tracking protocol. ~~A current revision of this procedure will be maintained within the WIPP Operating Record.~~

~~Insulated shipping containers packaged with crushed ice or reuseable ice packs will be used to keep the samples cool during transport to the contract laboratory. Holding times for specific analytical parameters require samples to be shipped by express air freight. The coolers will be packaged to meet Department of Transportation and International Air Transportation Association commercial carrier regulations.~~

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for ~~EM~~ sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3). ~~Procedure WP 02-EM3001. These procedures will be strictly followed throughout the course of each sample collection and analysis event. A current revision of this procedure will be maintained in the WIPP Operating Record.~~

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking ~~datalog books~~, and CofC/RFA ~~the request for analysis/chain of custody (RFA and CofC)~~ form~~.~~, An example form is shown in Figure L-13. ~~The forms are briefly defined in the following subsections.~~

~~All sample documentation will be completed for each sample and reviewed by the Team Leader or his/her designee for completeness and accuracy.~~

~~waste management practices including the management in satellite accumulation areas, the hazardous waste staging area for materials awaiting analysis, the establishment of accumulation times, and hazardous waste disposal.~~

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Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. ~~The Team Leader (see Section L-7) will assign the numbers prior to sample collection.~~ The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in ~~permanent,~~ indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, ~~The~~ custody seals that are~~will be~~ adhesive-backed strips ~~that~~ are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking ~~Logbook~~

~~AS~~ sample tracking information will be completed for each sample collected~~logbook (STLB) form will be completed for each sample collected~~. The sample tracking information~~STLB will~~ includes the following information: CofC/RFA form ~~C of C~~ number; ~~RFA No.,~~ date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

$$WQ6^{1}C^{2}R2^{3}N1^{4}$$

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking~~STLB~~ information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document~~, and checked by the Team Leader. When samples are shipped, the STLB will remain in the custody of the EM Section for sample tracking purposes.~~

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~~Request for Analysis and~~ Chain of Custody and Request for Analysis

A CofC/RFA~~n RFA and CofC~~ form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. ~~An example of the RFA and CofC form is presented in Figures L-17a and L-17b .~~ The CofC/RFA ~~RFA and CofC~~ form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the ~~CofC/RFA form. RFA and CofC.~~ The completed original (top page) of the CofC/RFA ~~RFA and CofC~~ will be returned to the Permittees ~~Team Leader~~ with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA ~~RFA and CofC~~ form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed ~~by~~ using ~~ma commercial laboratory. M~~ethods ~~will be specified in procurement documents and will be~~ selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b ~~L-3~~ presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical ~~selected~~ laboratory shall demonstrate, through laboratory ~~SOPs, that~~SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility Oeperating Rrecord, ~~and will be available for review upon request by NMED.~~ Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in ground water and the complexity of brines associated with the Culebra groundwater~~WIPP repository~~.

The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (QC) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. ~~Once the initial qualification criteria, as specified above, have been met, the Permittees will select a laboratory based upon competitive bid. The selected laboratory will perform analytical work for the Permittees for a predetermined period of time, as specified in the contract between the Permittees and the selected laboratory. As this period of performance comes to an end, a new laboratory selection/competitive bid process will be initiated by the Permittees. The same or a~~

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~~different laboratory may be selected for the new contract period.~~ A copy of the laboratory ~~The~~ SOPs ~~for the laboratory currently under contract~~ will be maintained ~~in a file~~ in WIPP facility files~~the operating record by the Permittees~~. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record. ~~on behalf of the Permittees by the Management and Operating Contractor (MOC) Environmental Monitoring (EM). Data validation results are documented on an Approval/Variation Request (AR/VR) form (Procedure WP 15-PC3041). If no discrepancies are found in the data, the AR/VR form will be signed and the approved box will be checked. If however, discrepancies are found, the AR/VR form will be signed and the disapproved or approved on condition box will be checked and the form will be returned to the team leader accompanied by an attached report discussing the data validation results, any anomalies, and resolutions. Copies of the data validation report will be distributed to the EM Manager, QA Manager, the Team Leader, and the Contract Administrator. Copies of the data validation report will be kept on file in the EM records section for review upon request by NMED.~~

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration ~~Requirements~~

The equipment used to collect data for ~~the WQSP and~~ this DMP will be calibrated in accordance with SOPs~~maintenance administrative procedures specified below~~. The Permittees ~~EM Section~~ will be responsible for calibrating needed equipment on schedule and~~, in accordance with written procedures. The EM Section will also be responsible~~ for maintaining current calibration records for each piece of equipment.

L-4d(2) Ground-water Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking ground-water surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). ~~Procedure WP 10-AD3029[9] A current revision of this procedure will be maintained in the WIPP Operating Record.~~ The Permittees ~~EM Section~~ will be responsible for ensuring ~~calibrating the needed~~ equipment is calibrated on schedule in accordance with SOPs~~written procedures~~. The Permittees ~~EM Section~~ will also be responsible for maintaining copies of records of the most recent ~~current~~ calibration ~~records~~ for each piece of equipment.

~~[9] WP 10-AD3029 "Calibration and Control of Monitoring and Data Collection Equipment" provides the step-by-step protocols for the establishment and maintenance of a master database of monitoring and data collection (M&DC) equipment, the recall process for equipment needing calibration, the performance of calibrations, the management of calibration results to determine the adequacy of recall frequencies, functional testing of M&DC equipment, and reporting including out-of-tolerance reporting and expired calibration reporting. In addition, the procedure provides step-by-step process for the storage of calibrated M&DC equipment and the use of rental equipment.~~

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L-4e Statistical Analysis of Laboratory Analytical Data

Analytical data collected ~~As required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98), data collected to establish background ground-water quality and~~ as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees. ~~DMP. Statistical analysis of DMP data will conform to EPA guidance "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (EPA, 1989) and "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

L-4e(1) Temporal and Spatial Analysis

Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

~~Environmental parameters vary with space and time. The effect of one or both of these two factors on the expected value of a point measurement will be statistically evaluated through spatial analysis and time series analysis. These methods often require extensive sampling efforts that may exceed the practical limits of the DMP sampling procedures.~~

~~Spatial analysis may have limited use DMP during the operational period, although the effect of spatial auto-correlation on the interpretation of the data will be considered for each parameter. Spatial variability will be accounted for by the use of predetermined key sampling locations. Data analysis will be performed on a location-specific basis, or data from different locations will be combined only when the data are statistically homogeneous. Statistical homogeneity will be determined by evaluating mean values and variances from the residuals from the individual well data.~~

~~Time series analysis plays a more important role in data analysis for the DMP. Parameters will be reported as time series, either in tabular form or as time plots. For key time series parameters, these plots will be in the form of control charts on which control levels will be identified based on preoperational database, fixed standards, control location databases, or other standards for comparison. Where significant seasonal changes in the expected value of the parameter are identified in the preoperational database or in the control locations, corrections in the control levels which reflect the seasonal change will be made and documented.~~

L-4e(2) Distributions and Descriptive Statistics

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (UTLV) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method

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detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

~~For data sets which include more than ten data points that are homogeneous in space and time (including seasonal homogeneity) and have less than ten percent missing data, a test for conformance to the normal distribution will be performed. The test for normality of the data will be performed in accordance with the methodologies presented in "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

~~If normality is not met, the data will be log-transformed (or transformed using a suitable mathematical transformation, e.g., square root) and retested for normality. If the transformed data fit a normal distribution, the original data will be accepted as having lognormal or an otherwise mathematically-transformed normal distribution. If normality is still not found, two courses may be taken. One will be to continue to test the fit to standard families of distributions, such as the gamma, beta, and Weibull, with proper modifications to subsequent analyses based on these results. The other course will be to use nonparametric methods of data analysis.~~

~~For data sets smaller than ten, but homogeneous and complete, the lognormal distribution will be assumed. Data sets with more than ten percent missing data will be analyzed using nonparametric methods. Nonhomogeneous data sets will be subdivided into homogeneous sets and each of these analyzed individually.~~

~~Descriptive statistics will be calculated for each homogeneous data set. At a minimum, these include a central value and a range of variation. The central value is the arithmetic mean of the untransformed data if the data are not censored at either end. If the data are censored, either a trimmed mean or the median will be used as the central value (which may be within the censored range). If the data set is greater than ten and is uncensored, the standard deviation will be calculated and used as a basis for the reported range in variation. If these criteria are not met, the range between the 0.25 and 0.75 cartelist will be used.~~

L-4e(3) Action Levels~~Data Anomalies~~

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the ~~Data anomalies include data points reported as being below the limit of detection (LD) or otherwise censored over a specific range of values, missing data points occurring randomly in the data set, and outliers that cannot be ascribed to a known source of variation.~~

~~Whenever possible, sample values which are reported below detection limits will be incorporated into the database as sample values measured at one-half the detection limit for statistical analysis. When values are not available, alternative methods of analysis, as specified~~

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~~in previous sections, will be used. In particular, the use of nonparametric statistics will be required.~~

~~Missing data points comprising less than 10 percent of the data set do not significantly affect data analyses. Results based on data in which more than 10 percent is missing will be identified as such at the time of reporting. Consideration of the potential effect of missing data shall be made when the majority of the data are missing from a discrete time span.~~

~~Formal testing for outliers will only be done in accordance with EPA guidance. The~~ methodologies specified in ~~Section 8.2 of the~~ "Statistical Analysis of Ground-~~w~~Water Monitoring Data at RCRA Facilities" (EPA, 2009~~1989~~). ~~will be used to check for outliers.~~

~~If an outside source of variation is not identified to account for outliers in a data set, it will be included in the data set and all subsequent analyses. If the inclusion of such outliers is found to affect the final results of the analyses significantly, both results (with and without outliers) will be reported.~~

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background ground-water quality hazardous constituent specified in Part 5, Table L-5.4b~~3~~ at every detection ~~DMP ground-water~~ monitoring well during each of the ten background sampling events (with the exception of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed disposal began). ~~If any background ground-water quality parameter or constituent has not been measured prior to waste receipt, measurements will be made for those parameters or constituents in hydraulically upgradient DMP ground-water monitoring wells for a sequence of four sampling events. Following completion of the four sampling events, the arithmetic mean and variance shall then be calculated by the field supervisor or designee for each well.~~ These measurements ~~will then~~ serve as a statistical baseline (Part 5, Table 5.6)~~background value~~ that is ~~against which used statistical values~~ for evaluating the significance of the results of subsequent sampling events during detection monitoring ~~will be compared.~~ Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with ~~Statistical analysis and comparison will be accomplished using one of the five statistical tests specified in~~ 20.4.1.500 NMAC (incorporating 40 CFR §264.~~97~~98(h)(4)~~, which may include Cochran's Approximation to the Behrens-Fisher students' t-test at the 0.01 level of significance (described in Appendix IV to 20.4.1.500 NMAC (incorporating 40 CFR §264).~~ If the comparisons show that a constituent statistically exceeds the baseline ~~a significant increase at any of the DMWs monitoring site~~ (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3~~2~~)). The results of the statistical comparison will be reported annually to ~~in~~ the NMED in the Annual Culebra Groundwater ~~Site Environmental~~ Report ~~by November 30, (ASER), and will be reported to NMED~~ as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)). ~~in October.~~

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L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees~~. Laboratory data reports will be forwarded to the Team Leader (see Section L-7) and NMED~~ and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.
- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.
- Parameter and hazardous constituents~~Analytical parameter~~, analytical results, reporting units, reporting limit, analytical method used.
- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specifiede in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from ~~semi-~~annual ground-water sampling activities will be compared and interpreted by the Permittees ~~Team Leader~~ through generation of statistical analyses as specified in Section L-4e. The Permittees ~~Team Leader~~ will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report ~~ASER~~ in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra Groundwater ~~Site Environmental~~ Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report~~, and to the EM Manager and NMED in the ASER~~. The report~~ASER~~ will include all applicable information that may affect the comparison of background ground-water quality and ground-water surface elevation data through time. This information will include but is not limited to:

- DMW and WLMP w~~W~~ell configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).
- P~~Any p~~umping activities that may have taken place since publication of the last annual report (i.e., related to ground-water quality sampling, hydraulic testing, and shaft installation or grouting ~~activities~~) that may have taken place since the last annual groundwater report.

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- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

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- The results of the annual measurements of densities.
- Annotated hydrographs.
- Groundwater flow rate and direction.
- Potentiometric surface map generated using the following steps:
  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.
  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.
  - Fit trend surface through freshwater heads.
  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (PABCs) and define initial fixed-head boundary conditions based on the trend surface.
  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.
  - Run MODFLOW with optimal boundary conditions fit.
  - Contour MODFLOW head results on WIPP site.
  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.
  - Data analysis that will accompany the potentiometric surface map will include:
    - Measured versus modeled scatter plot diagram
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 16.4 feet (5 meters);

PART 1 - GENERAL PERMIT CONDITIONS

1.1. AUTHORITY

This Permit is issued pursuant to the authority of the Secretary of the New Mexico Environment Department (**Secretary**) under the New Mexico Hazardous Waste Act (**HWA**), NMSA 1978, §§74-4-1 through 74-4-14, in accordance with the New Mexico Hazardous Waste Management Regulations (**HWMR**), 20.4.1 NMAC.

Pursuant to the Resource Conservation and Recovery Act (**RCRA**), 42 U.S.C. §§6901 to 6992k, and 40 CFR Part 271 and Part 272 Subpart GG, the State of New Mexico, through the Secretary, is authorized to administer and enforce the state hazardous waste management program under the HWA in lieu of the federal program.

This Permit contains terms and conditions that the Secretary has determined are necessary to protect human health and the environment, pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)).

Any violation of a condition in this Permit may subject the Permittees or their officers, employees, successors, and assigns to:

1) A compliance order under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a));

2) An injunction under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

3) Civil penalties under §§74-4-10 and 74-4-10.1 of the HWA or §§3008(a) and (g) of RCRA (42 U.S.C. §§6928(a) and (g)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

4) Criminal penalties under §74-4-11 of the HWA or §§3008(d), (e), and (f) of RCRA (42 U.S.C. §§6928(d), (e), and (f)); or

5) Some combination of the foregoing.

The list of authorities in this paragraph is not exhaustive and the Secretary reserves the right to take any action authorized by law to enforce the requirements of this Permit.

1.2. EFFECT OF PERMIT

The Secretary issues this Permit to the United States Department of Energy (**DOE**), the owner and co-operator of the Waste Isolation Pilot Plant (**WIPP**) (EPA I.D. Number NM4890139088), and Washington TRU Solutions LLC, Management and Operating Contractor (**MOC**), the co-operator of WIPP. This Permit authorizes DOE and MOC (**the Permittees**) to manage, store, and dispose contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste at WIPP, and establishes the general and specific standards for these activities, pursuant to the HWA and HWMR.

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As to those activities specifically authorized or otherwise specifically addressed under this Permit, compliance with this Permit during its term shall constitute compliance, for purposes of enforcement, with Subtitle C of RCRA and the HWA, and the implementing regulations at 40 CFR Parts 264, 266, and 268 except for those requirements that become effective by statute after the Permit has been issued [20 4.1.900 NMAC (incorporating 40 CFR §270.4)]

Compliance with this Permit shall not constitute a defense to any order issued or any action brought under Sections 74-4-10.E or 74-4-13 of the HWA; Sections 3008(a), 3008(h), 3013, or 7003 of RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. §9601 et seq., commonly known as CERCLA) Sections 106(a), 104, or 107; or any other federal, state, or local law providing for protection of public health or the environment. This Permit does not convey any property rights of any sort or any exclusive privilege, nor authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local laws or regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.4, 270.30(g), and 270.32(b)(1))]

1.3. PERMIT ACTIONS

1.3.1. Permit Modification, Suspension, and Revocation

This Permit may be modified, suspended, and/or revoked for cause as specified in Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §§270.41, 270.42, and 270.43). The filing of a request by the Permittees for a permit modification, suspension, or revocation, or the notification of planned changes or anticipated noncompliance, shall not stay any permit condition. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(f))]

1.3.2. Permit Renewal

The Permittees may renew this Permit by submitting an application for a new Permit at least 180 calendar days before the expiration date of this Permit. In reviewing any application for a Permit renewal, the Secretary shall consider improvements in the state of control and measurement technology and changes in applicable regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h) and 270.30(b))]

1.3.3. Permit Review

The Secretary shall review this Permit no later than five (5) years after the effective date of this Permit, and shall modify this Permit as necessary pursuant to Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §270.41). Such modification(s) shall not extend the effective term of this Permit specified in Permit Section 1.7.2. [20.4.1.900 NMAC (incorporating 40 CFR §§270.41 and 270.50(b) and (d))]

1.4. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to

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other circumstances and the remainder of this Permit shall not be affected thereby. [40 CFR §124.16(a)(1) and (2)]

1.5. DEFINITIONS

Unless otherwise expressly provided herein, the terms used in this Permit shall have the meaning set forth in RCRA, HWA, and/or their implementing regulations.

1.5.1. Contact-handled Transuranic Mixed Waste

"Contact-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate not greater than 200 millirem per hour. [Pub. L. 102-579 (1992)]

1.5.2. Remote-handled Transuranic Mixed Waste

"Remote-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate of 200 millirem per hour or greater. For WIPP, the surface dose rate shall not exceed 1,000 rems per hour. [Pub. L. 102-579 (1992)]

1.5.3. Facility

"Facility" or "permitted facility" means the Waste Isolation Pilot Plant (**WIPP**) owned by the DOE and located approximately twenty six (26) miles east of Carlsbad, New Mexico, EPA I.D. Number NM4890139088. The WIPP facility comprises the entire complex within the WIPP Site Boundary as specified in the WIPP Land Withdrawal Act of 1992, Pub. L. 102-579 (1992), including all contiguous land, and structures, other appurtenances, and improvements on the Permittees' land, used for management, storage, or disposal of TRU mixed waste.

1.5.4. Permittees

"Permittees" means the United States Department of Energy (**DOE**), an agency of the Federal government, and the owner and co-operator of the WIPP facility; and Washington TRU Solutions LLC, Management and Operating Contractor (**MOC**), the co-operator of the WIPP facility. References to actions taken by "the Permittees" indicate actions that may be taken by either co-Permittee.

1.5.5. Secretary

"Secretary" means the Secretary of the New Mexico Environment Department (**NMED**), or designee.

1.5.6. TRU Waste

"TRU Waste" means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (A) high-level radioactive waste; (B) waste that the DOE Secretary has determined, with the

concurrence of the EPA Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations. [Pub. L. 102-579 (1992)]

1.5.7. TRU Mixed Waste

"TRU Mixed Waste" means TRU waste that is also a hazardous waste as defined by the HWA and 20.4.1.200 NMAC (incorporating 40 CFR §261.3).

1.5.8. Contact Handled Packages

"Contact Handled Packages" means TRUPACT-II, HalfPACT, and TRUPACT-III shipping containers and their contents.

1.5.9. Remote-Handled Packages

"Remote-Handled Packages" means both CNS 10-160B and RH-TRU 72-B shipping containers and their contents.

1.5.10. Containment Pallet

"Containment pallet" means a device capable of holding a minimum of one 55-gallon drum, or 85-gallon drum, or 100-gallon drum or a standard waste box, or a ten-drum overpack and that has internal containment for up to ten percent of the volume of the containers on the containment pallet.

1.5.11. Waste Characterization

"Waste characterization" or "characterization" means the activities performed by or on behalf of the waste generator/storage sites (**sites**) to obtain information used by the Permittees to satisfy the general waste analysis requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)). Characterization occurs before waste containers have been certified for disposal at WIPP.

1.5.12. Waste Confirmation

"Waste confirmation" or "confirmation" means the activities performed by the Permittees or the co-Permittee DOE, pursuant to Permit Attachment C7 (TRU Waste Confirmation), to satisfy the requirements specified in Section 310 of Pub. L. 108-447. Confirmation occurs after waste containers have been certified for disposal at WIPP.

1.5.13. Substantial Barrier

"Substantial barrier" means salt or other non-combustible material installed between the waste face and the bulkhead to protect the waste from events such as ground movement or

vehicle impacts. The substantial barrier incorporates the chain link and brattice cloth room closure specified in Permit Attachment A2.

1.5.14. Bulkhead

"Bulkhead" means a steel structure, with flexible flashing, that is used to block ventilation as specified in Permit Attachment A2 (Geologic Repository).

1.5.15. Explosion-Isolation Wall

"Explosion-isolation wall" means the 12-foot wall intended as an explosion isolation device that is part of the approved panel-closure system specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System).

1.5.16. Filled Panel

"Filled panel" means an Underground Hazardous Waste Disposal Unit specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.17. Internal Container

"Internal container" means a container inside the outermost container examined during radiography or visual examination (**VE**). Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not designed to hold liquid at the time of original waste packaging are not internal containers.

1.5.18. Observable Liquid

"Observable liquid" means liquid that is observable using radiography or VE as specified in Permit Attachment C (Waste Analysis Plan).

1.5.19. Filled Room

"Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 will no longer receive waste for emplacement.

1.5.20. Active Room

"Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU mixed waste and is not a filled room.

1.6. EFFECT OF INACCURACIES IN PERMIT APPLICATION

This Permit is based on the assumption that all information contained in the permit application and the administrative record is accurate and that the Facility will be constructed and operated as specified in the application. The permit application consists of information submitted in September 2009 and supplementary technical documents.

Any inaccuracies found in the submitted information may be grounds for the termination or modification of this Permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.41, §270.42, and §270.43) and for potential enforcement action.

1.7. DUTIES AND REQUIREMENTS

1.7.1. Duty to Comply

The Permittees shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized in an emergency permit specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.61). Any Permit noncompliance, except under the terms of an emergency permit, constitutes a violation of RCRA and/or HWA and is grounds for enforcement action; for Permit modification, suspension, or revocation; or for denial of a Permit modification or renewal application. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(a))]

1.7.2. Permit Term

This Permit shall be effective for a fixed term not to exceed ten years from the effective date. The effective date of this Permit shall be 30 days after notice of the Secretary's decision has been served on the Permittees or such later time as the Secretary may specify. [20.4.1.900 NMAC (incorporating 40 CFR §270.50(a))]

1.7.3. Duty to Reapply

If the Permittees wish to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittees shall apply for and obtain a new Permit. The Permittees shall submit an application for a new Permit at least 180 calendar days before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h), 270.30(b))]

1.7.4. Continuation of Expiring Permits

If the Permittees have submitted a timely and complete application for renewal of this Permit as specified in 20.4.1.900 NMAC (incorporating 40 CFR §§270.10, 270.13 through 270.29), this Permit shall remain in effect until the effective date of the new Permit if, through no fault of the Permittees, the Secretary has not issued a new Permit on or before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.51)]

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1.7.5. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for the Permittees in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(c))]

1.7.6. Duty to Mitigate

In the event of noncompliance with this Permit, the Permittees shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(d))]

1.7.7. Proper Operation and Maintenance

The Permittees shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this Permit. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(e))]

1.7.8. Duty to Provide Information

The Permittees shall furnish to the Secretary, within a reasonable time frame as specified by the Secretary, any relevant information which the Secretary may request to determine whether cause exists for modifying, suspending, or revoking this Permit, or to determine compliance with this Permit. The Permittees shall also furnish to the Secretary, upon request, copies of records required to be kept by this Permit. Information and records requested by the Secretary pursuant to this condition shall be provided in a paper or an electronic format acceptable to the Secretary. [20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.74(a) and 270.30(h))]

1.7.9. Inspection and Entry

The Permittees shall allow the Secretary, or authorized representatives, upon the presentation of credentials and other documents as may be required by law and at reasonable times, the following inspection and entry privileges specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(i)):

1.7.9.1. Entrance to Premises

To enter upon the Permittees' premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

1.7.9.2. Access to Records

To have access to and copy any records that must be kept under the conditions of this Permit;

1.7.9.3. Inspection

To have access to, inspect, and obtain photographs of any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

1.7.9.4. Sampling

To sample or monitor, for the purposes of assuring Permit compliance or as otherwise authorized by RCRA and/or HWA, any substances or parameters at any location. If the Secretary obtains any sample, prior to leaving the premises the Secretary shall give the Permittees a receipt describing the sample obtained and, if requested, a portion of each sample of equal weight or volume to the portion retained. If any analysis is made of the sample, the Secretary shall promptly furnish a copy of the results of the analysis to the Permittees.

Permit Section 1.7.9 shall not be construed to limit, in any manner, the Secretary's authority under Section 74-4-4.3 of the HWA.

1.7.10. Monitoring and Records

1.7.10.1. Representative Sampling

For the purposes of monitoring, the Permittees shall take samples and measurements representative of the monitored activity. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(1))]

1.7.10.2. Record Retention

Beginning with the effective date of this Permit, the Permittees shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, and copies of all reports and records required by this Permit until closure. If original strip chart recordings are more than three years old, copies are acceptable. The Permittees shall retain the waste minimization certification required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(9)), and records of all data used to complete the application for this Permit for a period of at least 3 years from the date of certification or application. The Secretary may extend these periods at any time, and these periods shall be automatically extended during the course of any unresolved enforcement action

regarding this facility. The Permittees shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations, during the active life of the facility and the post-closure period. [20.4.1.500 NMAC (incorporating 40 CFR §264.74(b)), 20.4.1.501 NMAC, and 20.4.1.900 (incorporating §270.30(j)(2))]

1.7.10.3. Monitoring Records Contents

As specified by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(3)), records of monitoring information shall include:

i. The dates, exact place, and times of sampling or measurements;

ii. The individuals who performed the sampling or measurements;

iii. The dates analyses were performed;

iv. The individuals who performed the analyses;

v. The analytical techniques or methods used; and

vi. The results of such analyses.

1.7.11. Reporting Requirements

1.7.11.1. Reporting Planned Changes

The Permittees shall give notice to the Secretary, as soon as possible, of any planned physical alterations or additions to the permitted facility. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(1))]

1.7.11.2. Reporting Anticipated Noncompliance

The Permittees shall give advance notice to the Secretary of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall not store or dispose TRU mixed waste in any modified portion of the facility (except as provided in 20.4.1.900 NMAC (incorporating 40 CFR §270.42)) until the following conditions specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(2)) are satisfied:

i. The Permittees have submitted to the Secretary, by certified mail or hand delivery, a letter signed by the Permittees and a New Mexico registered professional engineer stating that the facility has been constructed or modified in compliance with this Permit, and:

ii. The Secretary has either inspected the modified portion of the facility and finds it is in compliance with the conditions of this Permit; or waived the inspection or, within 15 calendar days of the date of submission of the letter required above, has not notified the Permittees of his intent to inspect.

1.7.12. Transfer of Permits

The Permittees shall not transfer this Permit to any person, unless the Secretary has approved a permit modification request for such transfer in writing. The Secretary shall require modification or revocation and reissuance of this Permit as specified by 20.4.1.900 NMAC (incorporating 40 CFR §§270.40 and 270.41(b)(2)) to identify the new Permittees and incorporate other applicable requirements under the HWA, RCRA, and their implementing regulations. The prospective new Permittee shall file a disclosure statement with the Secretary, if applicable and as specified at §74-4-4.7 of the HWA, prior to modification or revocation and re-issuance of the Permit.

Before transferring ownership or operation of the facility during its active life or post-closure care period, the Permittees shall notify the new owner or operator in writing as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.12(c) and 270.30(l)(3)).

1.7.13. 24 Hour and Subsequent Reporting

1.7.13.1. Oral Report

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(i)), within 24 hours from the time the Permittees become aware of the circumstances, the Permittees shall report orally to the Secretary any noncompliance which may endanger human health or the environment, including:

i. Information concerning release of any TRU mixed or hazardous waste that may cause an endangerment to public drinking water supplies; and

ii. Any information of a release or discharge of TRU mixed or hazardous waste, or of a fire or explosion from the facility, which could threaten the environment or human health outside the facility.

The oral report shall be made by calling the Hazardous Waste Bureau's main telephone number during regular business hours, or by calling the New Mexico Department of Public Safety dispatch telephone number during non-business hours, and requesting that the report be forwarded to the NMED spill number.

1.7.13.2. Description of Occurrence

The description of the occurrence and its cause shall include:

i. Name, address, and telephone number of the Permittees;

ii. Name, address, and telephone number of the facility;

iii. Date, time, and type of incident;

iv. Name and quantity of materials involved;

v. The extent of injuries, if any;

vi. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and

vii. Estimated quantity and disposition of recovered material that resulted from the incident. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(ii))]

1.7.13.3. Written Notice

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(iii)), the Permittees shall submit a written notice within five calendar days of the time the Permittees become aware of the circumstances. The written notice shall contain the information required in Permit Section 1.7.13.2 and the following information:

i. A description of the noncompliance and its cause;

ii. The period(s) of the noncompliance including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and

iii. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

The Secretary may waive the five-day written notice requirement in favor of a written report within 15 calendar days if justifiable cause is provided in advance. The Permittees shall post a link to the written notice or report

transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

1.7.13.4. Contingency Plan Implementation

If the Contingency Plan is implemented, the Permittees shall comply with the reporting requirements specified in Permit Attachment D (RCRA Contingency Plan). [20.4.1.500 NMAC (incorporating 40 CFR §264.56(j))]

1.7.14. Other Noncompliance

The Permittees shall report to the Secretary all other instances of noncompliance not otherwise required to be reported above, in Permit Sections 1.7.10 through 1.7.13, at the time monitoring reports are submitted annually in October. The reports shall contain the information specified in Permit Section 1.7.13 and 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(10)).

1.7.15. Other Information

Whenever the Permittees become aware that they failed to submit any relevant facts in the Permit application, or submitted incorrect information in the Permit application or in any report to the Secretary, the Permittees shall promptly submit such facts or information in writing to the Secretary. The Permittees shall post a link to the transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(11))]

1.8. ADMISSIBILITY OF DATA

The Permittees waive any objection to the admissibility as evidence of any data required by this Permit in any administrative or judicial action to enforce a condition of this Permit.

1.9. SIGNATORY REQUIREMENT

The Permittees shall sign and certify, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.11) all applications, reports required by this Permit, or information submitted to or requested by the Secretary. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(k))]

1.10. SUBMITTAL OF REPORTS, NOTIFICATIONS, AND INFORMATION TO THE SECRETARY

1.10.1. Information Submittal

The Permittees shall submit, by certified mail or hand delivery or by electronic transmittal with a subsequent hard copy, all reports, notifications, or other submissions which are submitted to or requested by the Secretary or required by this Permit, to:

Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Telephone Number: (505) 476-6000
Facsimile Number: (505) 476-6060

1.10.2. Approval of Submittals

All documents prepared by the Permittees under the terms of this Permit and submitted to the Secretary that are subject to the provisions of 20.4.2 NMAC shall be subject to the procedures set forth therein. Documents requiring the Secretary's approval that are not subject to the provisions of 20.4.2 NMAC may be reviewed and approved, approved with modifications or directions, disapproved, denied, or rejected by the Secretary.

Submittals and associated schedules, upon the Secretary's written approval, shall become enforceable as part of this Permit in accordance with the terms of the Secretary's written approval, and such documents, as approved, shall control over any contrary or conflicting requirements of this Permit. This provision does not affect any public process that is otherwise required by this Permit, the HWA, or its implementing regulations, including 40 CFR §270.42 and 20.4.1.901 NMAC.

1.10.3. Extension of Time

The Permittees may seek an extension of time in which to perform a requirement of this Permit, for good cause, by sending a written request for extension of time and proposed revised schedule to the Secretary. The request shall state the length of the requested extension and describe the basis for the request. The Secretary will respond in writing to any request for extension following receipt of the request. If the Secretary denies the request for extension, reasons for the denial will be stated.

1.11. PUBLIC E-MAIL NOTIFICATION LIST

The Permittees shall develop and maintain an e-mail list to notify members of the public concerning actions identified in this Permit requiring e-mail notification. The Permittees shall send e-mail notifications required by this Permit to the e-mail list within seven days of the submittal date to the Secretary and shall include in the e-mail a direct link to the specific document to which it relates. The Permittees shall provide a link on the WIPP Home Page <http://www.wipp.energy.gov> whereby members of the public may review the actions requiring e-mail notification and submit a request to be placed on this list.

1.12. CONFIDENTIAL INFORMATION

The Permittees may claim confidentiality for any information submitted to or requested by the Secretary or required by this Permit. Any such claim must be asserted at the time of submittal in the manner prescribed on the application form, or in the case of other submittals, by stamping the words

"confidential business information" on each page containing such information. If no claim is made, the Secretary may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information), to the extent authorized by Section 74-4-4.3(D) and (F) of the HWA and 20.4.1.100 and .900 NMAC (incorporating 40 CFR §260.2 and §270.12).

1.13. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The Permittees shall comply with the recordkeeping and reporting requirements specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.73(a)) and elsewhere in this Permit.

The Permittees shall maintain at the facility, until closed as specified in Part 6, the following documents and all amendments, revisions and modifications to these documents:

1. Waste Analysis Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(b)) and this Permit, and records and results of waste analyses performed as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.13).

2. Inspection schedules, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(2)) and this Permit, and records and results of inspections as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

3. Personnel training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d)) and this Permit.

4. Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53(a)) and this Permit, including summary reports and details of all incidents that require implementation of the contingency plan as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)).

5. Operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73) and this Permit.

6. Closure Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.112(a)) and this Permit.

7. Post-Closure Plan as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(a)) and this Permit.

8. Procedures for limiting air emissions, as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.601(c) and 270.23(a)(2)) and this Permit.

9. All other documents required by Part 1, Permit Section 1.7.10, and Part 2.

1.14. INFORMATION REPOSITORY

1.14.1. Requirement for Information Repository

The Permittees shall establish and maintain an electronic Information Repository (**IR**) in accordance with the requirements of 20.4.1.1102 NMAC (incorporating 40 CFR §§124.33(c) through (f)) and 20.4.1.900 NMAC (incorporating 40 §270.30(m)). The documents contained in the IR shall be accessible to the public from the WIPP Home Page.

The Permittees shall establish the IR no later than the effective date of this Permit.

1.14.2. Contents of Information Repository

The Permittees shall ensure that the IR contains the following documents:

1. The Permittees' Part A and Part B Permit Applications associated with the permit renewal;
2. A complete copy of this Permit, as it may be modified;
3. Permit modification notifications and requests associated with this Permit submitted pursuant to 20.4.1. 900 NMAC (incorporating 40 CFR §270.42) and any associated responses from the Secretary;
4. The Waste Minimization Report submitted pursuant to Permit Section 2.4;
5. Requests for extensions of time submitted pursuant to Permit Section 1.10.3;
6. Corrective action documents submitted pursuant to Permit Part 8;
7. Each report submitted pursuant to Permit Sections 1.7.11 and 1.7.13 if such report is required to be submitted in writing;
8. Notices of deficiency or disapproval (**NODs**), NOD responses, final approval letters, and directives from the Secretary associated with the documents identified in paragraphs 1, 3, and 6 above;
9. Notices of violation, administrative compliance orders, responses to these documents required by the Secretary, and directives from the Secretary associated with the Permit;
10. Biennial Report submitted pursuant to Permit Section 2.14.2.

1.14.3. Index of Information Repository

The Permittees shall ensure that the IR includes an index of the documents contained in the IR identifying all document titles, publications dates, and authors. This index shall be

accessible on the internet through the WIPP Home Page. The Permittees shall ensure that all documents are searchable and printable.

The Permittees shall add new documents to the IR within ten days after the new documents are submitted to, or received from, the Secretary.

1.14.4. Notification to Public of Information Repository

The Permittees shall inform the public of the existence of the IR and how it may be accessed by the following methods:

1. Written notice to all individuals on the facility mailing list 30 days after the IR becomes operational;

2. Public notice in area newspapers, including the Carlsbad Current-Argus, Albuquerque Journal, and Santa Fe New Mexican, when the IR becomes operational;

3. Continuous notice on the WIPP Home Page of the existence of the IR; and

4. In the public notice related to any permit modification notification or request submitted by the Permittees, including permit renewals.

1.15. COMMUNITY RELATIONS PLAN

1.15.1. Requirement for Community Relations Plan

The Permittees shall establish and implement a Community Relations Plan (**CRP**) to describe how the Permittees will keep communities and interested members of the public informed of Permit-related activities, including waste management, closure, post-closure, and corrective action, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)). The CRP shall explain how communities and interested members of the public can participate in Permit-related activities.

The Permittees shall implement and post the CRP on the WIPP Home Page within 180 days of the effective date of this Permit. The Permittees shall maintain the CRP until the termination of this Permit.

1.15.2. Contents of Community Relations Plan

The CRP must describe how the Permittees will accomplish the following elements:

1. Identify and establish an open working relationship with communities and interested members of the public;

2. Establish a productive government-to-government relationship between the Permittee DOE and affected tribes and pueblos;

3. Keep communities and interested members of the public informed of permit actions of interest (e.g., implementation of the Contingency Plan, Permit modification requests, Permit compliance issues);

4. Minimize disputes and resolve differences with communities and interested members of the public;

5. Provide a mechanism for the timely dissemination of information in response to individual requests; and

6. Provide a mechanism for communities and interested members of the public to provide feedback and input to the Permittees.

1.15.3. Government to Government Consultation

DOE shall consult on a government-to-government basis with affected tribes and pueblos in New Mexico when developing the CRP in an effort to ensure the program is responsive to their needs. DOE shall document in the operating record of this Permit and post on the WIPP Home Page all consultations, communications, agreements, and disagreements between DOE and affected tribes and pueblos in New Mexico only with the express approval of those entities, regarding the development of the CRP. The CRP shall specify how DOE will consult on a government-to-government basis with affected tribes and pueblos annually concerning how they may be made better informed of the issues related to this Permit.

1.15.4. Initial Consultation on Community Relations Plan

The Permittees shall communicate with and solicit comments from communities and interested members of the public when developing the CRP in an effort to ensure the program is responsive to their needs. The Permittees shall document in the operating record of this Permit all consultations, communications, agreements, and disagreements between the Permittees and all participating entities, with the approval of those entities, regarding the development of the CRP.

1.15.5. Annual Compilation of Comments on Community Relations Plan

The CRP shall specify how the Permittees will solicit comments from communities and interested members of the public annually concerning how they may be made better informed of the issues related to this Permit. The CRP shall specify that the Permittees will annually post on the WIPP Home Page a compilation of all such comments, including any statements of disagreement, with the approval of those entities in a manner set forth in the CRP.

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1.16. DISPUTE RESOLUTION

1.16.1. Applicability

In the event DOE disagrees, in whole or in part, with either an action on a final audit report by NMED (as specified in Permit Section 2.3.2.4) or an evaluation by NMED of DOE's provisional approval of an AK Sufficiency Determination Request for a particular waste stream (as specified in Permit Attachment C), DOE may seek dispute resolution. The dispute resolution procedure in this Permit Section shall be the exclusive mechanism for resolving disputes related to NMED's final audit report action or a determination that DOE's provisional approval for a particular waste stream is inadequate.

1.16.2. Notice to NMED

To invoke dispute resolution, DOE shall notify NMED in writing within seven calendar days of receipt of the action or determination in dispute. Such notice shall be sent to the Hazardous Waste Bureau Chief and must set forth the specific matters in dispute, the position DOE asserts should be adopted, a detailed explanation for DOE's position, and any other matters considered necessary for the dispute resolution. For AK Sufficiency Determination disputes, DOE shall also submit all factual data, analysis, opinion, and other documentation upon which they relied for their provisional approval, and any other information that supports their position. NMED shall acknowledge receipt of notification by e-mail sent to DOE's representative as designated in their written notification.

1.16.3. Tier I - Informal Negotiations

DOE and NMED shall make all reasonable, good faith efforts to informally resolve disputes related to NMED's determination. DOE and NMED shall meet or teleconference within 15 calendar days from NMED's receipt of notice to commence negotiations to resolve the dispute. DOE and NMED shall have 30 calendar days from NMED's receipt of notice to resolve the dispute. If an agreement is reached, NMED shall promptly inform DOE of the terms of the agreement in writing. DOE shall comply with the terms of such agreement or, if appropriate, submit a revised submittal and implement the same in accordance with such agreement. If an agreement is not reached, NMED shall promptly inform DOE in writing that an agreement has not been reached.

1.16.4. Tier II - Final Decision of the Secretary

In the event agreement is not reached within the 30 calendar day period, DOE may submit a written Request for Final Decision to the Secretary. The Request must be submitted within seven calendar days after receipt of notification from NMED that an agreement under Tier I was not reached. The Secretary will notify the Permittees in writing of the decision on the dispute, and the Permittees shall comply with the terms and conditions of the decision. Such decision shall be the final resolution of the dispute and shall be enforceable under this Permit.

1.16.5. Actions Not Affected by Dispute

With the exception of those matters under dispute, the Permittees shall proceed to take any action required by those portions of the submission and of this Permit that NMED determines are not affected by the dispute.

1.16.6. E-Mail Notifications

If DOE submits a notice to NMED pursuant to Permit Section 1.16.2, the Permittees shall post a link to the notice on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. After receipt of NMED's letter concerning the conclusion of any Tier I negotiations, the Permittees shall post a link to the NMED letter on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. If a Tier I agreement is not reached and DOE submits a Tier II request for final decision to the Secretary, the Permittees shall post a link to the request on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. After receiving notice of the final action by the Secretary, the Permittees shall post a link to the final action on the WIPP Home Page and shall inform those on the e-mail notification list as specified in Permit Section 1.11.

PERMIT ATTACHMENTS

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" - Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter B).

Permit Attachment C7 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Permittee Level TRU Waste Confirmation Processes" - Appendix B7).

Permit Attachment D (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Contingency Plan" - Chapter F).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1)

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PART 2 - GENERAL FACILITY CONDITIONS

2.1. DESIGN AND OPERATION OF FACILITY

The Permittees shall design, construct, maintain, and operate WIPP to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of transuranic (**TRU**) mixed waste or mixed waste constituents to air, soil, groundwater, or surface water which could threaten human health or the environment, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.31).

2.2. WASTE SOURCES

2.2.1. Off-site Wastes

The Permittees may receive off-site TRU mixed waste in compliance with the requirements and conditions specified in this Permit. The Permittees may only receive TRU mixed waste from those sites which comply with the applicable requirements of the Waste Analysis Plan (**WAP**) specified in Permit Section 2.3.1 and Permit Attachment C, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)) and as verified through the Audit and Surveillance Program specified in Permit Section 2.3.2.

2.2.2. Required Notification to Off-Site Sources

Before the Permittees receive TRU mixed waste from an off-site source for the first time, they shall inform the generator/storage site in writing that they have the appropriate Permits for, and will accept, the waste the generator/storage site is shipping. The Permittees shall keep a copy of this written notice as part of the operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.12(b)).

2.3. GENERAL WASTE ANALYSIS

2.3.1. Waste Analysis Plan

The Permittees shall not manage, store, or dispose TRU mixed waste at WIPP which fails to meet the characterization requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13), as specified by this Permit.

The Permittees' WAP, as specified in Permit Attachment C, is approved subject to the following conditions:

2.3.1.1. Implementation of Requirements

i. The Permittees shall require that generator/storage sites implement applicable waste characterization requirements of the WAP, specified in Permit Attachment C, prior to the Permittees' receipt of TRU mixed waste at WIPP.

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ii. The Permittees or the co-Permittee DOE shall implement applicable waste confirmation requirements of the WAP, pursuant to Permit Attachment C7 (TRU Waste Confirmation), prior to shipment of TRU mixed waste from generator/storage sites to WIPP.

2.3.1.2. Waste Characterization Sampling and Analytical Methods

The Permittees shall require that generator/storage sites and DOE approved laboratories comply with the applicable method requirements, quality control, equipment testing, inspection, maintenance, and equipment calibration and frequency standards for the procedures specified in Permit Attachment C1 (Waste Characterization Sampling Methods). For all analytical methods for waste analysis not otherwise specified in Permit Attachment C1, the Permittees shall require the generator/storage sites and DOE approved laboratories to use "*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*", EPA Publication SW-846. Updates to EPA Publication SW-846 shall be incorporated into this permit by reference. Sites may use these new or revised methods once they have demonstrated that the results from the new methods will be at least equivalent to the results from the currently used methods.

2.3.1.3. Statistical Methods used in Sampling and Analysis

The Permittees shall require that generator/storage sites use the methods for statistically selecting retrievably stored and newly-generated TRU mixed waste containers for volatile organic compounds (**VOCs**), semivolatile organic compounds (**SVOCs**), and total metals analysis, and establishing upper confidence limits, as specified in Permit Attachment C2 (Statistical Methods Used in Sampling and Analysis).

2.3.1.4. Quality Assurance Objectives

The Permittees shall require that all waste characterization activities used by generator/storage sites and DOE approved laboratories comply with the appropriate quality assurance objectives (**QAOs**) specified in Permit Attachment C3 (Quality Assurance Objectives and Data Validation Techniques for Waste Characterization Sampling and Analytical Methods). The Permittees shall require generator/storage sites to review, validate, and verify all analytical data; reconcile analytical results with data quality objectives (**DQOs**); satisfy data reporting requirements; and identify, document, and report all nonconformances and operational variances in compliance with Permit Attachment C3.

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2.3.1.5. Acceptable Knowledge

The Permittees shall require generator/storage sites to assemble acceptable knowledge documentation and re-evaluate acceptable knowledge determinations, and shall audit (as specified in Permit Section 2.3.2) all aspects of the acceptable knowledge waste characterization process as specified in Permit Attachment C4 (TRU Mixed Waste Characterization Using Acceptable Knowledge).

2.3.1.6. Quality Assurance

The Permittees shall require each generator/storage site and DOE approved laboratory to develop and implement a quality assurance project plan (**QAPjP**) which demonstrates compliance with, and implementation of, applicable requirements of the WAP, Permit Attachment C, as specified in Permit Attachment C5 (Quality Assurance Project Plan Requirements).

2.3.1.7. WIPP Waste Information System (**WWIS**) Database

The Permittees shall provide the Secretary access to the WWIS database as necessary to determine compliance with the WAP. The WWIS shall meet all requirements presented in Section C-5a(1) of the WAP, Permit Attachment C, prior to acceptance of TRU mixed waste. The Secretary's access to the WWIS shall be direct, read-only (via modem or Internet) to all query and reporting functions of the Characterization, Certification, Shipping, and Inventory modules of the WWIS database.

Beginning on December 31, 2005, the Permittees instituted a public database containing certain information from the WWIS. The Permittees shall continue to provide such public access through the WIPP Home Page at <http://www.wipp.energy.gov>.

2.3.2. Audit and Surveillance Program

The Permittees shall not manage, store, or dispose TRU mixed waste at WIPP from a generator/storage site until the following conditions have been met as necessary for the Secretary to determine that the applicable characterization requirements of Permit Section 2.3.1 have been implemented:

2.3.2.1. Requirement to Audit

DOE shall demonstrate to the Secretary that the generator/storage sites and DOE approved laboratories have implemented and comply with applicable requirements of the WAP by conducting audits as specified in Permit Attachment C, Section C-5a(3), and Permit Attachment C6 (Audit

and Surveillance Program), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13).

2.3.2.2. Observation of Audit

The Secretary may observe such audits as necessary to validate the implementation of and compliance with applicable WAP requirements at each generator/storage site and DOE approved laboratory. DOE shall provide the Secretary with a current audit schedule on a monthly basis and notify the Secretary no later than 30 calendar days prior to each audit.

2.3.2.3. Final Audit Report

DOE shall provide the Secretary a final audit report as specified in Permit Attachment C6, and post a link to the final audit report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. The final audit report shall include all information specified in Permit Attachment C6, Section C6-4, and:

i. A detailed description of all corrective actions and the resolution of any corrective action applicable to WAP requirements, including re-audits if required;

ii. All documentation necessary for the Secretary to determine if the corrective action was resolved.

2.3.2.4. Secretary Notification of Approval

The Secretary shall approve DOE's final audit report by written notification to DOE that the applicable characterization requirements of the WAP at a generator/storage site and or DOE approved laboratory have been implemented.

2.3.3. Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**)

The Permittees shall not accept TRU mixed wastes at WIPP for storage, management, or disposal which fail to meet the treatment, storage, and disposal facility waste acceptance criteria as presented in Permit Sections 2.3.3.1 through 2.3.3.10 of this Permit.

2.3.3.1. Liquid

Liquid waste is not acceptable at WIPP. Liquid in the quantities delineated below is acceptable.

- Observable liquid shall be no more than 1 percent by volume of the outermost container at the time of radiography or visual examination.

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- Internal containers with more than 60 milliliters or 3 percent by volume observable liquid, whichever is greater, are prohibited.
- Containers with Hazardous Waste Number U134 (hydrofluoric acid) assigned shall have no observable liquid.
- Overpacking the outermost container that was examined during radiography or visual examination or redistributing untreated liquid within the container shall not be used to meet the liquid volume limits.

2.3.3.2. Pyrophoric Materials

Non-radionuclide pyrophoric materials, such as elemental potassium, are not acceptable at WIPP.

2.3.3.3. Non-mixed Hazardous Wastes

Hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes) are not acceptable at WIPP.

2.3.3.4. Chemical Incompatibility

Wastes incompatible with backfill, seal and panel closures materials, container and packaging materials, shipping container materials, or other wastes are not acceptable at WIPP.

2.3.3.5. Explosives and Compressed Gases

Wastes containing explosives or compressed gases are not acceptable at WIPP.

2.3.3.6. PCB Waste

Wastes with polychlorinated biphenyls (**PCBs**) not authorized under an EPA PCB waste disposal authorization are not acceptable at WIPP.

2.3.3.7. Ignitable, Corrosive, and Reactive Wastes

Wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003) are not acceptable at WIPP.

2.3.3.8. Excluded Waste

TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at

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WIPP unless specifically approved through a Class 3 permit modification. Such wastes are listed in Table 2.3.3.8 below.

Table 2.3.3.8 - Additional Approved Waste Streams	
Date Class 3 Permit Modification Request Approved	**Description of Waste Stream**

2.3.3.9. Unconfirmed Waste

Any waste container that has not been subject to confirmation pursuant to Permit Attachment C7 is not acceptable at WIPP. This prohibition shall not apply to waste containers accepted before confirmation activities were required by this Permit.

2.3.3.10. Waste Stream Profiles

Any waste container from a waste stream which has not been preceded by an appropriate, certified Waste Stream Profile Form (Attachment C, Figure C-1) is not acceptable at WIPP.

2.3.4. Permitted TRU Mixed Wastes

The Permittees shall accept containers which contain only those TRU mixed wastes listed in Permit Attachment B (Hazardous Waste Permit Application Part A). Allowable TRU mixed wastes are specified in Table 2.3.4 below. Some of the waste may also be identified by unique state hazardous waste codes. These wastes are acceptable at WIPP as long as the TSDF-WAC are met:

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Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
F001	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Trichloroethylene	79-01-6
	Methylene chloride	75-09-2
	1,1,1-Trichloroethane	71-55-6
	Carbon tetrachloride	56-23-5
	Chlorinated fluorocarbons	NA
F002	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Methylene chloride	75-09-2
	Trichloroethylene	79-01-6
	1,1,1-Trichloroethane	71-55-6
	Chlorobenzene	108-90-7
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1
	Ortho-dichlorobenzene	95-50-1
	Trichlorofluoromethane	75-69-4
	1,1,2-Trichloroethane	79-00-5
F003	Spent non-halogenated solvents:	
	Xylene	1330-20-7
	Acetone	67-64-1
	Ethyl acetate	141-78-6
	Ethyl benzene	100-41-4
	Ethyl ether	60-29-7
	Methyl isobutyl ketone	108-10-1
	n-Butyl alcohol	71-36-3
	Cyclohexanone	108-94-1
	Methanol	67-56-1
F004	Spent non-halogenated solvents:	
	Cresols and cresylic acid	1319-77-3
	Nitrobenzene	98-95-3

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Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
F005	Spent non-halogenated solvents:	
	Toluene	108-88-3
	Methyl ethyl ketone	78-93-3
	Carbon disulfide	75-15-0
	Isobutanol	78-83-1
	Pyridine	110-86-1
	Benzene	71-43-2
	2-Ethoxyethanol	110-80-5
	2-Nitropropane	79-46-9
F006	Wastewater treatment sludges from electroplating operations:	
	Cadmium	7440-43-9
	Chromium	7440-47-3
	Cyanide	57-12-5
	Lead	7439-92-1
	Nickel	7440-02-0
	Silver	7440-22-4
F007	Spent cyanide plating bath solutions from electroplating operations:	
	See F006	
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process:	
	See F006	
D004	Arsenic	7440-38-2
D005	Barium	7440-39-3
D006	Cadmium	7440-43-9
D007	Chromium	7440-47-3
D008	Lead	7439-92-1
D009	Mercury	7439-97-6
D010	Selenium	7782-49-2
D011	Silver	7440-22-4
D018	Benzene	71-43-2

Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
D019	Carbon Tetrachloride	56-23-5
D021	Chlorobenzene	108-90-7
D022	Chloroform	67-66-3
D026	Cresol	1319-77-3
D027	1,4-Dichlorobenzene	106-46-7
D028	1,2-Dichloroethane	107-06-2
D029	1,1-Dichloroethylene	75-35-4
D030	2,4-Dinitrotoluene	121-14-2
D032	Hexachlorobenzene	118-74-1
D033	Hexachlorobutadiene	87-68-3
D034	Hexachloroethane	67-72-1
D035	Methyl ethyl ketone	78-93-3
D036	Nitrobenzene	98-95-3
D037	Pentachlorophenol	87-86-5
D038	Pyridine	110-86-1
D039	Tetrachloroethylene	127-18-4
D040	Trichloroethylene	79-01-6
D043	Vinyl chloride	75-01-4
P015	Beryllium powder (H)	7440-41-7
P030	Cyanides (soluble cyanide salts), not otherwise specified (H)	N/A
P098	Potassium Cyanide (H)	151-50-8
P099	Potassium Silver Cyanide (H)	506-61-6
P106	Sodium Cyanide (H)	143-33-9
P120	Vanadium Pentoxide (H)	1314-62-1
U002	Acetone (I)	67-64-1
U003	Acetonitrile (I,T)	75-05-8

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Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
U019	Benzene (I,T)	71-43-2
U037	Chlorobenzene (T)	108-90-7
U043	Vinyl Chloride (T)	75-01-4
U044	Chloroform (T)	67-66-3
U052	Cresol (T)	1319-77-3
U070	1,2-Dichlorobenzene (T)	95-50-1
U072	1,4-Dichlorobenzene (T)	106-46-7
U078	1,1-Dichloroethylene (T)	75-35-4
U079	1,2-Dichloroethylene (T)	156-60-5
U103	Dimethyl Sulfate (T)	77-78-1
U105	2,4-Dinitrotoluene (T)	121-14-2
U108	1,4-Dioxane (T)	123-91-1
U122	Formaldehyde (T)	50-00-0
U133	Hydrazine (R,T)	302-01-2
U134	Hydrofluoric Acid (C,T)	7664-39-3
U151	Mercury (T)	7439-97-6
U154	Methanol (I)	67-56-1
U159	Methyl Ethyl Ketone (I,T)	78-93-3
U196	Pyridine (T)	110-86-1
U209	1,1,2,2-Tetrachloroethane (T)	79-34-5
U210	Tetrachloroethylene (T)	127-18-4
U220	Toluene (T)	108-88-3
U226	1,1,1-Trichloroethane (T)	71-55-6
U228	Trichloroethylene (T)	79-01-6
U239	Xylene (I,T)	1330-20-7

[1] Designations in parentheses for P- and U-coded wastes reflect the basis for the listing and are as follows:
H - acute toxicity
T - toxicity

R - reactivity
I - ignitability
C - corrosivity
Acceptance of U-coded wastes listed for reactivity, ignitability, or corrosivity characteristics is contingent upon a demonstration that the wastes meet the requirements specified in Permit Section 2.3.3.7

2.3.5. Derived Waste

Any WIPP-generated waste derived from adequately characterized, WIPP-accepted TRU mixed waste generated at an off-site facility (*derived waste*) does not need to be additionally characterized for hazardous waste components if the Permittees use the generator's characterization data and knowledge of the processes at the WIPP facility to identify and characterize derived waste. Derived waste containers shall be managed according to Permit Attachment A1 (Container Storage), Section A1-1d(1), and meet all TSDF waste acceptance criteria in Permit Section 2.3.3 prior to disposal at WIPP.

2.4. WASTE MINIMIZATION PROGRAM

The Permittees shall implement and maintain a waste minimization program to reduce the volume and toxicity of hazardous and mixed wastes generated at the facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(9)). The waste minimization program shall include proposed, practicable methods of treatment and storage currently available to the Permittees to minimize the present and future threat to human health and the environment. The waste minimization program shall include the following items:

1. Written policies or statements that outline goals, objectives, and methods for source reduction and recycling of hazardous and mixed waste at the facility;

2. Employee training or incentive programs designed to identify and implement source reduction and recycling opportunities for all hazardous and mixed wastes;

3. Source reduction or recycling measures implemented in the last five years or planned for the next federal fiscal year;

4. Estimated dollar amounts of capital expenditures and operating costs devoted to source reduction and recycling of hazardous and mixed waste;

5. Factors which have prevented implementation of source reduction or recycling;

6. Summary of additional waste minimization efforts that could be implemented at the facility that analyzes the potential for reducing the quantity and toxicity of each waste stream through production process changes, production reformulations, recycling, and all other appropriate means including an assessment of the technical feasibility, cost, and potential waste reduction for each option;

7. Flow charts and/or tables summarizing all hazardous and mixed waste streams produced by the facility by quantity, type, building or area, and program; and

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8. Demonstration of the need to use those processes which produce a particular hazardous or mixed waste due to a lack of alternative processes, available technology, or available alternative processes that would produce less volume or less toxic waste.

The Permittees shall submit to the Secretary a report regarding progress made in the waste minimization program in the previous year. The report shall address items 1 – 8 above, shall show changes from the previous report, and shall be submitted annually by December 1 for the year ending the previous September 30th.

2.5. DUST SUPPRESSION

The Permittees shall not use waste, used oil, or any other material which is contaminated with dioxin, polychlorinated biphenyls (**PCBs**), or any other hazardous waste (other than a waste identified solely on the basis of ignitability), for dust suppression or road treatment, as specified in 20.4.1.700 NMAC (incorporating 40 CFR §266.23(b)).

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2.6. SECURITY

In order to prevent the unknowing entry, and minimize the possibility of unauthorized entry, of persons or livestock onto the active portion of the facility, the Permittees shall comply with the following security provisions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.14).

2.6.1. 24-Hour Surveillance System

The Permittees shall maintain a 24-hour surveillance system comprised of security officers that provide protection 24 hours per day, every day. Security officers shall continuously monitor and control personnel, vehicle, and material access/egress to the active portion of the facility, known as the Property Protection Area (**PPA**), in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(1)).

During non-operational hours, security officers shall conduct documented security patrols outside of the PPA, at a minimum rate of two per 12-hour shift. Whenever scheduled security patrols cannot be made, the reason for missing the patrol shall be documented in the security logbook.

2.6.2. Barrier

The PPA shall be enclosed by a permanent seven ft high chain-link fence topped by three strands of barbed wire, for a total height of eight ft. The fence shall completely surround all major surface structures on the active portion of the facility and shall also be inspected as specified in Permit Attachment E to ensure it remains in good repair, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(2)(i)).

2.6.3. Means to Control Entry

The Permittees shall control entry to the active portion of the facility at all times, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(2)(ii)). Entry into the

PPA, whether by personnel or vehicles, shall be through controlled gates and doors. Only properly identified and authorized persons, vehicles, and property shall be allowed entrance to and exit from the active portion of the facility. Security shall require employees to identify themselves with an identification badge when entering or leaving the premises, and shall require visitors to show proper authorization prior to allowing them to enter the active portion of the facility. Visitors shall be required to wear an approved badge and may require an authorized escort.

For the purposes of entry control to areas where wastes are managed, stored, or disposed, these areas shall be posted as Controlled Areas, and access shall be limited to trained and qualified individuals and visitors escorted by trained and qualified individuals.

2.6.4. Warning Signs

The Permittees shall post "No Trespassing" signs and "Danger: Authorized Personnel Only" signs in English and Spanish at approximately 50 ft intervals on the permanent chain-link fence surrounding the PPA. The signs shall be legible from a distance of 25 ft and shall be visible from any approach to the facility. These same signs, plus security and traffic signs, shall also be located on the controlled gates, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(c)).

2.7. GENERAL INSPECTION REQUIREMENTS

2.7.1. Inspection Schedule

The Permittees shall implement the inspection schedule specified in Permit Attachment E (Inspection Schedule, Process and Forms) to detect any malfunctions and deteriorations, operator errors, and discharges, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.2. Inspection Log Forms

The Permittees shall use the inspection logbooks and forms as specified in Permit Attachment E. Original copies of these completed forms are maintained in the Operating Record. The Permittees shall record the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

2.7.3. Inspection Frequency

The Permittees shall inspect monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment at the frequency specified in Tables E-1 and E-2 of Permit Attachment E, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

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2.7.4. Inspection Remediation

The Permittees shall remedy any deterioration or malfunction of equipment or structures which an inspection reveals, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

2.7.5. Inspection Records

Beginning with the effective date of this Permit, the Permittees shall maintain inspection logbooks and forms in the operating record until closure, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(d) and 264.73(b)(5)).

2.8. PERSONNEL TRAINING

The Permittees shall conduct personnel training, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.1. Personnel Training Content

The personnel training program shall include the requirements specified in Permit Attachment F (Personnel Training) and Permit Attachment F2 (Training Course and Qualification Card Outlines), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.2. Personnel Training Requirements

The Permittees shall train all persons involved in the management of mixed and hazardous waste in procedures relevant to the positions in which they are employed, as specified in Permit Attachment F1 (RCRA Hazardous Waste Management Job Titles and Descriptions), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.3. Personnel Training Records

The Permittees shall maintain training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d) and (e)).

2.8.4. Continuing Training

Unless otherwise specified by this Permit, continuing training required by this Permit on an annual or biennial basis shall be completed by the end of the month of the anniversary date when the training was previously completed.

2.9. GENERAL REQUIREMENTS FOR HANDLING IGNITABLE, CORROSIVE, REACTIVE, OR INCOMPATIBLE WASTES

The Permittees shall not manage, store or dispose of ignitable, corrosive, reactive, or incompatible wastes, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §§261.21, 261.22, and 261.23) and 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix V) within the permitted units. The Permittees shall comply with the procedures to prevent acceptance of ignitable, corrosive, reactive, and incompatible waste specified in Permit Sections 2.3.1 and 2.3.3.

2.10. PREPAREDNESS AND PREVENTION

2.10.1. Required Equipment

The Permittees shall maintain at the facility the equipment specified in the Contingency Plan, Permit Attachment D (RCRA Contingency Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32).

2.10.1.1. Internal Communications

The Permittees shall have an internal communications or alarm system capable of providing immediate emergency instruction (voice or signal) to facility personnel, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(a)). The internal communication systems shall include two-way communication by the public address (**PA**) system and its intercom phones and paging channels, an internal telephone system, mine phones, pagers and plectrons, and portable two-way radios. The alarm system shall include local and facility-wide alarm systems.

2.10.1.2. External Communications

The Permittees shall have a communications device or system capable of summoning outside agencies for emergency assistance, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(b)). The external communication systems shall include the commercial telephone system and two-way radios.

2.10.1.3. Emergency Equipment

The Permittees shall have portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment as described in Permit Attachment D (RCRA Contingency Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(c)).

2.10.1.4. Water for Fire Control

The Permittees shall have water at adequate volume and pressure to supply water-hose streams, foam-producing equipment, automatic

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sprinklers, or water-spray systems, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(d)). The WIPP facility water system shall consist of water furnished by the City of Carlsbad capable of providing water at a rate of 6,000 gallons per minute; two water storage tanks, one 180,000-gallon capacity tank for use by the fire-water system and a second tank with a 100,000-gallon reserve; dedicated fire-water pumps rated at 1,500 gallons per minute at 125 pounds per square inch; and a wet-pipe sprinkler system connected to surface buildings as described in Permit Attachment D (RCRA Contingency Plan).

2.10.1.5. Electrical Backup

In case of loss of AC power input to the UPS units, the dedicated batteries were designed to supply power to a fully loaded UPS for 30 minutes. It is expected that the AC power input to the UPS will be restored within 30 minutes, either from the off-site electric utility or from the site back-up power generator system.

The RH Complex is included in the WHB. The Central UPS supplies power to the WHB which includes the RH Complex. The RH Bay, Hot Cell and Transfer Cell equipment are serviced by dual 1,300 KW diesel powered generators located between the exhaust shaft and the WHB. The generators provide backup power to both CH and RH waste handling operations. The RH waste handling equipment is designed to stop as a result of loss of power in a fail-safe condition. Power from the back-up generators may be utilized to place RH TRU mixed waste containers in process into a safe configuration. During a total power outage condition selected RH loads can be powered by the Central UPS. Within a short time selected RH loads at 480 volts and below can be powered by the Backup Diesel Generators. The backup central UPS for the WHB would also supply backup power to the RH Complex.

Human health and the environment are protected during a loss of off-site power by a combination of factors:

i. The underground filtration system fails in the "filter" mode so that no releases of contaminated particulates will occur

ii. The UPS maintains all monitoring systems and alarms in waste handling areas so that fires or pressure loss will be detected and an appropriate response initiated

iii. Generators are brought on line within 30 minutes, at which time hoisting can be initiated so that personnel do not have to stay underground for extended lengths of time.

iv. Decisions to evacuate underground personnel will be made in accordance with the requirements of the Mine Safety and Health Administration (MSHA)

v. The waste hoist brakes set automatically so that loads do not fall

vi. Cranes retain their loads so that spills do not occur from dropped containers

vii. Communication systems are maintained

viii. The emergency operations center is powered if it is needed

2.10.2. Testing and Maintenance of Equipment

The Permittees shall test and maintain the equipment specified in Permit Section 2.10.1, as necessary, to assure its proper operation in time of emergency, as specified in Permit Attachment E and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.33).

2.10.3. Access to Communications or Alarm System

The Permittees shall maintain access to the communications and alarm systems specified in Permit Section 2.10.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.34).

2.10.4. Required Aisle Space

The Permittees shall maintain aisle space in the WHB Unit and Parking Area Unit (Part 3) to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation in an emergency, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.35).

2.10.5. Arrangements with Local Authorities

2.10.5.1. Parties to Arrangements

The Permittees shall maintain preparedness and prevention arrangements with state and local authorities, other mining operations, contractors, and other governmental agencies specified in Permit Attachment D, Section D-6, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.37(a) and 264.52(c)). If state or local authorities, other mining operations, contractors, or other governmental agencies decline to enter into preparedness and prevention arrangements with the Permittees, the Permittees shall document this refusal in the operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37(b)).

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2.10.5.2. Coordination Agreements

As specified in Section D-6 of Permit Attachment D, these arrangements shall be either Memoranda of Understanding (**MOU**) or Mutual Aid Agreements (**MAA**) between the Permittees and the off-site cooperating agencies, and shall include the elements required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37(a)). Copies and descriptions of these MOUs and agreements shall be maintained at the facility in the operating record.

2.11. HAZARDS PREVENTION

The Permittees shall operate the WIPP facility to fully meet each of the requirements of 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(8)), to prevent hazards associated with unloading operations, prevent runoff from hazardous waste handling areas, prevent contamination of water supplies, mitigate the effects of equipment and power failures, prevent undue exposure of personnel to hazardous waste, and prevent releases to the atmosphere, as specified in Permit Attachments A (General Facility Description and Process Information), A1 (Container Storage), and A2 (Geologic Repository).

2.12. CONTINGENCY PLAN

2.12.1. Implementation of Plan

The Permittees shall immediately implement the Contingency Plan as specified in Permit Attachment D whenever there is a fire, explosion, or release of mixed or hazardous waste or hazardous waste constituents which could threaten human health or the environment, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)).

2.12.2. Copies of Plan

The Permittees shall maintain copies of the Contingency Plan and all revisions and amendments to the Contingency Plan as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53). The Permittees shall provide copies of the current Contingency Plan and all revisions to the Contingency Plan through an electronic controlled document distribution system or in appropriate controlled-document locations at the facility, and to the Secretary and all entities with which the Permittees have emergency MOUs or MAAs, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53(b)). The Permittees shall maintain at least one current controlled-document paper copy of the Contingency Plan at the facility in a location readily accessible to the Emergency Coordinator specified in Permit Section 2.12.4.

2.12.3. Amendments to Plan

The Permittees shall review and immediately amend, if necessary, the Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.54).

2.12.4. Emergency Coordinator

An Emergency Coordinator as specified in Table D-2 of Permit Attachment D shall be available at all times in case of an emergency. The Emergency Coordinator shall be thoroughly familiar with the Contingency Plan and shall have the authority to commit the resources needed to implement the Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55). In the event of an imminent or actual emergency, the Emergency Coordinator shall implement the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.56).

2.13. MANIFEST SYSTEM

The Permittees shall comply with the manifest requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.71 and 264.72). The Permittees shall not accept for storage or disposal any mixed waste from an off-site source without an accompanying manifest.

2.14. RECORDKEEPING AND REPORTING

In addition to the recordkeeping and reporting requirements specified elsewhere in this Permit, the Permittees shall comply with the following conditions:

2.14.1. Operating Record

The Permittees shall maintain a written operating record at the facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(a)). The written operating record shall include all information required under 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)) subject to the limitations on the storage of classified information as discussed in Permit Attachment C. Unless specifically prohibited by this Permit, an electronic record that cannot be altered by the user and capable of producing a paper copy shall be deemed to be a written record. The Permittees shall maintain the operating record until closure of the facility.

2.14.2. Biennial Report

The Permittees shall submit to the Secretary a biennial report, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.75).

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PERMIT ATTACHMENTS

Permit Attachment A (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "General Facility Description and Process Information" - Chapter A and "Information for Specific Units - Chapter M)

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage - Appendix M1)

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository - Appendix M2)

Permit Attachment B (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Part A Application").

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter B).

Permit Attachment C1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Characterization Sampling Methods" - Appendix B1).

Permit Attachment C2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Statistical Methods Used in Sampling and Analysis" - Appendix B2).

Permit Attachment C3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Quality Assurance Objectives and Data Validation Techniques for Waste Characterization Sampling and Analytical Methods" - Appendix B3).

Permit Attachment C4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "TRU Waste Characterization Using Acceptable Knowledge" - Appendix B4).

Permit Attachment C5 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Quality Assurance Project Plan Requirements" - Appendix B5).

Permit Attachment C6 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Isolation Pilot Plant DOE Audit and Surveillance Program" - Appendix B6).

Permit Attachment C7 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Permittee Level TRU Waste Confirmation Processes" - Appendix B7).

Permit Attachment D (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Contingency Plan" - Chapter F).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

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Permit Attachment F (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Personnel Training" - Chapter H).

Permit Attachment F1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Hazardous Waste Management Job Titles and Descriptions" - Appendix H1).

Permit Attachment F2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Training Course and Qualification Card Outlines" - Appendix H2).

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PART 4 - GEOLOGIC REPOSITORY DISPOSAL

4.1. DESIGNATED DISPOSAL UNITS

This Part authorizes the management and disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste containers in the Underground Hazardous Waste Disposal Units (**Underground HWDUs**) identified herein. Specific facility and process information for the management and disposal of CH and RH TRU mixed waste in the Underground HWDUs is incorporated in Permit Attachment A2 (Geologic Repository).

4.1.1. Underground Hazardous Waste Disposal Units

The Underground HWDUs are located at the WIPP facility approximately 2150 feet (665 meters) below the ground surface within the Salado formation. An Underground HWDU is a single excavated panel, consisting of seven rooms and two access drifts, designated for disposal of TRU mixed waste containers.

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.1.1.1. Disposal Containers

The Permittees shall dispose TRU mixed waste in containers specified in Permit Section 4.3.1.

4.1.1.2. Disposal Locations and Quantities

The Permittees shall dispose TRU mixed waste containers in eight Underground HWDUs, as specified in Table 4.1.1 below and depicted in Permit Attachment A2, Figure A2-1. The Permittees may dispose quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 4.1.1 below. The Permittees may increase these capacities subject to the following conditions:

i. The Permittees may submit a Class 1 permit modification requiring prior approval of the Secretary in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(a)) to increase the CH TRU mixed waste capacity by 35,300 ft^3 (1,000 m^3) or less, and the RH TRU mixed waste capacities in Panels 5 and 6 to a maximum of 22,950 ft^3 (650 m^3).

At least 15 calendar days before submittal to NMED, the Permittees shall post a link to the Class 1 permit modification on the WIPP Home Page and inform those on the e-mail notification list.

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ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	Container Equivalent	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	400 RH TRU Canisters	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)	500 RH TRU Canisters	8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	600 RH TRU Canisters	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	**2960 RH TRU Canisters**	

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

4.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

4.2.1. Permitted Waste

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

4.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

4.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

Derived waste may be disposed in the Underground HWDUs as specified in Permit Section 2.3.5.

4.2.2. Prohibited Waste

4.2.2.1. General Prohibition

The Permittees shall not dispose any TRU mixed waste that fails to comply with Permit Section 4.2.1.

4.2.2.2. Specific Prohibition

After this Permit becomes effective, the Permittees shall not dispose non-mixed TRU waste in any Underground HWDU unless such waste is characterized in accordance with the requirements of the WAP specified in Permit Section 2.3.1. The Permittees shall not dispose TRU mixed waste in any Underground HWDU if the Underground HWDU contains non-mixed TRU waste which was disposed of after this Permit became effective and was not characterized in accordance with the requirements of the WAP.

4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.2. Condition of Containers

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak prior to disposal in an Underground HWDU, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 4.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

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4.4. VOLATILE ORGANIC COMPOUND LIMITS

The Permittees shall limit releases to the air of volatile organic compound waste constituents (**VOCs**) as specified by the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)):

4.4.1. Room-Based Limits

The measured concentration of VOCs in any open (active) room and in each closed room in active panels within an Underground HWDU shall not exceed the limits specified in Table 4.4.1 below:

Table 4.4.1 - VOC Room-Based Limits

Compound	VOC Room-Based Concentration Limit (PPMV)
Carbon Tetrachloride	9625
Chlorobenzene	13000
Chloroform	9930
1,1-Dichloroethene	5490
1,2-Dichloroethane	2400
Methylene Chloride	100000
1,1,2,2-Tetrachloroethane	2960
Toluene	11000
1,1,1-Trichloroethane	33700

There are no maximum concentration limits for other VOCs.

4.4.2. Determination of VOC Room-Based Limits

The Permittees shall confirm the VOC concentration and emission rate limits identified in Permit Section 4.4.1 using the VOC Monitoring Plan specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan). The Permittees shall conduct monitoring of VOCs as specified in Permit Sections 4.6.2 and 4.6.3.

4.4.3. Ongoing Disposal Room VOC Monitoring in Panels 3 Through 8

The Permittees shall continue disposal room VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless the explosion-isolation wall specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System) is installed in the panel.

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4.5. DESIGN, CONSTRUCTION, AND OPERATION REQUIREMENTS

The Permittees shall design, construct, and operate the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601):

4.5.1. Repository Design

The Permittees shall construct each Underground HWDU in conformance with the requirements specified in Permit Attachment A2 and Permit Attachment A3 (Drawing Number 51-W-214-W, "Underground Facilities Typical Disposal Panel").

4.5.2. Repository Construction

4.5.2.1. Construction Requirements

Subject to Permit Section 4.5.1, the Permittees may excavate the following Underground HWDUs, as depicted in Permit Attachment A2, Figure A2-1, "Repository Horizon", and specified in Section A2-2a(3), "Subsurface Structures (Underground Hazardous Waste Disposal Units (HWDUs))":

- Panel 10 (Disposal area access drift)
- Panel 2
- Panel 9 (Disposal area access drift)
- Panel 3
- Panel 4
- Panel 5
- Panel 6
- Panel 7
- Panel 8

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.7.11.2.

4.5.2.2. Notification Requirements

At least 30 calendar days prior to the projected start date of excavation of each Underground HWDU, the Permittees shall provide written notification to the Secretary stating the projected start date of excavation, along with supporting rationale (e.g., projected waste receipt rate, etc.). The Permittees shall post a link to the notification transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

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Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min when workers are present in an active room adjacent to a filled room or in Room 7 when it is an active room ~~the room,~~ as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

4.6.2.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the VOC Monitoring Plan.

4.6.2.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall post a link to any exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.2.3 - VOC Concentrations of Concern

Compound	Drift E-300 Concentration	
	ug/m3	ppbv
Carbon Tetrachloride	6040	960
Chlorobenzene	1015	220
Chloroform	890	180
1,1-Dichloroethene	410	100
1,2-Dichloroethane	175	45
Methylene Chloride	6700	1930
1,1,2,2-Tetrachloroethane	350	50
Toluene	715	190
1,1,1-Trichloroethane	3200	590

4.6.2.4. Remedial Action

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3, the

Permittees shall cease disposal in the active CH disposal room and install ventilation barriers as specified in Permit Section 4.5.3.3.

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 for six consecutive months, the Permittees shall close the affected Underground HWDU as specified in Permit Section 4.9.1.

For any remedial action taken under this Permit Section, the Permittees shall submit to the Secretary written quarterly status reports, beginning 30 calendar days after the Permittees submit the initial notification in Permit Section 4.6.2.3 which resulted in the remedial action. The quarterly status report shall analyze the cause of exceedance, describe the implementation and results of the remedial action, and describe measures taken to prevent future exceedances. The Permittees shall submit such reports until the Secretary determines the remedial action has been completed in accordance with all applicable requirements of this Permit.

4.6.3. Disposal Room Volatile Organic Compound Monitoring

4.6.3.1. Implementation of Disposal Room VOC Monitoring

The Permittees shall implement disposal room VOC monitoring as specified in Permit Attachment N and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.3.2. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 in any closed room in an active panel or in the immediately adjacent closed room exceeds the action levels specified in Table 4.6.3.2 below. The Permittees shall post a link to the exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring		
Compound	**50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv**	**95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv**
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

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4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved, t~~The Permittees shall ~~notify~~ report to the Secretary in ~~writing within seven calendar days.~~ the annual report specified in Permit Section 4.6.2.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

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4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

The Permittees shall post a link to the notification letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.5.3 - Action Levels for Hydrogen and Methane Monitoring

Compound	Action Level 1	Action Level 2
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

4.6.5.4. Remedial Action

Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 1" in Table 4.6.5.3, the sampling frequency in that filled panel will increase to once per week. Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 2" in Table 4.6.5.3 in two consecutive weekly samples, the Permittees shall install in that panel the explosion-isolation wall specified in Permit Attachment G1.

4.6.5.5. Sampling Line Loss

The Permittees shall notify the Secretary in writing within seven calendar days of the discovery of loss of sampling line(s). The Permittees shall evaluate any loss of sampling lines as described in Permit Attachment N1, Section N1-5b, "Sample Tubing", and shall notify the Secretary in writing within seven calendar days the results of such evaluation. The Permittees shall also post a link to such notification letters on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11

4.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the Underground HWDUs at least weekly, as specified in Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15). The Permittees shall perform these inspections to detect malfunctions, signs of deterioration, operator errors, discharges, or any other factors which

have caused or may cause a release of hazardous wastes or hazardous waste constituents to the environment or which may compromise the ability of any Underground HWDU to comply with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

4.8. RECORDKEEPING

4.8.1. Underground HWDU Location Map

The Permittees shall maintain, in the operating record, a map containing the exact location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks.

4.8.2. Disposal Waste Type and Location

The Permittees shall maintain, in the operating record, a record identifying the types and quantities of TRU mixed waste in each Underground HWDU and the disposal location of each container or container assembly (e.g., a 7-pack of standard 55-gallons drums) within each Underground HWDU, using the following fields from the WWIS data dictionary:

1. Panel Number
2. Room Number or Drift Number
3. Row Number (for CH TRU mixed waste) or Borehole Number (for RH TRU mixed waste)
4. Column Number (for CH TRU mixed waste)
5. Column Height (for CH TRU mixed waste)
6. Container Type Code
7. Container Identification Number
8. Manifest Document Number
9. Disposal Date

The Permittees shall also maintain, in the operating record, a map or diagram depicting the location and quantity of each waste. The map or diagram shall include a cross reference to specific manifest document numbers, if the waste was accompanied by a manifest, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(2)).

4.8.3. Ventilation Rates

The Permittees shall maintain, in the operating record, a record identifying any non-conformance to the ventilation rates specified in Permit Section 4.5.3.2.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment A3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Underground Facilities Typical Disposal Panel" – Drawing Number 51-W-214-W, Appendix M3).

Permit Attachment A4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Traffic Patterns" – Chapter G).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, " Volatile Organic Compound Monitoring Plan" - Chapter N).

Permit Attachment N1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Hydrogen and Methane Monitoring Plan" - Appendix N1)

Permit Attachment O (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Mine Ventilation Rate Monitoring Plan" - Chapter Q).

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Field Code Changed

ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

Introduction

This Permit Attachment describes the facility inspections (including container inspections) that are conducted to detect malfunctions, deterioration, operator errors, and discharges that may cause or lead to releases of hazardous waste or hazardous waste constituents to the environment or that could be a threat to human health.

E-1 Inspection Schedule

Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as monitoring equipment, safety and emergency equipment, security devices, and operating or structural equipment are inspected. The equipment will be inspected for malfunctions, deterioration, potential for operator errors, and discharges which could lead to a release of hazardous waste constituents to the environment or pose a threat to human health.

The WIPP facility has developed and will maintain a series of written procedures that include all the detailed inspection procedures and forms necessary to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)), during the Disposal Phase. Tables E-1 and E-1a list each item or system requiring inspection under these regulations, the inspection frequency, the organization responsible for the inspection, the applicable inspection procedure, and what to look for during the inspection. 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(b), 264.174, and 264.602) list requirements that are applicable to the WIPP facility.

Operational procedures detailing the inspections required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(a) and (b)), are maintained in electronic format on the WIPP computer network, in the Operating Record and, as appropriate, in controlled document locations at the WIPP facility. Frequency of inspections is discussed in detail in Section E-1a(2). Inspections are conducted often enough to identify problems in time to correct them before they pose a threat to human health or the environment and are based on regulatory requirements. The operational procedures assign responsibility for conducting the inspection, the frequency of each inspection, the types of problems to be watched for, what to do if items fail inspection, directions on record keeping, and inspector signature, date, and time. The operational procedures are maintained at the WIPP facility. Tables E-1 and E-1a summarize inspections, frequencies, responsible organizations, personnel making the inspection (by job title), and the types of anticipated problems as well as the references for the operational procedures. Inspection records are maintained at the WIPP site for three years. Beginning with the effective date of this Permit, records that are over the three year retention period are either maintained at the WIPP site or transferred to the WIPP Records Archive located in Carlsbad, NM until closure. The records maintained at the WIPP Records Archive are stored in facilities that are temperature and humidity controlled especially for the long term storage of records and readily retrievable and available for inspection.

Waste handling equipment and area inspections are typically controlled through established procedures and the results are recorded in logbooks or on data sheets. Operators are trained to consult the logbook to identify the status of any piece of waste handling equipment prior to its

use. Once a piece of equipment is identified to be operable, a preoperational inspection is initiated in accordance with the appropriate inspection procedure in Tables E-1, E-1a, or in operational procedures. Inspection results as described below are entered in the applicable logbook.

Inspections include identifying malfunctions or deteriorating equipment and structures. Inspection results and data, including deficiencies, discrepancies, or needed repairs are recorded. A negative inspection result does not necessarily lead to a repair. A deficiency, such as low fluid level, may be corrected by the inspector immediately. A discrepancy, such as an increasing trend of a data point, may necessitate additional inspection prior to the next scheduled frequency. The actions taken (corrected, additional inspection, or Action Request (**AR**) for repair submitted) are recorded on the inspection form, the WIPP automated Maintenance Management tracking program (**CHAMPS**) work order sheet, or the equipment logbook, whichever is applicable.

Items that are operational with restrictions are tagged with those restrictions. Items that are not operational are tagged and locked to prevent their use. Tagged and locked items are listed on the Tagout/Lockout Index. Once a scheduled repair or replacement is accomplished in accordance with the work authorization procedures, the tag or lock is removed from the item in accordance with the equipment tagout/lockout procedures. Normally, the individual inspecting the equipment/system is not qualified to make repairs and consequently, prepares an AR if repairs are needed. The AR is tracked by the CHAMPS system through the work control process. When parts are received and work instructions are completed, the work order can be scheduled on the Plan of the Day (**POD**). The POD is held daily to ensure facility configuration can support scheduled work items and to allocate and coordinate the resources necessary to complete the items.

Work orders are released for work by the responsible organization. When repairs are complete the responsible organization tests the equipment to ensure the repairs corrected the problem, then closes out the work order, to return the equipment to an operational status for normal operations to resume. Implementation of these procedures constitutes compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

Requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)), are met by the inspections for each item or system included in Tables E-1 and E-1a. Beginning with the effective date of this Permit, the results of the inspections are maintained in the operating record for three years and are then transferred to the WIPP Records Archive where they are maintained until closure. The inspection logs or summary records include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions. Major pieces of waste handling equipment are inspected using proceduralized inspections. Current copies of inspection forms are maintained in the Operating Record. Non-administrative changes (i.e., changes that affect the frequency or content of inspections) to inspection forms must be submitted to the NMED in accordance with the appropriate portions of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42). The status of these pieces of equipment is maintained in an equipment logbook that is separate from the checklist. The logbook contains information regarding the condition of the equipment. Equipment operators are required, by the inspection checklist, to consult the logbook as the first activity in the inspection procedure. This logbook is maintained in the operating record. CH transuranic (**TRU**) mixed waste equipment that is controlled by a logbook includes the waste handling forklifts, all waste handling cranes, the adjustable center of gravity lift fixture, the CH

TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and ~~horizontal~~ emplacement ~~and retrieval~~ equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

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E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**) or in standard large box 2s (**SLB2s**). The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

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As described in Permit Attachment A1, Section A1-1d(3), RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

RH TRU mixed waste is handled and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity of the shipping containers and the spacing between trailers carrying the Contact-Handled or Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Container inspections will be included as part of the surface TRU mixed waste handling areas (i.e. Parking Area Unit and WHB Unit) inspections described in Tables E-1 and E-1a. These inspections will also include the Derived Waste Storage Areas of the WHB Unit. The Derived Waste Storage Areas will consist of containers of 55 or 85-gallon drums or SWBs for CH TRU mixed waste and 55-gallon drums for RH TRU mixed waste. A Satellite accumulation area (**SAA**) may be required in an area adjacent to the TRUDOCKs for CH TRU mixed waste. A SAA may also be required in the RH Bay and Hot Cell for RH TRU mixed waste. These SAAs will be set up on an as needed basis at or near the point of generation and the derived waste will be discarded into the active derived waste container. All SAAs will be inspected in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34).

E-1b(2) Miscellaneous Unit Inspection

20.4.1.500 NMAC (incorporating 40 CFR §264.602), requires that inspections required in 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33), as well as any additional requirements needed to protect human health and the environment, be met. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33) are discussed in Section E-1 of this Permit Attachment, along with how the WIPP facility complies with those requirements for standard types of inspections. Inspection frequencies for geomechanical monitoring equipment are provided in Table E-1. The monitoring schedule for geomechanical instrumentation is given in Table E-2.

References

DOE, 1999. "WIPP Safety Analysis Report," DOE/WIPP-95-2065. Rev. 4, U.S. Department of Energy. Washington, D.C.

DOE, 2000. "WIPP Remote-Handled Waste Preliminary Safety Analysis" (RH PSAR), U.S. Department of Energy. Washington, D.C.

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FIGURES

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TYPICAL EQUIPMENT
WEEKLY CHECK LIST

__√__ **OK** __X__ **Adjustment Made** __O__ **Repairs Required**

AR Written [ ] Yes [ ] No AR # _____

(check or complete appropriate information)

ITEM INSPECTED	Condition	Comments/Corrective Action
Mechanical Checks: (examples)		
Oil level		
Radiator fluid level		
Automatic transmission fluid level		
Operate all valves/check gauges		
Emergency brake		
Fuel level (> ¾ full)		
Oil pressure (at warm idle)		
Tire Pressure		
Sirens, horn, & back-up alarm		
Deterioration Checks: (examples)		
Fan belts		
Battery (terminals, cables)		
Run generator 5 min.		
Hose, nozzles & valves		
Leaks/Spills Checks: (examples)		
Leaks around pump		
Foam tank level		
Required Equipment: (examples)		
Inspect SCBAs (> 4050 psi)		
Hand tools & equipment		
Trauma Kit		

Inspected by: _____
Print Name Signature Time/Date

Inspected by: _____
Print Name Signature Time/Date

Reviewed by: _____
Print Name Signature Time/Date

Comments: _____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-1
Typical Inspection Checklist

: 21052

HOUR METER READING _____ EQUIPMENT NO. _____

DEFICIENCIES NOTED: _____

_____

_____

_____

_____

PRE OPS COMPLETED PER __{Procedure Number}__ SAT _____ **PROBLEMS NOTED** _____

CORRECTIVE ACTIONS TAKEN: _____

_____

_____

_____

_____

_____

_____

OPERATOR SIGNATURE	**DATE**	**TIME**	**SUPERVISOR SIGNATURE/DATE**
_____	_____	_____	_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-2
Typical Logbook Entry

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TABLES

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Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	~~PM00003012~~-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	~~PM000027~~12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[j]	Emergency Services	Monthly See List 11	~~PM000036~~12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031~~PM000031~~ Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	~~PM000034~~12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	~~PM000033~~12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035~~PM000035~~ Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[j] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-~~008~~010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029~~PM000029~~ Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[j] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030~~PM000030~~ and 12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

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Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
Senior Mining Technician *
Continuous Mining Specialist *
Senior Mining Specialist *
Mine OPS Supervisor *
b. Waste Hoist Operator
Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
Shaft Technician *
d. Operations Engineer
Supervisor U/G Services*
Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
Senior Safety Technician *
Safety Specialist *
Safety Engineer *
Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

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Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

Table E-1a
RH TRU Mixed Waste Inspection Schedule/Procedures

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Transfer Car(s)	Waste Operations	Pre-evolution [c,d,e] See List 1	WP05-WH1701 PM041187 (Semi-Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
RH Bay Overhead Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041232 (Quarterly) PM041117 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041201 (Annual) PM041203 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical PM.
RH Bay Cask Lifting Yoke	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041169 (Annual)	Yes	NA	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask Transfer Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1704 PM041186 (Quarterly) PM041195 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Cask Rotating Device	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041175 (Annual) PM041176 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Grapple	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041172 (Quarterly) PM041177 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear. Non-Destructive Examination
6.25-Ton Grapple Hoist	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041173 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Transfer Cell Shuttle Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1705 PM041184 (Semi-Annual) PM041222 (Annual)	Yes	Yes	Pre-evolution Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection.

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Unloading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell	Waste Operations	Preoperational [c,d,e,f,g,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell Overhead Powered Manipulator	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1743 PM041215 (Annual) PM041216 (Annual) IC411037 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration
Hot Cell Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1742 PM041217 (Annual) PM041209 (Annual) IC411038 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.
Transfer Cell	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Facility Cask Loading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Closed Circuit Television Camera	Waste Operations	Preoperational [c,i] See List 1	WP05-WH1757	NA	NA	Operability
Radiation Monitoring Equipment	Radiation Control	Preoperational [c,d,e] See List 2	WP12-HP1245 IC240010 WP12-HP1307 IC240007 WP12-HP1314 (Annual)	Yes	NA	Operability Checks, Functional Checks, Instrument calibrations, Flow Calibration, Efficiency Checks.
Cask Unloading Room Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1719 PM041190 (Quarterly) PM041191 (Annual) PM041192 (Annual) IC411035 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,g,u,l] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,l] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,l] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [l] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer

Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts, and concrete walls.

[b] Deterioration includes: visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Pre-evolution" signifies that inspections are required prior to equipment use in the waste handling process. (An evolution is considered to be from the receipt of a cask into the RH Bay through canister emplacement in the underground.) For an area, preoperational inspection includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that functional components and emergency equipment are present and operational. When the equipment is not in use, no inspections are required.

[d] When equipment needs to be inspected while handling waste (i.e., during waste unloading or transfer operations), general cleanliness and functional components will be inspected to detect any problem that may harm human health or the environment. The inspection will verify that emergency equipment is present.

[e] Inspection of RH TRU mixed waste equipment and areas in the RH Complex applies only after RH TRU mixed waste receipt begins.

[f] The inspection/maintenance activities associated with these pieces of equipment are performed when the RH Complex is empty of RH TRU mixed waste. If contamination is present, a radiation work permit may be needed.

[g] For the Hot Cell and Transfer Cell, if RH TRU mixed waste is present, camera inspections will be performed in lieu of physical inspection.

[h] The integrity of the floor coating will be inspected weekly if RH TRU mixed waste is present.

[i] "Preoperational" signifies that inspections are required prior to the first use in a calendar day.

[j] Responsible organizations refers to the organization that owns the equipment. Preventive Maintenance (PM) procedures are conducted by either mine maintenance or surface operations maintenance personnel and Instrument Calibration (IC) procedures are conducted by instrument and calibration maintenance personnel.

[k] Inspection will be performed after 250 evolutions (actual and training emplacements), if such usage occurs prior to the semi-annual inspection.

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Table E-2
Monitoring Schedule

System/Equipment Name	Responsible Organization	Monitoring Frequency	Purpose
Geomechanical [b]	Geotechnical Engineering	Monthly	To evaluate the geotechnical performance of the underground facility and to detect ground conditions that could affect operational safety
Central Monitoring System	Facility Operations	System Dependent	Monitor and provide status for the following facility parameters: Electrical Power Status [d] Fire Alarm System [e] Ventilation System Status [f] Meteorological Data System [g] Facility Systems (compressors [g], pumps [h], water tank levels [i], waste hoists [j])

[b] Equipment is listed as Underground-Geomechanical Instrumentation System (GIS) in Table E-1.
[d] Equipment listed as Backup Power Supply Diesel Generator in Table E-1.
[e] Equipment listed as Fire Detection and Alarm System in Table E-1.
[f] Equipment listed as Ventilation Exhaust in Table E-1.
[g] Not RCRA equipment.
[h] Equipment listed as Fire Pumps in Table E-1.
[i] Equipment listed as Water Tank Level in Table E-1.
[j] Equipment listed as Waste Hoist in Table E-1.

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Field Code Changed

ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

Introduction

The WIPP facility is owned and co-operated by the U.S. Department of Energy (**DOE**) and co-operated by its designated Management and Operating Contractor (**MOC**) (Permit Section 1.5.3).

This Contingency Plan was prepared in accordance with the Resource Conservation and Recovery Act (**RCRA**) requirements codified in 20.4.1.500 NMAC (incorporating 40 CFR §264.50 to §264.56), "Contingency Plan and Emergency Procedures," and submitted in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(7)). The purpose of this document is to define responsibilities, to describe coordination of activities, and to minimize hazards to human health and the environment from fires, explosions, or any sudden or nonsudden release of hazardous waste, or hazardous waste constituents to air, soil, or surface water (20.4.1.500 NMAC (incorporating 40 CFR §264.51 [a])). This plan consists of descriptions of processes and emergency responses specific to hazardous substances, contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste and other hazardous waste handled at the WIPP facility.

D-1 General Information

The WIPP facility is located 26 miles (mi) (42 kilometers [km]) east of Carlsbad, in Eddy County in southeastern New Mexico, and includes an area of 10,240 acres (ac) (4,144 hectares [ha]). The facility is located in an area of low-population density, with fewer than 30 permanent residents living within a 10 mi (16 km) radius of the facility. The area surrounding the facility is used primarily for grazing, potash mining, and mineral exploration. Resource development that would affect WIPP facility operations or the long-term integrity of the facility is not allowed within the 10,240 ac (4,144 ha) that have been set aside for the WIPP Project.

The WIPP facility is designed to receive containers of TRU waste, which will be transported to the WIPP facility from the ten major and other minor DOE TRU mixed waste generator and/or storage sites. The waste will be emplaced in the bedded salt of the Salado Formation, 2,150 feet (ft) (655 meters [m]) below ground surface.

As a geologic facility for the management of TRU mixed waste, the WIPP repository is regulated as a "miscellaneous unit," as defined under 20.4.1.500 NMAC (incorporating 40 CFR §264.601 to §264.603). The areas at the WIPP facility subject to this permit include the surface container storage areas in the Waste Handling Building (**WHB**) Container Storage Unit (**WHB Unit**) and the Parking Area Container Storage Unit (**Parking Area Unit**), located south of the WHB, and the areas below ground in which waste will be emplaced.

The WIPP facility includes other surface structures, shafts, and underground areas (Figures D-1, D-2, and D-3). Surface structures other than the WHB, that support TRU mixed waste management include:

Exhaust Filter Building - houses the filter banks to which the underground ventilation can be diverted in the unlikely event of an underground release of radionuclides.

Guard and Security Building - houses the facility security personnel and communications equipment necessary for them to perform their duties. Section D-4a specifies the duties of the security officers relative to contingency actions.

Safety and Emergency Services Building - houses the surface emergency response vehicles (fire truck, rescue truck, ambulance), Health Services (first aid), Emergency Operations Center, and the Dosimetry Laboratory. The Hazardous Material Response Trailer is staged at the WIPP facility in an area that is readily accessible to Emergency Services. Emergency Services is located in Building 452. Table D-6 describes emergency equipment and associated locations.

Support Building - houses the Central Monitoring Room (see section D-4a).

Transuranic Package Transporter-II (**TRUPACT-II**) Maintenance Facility - is located west of the CH bay. No TRU mixed waste management activities will occur in this facility.

Surface facilities used for storage of support equipment are identified in Table D-6.

Building 452, Safety and Emergency Services Facility, houses the emergency response vehicles, emergency equipment, the mine rescue room, mine rescue team equipment, and the Emergency Operations Center (**EOC**). The Hazardous Material Response Trailer is staged at the WIPP facility in an area readily accessible to Emergency Services. Emergency Services is located in Building 452.

The RCRA permit addresses TRU mixed waste management activities in the WHB Unit, the Parking Area Unit, and the disposal units. The provisions of this Contingency Plan apply to hazardous waste disposal units (**HWDU**) in the underground waste disposal panels, storage in the WHB Unit and the Parking Area Unit, the Waste Shaft, and supporting TRU mixed waste handling areas. The remainder of the facility will not manage TRU mixed waste. This Contingency Plan has also been designed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR § 262.34(a)(4) - Standards for Generators of Hazardous Waste), and will be implemented whenever there is a fire, explosion, or release of hazardous waste which could threaten human health or the environment. Hazardous substances in the remainder of the facility are included as possible triggers of the Contingency Plan but are outside the scope of the regulations promulgated pursuant to RCRA. This allows WIPP to maintain one emergency response plan which is consistent with the National Response Teams Integrated Contingency Plan Guidance (Federal Register, Vol. 61, No. 109, June 5, 1996). Inclusion is based on their National Fire Protection Association (**NFPA**) ratings in addition to their storage quantities. The majority of hazardous substances on-site are not expected to trigger the Contingency Plan because they are present in the same form and concentration as the product packaged for distribution and use by the general public or are used in a laboratory under the direct supervision of a technically qualified individual. Superfund Amendments and Reauthorization Act (**SARA**) Title III excludes these from emergency planning reporting. The list of hazardous substances in large enough quantities to constitute a Level II incident (Section D-3) is provided in Table D-1. In addition to TRU mixed waste, these are the only hazardous substances currently on site which, if spilled, may be of sufficient impact to cause this Contingency Plan to be implemented. Magnesium Oxide (**MgO**) is stored on-site in large quantities. It is used as backfill in the waste emplacement rooms as a pH buffer. The pH buffer will limit the solubility of radionuclides after the underground rooms are filled and closed. MgO is not a hazardous

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substance, a release of MgO will not create hazardous waste and poses no threat to human health or the environment, and is therefore not addressed in the Contingency Plan.

Wastes generated as a result of maintenance or response actions will be categorized into one of three groups and disposed of accordingly. These are: 1) nonhazardous wastes to be disposed of in an approved landfill, 2) hazardous nonradioactive wastes to be disposed of at an off-site RCRA permitted facility, and 3) TRU mixed waste to be disposed of in the underground HWDUs. Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees will demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the HWDUs in the underground, will be met. In addition, the technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178) are applied to the operation of the container storage units in the WHB Unit and in the Parking Area Unit south of the WHB. Liquid wastes that may be generated as a result of the fire fighting water or decontamination solutions will be managed as follows:

Non-Mixed - Hazardous waste liquids contaminated only with hazardous constituents will be placed into containers and managed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34) requirements. The waste will be shipped to an approved off-site treatment, storage, or disposal facility.

Mixed - Liquids contaminated with TRU mixed waste (inside the WHB Unit) will be solidified as they are placed into containers with cement, Aquaset, or absorbent material in them. The solidified materials will be disposed of in the underground WIPP repository as derived waste.

This chapter of the permit application describes the HWDUs, the TRU mixed waste management facilities and operations, compliance with the environmental performance standards, and with the applicable technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178 and §264.601, respectively). The configuration of the WIPP facility consists of completed structures; including all buildings and systems for the operation of the facility.

D-1a Disposal Phase Overview

The Disposal Phase will consist of receiving CH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations.

The TRU mixed waste that will be disposed at the WIPP facility results primarily from activities related to the reprocessing of plutonium-bearing reactor fuel and fabrication of plutonium-bearing weapons, as well as from research and development. This TRU mixed waste consists largely of such items as paper, cloth, and other organic material; laboratory glassware and utensils; tools; scrap metal; shielding; and solidified sludges from the treatment of wastewater. Much of this TRU mixed waste is also contaminated with substances that are defined as hazardous under 20.4.1.200 NMAC.

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D-1b Waste Description

Waste destined for WIPP are, or were, produced as a byproduct of weapons production and have been identified in terms of waste streams based on the processes that produced them. Each waste stream identified by generators is assigned to a Waste Summary Category to facilitate RCRA waste characterization, and reflect the final waste forms acceptable for WIPP disposal.

These Waste Summary Categories are:

S3000—Homogeneous Solids

Solid process residues defined as solid materials, excluding soil, that do not meet the applicable regulatory criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2[g] and [h])). Included in solid process residues are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Waste Summary Category based on the specific waste stream types and final waste form. This category includes wastes that are at least 50 percent by volume solid process residues.

S4000—Soils/Gravel

This waste summary category includes waste streams that are at least 50 percent by volume soil. Soils are further categorized by the amount of debris included in the matrix.

S5000—Debris Wastes

This waste summary category includes waste that is at least 50 percent by volume materials that meet the criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2)). Debris is a material for which a specific treatment is not provided by 20.4.1.800 NMAC (incorporating 40 CFR §268 Subpart D), including process residuals such as smelter slag from the treatment of wastewater, sludges or emission residues.

> Debris means solid material exceeding a 2.36 inch (60 millimeter) particle size that is intended for disposal and that is: 1) a manufactured object, 2) plant or animal matter, or 3) natural geologic material.

Included in the S5000 Waste Summary Category are metal debris, lead containing metal debris, inorganic nonmetal debris, asbestos debris, combustible debris, graphite debris, heterogeneous debris, and composite filters, as well as other minor waste streams. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

Examples of waste that might be included in the S5000 Waste Summary Category are asbestos-containing gloves, fire hoses, aprons, flooring tiles, pipe insulation, boiler jackets, and laboratory tabletops. Also included are combustible debris constructed of plastic, rubber, wood, paper, cloth, graphite, and biological materials. Examples of graphite waste that would be included are crucibles, graphite components, and pure graphite.

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Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such generated waste may occur in either the WHB Unit or the Underground. For example, when TRU mixed wastes are received at the WHB Unit, the CH or RH Package shipping containers and the TRU mixed waste containers are checked for surface contamination. Under some circumstances,[1] if contamination is detected, the shipping container and/or the TRU mixed waste containers will be decontaminated. In the underground, waste may be generated as a result of radiation control procedures used during monitoring activities. The waste generated from radiation control procedures will be assumed to be TRU and/or TRU mixed waste. Throughout the remainder of this plan, this waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

D-1c Containers

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

TRU mixed waste containers, containing off-site waste, will not be opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Waste, including "derived waste," containing liquid in excess of TSDF-WAC limits shall not be emplaced in the WIPP (See Permit Attachment C, Section C-1c).

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 177). The RCRA Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) precludes ignitable, reactive, or incompatible TRU mixed waste from being placed into storage or disposed of at WIPP.

D-1d Description of Containers

CH TRU mixed waste containers will be either 55-gallon (gal) (208-liter (L)) drums singly or arranged into seven (7)-packs, 85-gal (322-L) drums (used as singly or arranged into four (4)-packs, 100-gal (379 L) drums singly or arranged into three (3)-packs, ten-drum overpacks (**TDOP**), 66.3 ft^3 (1.88 m^3) SWBs, or standard large box 2s (**SLB2**).

RH TRU mixed waste containers are either canisters or drums. Canisters will be loaded singly in an RH-TRU 72-B cask and drums will be loaded in a CNS 10-160B cask. Drums in the CNS 10-160B cask will be arranged singly or in drum carriage units containing up to five drums each. Canisters and drums are described in Permit Attachment M1.

D-1e Description of Surface Hazardous Waste Management Units

The WHB is the surface facility where waste handling activities will take place. The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters [m^2]) of which 49,710

[1] Typically contamination that is less than six square feet in area and less than 2000 disintegrations per minute (dpm) alpha or 20,000 dpm beta/gamma, may be decontaminated. Containers that exceed these thresholds will be returned to the point of origin for decontamination.

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ft^2 (4,618 m^2) are designated as the WHB Unit for TRU mixed waste management. Within the WHB Unit, 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for the handling and storage of RH TRU mixed waste. These areas are being permitted as container storage units. The concrete floors within the WHB Unit are sealed with an impermeable coating that has excellent resistance to the chemicals in TRU mixed waste and, consequently, provide secondary containment for TRU mixed waste. In addition, a Parking Area Unit south of the WHB will be used for storage of waste in sealed shipping containers awaiting unloading. This area is also being permitted as a container storage unit. The sealed shipping containers provide secondary containment in this hazardous waste management unit (**HWMU**).

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

In addition, four Contact-Handled Packages, containing up to 640 ft^3 of CH TRU waste in containers, may occupy positions at the TRUPACT-II Unloading Docks (**TRUDOCK**).

Aisle space shall be maintained in all CH Bay waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire response personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space between facility and containment pallets will be maintained in all CH TRU mixed waste storage areas.

D-1e(2) RH Complex Operations

Loaded RH TRU casks are received in the RH Bay of the WHB. The RH Bay is served by an overhead bridge crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. A maximum of two loaded casks may be stored in the RH Bay and a maximum of one cask in the Cask Unloading Room may be stored at one time. A minimum of 44 inches (1.1 m) will be maintained between loaded casks in the RH Bay. The cask serves as secondary containment in the RH Bay for the RH TRU mixed waste payload container. In addition, the RH Bay has a concrete floor.

Single RH TRU mixed waste canisters are unloaded from the RH-TRU 72-B casks in the Transfer Cell of the RH Complex where they are transferred to facility casks. Drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, into the Hot Cell, and loaded into a canister. Storage in the Hot Cell occurs in either drums or canisters. A maximum of 12 55-gallon drums of RH TRU mixed waste and one 55-gallon drum of derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell. Except for the derived waste drum, individual 55-gallon drums may not be stored in the Hot Cell for more than 25 days. The Transfer Cell houses the Transfer Cell Shuttle Car, which is used to facilitate transferring the canister to the facility

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cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in a shielded insert in the Transfer Cell Shuttle Car or in a RH-TRU 72-B cask.

The Facility Cask Loading Room provides for transfer of a canister to the facility cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit. The Facility Cask Loading Room also functions as an air lock between the waste shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask in the Facility Cask Loading Room.

Derived waste will be stored in the RH Bay and in the Hot Cell.

D-1e(3) Parking Area Container Storage Unit (Parking Area Unit)

The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Container Storage Unit. This area provides storage for up to 6,734 ft^3 (191 m^3) of CH and/or RH TRU mixed waste contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing rainwater are provided by the transportation containers. Up to 12 additional Contact-Handled Packages and four additional Remote-Handled Packages may be stored in the Parking Area Surge Area so long as the requirements of Permit Sections 3.1.2.3 and 3.1.2.4 are met. No more than 50 Contact-Handled and 12 Remote-Handled Packages may be stored in the Parking Area Storage Unit.

The safety criteria for Contact-Handled and Remote-Handled Packages require that they be opened and vented at a frequency of at least once every 60 days. During normal operations, Contact-Handled and Remote-Handled Packages will not require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be mitigated by returning the shipment to the generator prior to the expiration of the 60 day NRC venting period or by moving the Contact-Handled or Remote-Handled Package inside the WHB Unit where the waste will be removed and placed in one of the permitted storage areas or in the underground hazardous waste disposal unit.

D-1f Off-Normal Events

Off-normal events could interrupt normal operations in the waste management process line. Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

D-1g Containment

The WHB Unit has concrete floors, which are sealed with a coating designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor.

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During normal operations, the floor of the normal storage areas within the CH Bay and RH Complex shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. When a RH TRU mixed waste container is present in the RH Complex, inspections will be conducted visually and/or using closed-circuit television cameras in order to manage worker dose and minimize radiation exposures. Manual inspections of the areas are performed at least annually during routine maintenance periods when waste is not present.

Floor areas of the WHB used during off-normal events will be inspected prior to use and weekly while in use. Containers located in the permitted storage areas shall be elevated from the surface of the floor. Facility pallets provide at least 6 in (15 centimeters [cm]) of elevation from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packages shall be stored at a designated storage area inside the WHB so as to preclude exposure to the elements.

Secondary containment at permitted storage areas inside the WHB Unit shall be provided by the floor. The Parking Area Unit and TRUDOCK storage area of the WHB Unit do not require engineered secondary containment, since waste is not stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging. Floor drains, the fire suppression water collection sump, and portable dikes, if needed, will provide containment for liquids that may be generated by fire fighting. Sump capacities and locations are shown in Drawing 41-F-087-014. Residual fire fighting liquids will be placed in containers and managed as described above. Secondary containment at storage locations inside the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room is provided by the cask or canisters that contain drums of RH TRU mixed waste. In the Hot Cell, secondary containment is provided by the Hot Cell subfloor. In addition, the RH Complex contains a 220-gallon (833-L) sump in the Hot Cell, a 11,400-gallon (43,152-L) sump in the RH Bay, and a 220-gallon (833-L) sump in the Transfer Cell to collect any liquids.

D-2 Response Personnel

Persons qualified to act as the RCRA Emergency Coordinator, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55), are listed in Table D-2.

A RCRA Emergency Coordinator will be on-site at the WIPP facility 24 hours a day, seven days a week, with the responsibility for coordinating emergency response measures. RCRA Emergency Coordinators are listed in Table D-2, where four individuals have been designated primary RCRA Emergency Coordinators. This is because the on-duty Facility Shift Manager (**FSM**) is designated as the RCRA Emergency Coordinator. The four individuals shown serve as FSM on a rotating shift basis.

Persons qualified to act as the RCRA Emergency Coordinator are thoroughly familiar with this Contingency Plan, the TRU mixed waste and hazardous waste operations and activities at the WIPP facility, the locations of TRU mixed waste and hazardous waste activities, the locations on the site where hazardous materials are stored and used, and the locations of waste staging and accumulation areas. They are familiar with the characteristics of hazardous substances, TRU mixed waste and hazardous waste handled at the WIPP facility, the location of TRU mixed waste and hazardous waste records within the WIPP facility, and the facility layout. In addition, persons qualified to act as the RCRA Emergency Coordinator have the authority to commit the

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necessary resources to implement this Contingency Plan. Figure D-4 outlines the RCRA Emergency Coordinator's position relative to other organizations that provide support.

In addition to the RCRA Emergency Coordinator, the following individuals or groups have specified responsibilities during any WIPP facility emergency:

- Assistant Chief Office Warden (**ACOW**)—Persons assigned to take accountability for sections of the site, and then reporting the accountability to the Chief Office Warden.
- Central Monitoring Room Operator (**CMRO**)—The on-shift operator responsible for Central Monitoring Room (**CMR**) operations, including coordination of facility communications. The facility log is maintained by the CMRO.
- Chief Office Warden (**COW**)—A predesignated individual with responsibilities for complete surface accountability at staging areas in the event of an evacuation. The Chief Office Warden receives reports from the ACOWs.
- Emergency Response Team (**ERT**)—Supplemental group trained to respond to surface emergencies, to provide emergency first aid, and to respond to releases of hazardous waste or hazardous material. ERT members are part of the WIPP Supplemental Emergency Response Program.
- Emergency Services Technician (**EST**)/Fire Protection Technician (**FPT**)—Regular employee whose job is that of full-time emergency responder. During non-emergency conditions, the EST/FPT inspects facility fire suppression systems and emergency equipment. The EST/FPT completes specific sections of the "WIPP Hazardous Material Incident Report." Additional technical personnel complete identified sections of the report.
- Fire Brigade—The fire brigade is a team of five personnel who respond to site emergencies. The team consists of an Incident Commander and four fire fighters. The fire fighters are trained in accordance with NFPA Standards for Industrial Fire Brigades (Fire Brigades that perform both advanced exterior and interior structural fire fighting).
- First Line Initial Response Team (**FLIRT**)—Supplemental primary responders in the event of a general underground emergency for medical and hazardous material response. The FLIRT also provides backup support for the ERT in the event of a general surface-facility emergency. FLIRT members are part of the WIPP Supplemental Emergency Response Program.
- Mine Rescue Team (**MRT**)—Supplemental group responsible for underground reentry and rescue after an emergency evacuation. The MRT responds in accordance with 30 CFR Part 49 requirements. MRT members are part of the WIPP Supplemental Emergency Response Program.
- Office Warden—An individual assigned responsibility for assuring that personnel are evacuated from his/her assigned area or building during evacuations. Office Wardens maintain a list of all personnel in their specific area. This list is compared with the

physical presence of personnel who assemble at the staging areas. The Office Wardens report area accountability to the ACOWs.

- EOC Staff-The EOC consists of a minimum staff of three MOC management positions (the Crisis Manager, a Safety Representative and an Operations Representative) to activate the EOC. The full EOC Staff includes the Crisis Manager, the Deputy Crisis Manager, a Safety Representative, an Operations Representative and the EOC Coordinator. Additional technical and logistics personnel will provide support as necessary. The EOC is activated by the FSM. Since EOC staff are performing duties similar to their normal job functions and providing support related to their area of expertise, no specific RCRA training is required.

D-3 Implementation

The provisions of this Contingency Plan will be implemented immediately whenever there is an emergency event (e.g., a fire, an explosion, or a natural occurrence that involves or threatens hazardous or TRU mixed wastes or a release of hazardous substances, hazardous materials, or hazardous wastes) that could threaten human health or the environment, or whenever the potential for such an event exists as determined by the RCRA Emergency Coordinator, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)). The following information is utilized for categorization of events to determine implementation of the Contingency Plan:

1. Medical Emergencies (does not implement the Contingency Plan)

2. Non-emergency (does not implement the Contingency Plan)

   a. Fire already out, did not involve any hazardous materials.

   b. Spill or release involved materials excluded according to the SARA Title III, Statute 42 U.S.C. 11021 (e). Such as:

      1) Any substance present in the same form and concentration as product packaged for distribution and use by the general public. (Example: Cleaning solutions)

      2) Any substance to the extent it is used in a laboratory under the direct supervision of a technically qualified individual.

      3) Petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance by Comprehensive Environmental Response, Compensation and Liability Act (**CERCLA**).

3. Incident Level I: According to the NFPA 471, Responding to Hazardous Materials Incidents (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level I incident and does not implement the Contingency Plan.

   a. The product does not require a U.S. Department of Transportation (**DOT**) placard, is a NFPA listed 0 or 1 for all categories, or is Other Regulated Materials A, B, C, or D.

b. The fire is under control and the reactivity rating of the material is less than a rating 2, indicating a low potential for subsequent explosion as the hazardous material can be considered normally stable.

c. There was no release or the release can be confined with readily available resources.

d. There is no life-threatening situation.

e. There is no potential environmental impact.

4. Incident Level II: According to NFPA 471, Responding to Hazardous Materials Incidents, (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level II incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

   a. The product requires a DOT placard, is an NFPA 2 for any categories, or is Environmental Protection Agency (**EPA**) regulated waste (Site-specific: Table D-1 and TRU mixed waste) AND

   b. The incident involves multiple packages.

   c. There is potential for the fire to spread since the hazardous material's flammability level (rating 2) is below 200 degrees Fahrenheit, or the reactivity (rating 2) indicates that violent chemical changes are possible and thus may be explosive.

   d. The release may not be controllable without special resources.

   e. The incident requires evacuation of a limited area for life safety.

   f. The potential for environmental impact is limited to soil and air within incident boundaries.

   g. The container is damaged but able to contain the contents to allow handling or transfer of product.

5. Incident Level III: According to NFPA 471, Responding to Hazardous Materials Incidents (See Table D--3). If the product(s) involved in the fire, explosion, spill or leakage meet the following criteria, it will be classified as a Level III incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

   a. The product is a poison A (gas), an explosive A/B, organic peroxide, flammable solid, material that is dangerous when wet, chlorine, fluorine, anhydrous ammonia, NFPA 3 and 4 for any categories including special hazards, EPA extremely hazardous substances, and cryogenics.

   b. The site-specific container size for this incident level will be a tank truck.

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c. There is potential for the fire to spread since the hazardous material's flammability level (rating 3 or 4) is below 100 degrees Fahrenheit, or the reactivity (rating 3 or 4) indicates that the material may explode.

d. The release may not be controlled even with special resources.

e. The incident requires mass evacuation of a large area for life safety.

f. Even though the NFPA guidelines for this incident level indicate that the potential for environmental impact is severe, due to the site engineering controls, the impact is contained within the HWMUs.

g. The container is damaged to such an extent that catastrophic rupture is possible.

The above categories include fire situations, weather conditions, natural phenomena, and explosions which will have to be evaluated to make an incident level determination. A Level II (potential threat to human health in localized area, potential for moderate on-site environmental impact) or Level III (potential threat to human health in a larger area, potential for severe environmental impact) incident by definition is considered to be a potential threat to human health or the environment and, therefore, is considered to be an emergency requiring activation of the Contingency Plan.

D-4 Emergency Response Method

Methods that describe how and when the WIPP Contingency Plan will be implemented cover the following 11 implementation areas:

1. Notification (Section D-4a)
2. Identification of hazardous materials (Section D-4b)
3. Assessment of the nature and extent of the emergency (Section D-4c)
4. Control, containment, and correction of the emergency (Section D-4d)
5. Prevention of recurrence or spread of fires, explosions, or releases (Section D-4e)
6. Management and containment of released material and waste (Section D-4f)
7. Incompatible waste (Section D-4g)
8. Post-emergency facility and equipment maintenance and reporting (Section D-4h)
9. Container spills and leakage (Section D-4i)
10. Tank spills and leakage (Section D-4j)
11. Surface impoundment spills and leakage (Section D-4k)

D-4a Notification

Notification requirements in the event of an emergency at a RCRA hazardous waste management facility are defined by 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(a) and (d)). Necessary notifications in case of an emergency at the WIPP facility are described in this section (Figure D-4a). Personnel at the WIPP facility are trained to respond to emergency notifications.

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D-4a(1) Initial Emergency Response and Alerting the RCRA Emergency Coordinator

The first person to become aware of an incident shall immediately report the situation to the CMRO, and provide the following information, as appropriate:

- Name and telephone number of the caller
- Location of the incident and the caller
- Time and type of incident
- Severity of the incident
- Magnitude of the incident
- Cause of the incident
- Assistance needed to deal with or control the incident
- Areas or personnel affected by the incident

In addition to receiving incident reports, the CMRO, who is located in the Support Building (Building 451) (Figure D-1), continuously monitors (24 hours a day) the status of mechanical, electrical, and/or radiological conditions at selected points on the site, both above and below ground. Alarms to indicate abnormal conditions are located throughout the WIPP facility. The alarm(s) (e.g., fire, radiation) may be the first notification of an emergency situation received by the CMRO. The CMRO monitors alarms, takes telephone calls and radio messages, and initiates outgoing calls to emergency staff and outside agencies.

Once the CMRO is notified of a fire, explosion, or a release anywhere in the facility (either by eyewitness or an alarm), the RCRA Emergency Coordinator is immediately notified. Once notified, the RCRA Emergency Coordinator assumes responsibility for the management of activities related to the assessment, abatement, and/or cleanup of the incident.

A RCRA Emergency Coordinator is on-site at all times and, therefore, can be reached at any time via a two-way radio or over the public address (**PA**) and plectrons on-site. If the RCRA Emergency Coordinator is unavailable or unable to perform these duties, a qualified alternate RCRA Emergency Coordinator is available.

The EST/FPT is also notified in case of fire, explosion, or release. The RCRA Emergency Coordinator, as incident commander, determines if supplemental emergency responders are necessary. Notification of the ERT (surface) is made by using the ERT pagers and/or the public announcement system. Notification of the FLIRT is by using the Mine Page Phone System. If the MRT is needed the RCRA Emergency Coordinator will instruct the CMRO to make a PA announcement for the MRT to assemble in the Mine Rescue Room, located in a predetermined location.

Off-shift personnel may be notified using the on-call list, which is updated weekly by the Permittees. The FSM/CMRO, each individual on the on-call list, and WIPP Security receive copies of the on-call list. The CMRO may direct Security to make the notifications.

The response to an unplanned event will be performed in accordance with procedures based on the applicable Federal, State, or local regulations and/or guidelines for that response. These include the U.S. Mine Safety and Health Administration (**MSHA**); NMAC; CERCLA; Chapter 74, Article 4B, New Mexico Statutes Annotated 1978, New Mexico Emergency Management Act;

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and agreements between the Permittees and local authorities (Section D-6) for emergencies throughout the WIPP facility.

After notification by the CMRO, the EST/FPT shall immediately investigate to determine pertinent information relevant to the actual or potential threat posed to human health or the environment. The information will include the location of release, type, and quantity of spilled or released material (or potential for release due to fire, explosion, weather conditions, or other naturally occurring phenomena), source, areal extent, and date and time of release. The EST/FPT shall provide information for classification of the incident, according to the emergency response guidelines, to the RCRA Emergency Coordinator. The RCRA Emergency Coordinator then classifies the incident after evaluation of all pertinent information. This classification will consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).

When the RCRA Emergency Coordinator determines that an Incident Level II or III has occurred, the Contingency Plan is implemented. The RCRA Emergency Coordinator then may choose to activate the EOC for additional support (Figure D-4). If the RCRA Emergency Coordinator determines that due to extenuating circumstances the potential to upgrade to an incident Level II or III exists, the RCRA Emergency Coordinator also may activate the EOC. The EOC will assist the RCRA Emergency Coordinator in mitigation of the incident with use of communications equipment and technical expertise from any WIPP organization (see Section D-4c).

The EOC staff will assess opportunities for coordination and the use of mutual-aid agreements with local outside agencies making additional emergency personnel and equipment available (Section D-6), as well as the use of specialized response teams available through various State and Federal agencies. As a DOE-owned facility, the WIPP facility may use the resources available from the Federal Response Plan, signed by 27 Federal departments and agencies in April 1987, and developed under the authorities of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7701 et seq.) and amended by the Stafford Disaster Relief Act of 1988. Most resources are available within 24 hours. The WIPP facility maintains its own emergency response capabilities on-site. In addition to the supplemental emergency responders, radiological control technicians, environmental sampling technicians, wildlife biologists, and various other technical experts are available for use on an as-needed basis.

D-4a(2) Communication of Emergency Conditions to Facility Employees

Procedures for notifying facility personnel of emergencies depend upon the type of emergency. Methods of notification are:

- Local Fire Alarms

  The local fire alarms sound a bell tone and may be activated automatically or manually in the event of a fire.

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- Surface Evacuation Signal

  The evacuation signal is a yelp[2] tone and is manually activated by the CMRO when needed. The CMRO shall follow the evacuation signal with verbal instructions and ensure the Site Notification System (i.e., the plectron) has been activated.

- Underground Evacuation Warning System

  The evacuation signal is a yelp tone and flashing strobe light. In the event of an evacuation signal, underground personnel will proceed to the nearest egress hoist station (Section D-7b) to be apprised of the nature of the emergency and the evacuation route to take. Underground personnel are trained to report to the underground assembly areas and await further instruction if all power fails or if ventilation stops. If evacuation of underground personnel is required, this will be done using the backup electric generators and in accordance with the applicable requirements of MSHA.

- Contingency Evacuation Notification

  If the primary warning system consisting of alarms and signals fails to operate when activated (as in a total power outage and failure of the back-up power systems), WIPP Security will be notified by the CMRO to initiate the contingency evacuation plan. In this event Security officers will alert personnel to evacuate the area and will check trailers, if possible, to ensure that personnel have been alerted/evacuated.

WIPP facility personnel are trained and given instruction during General Employee Training to recognize the various alarm signals and the significance of each alarm. WIPP facility employees and site visitors are required to comply with directions from emergency personnel and alarm system notifications and to follow instructions concerning emergency equipment, shutdown procedures, and emergency evacuation routes and exits.

D-4a(3) Notification of Local, State, and Federal Authorities

If it is determined that the facility has had a fire, an explosion, a spill, or a release of hazardous waste or hazardous waste constituents (included in 20.4.1.200 NMAC (incorporating 40 CFR § 261)) in the miscellaneous unit or TRU mixed waste handling areas, or an emergency resulting in a release of a hazardous substance (included in 40 CFR §302.4 and §302.6 or the New Mexico Emergency Management Act, §74-4B-3 and §74-4B-5) that could threaten human health or the environment outside the facility, the RCRA Emergency Coordinator, after consultation with the DOE as the owner of the facility, will assure that local authorities are notified by telephone and/or radio, including:

- Carlsbad Police Department (telephone number: [575] 885-2111) (or 911)
- Carlsbad Fire Department (telephone number: [575] 885-2111) (or 911)
- Eddy County Sheriff (telephone number: [575] 887-7551)
- Hobbs Fire Department (telephone number: [575] 397-9265)

[2] The yelp tone increases from 500 to 1,000 hertz and drops to 500 hertz.

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After local authorities are notified, the RCRA Emergency Coordinator will ensure notification of the following:

- New Mexico Environment Department (**NMED**)
  Department of Public Safety
  24-Hour Emergency Reporting Telephone Number: (505) 827-9329
  FAX number: (505) 827-9368

- Department of Public Safety WIPP Coordinator
  Telephone Number: (505) 827-9221
  FAX number: (505) 829-3434

- Hazardous Materials Emergency Response, Chemical Safety Office, Department of Public Safety, State Emergency Response Commission
  Telephone number: (505) 476-9681
  FAX number: (505) 476-9695

- National Response Center
  Telephone number: 1-800-424-8802
  FAX number: (202) 479-7181

- Local Emergency Planning Committee
  Telephone number: (575) 885-3581
  Fax number: (575) 628-3973

The first notification of public safety and regulatory agencies will include the following:

- The name and address of the facility and the name and phone number of the reporter
- The type of incident (fire, explosion, or release)
- The date and time of the incident
- The type and quantity of material(s) involved, to the extent known
- The exact location of the incident
- The source of the incident
- The extent of injuries, if any
- Possible hazards to human health and the environment (air, soil, water, wildlife, etc.) outside the facility
- The name, address, and telephone number of the party in charge of or responsible for the facility or activity associated with the incident
- The name and the phone number of the RCRA Emergency Coordinator

- The identity of any surface and/or groundwater involved or threatened and the extent of actual and potential water pollution

- The steps being taken or proposed to contain and clean up the material involved in the incident

The RCRA Emergency Coordinator will also be available to advise the appropriate local, State, or Federal officials on whether or not local areas should be evacuated.

D-4a(4) Notification of the General Public

Immediate notification of the general public through the public safety and emergency agencies listed above will be made by, or under the direction of, the RCRA Emergency Coordinator following an evaluation to determine if local adjacent areas need to be evacuated. This evaluation will be made in consultation with the DOE who, as the owner of the facility, has management responsibility for the land withdrawal area. DOE policy is to provide accurate and timely information to the public by the most expeditious means possible concerning emergency situations at the WIPP site that may affect off-site personnel, public health and safety, and/or the environment. A DOE (**DOE**) Management representative is always on-call. This person is available by pager or telephone 24 hours a day.

A Hazards Assessment was conducted, which indicated no need for protective actions or emergency action levels, as defined by the Permittees, for the facility. Therefore, no procedures are in place for evacuation of the public. Procedures are in place for notification of the public by radio, television, and newspapers for news items which might include notification of on-site emergency situations. These procedures include a Public Affairs Coordinator in the EOC who writes and transmits press releases to the DOE office, where formal press conferences are conducted.

D-4b Identification of Hazardous Materials

The identification of hazardous wastes, hazardous waste constituents, or hazardous materials involved in a fire, an explosion, or a release to the environment is a necessary part of the assessment of an incident, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). RCRA hazardous waste and hazardous substances and materials listed in 40 CFR §302.4 and §302.6 or New Mexico Emergency Management Act, §74-4B-3 and §74-4B-5 and, involved in any release at the WIPP facility will be identified. The identification of likely hazardous materials at any location is enhanced because hazardous materials and hazardous waste are only stored or managed in specified locations throughout the WIPP facility. An attempt will be made to identify products involved by occupancy/location, container shape, markings/color, placards/labels, United Nations/North America/Product Identification Number, on-site technical experts, or field sampling. Further, the ES&H department maintains an updated inventory of hazardous materials/substances that are brought on site, and a master MSDS listing in the Safety and Emergency Services Facility, Building 452.

Sources of information available to identify the hazardous wastes, substances, or materials involved in a fire, an explosion, or a release at the WIPP facility include operator/supervisor knowledge of their work areas, materials used, and work activities underway; the WIPP Waste Information System (**WWIS**), which identifies the location within the facility of emplaced TRU mixed waste, including emplaced derived waste; and waste manifests and other waste

characterization information in the operating record. The WWIS also includes information on wastes that are in the waste handling process. Also available are MSDSs for hazardous material in the various user areas throughout the facility, waste acceptance records, and materials inventories for buildings and operating groups at the WIPP facility. Information or data from the derived waste accumulation areas, the hazardous waste staging area, satellite staging areas, and nonregulated waste accumulation areas are included.

TRU mixed waste received by the WIPP facility during the Disposal Phase will be characterized for hazardous constituents prior to receipt, and acceptable knowledge will be used to characterize derived waste prior to emplacement.

Information required for identifying TRU mixed hazardous constituents in case of an incident is readily available through the WWIS and the waste acceptance records. Waste accepted at WIPP is already known to be compatible with all materials used to respond to an emergency. All non-TRU mixed waste materials received on site, other than those listed in Table D-1, are in such small quantities that no reaction could develop which would trigger an Incident Level II or III response.

The RCRA Emergency Coordinator will have access to the WWIS through Operations, or through the Facility Shift Manager's Office.

The RCRA Emergency Coordinator has access to the inventory lists and MSDSs in the Safety and Emergency Services Facility at all times.

D-4c Assessment of the Nature and Extent of the Emergency

Once the required notifications have been made, the RCRA Emergency Coordinator will ensure that the identity, exact source, amount, and areal extent of any released materials are determined, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). The RCRA Emergency Coordinator will determine whether the occurrence constitutes an emergency based on knowledge of the area and access to the waste identification/characterization information described in Section D-4b. An emergency will require response by only trained emergency response personnel. The RCRA Emergency Coordinator will be responsible for responding to immediate and potential hazards, using the services of trained personnel to determine: 1) the identity of hazardous wastes, hazardous waste constituents, and other hazardous materials involved in a release, as described in Section D-4b; 2) whether or not a release involved a reportable quantity of a hazardous substance; 3) the areal extent of a release; 4) the exact source of a release; and 5) the potential hazards to human health or to the environment.

After the materials involved in an emergency are identified, the specific information on the associated hazards, appropriate personal protective equipment (**PPE**), decontamination, etc., will be obtained from MSDSs and from appropriate chemical reference materials at the same location. These information sources may be accessed by the RCRA Emergency Coordinator or through several WIPP facility organizations.

The emergency assessment requires determination of hazards involving evaluation of several criteria, including:

- Exposure: magnitude of actual or potential exposure to employees, the general public, and the environment; duration of human and environmental exposure; pathways of exposure
- Toxicity: types of adverse health or environmental effects associated with exposures; the relationship between the magnitude of exposure and adverse effects
- Reactivity: hazardous materials or hazardous wastes, which are not TRU mixed wastes, involved in an incident will be assessed for reactivity through accessing the MSDSs for the affected material and the recommended method(s) for managing such waste
- Uncertainties: considerations for undeterminable or future exposures; uncertain or unknown health effects, including future health effects

D-4d Control, Containment, and Correction of the Emergency

The WIPP facility is required to control an emergency and to minimize the potential for the occurrence, recurrence, or spread of releases due to the emergency situation, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56 (e)). The WIPP Emergency Response procedures utilize the incident mitigation guidelines in NFPA 471, Responding to Hazardous Materials Incidents, with initial response priority being on control, and those actions necessary to ensure confinement and containment (the first line of defense) in the early, critical stages of a spill or leak. The RCRA Emergency Coordinator is responsible for stopping processes and operations when necessary, and removing or isolating containers. TRU mixed waste will remain within the WHB Unit, the Parking Area Unit, and the underground HWDU.

D-4d(1) All Emergencies

The WIPP Emergency Response procedures include, but are not limited to, the following actions appropriate for control:

1. Isolate the area from unauthorized person by fences, barricades, warning signs, or other security and site control precautions. Isolation and evacuation distances vary, depending upon the chemical/product, fire, and weather situations.
2. Identify the chemical/product according to Section D-4b.
3. Drainage controls.
4. Stabilization of physical controls (such as dikes or impoundment[s]).
5. Capping of contaminated soils to reduce migration.
6. Using chemicals and other materials to retard the spread of the release or to mitigate its effects.

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7. Excavation, consolidation, removal, or disposal of contaminated soils.

8. Removal of drums, barrels, or tanks where it will reduce exposure risk during situations such as fires.

If the facility stops operations in response to a fire, explosion, or release, the RCRA Emergency Coordinator shall ensure continued monitoring for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever appropriate. If operations continue, personnel normally assigned to these tasks will continue.

Both natural and synthetic methods will be employed to limit the releases of hazardous materials so that effective recovery and treatment can be accomplished with minimum additional risk to human health or the environment. A combination of the above methods to achieve protection of human health and the environment, with emphasis on two basic methods for mitigation of hazardous materials incidents - Physical and Chemical (Tables D-4, D-5) mitigation, will be used.

1. Physical methods of control involve any of several processes to reduce the area of the spill/leak, or other release mechanism (such as fire suppression).

   A. Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume of the sorbate/sorbent system through the process of swelling. Some of the materials utilized in response to Level I incidents or Level II incidents involving liquids will be absorbent sheets of polyolefin-type fibers, spill control bucket materials (specifically for solvents, neutralization, or for acids/caustics), and absorbent socks for general liquids or oils.

   B. Covering refers to a temporary form of mitigation for radioactive incidents that will be utilized in response to Level II or Level III incidents involving CH TRU mixed waste. These could include absorbent sheets, plastic, or actual ambulance blankets.

   C. Dikes or Diversions refer to the use of physical barriers to prevent or reduce the quantity of liquid flowing into the environment. Dikes may be soil or other barriers temporarily utilized to hold back the spill or leak. Diversion refers to the methods used to physically change the direction of the flow of the liquid. Absorbent socks or earth may be utilized as dikes or diversions for all levels of incidents.

   D. Overpacking is accomplished by the use of an oversized container. Overpack containers will be compatible with the hazards of the materials involved.

   E. Plug and Patch refers to the use of compatible plugs and patches to reduce or temporarily stop the flow of materials from small holes, rips, tears, or gashes in containers. A Series "A" hazardous response kit containing nonsparking equipment to control and plug leaks may be utilized for response to all levels of incidents.

   F. Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually or by pump, from a leaking or damaged container. Scoops,

shovels, jugs, and pails as well as drum transfer pumps for chemical and petroleum transfer are utilized as needed in response to all levels of incidents.

G. Vapor Suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents such as an aqueous foam blanket.

2. Chemical Methods of Mitigation

A. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. This would include using the neutralizing adsorbents.

B. Solidification is the process whereby a hazardous liquid is added to material such as an absorbent so that a solid material results.

The established procedures are based upon the incident level and a graded approach for nonradioactive or CH TRU waste emergencies and initiated to:

1. Minimize contamination or contact (through PPE, etc.)
2. Limit migration of contaminants
3. Properly dispose of contaminated materials

For RH TRU mixed waste, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(2) Fire

The incident level emergency response identified in Section D-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using control doors associated with the underground ventilation system. The following actions are implemented in the event of a fire:

1. All emergency response personnel at an incident will wear appropriate PPE.

2. Only fire extinguishing materials that are compatible with the materials involved in the fire will be used to extinguish fires. Compatibility with materials involved in a fire are determined by pre-fire plans, Emergency Response Guide Book (DOT, 1993), DOT labeling, and site-specific knowledge of the emergency response personnel. Water and dry chemical materials have been determined to be compatible with all components of the TRU mixed waste. Pre-fire plans for the WHB are included in Figures D-10 and D-11.

   Fires in areas of the WHB Unit should not propagate, due to limited amount of combustibles, and the concrete and steel construction of the structures. Administrative controls, such as landlord inspections and EST/FPT inspections, help to insure good housekeeping is maintained. Combustible material and TRU mixed waste will be isolated, if possible. Firewater drain trenches collect the water and channel it into a sump. In areas not adjacent to the trenches, portable absorbent dikes (pigs) will be used to retain as much as possible, until it can be transferred to containers or sampled and analyzed for hazardous constituents.

3. If the fire spreads or increases in intensity, personnel will be directed to evacuate.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards.

5. In order to ensure that storm drains and/or sewers do not receive potentially hazardous runoff, dikes will be built around storm drains to control discharge as needed. Collected waste will be sampled and analyzed for hazardous constituents, before being discharged to evaporation ponds. There are two ponds south of the security fence, opposite the WHB Unit, that will collect drainage from the parking area. The rest of the site, inside the security fence, drains to the large pond to the west. Samples will be taken from these ponds, after the emergency has been abated, to determine any cleanup requirements. NMED will approve any procedures associated with the sampling and analysis of the ponds.

6. The RCRA Emergency Coordinator maintains overall control of the emergency and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains overall responsibility.

7. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

8. Materials involved in a fire can be identified in the following ways:

   - According to Section D-4b.

   - If the contents of the waste container cannot be determined based on its location and the label is destroyed by fire, the material will be treated as an unknown, evaluated for radiological contamination, and analyzed according to methods in the EPA's "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (**SW-846**), Third Edition, after the fire has been extinguished.

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- Airborne radioactivity samples may be obtained during a fire involving radioactive materials, using portable and fixed air samplers. Response personnel will be adequately protected from airborne radioactivity by their PPE required for fire response.

9. Only materials compatible with the waste may be used for fire response.

10. When cleanup has proceeded to the point of finding no radionuclide activity, then the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

    - For waste containers, once radiologically clean and free of any visible evidence of hazardous waste spills on the container, it will be placed in the underground without further action.

    - For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues (for further information see Section D-4d, Emergency Termination Procedures).

11. Fire suppression materials used in response to incidents will be retained on-scene, where an evaluation will be performed to determine appropriate recovery and disposal methods.

D-4d(3) Explosion

The following actions will be implemented in the event that an explosion that involves or threatens hazardous or TRU mixed waste or hazardous materials has occurred:

1. The area will be evacuated immediately.

2. The CMRO will immediately notify the appropriate emergency response personnel and the RCRA Emergency Coordinator about the explosion.

3. Injured personnel will be treated and transported as necessary.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards involved and the degree and location of the explosion and associated fires.

5. The RCRA Emergency Coordinator will be in command and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains the overall responsibility. Selections of methods and tactics of response are the responsibility of the Incident Commander.

6. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

7. When cleanup has proceeded to the point of finding no radionuclide activity, then samples may be taken for chemical analysis if there is visible evidence to suspect

additional hazardous waste residues. Chemical residues on floor surfaces resulting from a hazardous waste explosion will be evaluated, sampled, analyzed (if required), isolated, and returned to appropriate containers, and surfaces will be cleaned using appropriate cleaners.

8. The RCRA Emergency Coordinator may shut down operational units (e.g., process equipment and ventilation equipment) that have been affected directly or indirectly by the explosion. Once the areas have been determined safe for reentry, processes may be reactivated.

D-4d(4) Spills

Protection of response personnel at a hazardous material incident is paramount. The primary methods to protect personnel are time, distance, and shielding. If a Level II or III incident exists, the RCRA Emergency Coordinator will implement the following actions:

1. The immediate area will be evacuated.

2. The RCRA Emergency Coordinator will review facility records to determine the identity and chemical nature of released material.

3. Entry team procedures will be utilized, with special attention to the following:

   - Buddy system
   - Appropriate PPE
   - Backup rescue team
   - Supplemental communication signals (hand signals and hand-light signals)
   - Monitoring equipment
   - Exposure time limitations

4. If possible, the source of the release will be secured.

5. A dike to contain runoff may be built.

6. Emergency responders will ensure that storm drains and/or sewers do not receive potentially hazardous runoff or spilled material. They may build dikes around storm drains to control discharge.

7. Released wastes may be collected and contained by stabilizing or neutralizing the spilled material, as appropriate, pouring an absorbent over the spilled material, and sweeping or shoveling the absorbed material into drums or other appropriate containers. The absorbents have been determined to be compatible with all components of the TRU mixed waste.

8. No TRU mixed waste that may be incompatible with the released material will be managed in the affected area until cleanup procedures are complete.

9. The RCRA Emergency Coordinator will direct spill control, decontamination, and termination procedures described below.

D-4d(5) Decontamination of Personnel

Decontamination of personnel with radioactive contamination is the responsibility of the Radiological Control (**RC**) section. If a person is contaminated with radioactivity during a site evacuation to the staging areas, the contaminated area will be covered before the person can be moved (under escort by RC personnel) to the staging area. The RC personnel will ensure the contaminated person remains segregated from other site personnel while under RC supervision.

In the event of an emergency that requires immediate evacuation of the area, the contamination can be covered by any method warranted, given the circumstance (e.g., clean clothing wrapped around the area). If the size of the radioactive contamination on the body is small and localized, it can be covered with clothing (e.g., glove, shoe cover, coveralls). If the size of the radioactive contamination on the body is large, it may be covered by dressing the individual in a full set of Anti-Contamination clothing (coveralls, hood, gloves, shoe covers, etc.).

If time and location permit and the contamination is on the face, it will be decontaminated immediately using a cloth moistened with tepid water (and a mild detergent, if necessary). If the size of the radioactive contamination on the individual's body is small and localized, it will be decontaminated using the same method as for the face, but after the individual has been transferred to an area appropriate for conducting decontamination.

If the individual is transferred to the staging area prior to decontamination, he/she will be decontaminated at the staging area using site procedures for personnel decontamination and using decontamination supplies and equipment as appropriate for the extent and magnitude of the contamination.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

In the event of spills or leaking or punctured containers of CH and RH TRU mixed waste, the WIPP responds to three distinct phases: 1) the event, 2) the re-entry, and 3) the recovery.

During the event, the following immediate actions are completed: 1) stop work, 2) warn others (notify CMR), 3) isolate the area, 4) minimize exposure, and 5) close off unfiltered ventilation. These actions can take place simultaneously, as long as they are completed before proceeding to the re-entry phase.

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers of CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and or any approved fixatives such as polyvinyl alcohol (**PVA**) or paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and counted. This information is used by cognizant managers, RC personnel, and As Low As Reasonably Achievable (**ALARA**) Committee representatives to determine an appropriate course of action to recover the area. A plan to decontaminate and recover affected areas and equipment will be approved with a separate RWP written to establish the radiological controls required for the recovery.

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During the recovery phase, the plan will be executed to utilize the necessary resources to conduct decontamination and/or overpacking operations as needed. The completion of this phase will occur prior to returning the affected area and/or equipment to normal activities. The recovery phase will include activities to minimize the spread of contamination to other areas. These activities will involve placing the waste material in another container; vacuuming the waste material; overpacking or plugging/patching the spilled, leaking, or punctured waste container; and/or decontaminating the affected area(s). If an affected surface cannot be decontaminated to releasable levels, it may be covered with a fixative coating and established as a Fixed Contamination Area to prevent spread of contamination, or it may be removed using heavy machinery and tools, packaged in approved waste containers, and emplaced in the underground. Every reasonable effort to minimize the amount of derived waste, while providing for the health and safety of personnel, will be made.

Should a breach of a CH TRU mixed waste container occur at the WIPP that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into an available overpack container (e.g., 85-gal drum, SWB, TDOP), except that TDOPs and SLB2s will be decontaminated, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. The decontamination of equipment and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations CH TRU mixed waste will be handled only in the areas of the WHB Unit. Therefore, it is within these same areas that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced.

Equipment used during a spill cleanup or CH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and others as needed for a given incident.

At the underground emplacement room, salt contaminated by a spill of CH TRU mixed waste would be either covered or cleaned up, depending on location, extent, and spilled material, due to potential radioactive contamination spread via the salt dust. The contaminated salt would be covered to isolate it from the workers, and the stacking of waste containers would resume or would be removed and packaged as site-derived waste using applicable site procedures for decontaminating surfaces.

The decontamination methods will initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for uncontrolled use. The free release criteria for items, equipment, and areas is < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to verify the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log.

RH TRU Mixed Waste

For RH TRU mixed waste, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using the following measures, as appropriate:

During the re-entry phase, an evaluation of the incident, including the nature of the release, amount, location, and other appropriate factors, will be performed. A RWP will be written and approved prior to personnel entering the Hot Cell with the appropriate PPE to further assess the situation, perform surveys and take samples, and, if possible, mitigate problems that could compound the hazards in the area. Based on the results of the evaluation, a determination will be made by the RCRA Emergency Coordinator, with input from the cognizant managers, radiological control personnel, and ALARA Committee representatives whether to implement the Contingency Plan and to determine the appropriate course of action to recover from the event. An action response plan to decontaminate and recover affected areas and equipment, together with an RWP establishing the radiological controls required for the recovery will be developed and approved.

Should a breach of a RH TRU mixed waste container occur in the Hot Cell that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into a canister and processed for disposal. The decontamination of equipment, cleanup of spilled material and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations RH TRU mixed waste in 55-gallon drums will be handled only in the Hot Cell. Therefore, it is within this area that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced. Contaminated materials for the cleanup and overpacking of a breached RH TRU mixed waste container may be managed as CH TRU mixed waste, depending on the surface dose rate.

Equipment used during a spill cleanup or RH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and other equipment as needed for a given incident.

The decontamination methods may initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox®, Simple Green®, Windex®, citric acid, Bartlett Strip Coat®, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment within the Hot Cell may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination of the Hot Cell is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for continued use. The free release criteria for items and equipment that will be released for uncontrolled use are < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to confirm the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log. The recovery phase must be completed before the affected area and/or equipment are returned to service.

D-4d(7) Natural Emergencies

After a natural emergency (earthquake, flood, lightning strike, etc.) that involves hazardous waste or hazardous materials, the FSM will ensure the following actions are taken:

1. Inspect containers which have not been disposed and containment for signs of leakage or damage. Inspect areas where containers are stored looking for leaking containers and for deterioration of containers and the containment system.

2. Inspect affected equipment or areas associated with hazardous waste management activities for proper operating mode in accordance with site procedures and manually check to ensure automatic and alarmed features on the units are working.

3. Inspect affected equipment or areas within the HWMUs in accordance with site procedures for damage.

4. Inspect electrical boards and overhead electrical lines for damage.

5. Check container areas for signs of leakage or damage to drums and containers.

6. Check affected buildings and fencing directly related to hazardous waste management activities for damage.

7. Conduct a general survey of the site looking for signs of land movement, etc.

8. Take any necessary corrective measures, however temporary, to rectify potential or real problems.

9. Record inspection results.

D-4d(8) Roof Fall

Roof fall is not expected to affect RH TRU mixed waste because it is emplaced in the rib of the disposal room and not subject to impact from a roof fall. The following incident description and mitigation apply to CH TRU mixed waste.

The WIPP underground is routinely evaluated for stability and safety of the underground openings. These evaluations can be as simple as the MSHA required visual checks by personnel working in the area or as extensive as the expert review of the roof support system for Room 1 Panel 1 conducted in 1991. An in-depth evaluation of all of the accessible underground is performed on an annual basis as part of the formal ground control operating plans. Weekly visual and sounding inspections are performed by the Permittees. More frequent inspections and evaluations are performed in areas where roof or ribs are in need of evaluations, based on visual observations, analysis of rock deformation data, excavation effects program data acquired from observation holes, and support system performance.

This process applies not only to the waste disposal rooms but to the entire WIPP underground. Prior to waste emplacement, stability of each room will be evaluated. This evaluation will concentrate on the age and current performance of the installed support systems (if any) and the rate of roof beam expansion based on data from installed instrumentation. The roof support system's performance and surety, to provide the support necessary for the required time will be addressed. Criteria used will include design parameters such as the amount of load, the deformation of the installed system, and the number and type of component failures observed, if any. Geotechnical criteria will include parameters such as the type and quantity of fracturing, roof beam expansion rates, and future ground performance based on a predictive model.

Should the evaluation results indicate that remedial actions are necessary prior to placement of waste, experiences at the WIPP indicate that rebolting or installing supplemental support can extend the safe life of a room for several years.

After waste emplacement commences, geomechanical monitoring will continue with monitors that are tied into a computer network program. The readings obtained will provide information needed for the roof beam stability assessment. Visual observations of the ground and the support systems will also continue in all accessible areas. Based on the experiences from the Site and Preliminary Design Validation test rooms, it has been proven that any developing instability will be detected through monitoring. Multiple measures to deal with the observed conditions can be implemented months before an event to mitigate any risk associated with a roof fall in the storage room or any affected area within the mine. At a minimum, the affected area will be isolated and withdrawn from ventilation flow. Isolation operations will utilize current available methods, materials, and equipment.

Ground control conditions which could result in a fall can be divided into two scenarios: The first consists of spalling (falling) of individual small and localized rock falling on waste containers.

By definition, they can be considered insignificant as no damage to the drums can occur. The second consists of an entire section of roof falling on multiple stacks of waste containers. Each of these scenarios is discussed below.

Spalling-of-Ground Scenario

The maximum distance between the room roof and a container of waste is 10 ft. Waste containers are designed to withstand impact loads of at least 1,000 pounds (lbs) dropped from a height of 6 ft. flat or 450 lbs dropped on a circumferential edge from a height of 4 ft. Both of which correspond to an allowable impact stress of 25,450 pounds per square inch (psi). Rocks from spalling are small and would not be of sufficient weight when striking a drum from a 10 ft vertical height to cause an impact stress of more than 25,450 psi. Taking into account the falling distance, average weight, and the typical shape of the salt rock, the conclusion is that puncturing a drum by spalling is non-credible.

Fall-of-Ground Scenario

Fall-of-ground occurs when a large section of roof beam falls onto the waste containers. As previously discussed, the possibility of this occurring in an active room is remote, due to continuous monitoring and engineered roof support systems.

The following actions have been developed and will be taken by the RCRA Emergency Coordinator should a rock fall occur in an active waste emplacement area of the repository:

Spalling-of-Ground Actions

1. Determine whether the roof conditions allow for safe entry and if the waste container or containers in question are accessible.

   The process used to determine if a roof condition of a room will allow for safe entry is the same as the ground control inspection process used for inspection of the ground conditions and roof bolt integrity. The inspection will begin at a safe and sound roof starting point and consist of visual inspections of roof bolts, roof, and rib areas for missing or damaged bolts; deformed roof bolt plates; or roof and rib cracks, fractures, or separations. If during the visual inspection suspicious roof bolts, roof, or ribs are found, then operators will proceed with sounding the area in question with a scaling bar for loose roof bolts, bad roof, or ribs (loose roof bolts will not ring when sounded). Bad roof or ribs will have a drummy, hollow, or un-solid sound when struck with the scaling bar. When this operation is performed, a safe avenue for retreat is always maintained. Also maintained is a position such that an unexpected event will not place personnel in a position where the scaling bar or material being scaled could fall on personnel. If the inspection reveals ground that cannot be safely scaled manually or with the available mining equipment, the affected area, up to and including the entire room, will be barricaded and removed from ventilation flow.

   The criteria used to determine whether a waste container is accessible is based on the location of the container, the amount of waste in the room, and the expense of reaching the waste container safely versus the expense of abandonment of the room. For example, if the room is 95% filled and spalling-of-ground punctured a waste

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container at or near the exit of the room, the decision to isolate the room and move waste emplacement activities to the next room would be prudent.

2. Restrict access in ventilation flow path downstream of the incident.

3. Restrict ventilation to the affected room to ensure that there is no spread of contamination that may have been released. Survey for contamination and establish the boundaries.

4. Inspect accessible and affected containers and containment for signs of leakage or damage.

5. Cover the spill area with material such as plastic or fabric sheets or PVA, in a way that would safely isolate the area.

6. Determine if the covered spill area safely allows for continued waste disposal operations or whether further cleanup is required. If further cleanup is required, provide with cleanup methods described below. Note: Cleaning may not be required since this is the permitted disposal area.

7. Inspect any affected equipment (vehicles, handling equipment, and communication and alarm equipment) for proper function.

8. Repackage spilled waste and repackage, plug, or patch breached waste containers into 55 or 85-gallon drums, SWBs, or TDOPs, depending on volume. Temporarily locate overpack waste containers in an adjacent room. Remove only those intact waste containers necessary to clear the area for decontamination.

9. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets or PVA to isolate it from the workers or removed and packaged as site derived waste in accordance with site procedures for decontaminating surfaces.

10. Manage the radioactive debris as derived waste.

11. Characterize containers of waste based on the waste containers that were damaged.

12. Replace the removed and derived waste containers into the waste stack as appropriate and update the WWIS.

13. Document activities and record results.

<u>Fall-of-Ground Actions</u>

1. Restrict access in ventilation flow path downstream of the incident.

2. Restrict the room from ventilation flow by closing bulkhead regulators.

3. Survey for radiological contamination and establish the boundary for a Radiological Buffer Area.

4. Install barricade devices to remove access.

5. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets, or PVA to isolate it from the worker or removed and packaged as site derived waste using damp rags, hand tools, and HEPA filtered vacuums.

   The criteria used to determine whether to close the entire panel or just the affected room of waste containers would include the location of the roof fall and the stability of the unaffected roof area in the panel. Techniques to determine the stability would be the same as previously described in this section.

D-4d(9) Structural Integrity Emergencies

In the event of a WIPP facility emergency involving underground structural integrity, the situation will be handled as a natural emergency. Monitoring and inspection procedures ensure the safety and integrity of the WIPP facility underground.

D-4d(10) Emergency Termination Procedures

For the transition from emergency phase to cleanup phase, the following items will be complete:

- Emergency scene will be stable
- Release of hazardous substance will be stopped
- Reaction of hazardous substance will be controlled
- The released hazardous substance will be contained within a localized and manageable area
- The area of contamination will be adequately secure from unauthorized entry

At every incident involving hazardous materials, there is a possibility that response personnel and their equipment will become contaminated. Emergency response personnel have procedures to minimize contamination or contact, and to properly dispose of contaminated materials.

For nonemergencies and Incident Level I emergencies, the following methods of decontamination are available for personnel, environment, and/or equipment according to emergency response procedures:

- Absorption
- Adsorption
- Chemical degradation
- Dilution
- Disposal
- Isolation

- Neutralization
- Solidification

Any necessary verification of air, soil, or water samples will be directed by the RCRA Emergency Coordinator. Immediately after an emergency, the RCRA Emergency Coordinator will provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility in accordance with standard operating procedures.

For Level II and III incidents after the emergency itself is controlled and contained, the RCRA Emergency Coordinator will be responsible for the development and implementation of an incident-specific decontamination plan.

PPE will be decontaminated or disposed according to procedure before it is returned to its storage location.

As part of the facility's defense-in-depth approach, equipment will be assumed to be contaminated after each hazardous material response and a thorough check for radioactive contamination will be conducted. If contamination is found, a technically sound decontamination process will be followed. Many types of equipment are difficult to decontaminate and may have to be discarded as hazardous or derived waste. Whenever possible, pieces of equipment will be disposable or made of nonporous material.

If radioactive contamination is detected on equipment or on structures, it will be assumed that hazardous constituents may also be present. Radiological surveys to determine whether a potential release of hazardous constituents has occurred (Permit Attachment I3) will be used along with other techniques as a detection method to determine when decontamination is required. Radiological cleanup standards will be used to determine the effectiveness of decontamination efforts. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses become documentation of the condition of the container at the time of emplacement. These containers will be placed in the underground without further action, once the radiological contamination is removed, unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground. In no case shall these containers contain a total liquid content equal to, or which exceeds, one volume percent of the container.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed. The sampling plan will be approved by the NMED before it is implemented. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether further cleaning will be beneficial or whether final clean up will be deferred until closure. Appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore,

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measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

For all Contingency Plan emergency responses, the RCRA Emergency Coordinator will ensure, in keeping with standard operating procedures, that, in the affected area(s) of the facility:

- No waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed
- All emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use, or replaced before operations are resumed

D-4e Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the RCRA Emergency Coordinator will ensure that reasonable measures are taken so that fires, explosions, and releases do not occur, recur, or spread to TRU mixed waste or other hazardous materials at the facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(e) and (f)). These measures include:

- Stopping processes and operations.
- Collecting and containing released wastes and materials.
- Removing or isolating containers of waste or hazardous substances posing a threat.
- Ensuring that wastes managed during an emergency are handled, stored, or treated with due consideration for compatibility with other wastes and materials on site and with containers utilized (Section D-4h).
- Restricting personnel not needed for response activities from the scene of the incident.
- Evacuating the area.
- Curtailing nonessential activities in the area.
- Conducting preliminary inspections of adjacent facilities and equipment to assess damage.
- Overpacking and/or removing damaged containers/drums from affected areas. Damaged equipment and facilities will be repaired as appropriate.
- Constructing, monitoring, and reinforcing temporary dikes as needed.
- Maintaining fire equipment on standby at the incident site in cases where ignitable liquids have been or may be released and ensuring that all ignition sources are kept out of the area. Ignitable liquids will be segregated, contained, confined, diluted, or otherwise controlled to preclude inadvertent explosion or detonation.

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No operation that has been shut down in response to the incident will be restarted until authorized by the RCRA Emergency Coordinator. Sections D-4g, Incompatible Waste, and D-4h, Post-Emergency Facility and Equipment Maintenance and Reporting, address specific issues related to decreasing the possibility of a recurrence or spread of a release, a fire, or an explosion.

After resolution of the incident, a Root Cause Analysis will be conducted to review all Level II and Level III incidents for determination of cause, and the corrective action plan to prevent recurrence.

D-4f Management and Containment of Released Material and Waste

Once initial release or spill containment has been completed, the RCRA Emergency Coordinator will ensure that recovered hazardous materials and waste are properly stored and/or disposed, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.56(g)). For spills of liquid, the perimeter of the spill will be diked with an absorbent material that is compatible with the material(s) released. Free-standing liquid will be transferred to a marked compatible container. The remaining liquid will be absorbed with an absorbent material and swept or scooped into a marked compatible container. Spill residue will be removed. Spills of dry material will be swept or shoveled into a labeled compatible recovery container. Material recovered from the spill will be transferred to clean containers or tanks or to containers or tanks that have held a compatible material. All containers will meet DOT specifications for shipping the wastes, and materials will be recovered.

Nonradioactive hazardous waste resulting from the cleanup of a fire, an explosion, or a release involving a nonradioactive hazardous waste or hazardous substance at the WIPP facility will be contained and managed as a hazardous waste until such time as the waste is disposed of, or determined to be nonhazardous, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §261) Subparts C and D. In most cases, hazardous materials inventories for the various buildings and areas at the facility will allow a determination of the hazardous materials present in any cleanup of a release or of the residues from an emergency condition (The quantities of such spills are so small, it is not likely to trigger an Incident Level II or III). When necessary samples of the waste will be collected and analyzed to determine the presence of any hazardous characteristics and/or hazardous waste constituents; this information is needed to evaluate disposal options. EPA-approved sampling and analytical methods will be utilized. Hazardous wastes will be transferred to the Hazardous Waste Staging Area. The staging area is used to store hazardous waste awaiting transfer to an off-site treatment or disposal facility in accordance with applicable regulations (e.g., 20.4.1 NMAC and DOT regulations). The Hazardous Waste Staging Area for nonradioactive hazardous waste is Buildings 474A and 474B, as shown in Figure D-1. Nonradioactive hazardous wastes will be shipped off-site for disposal at a RCRA permitted disposal facility.

Under normal operations, administrative controls will be implemented to ensure that hazardous materials and incompatible materials will not be introduced to the radioactive materials area during TRU mixed waste handling operations. Examples of administrative controls include restricting the waste received in the TRU mixed waste management area(s) to TRU mixed waste properly manifested from the generator sites and ensuring that materials used in these area(s) are restricted to only those that have previously been determined to be compatible with the TRU mixed waste. The RCRA Emergency Coordinator will have access to building design information and information on specific equipment used within an area upon which to base a

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determination of the compatibility of materials with the area. If necessary, the RCRA Emergency Coordinator will use EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Waste," (EPA, 1980) for making compatibility determinations. Waste resulting from the cleanup of a fire, explosion, or release in the miscellaneous unit, the CH TRU mixed waste handling areas, or the RH Complex will be considered derived from the received TRU mixed waste and may be treated and managed as CH TRU mixed waste depending on the surface dose rate.

In the event of a prolonged cessation of TRU mixed waste handling operations, TRU mixed waste can be placed in areas of the WHB Unit that are available for such contingencies. These areas and the TRU mixed waste containers in them would be located so that adequate aisle space would be maintained for unobstructed movement of personnel and equipment in an emergency. Permit Attachments A1 and A2 describe the HWMUs in detail, including the facility description, support structures and equipment, security, waste handling areas, ventilation, and fire protection.

The contaminated area will be decontaminated. If a release is to a permeable surface, such as soil, asphalt, concrete, or other surface, the surface material will be removed and placed in containers meeting applicable DOT requirements. Contaminated soil, asphalt, concrete, or other surface material, as well as materials used in the cleanup (e.g., rags and absorbent material) will be contained and disposed of in the same manner as dictated for the contaminant. Clean soil, new asphalt, or new concrete will be emplaced at the spill location.

If a spill occurs on an impermeable surface, the surface will be decontaminated with water and/or a detergent. In the event that the spilled material is water reactive, a compatible nonhazardous cleaning solution will be used. Contaminated wash water or cleaning solution will be transferred to an appropriate container, marked, and managed as described above for nonradioactive or radioactive liquid wastes.

In the event of a hazardous material or hazardous waste release, the RCRA Emergency Coordinator will ensure that no wastes will be received or disposed of in the affected areas until cleanup operations have been completed. This is to ensure that incompatible waste will not be present in the vicinity of the release.

Because of the restrictions which the WIPP facility places on generators, and because of control of WIPP operations, TRU mixed wastes and derived wastes will not contain any incompatible wastes. However, the areas established for the temporary holding of nonradioactive waste routinely generated at the WIPP facility is divided into bays to accommodate the management of wastes that may be incompatible. If waste is generated as the result of a spill or release of hazardous materials or nonradioactive hazardous waste, the waste generated as a result of abatement and cleanup will be evaluated to determine its compatibility with other wastes being managed in the temporary holding areas. The evaluation will be by identifying the material or waste that was spilled or released and determining its characteristics (e.g., ignitable, reactive, corrosive, or toxic). The waste generated by the abatement and cleanup activities will be stored in that part of the temporary holding area that has been established to manage wastes with which it is compatible.

For small nonemergency liquid spills (e.g., a detergent solution leaking out of the pump handle during decontamination, a spill of hydraulic fluid while servicing a vehicle), spill control procedures will be used to contain and absorb free-standing liquid. The contaminated absorbent

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will be swept or shoveled into a compatible container and managed as described above. No notifications will be required, but site procedures require documentation of the incident.

D-4g Incompatible Waste

Implementation of the TSDF-WAC for the WIPP ensures that incompatible TRU mixed waste will not be shipped to the WIPP facility. Nonradioactive waste at the WIPP facility will be carefully segregated during handling and holding and will be transported within and off the facility. The RCRA Emergency Coordinator will not allow hazardous or TRU mixed waste operations to resume in a building or area in which incompatible materials have been released prior to completion of necessary post-emergency cleanup operations to remove potentially incompatible materials. In making the determination of compatibility, the RCRA Emergency Coordinator will have available the resources and information described in Section D-4b, Identification of Hazardous Materials. In addition, ES&H department personnel will be available for consultation. Finally, the RCRA Emergency Coordinator may use EPA-600/2-80-076, (EPA, 1980).

D-4h Post-Emergency Facility and Equipment Maintenance and Reporting

The RCRA Emergency Coordinator will ensure that emergency equipment that is located or used in the affected area(s) of the facility and listed in the Contingency Plan is cleaned and ready for its intended use before operations are resumed, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(h)(2)). Any equipment that cannot be decontaminated will be discarded as waste (e.g., hazardous, mixed, solid), as appropriate. The WIPP facility is committed to replacing any needed equipment or supplies that cannot be reused following an emergency. After the equipment has been cleaned, repaired, or replaced, a post-emergency facility and equipment inspection will be performed, and the results will be documented.

Cleaning and decontaminating equipment will be accomplished by physically removing gross or solid residue; rinsing with water or another suitable liquid, if required; and/or washing with detergent and water. Decontamination and cleaning will be conducted in a confined area, such as a wash pad or building equipped with a floor drain and sump isolated from the environment. Care will be taken to prevent wind dispersion of particles and spray. Liquid or particulate resulting from cleaning and decontamination of equipment will be placed in clean, compatible containers. Waste produced in an emergency cleanup in the TRU mixed waste handling areas is derived waste and will be emplaced in the underground derived waste emplacement area. Waste resulting from decontamination operations elsewhere in the WIPP facility will be analyzed for hazardous waste constituents and/or hazardous waste characteristics to ensure proper management.

When the WIPP facility has completed post-emergency cleanup of waste and hazardous residues from areas where waste management operations are ready to resume and the RCRA Emergency Coordinator has ensured that emergency equipment used in managing the emergency has been cleaned or replaced and is fit for service, the notifications will be made by the Permittees to the following: the EPA Region VI Administrator; the Secretary of the NMED; and any relevant local authorities. This post-emergency notification complies with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), and is the responsibility of the RCRA Emergency Coordinator.

D-4i Container Spills and Leakage

The waste received at the WIPP facility will meet stringent TSDF-WAC (e.g., no more than one percent liquid), which will minimize the possibility of waste container degradation and liquid spills. Should a spill or release occur from a container, following an initial assessment of the event, the WIPP facility will immediately take the following actions, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.52(a) and §264.171):

- Assemble the required response equipment, such as protective clothing and gear, heavy equipment, empty drums, overpack drums, and hand tools
- Transfer the released material to a container that is in good condition or overpack the leaking container into another container that is in good condition
- Once the release has been contained, determine the areal extent of migration of the release and proceed with appropriate cleanup action, such as chemical neutralization, vacuuming, or excavation

D-4j Tank Spills and Leakage

The TRU mixed waste handling areas at the WIPP facility do not include tank storage or treatment of hazardous waste, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR §264) Subpart J. At the WIPP facility, tanks are used to store water and petroleum fuels only. The petroleum tanks store diesel and unleaded gasoline.

D-4k Surface Impoundment Spills and Leakage

The WIPP facility does not manage hazardous or TRU mixed waste using a surface impoundment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR, §264) Subpart K. Surface impoundment regulations are not applicable to the WIPP facility.

D-5 Emergency Equipment

A variety of equipment is available at the facility for emergency response, containment, and cleanup operations in both the HWMUs and the facility in general. This includes equipment for spill control, fire control, personnel protection, monitoring, first aid and medical attention, communications, and alarms. This equipment is immediately available to emergency response personnel. A listing of major emergency equipment available at the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.52(e)), is shown in Table D-6. Table D-7 identifies the locations where fire suppression systems are provided. Locations of the underground emergency equipment are shown in Figure D-5. The firewater-distribution system map is shown in Figure D-6. The underground fuel area fire-protection system is shown in Figure D-7.

D-6 Coordination Agreements

The Permittees have established MOUs with off-site emergency response agencies for firefighting, medical assistance, hazardous materials response, and law enforcement. In the

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event that on-site response resources are unable to provide all the needed response actions during either a medical, fire, hazardous materials, or security emergency, the RCRA Emergency Coordinator will notify appropriate off-site response agencies and request assistance. Once on site, off-site emergency response agency personnel will be under the direction of the RCRA Emergency Coordinator.

The MOUs with off-site cooperating agencies are available from the Permittees. A listing and description of the MOUs with state and local agencies and mining operations in the vicinity of the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37 and §264.52(c)), are:

- An agreement among the Permittees, Intrepid Potash NM LLC, and Mosaic Potash Carlsbad Inc., provides for the mutual aid and assistance, in the form of MRTs, in the event of a mine disaster or other circumstance at either of the two facilities. This provision ensures that the WIPP MOC will have two MRTs available at all times when miners are underground.

- A memorandum of agreement between the City of Carlsbad, New Mexico, and the WIPP MOC for ambulance service assistance provides that, upon notification by the WIPP MOC, the Carlsbad Fire Department/Ambulance Service will be dispatched from Carlsbad toward the WIPP site by a designated route and will accept the transfer of patient(s) being transported by the WIPP facility ambulance at the point both ambulances meet. If the patient(s) is not transferrable, the Carlsbad Fire Department/Ambulance Service will provide equipment and personnel to the WIPP facility ambulance, as necessary.

- A MOU between the DOE and the Carlsbad Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Carlsbad Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the Lea Regional Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Lea Regional Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the U.S. Department of Interior (**DOI**), represented by the Bureau of Land Management (**BLM**), Roswell District, provides for a fire-management program that will ensure a timely, well-coordinated, and cost-effective response to suppress wild fire within the withdrawal area using the WIPP incident commander for fire-management activities. The DOI will provide firefighting support if requested. In addition, the MOU provides for responsibilities concerning cultural resources, grazing, wildlife, mining, gas and oil production, realty/lands/rights-of-way, and reclamation.

- A mutual-aid firefighting agreement between the Eddy County Commission and the DOE provides for the assistance of the Otis and Joel Fire Departments (a volunteer fire district created under the Eddy County Commission and the New Mexico State Fire

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Marshall's Office), including equipment and personnel, at any location within the WIPP Fire Protection Area upon request by an authorized representative of the WIPP Project. These responsibilities are reciprocal.

- A mutual-aid agreement between the City of Hobbs and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Hobbs during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A mutual-aid agreement between the City of Carlsbad and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Carlsbad during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A MOU between the DOE and the New Mexico Department of Public Safety (**DPS**) concerning Mutual Assistance and Emergency Management applies to any actual or potential emergency or incident that: 1) involves a significant threat to employees of the Permittees or general public; 2) involves property under the control or jurisdiction of either the DOE or the State; 3) involves a threat to the environment which is reportable to an off-site agency; 4) requires the combined resources of the DOE and the state; 5) requires a resource that the DOE has which the State does not have, or a resource the State has which DOE does not have; or 6) involves any other incident for which a joint determination has been made by the DOE and the State that the provisions of this MOU will apply. The MOU provides that the DPS shall permit qualified and security cleared DOE Emergency Management members into the State EOC for the purpose of: a) coordinating communications functions; b) evaluating and maintaining communications capabilities; c) participating in exercises; d) link the State's High Frequency radio communications network with the DOE; and e) assisting the State during radioactive materials accidents that require joint operations or the use of the DOE Radiological Assistance Program team. The DOE shall permit qualified and security cleared members the State Emergency Management community into the DOE's EOCs for the purposes of coordinating communications and activities. Additional duties for each participant are specified for assistance in incidents or emergencies.

D-7 Evacuation Plan

If it becomes necessary to evacuate the WIPP facility, the assigned on-site and off-site staging areas have been established. The off-site staging areas are outside the security fence. The WIPP facility has implementation procedures for both surface and underground evacuations. Drills are performed on these procedures at the WIPP facility at least once annually. The following sections describe the evacuation plan for the WIPP facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.52(f)).

D-7a Surface Evacuation On-site and Off-site Staging Areas

Figure D-8 shows the surface staging areas. Personnel report to their Office Wardens at designated staging areas where accountability is conducted. If site evacuation is necessary, the

RCRA Emergency Coordinator will decide which staging areas are to be used and will advise Office Wardens of the selections. The RCRA Emergency Coordinator will communicate the locations to Office Wardens via office warden pager, radio, plectron, WIPP Security, or telephone, as appropriate. Office Wardens will direct personnel to the selected staging area outside the security fence. Personnel who are working in a contaminated area when site evacuation is announced, will assemble at specific staging areas to minimize contact with other personnel during the evacuation (Figure D-8).

Office Wardens conduct accountability of personnel assigned to their specific areas. For complete surface accountability, the Office Wardens report to their ACOW, who reports to the COW. When the COW has reports from all ACOWs, surface accountability is reported to the CMRO, who then notifies the RCRA Emergency Coordinator of the accountability.

The COW and all ACOWs have radios for communication between them and the CMRO. The Office Wardens, Assistant Office Wardens, ACOWs, and COW also have pagers with which they are notified of evacuations. At the staging areas Office Wardens report directly to their ACOW.

There are three off-site staging areas identified on Figure D-8. The RCRA Emergency Coordinator determines which staging area will be used. Security officers remain at the primary staging area gate 24 hours a day, and the vehicle trap is opened for personnel during emergency evacuations. The north gate has a single person gate and large gate which can be opened, similar to the main gates for the primary staging area. The east gate is a turnstile gate. Upon notification by the RCRA Emergency Coordinator, Security will respond, open gates, and facilitate egress for evacuation.

The on-site staging areas are identified in Figure D-8. These are used for building or area evacuations as determined by the RCRA Emergency Coordinator.

D-7b Underground Assembly Areas and Egress Hoist Stations

In the event of an underground or surface event, the RCRA Emergency Coordinator can call for underground personnel to report to assembly areas (Figure D-9). Underground personnel are also trained to immediately report to assembly areas under specific circumstances (i.e. loss of underground power or ventilation). If accountability is required, the underground will be evacuated. The Underground Controller is responsible for underground accountability by comparing the brass numbers with the brass tags signed out in the lamproom. Each assembly area contains a Mine Page Phone, miner's aid station, and evacuation maps.

In accordance with 30 CFR §57.11, the mine maintains two escapeways. These escapeways are designated as Egress Hoist Stations. When an underground evacuation is called for, all underground personnel report to the Egress Hoist Stations.

Decontamination of underground personnel will be conducted the same way as described for surface decontamination. Contaminated personnel are trained to remain segregated from other personnel until RC personnel can respond to the incident at the underground location.

D-7c Plan for Surface Evacuation

Surface evacuation notification is initiated by the RCRA Emergency Coordinator directing the CMRO to sound the surface evacuation alarm. The Office Wardens assist personnel in evacuation from their areas. Evacuation routes and instructions are posted throughout the site.

If the EST/FPT notifies the ERT members by pager to respond to an identified area, these members will not depart the site during an evacuation, but will report to the EST/FPT for instructions and accountability. The EST/FPT notifies the COW of response members present. These personnel will not evacuate until released by the RCRA Emergency Coordinator.

D-7d Plan for Underground Evacuation

Notification for underground evacuation will be made using the underground evacuation alarm and strobe light signals.

Personnel will evacuate to the nearest egress hoist station. Primary underground evacuation routes (identified by green reflectors on the rib) will be used, if possible. Secondary underground evacuation routes (identified by red reflectors on the rib) will be used if necessary (Figure D-5). Brass tags will be collected from personnel at the hoist collar on the surface, and taken to the Underground Controller, who functions as an Office Warden. When all brass tags are accounted for, underground accountability is reported to the RCRA Emergency Coordinator.

Upon reaching the surface, personnel will report to their on-site staging area to receive further instructions.

Members of the FLIRT and the MRT who may be underground, will evacuate the underground when an underground evacuation is called for. A reentry by the MRT will be performed according to 30 CFR 49 and MSHA regulations for reentry into a mine. The two MRTs are trained in compliance with 30 CFR 49 in mine mapping, mine gases, ventilation, exploration, mine fires, rescue, and recovery.

D-7e Further Site Evacuation

In the event of an evacuation involving the need to transport employees, the following transportation will be available:

- Buses/vans—WIPP facility buses/vans will be available for evacuation of personnel. The buses/vans are stationed in the employee parking lot.

- Privately Owned Vehicles—Because many employees drive to work in their own vehicles, these vehicles may be utilized in an emergency. Personnel may be directed as to routes to be taken when leaving the facility.

These vehicles may be used to transport personnel who have been released from the site by the RCRA Emergency Coordinator.

D-8 Required Reports

The RCRA Emergency Coordinator, on behalf of the Permittees, will note in the operating record the time, date, and details of any incident that requires implementing this Contingency Plan. This notation will be in the facility log maintained by the CMRO. In compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)), within 15 days after the incident, the Permittees will ensure that a written report on the incident will be submitted to the EPA Region VI Administrator and to the Secretary of the NMED. The report will include:

- The name, address, and telephone number of the Owner/Operator
- The name, address, and telephone number of the facility
- The date, time, and type of incident (e.g., fire, explosion or release)
- The name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where this is applicable
- The estimated quantity and disposition of recovered material that resulted from the incident

In addition to the above report, the Permittees will ensure that the ES&H Manager, or designee, submits reports to the appropriate agencies as listed in Tables D-8 and D-9.

In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), the Permittees will notify the Secretary of the NMED and EPA Region VI Administrator that the WIPP facility is in compliance with requirements for the cleanup of areas affected by the emergency and that emergency equipment used in the emergency response has been cleaned, repaired, or replaced and is fit for its intended use prior to the resumption of waste management operations in affected areas. The means the WIPP facility will use to meet these requirements are described in Sections D-4e, D-4f, D-4g, and D-4h.

The WIPP requires the EST/FPT to initiate the "WIPP Hazardous Materials Incident Report" if the Contingency Plan is implemented. A form is attached as Figure D-12. The form is initiated by the EST/FPT. The RCRA Emergency Coordinator, CMRO, and Environmental Compliance representatives complete their respective sections.

D-9 Location of the Contingency Plan and Plan Revision

The owner/operator of the WIPP facility will ensure that copies of this Contingency Plan are available through the WIPP electronic controlled-document distribution system or in appropriate controlled-document locations throughout the facility, and the alternate Emergency Operations Center and the Joint Information Center at the Skeen Whitlock Building, and are, consequently, available to all emergency personnel and organizations described in Section D-2. In addition, the owner/operator will make copies available to the following outside agencies:

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- Intrepid Potash NM LLC and Mosaic Potash Carlsbad Inc.
- Carlsbad Fire Department, Carlsbad
- Carlsbad Medical Center, Carlsbad
- Lea Regional Medical Center, Hobbs
- Otis Fire Department, Otis
- Hobbs Fire Department, Hobbs
- Joel Fire Department, Carlsbad
- BLM, Carlsbad
- New Mexico State Police

The owner/operator of the WIPP facility will ensure that this plan is reviewed annually and amended whenever:

- Applicable regulations are revised
- The RCRA Part B permit for the WIPP facility is revised in any way that would affect the Contingency Plan
- This plan fails in an emergency
- The WIPP facility design, construction, operation, maintenance, or other circumstances change in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents or change the response necessary in an emergency
- The list of RCRA Emergency Coordinators change
- The list of WIPP facility emergency equipment changes.

References

U.S. Environmental Protection Agency, "A Method for Determining the Compatibility of Hazardous Waste," EPA-600/2-80-076, 1980.

U.S. Department of Transportation, Emergency Response Guidebook, U.S. Government Printing Office, 1993.

Westinghouse Electric Corporation, 1994, "Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling," WP 02-EM1, Westinghouse Electric Corporation, Carlsbad, New Mexico.

U. S. Department of Energy, "WIPP Safety Analysis Report," DOE/WIPP-95-2065, Rev. 2

U. S. Department of Energy, "WP 12-5, WIPP Radiation Safety Manual".

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TABLES

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Table D-1
Hazardous Substances in Large Enough Quantities to Constitute a Level II Incident

Chemical Description	Building Location	Hazard Category
Ethylene Glycol Solution - 35%	Buildings 411; 412; 451; 452; 486; 463; 474C; FAC 414	Immediate (acute) Delayed (chronic)
Gasoline, Unleaded GASC0001	FAC 480	Fire Immediate (acute) Delayed (chronic)
No. 1 Diesel Fuel Oil GASC0210	Oil Depot U/G; FACs 480, 255.1 & 255.2; Transport Tank; Building 456 Trailer 911F	Fire Immediate (acute) Delayed (chronic)
Multiple containers of TRU Waste as described in Permit Section 3.3.1	WHB Waste Shaft U/G	Delayed (chronic)
Hazardous materials in quantities that exceed 5 times the Reportable Quantity (Per DOE O 151.1) values as defined in 40 CFR 302	It should be noted that WIPP is not expected to possess such quantities.	Fire Immediate (acute) Delayed (chronic)

Table D-2
Resource Conservation and Recovery Act Emergency Coordinators

Name	Address*	Office Phone	Personal Phone*
R. C. (Russ) Stroble (primary)[1]		234-8276 or 234-8554	
J. E. (Joseph) Bealler[2]		234-8276 or 234-8916	
M. G. (Mike) Proctor[2]		234-8143	
G. L. (Gary) Kessler[2]		234-8326	
A. E. (Alvy) Williams[1] (primary)		234-8276 or 234-8216	
P. J. (Paul) Paneral[1] (primary)		234-8498	
J. R. (Joel) Howard[2]		234-8325	
M. L. (Mark) Long[1] (primary)		234-8170	

* NOTE: Personal information (home addresses and personal phone numbers) has been removed from informational copies of this Permit.

1 The on-duty Facility Shift Manager is the primary RCRA Emergency Coordinator pursuant to 20.4.1.500 NMAC (incorporating 40 CFR §264.52), and is designated to serve as the RCRA Emergency Coordinator.

2 The on-duty Facility Operations Engineer is the alternate RCRA Emergency Coordinator and is available as needed.

Table D-3
Planning Guide for Determining Incident Levels and Response

Incident Condition	Incident Level		
	I	II *	III *
Product identifications	Placard not required, NFPA 0 or 1 all categories, all Other Regulated Materials A, B, C, and D.	DOT placarded, NFPA 2 for any categories, PCBs without fire, EPA regulated waste. SITE SPECIFIC: Table D-1 and TRU mixed waste AND	Poison A (gas), explosive A/B, organic peroxide, flammable, solid, materials dangerous when wet, chlorine, fluorine, anhydrous ammonia, radioactive materials, NFPA 3 and 4 for any categories including special hazards, PCBs and fire including special hazards, PCBs and fire DOT inhalation hazard, EPA extremely hazardous substances, and cryogenics.
Container size	Container size does not impact this incident level.	Involves multiple packages.	Tank truck.
Fire/explosion potential	Under control.	May spread/may be explosive.	May spread/may be explosive.
Leak severity	No release or small release contained or confined with readily available resources.	Release may not be controllable without special resources.	Release may not be controllable even with special resources.
Life safety	No life-threatening situation from materials involved.	Localized area, limited evacuation area.	Localized area, limited evacuation area.
Environmental impact (Potential)	None.	Limited to incident boundaries	Contained within the Hazardous waste Management Units.
Container integrity	Not damaged.	Damaged but able to contain the contents to allow handling or transfer of product.	Damaged to such an extent that catastrophic rupture is possible.

* Contingency Plan is implemented

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Table D-4
Physical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Absorption	Yes	No	Yes	No
Covering	Yes	Yes	Yes	Yes
Dikes, diversions	Yes	Yes	Yes	Yes
Overpack	Yes	Yes	Yes	Yes
Plug/patch	Yes	Yes	Yes	Yes
Transfer	Yes	Yes	Yes	Yes
Vapor suppression	Yes	Yes	No	No

Table D-5
Chemical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Neutralization	Yes	Yes[1]	No	No
Solidification	Yes	No	Yes[2]	No

(1) When solid neutralizing agents are used, they will be used simultaneously with water.

(2) This method could be utilized for mitigation of firewater involving TRU-waste.

Table D-6
Emergency Equipment Maintained at the Waste Isolation Pilot Plant

Equipment	Description and Capabilities	Location
Communications		
Building Fire Alarms	Manual pull stations and automatic devices (sprinkler system flow, and smoke and thermal detectors) trigger fire alarm; locally visible and audible; visual display and alarm in Central Monitoring Room (CMR)	Guard and Security Building, Pumphouse, Warehouse/Shops, Exhaust Filter Building, Support Building, CMR/ Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, SH Hoisthouse, Maintenance Shops, Guard Shack*, Auxiliary Warehouse, Core Storage Building, Engineering Building, Training Facility, Safety Building, Maintenance Shop, Hazardous Waste Storage (non-TRU) Area (Facility 474) *local alarms; not connected to the CMR
Underground Fire Alarms	Automatic/Manual; have priority over other paging channel signals but not override intercom channels; alarms sound in the general area of the control panel and are connected to the underground evacuation alarms; they also interface with the CMR.	Fire detection and control panel locations: Waste Shaft Underground Station, SH Shaft Underground Station, Between E-140 and E-300 in S-2180 Drift, E-O/N-1200, Fuel Station
Site-wide Evacuation Alarm	Transmitted over paging channel of the public address system, overriding its normal use; manually initiated according to procedures requiring evacuation; audible alarm produced by tone generator at 10 decibels above ambient noise level (or at least 75 decibels); flashing strobe lights; radios and/or pagers are used to notify facility personnel outside alarm range. Monthly test are performed on the PA, site notification alarms, and plectrons.	Site-wide
Vehicle Siren	Manual; oscillating; emergency services/surface response vehicles, is mechanical and electronic.	WIPP surface emergency vehicles
Public Address System	Includes intercom phones; handset stations and loudspeaker assemblies, each with own amplifiers; multichannel, one for public address and pages, and others for independent party lines.	Surface and underground
Intraplant Phones	Private automatic branch exchange; direct dial; provide communication link between surface and underground operations	Throughout surface and underground

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Equipment	Description and Capabilities	Location
Mine Page Phones	Battery-operated paging system	CMR, Mine Rescue Room, EOC, lamproom, underground at S550/W30, S100/W30, S1950/E140, SH Shaft Collar and Underground Station, Waste Shaft Collar and Underground Station, FSM desk.
Emergency Pagers	Manual; , intermittent alarm signals	Issued to appropriate emergency personnel
Plectrons	Tone-alert radio receivers placed in areas not accessible by the public address system	Site-wide
Portable Radios	Two-way, portable; transmits and monitors information to/from other transmitters	Issued to individuals
Plant Base Radios	Two-way, stationary, VHF-FM; linked to Eddy County Sheriff Department, NM State Police, and Otis Fire Department), and WIPP Channels 1-18 (Communication with the Lea County Sheriff's Department, the Hobbs Fire Department, Carlsbad Medical Center and Lea Regional Hospital is available via the Eddy County dispatcher) (Site Security, Site Operations and Site Emergency, maintenance, repeater to Carlsbad). Wireless communications such as cellular phones may be used to contact the Eddy County emergency responders.	Various site locations
Mobile Phones	Provide communications link between WIPP Security and key personnel	Issued to individuals plus emergency vehicles,
Spill Response		
SPILL-X-S Guns and Recharge Powder	Containment; (1)SPILL-X model SC-30-C(Gun) (1)SPILL-X model XC-30-S(Gun) (1)SPILL-X model SC-30-A(Gun); (1) A-Acid, 5 gallon bucket (Recharge Powder) (1)S-Solvent, 5 gallon bucket (Recharge Powder) (1)C-Caustic, 5 gallon bucket (Recharge Powder)	HAZMAT trailer
Absorbent Sheets	Containment or cleanup; (1) 3' x 100' Sheet	HAZMAT trailer
Absorbents	Grab and Go container; spill control bucket; (1) for solvents and neutralizing absorbents; 5 gallon bucket (1) for acids/caustics; 5 gallon bucket	HAZMAT trailer
Absorbent Material	Containment or cleanup; (1) 100 ft. rolled or equivalent socks "Pig" for general liquid (1) 100 ft. rolled or equivalent socks "Pig" for oil	HAZMAT trailer

Equipment	Description and Capabilities	Location
Air Bag System	Extrication, Stabilization, Cribbing (1) bag system with tank kit and the following bag sizes: (1)12-ton, (1) 21.8-ton, (1)17-ton	Surface rescue truck
Air Chisel	Extrication (1) Capable of cutting 3/16" steel	Surface rescue truck
Drum Transfer Pumps and Drum Opener	Containment or cleanup; (1) unit for chemical transfer (1) hand operated pump for petroleum transfer (1) drum opener	HAZMAT trailer
Floor Squeegee	Containment or cleanup; (1) straight rubber blade, nonwood handle	HAZMAT trailer
Foam Concentrate	AFFF 6% (4) 5-gallon pail	Fire truck # 1
Gas Cylinder Leak Control Kit	(1)Series A Hazardous Material Response Kit; contains nonsparking equipment to control and plug leaks	HAZMAT trailer
Portable Generator	(1)Backup power; 5,000 watt; 120 or 240 volt	Surface rescue truck

Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
	Medical Resources	
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ~~hardcab~~ ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
	Fire Detection and Fire Suppression Equipment	
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

Equipment	Description and Capabilities	Location
Water Tanks, Hydrants	Fire suppression water supply; one 180,000-gallon capacity tank, plus a second tank with 100,000 gallon reserve	Tanks are at southwestern edge of WIPP facility; pipelines and hydrants are throughout the surface
Fire Water Pumps	Fire suppression water supply; 125 pounds per square inch, 1,500 gallons per minute centrifugal pump, one with electric motor drive, the other with diesel engine; pressure maintenance pump	Pumphouse
Personal Protection Equipment		
Headlamps	Mounted on hard hat; battery operated	Each person underground
Underground Self-Rescuer Units	Short-term rebreathers; approximately 300	Each person underground
Self-Contained Self-Rescuer	At least 60 minutes of oxygen available. Approximately 400 units cached throughout the underground	Cached throughout the underground
Self-Contained Breathing Apparatus (SCBA)	Oxygen supply; 4-hour units; approximately 14 Mine Rescue Team Draeger units	Mine Rescue Training Room
Chemical and Chemical-Supported Gloves	Body protection; (12 pair) inner-cloth, (12 pair) outer-pvc, (5 pair) outer-viton	HAZMAT trailer
Suit, Acid	Body protection; (4) acid	HAZMAT trailer
Suit, Fully Encapsulated	Body protection; used with SCBAs; full outerboot; (4) Level A; (4) Level B	HAZMAT trailer
Emergency Medical Equipment		
Antishock Trousers	Shock treatment; (2) inflatable, one on each ambulance	Ambulance # 1 and # 2
Zoll 1600 Heart Monitor and Defibrillator	Heart Monitor/defibrillator	Ambulance # 1 and # 2
Oxygen	Patient care; Size D: (2) Ambulance #1 (1) Underground Ambulance (1) Health Services Size E: (1) Rescue Truck (2) Underground Ambulance Size M: (1) Ambulance #1	Ambulance # 1 and # 2, surface rescue truck

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Equipment	Description and Capabilities	Location
Resuscitators (Bag)	Disposable bag resuscitation Ambulance #1: (2) adult size (1) child size Underground Ambulance: (2) adult size	Ambulance # 1, Ambulance # 2
Splints	Immobilize limbs; (1) Adult traction splint, lower extremity, with limb-supporting slings, padded ankle hitch and traction device per ambulance. (2) Rigid splinting devices or equivalents, suitable for immobilization of upper extremities per ambulance. (2) Rigid splinting devices or equivalents, suitable for the immobilization of lower extremities. (1) Set of Airsplints: 6 assorted splints; hand/wrist, half arm, full arm, foot/ankle, half leg, and full leg per miner's aid stations.	Ambulance # 1 and # 2, Miner's Aid Stations
Stretchers	Patient transport; (2) Spine Boards, one short and one long, with nylon straps per ambulance. (also used to perform cardiopulmonary resuscitation) (2) Emergency Stretchers or scoops, or combination per ambulance (1) All-purpose multi-level ambulance stretch (gurney), with 3 safety straps and locking mechanism per ambulance. (1) Stretcher in each miner's aid station.	Various combinations in Ambulance # 1 and # 2, Miner's Aid Station
Suctions	For medical emergencies: Portable (1) Suction unit, capable of delivering at least 300 mm. HG on each ambulance.	Ambulances #1 and #2
Trauma Kits	(1) adult blood pressure cuff and stethoscope (4) soft-roller bandages (3) triangular bandages (1) pkg. band-aids (2) trauma dressings (25) 4X4 sponges (1) roll adhesive tape (1) bite stick (1) penlight (1) sterile burn sheet (1) oropharyngeal airway (1) glucose substance (2) sterile gauze dressings	(1) kit in each: Ambulances #1 and #2, surface rescue truck

Equipment	Description and Capabilities	Location
Miner's Aid Station	For First Aid Stations in the Underground (1) Stretcher--as referenced above per station (1) Set of airsplints--as referenced above per station (1) Blanket per station (1) Box of latex gloves (50) per station (5) Pathogen Wipes per station (1) First Aid Kit (24) per station; includes, (3) Band-Aid Combo Paks (2) Swabs, PVP (1) Antibiotic Ointment (1) Sting-Kill Swab (2) Dressing, compresses (2) Roller Bandages (2) Tape (2) Triangle Bandage (1) Eyedressing Pak (1) Burn Dressing (1) Ammonia Inhalants (1) User Log Sheet	Miner's Aid Stations - Various Underground Locations
First Aid Supplies	According to General Order #35 (12) bandages, soft roller, self-adhering type--4" or 6" x 5 yards. (6) triangular bandages, 40" (1) box band-aids (1) 1 pair bandage shears (6) Trauma dressings, 30" x 10" (6) Trauma dressings, 5" x 7" (50) 4" x 4" sponges, individually wrapped and sterile (2) rolls adhesive tape (1) penlight (2) sterile burn sheets (2) oropharyngeal airways -- adult (2) oropharyngeal airways -- child (Ambulance #1 only) (2) oropharyngeal airways -- infant (Ambulance #1 only) (1) Glucose substance (3) Occlusive dressings (1) Roll aluminum foil (6) Rigid cervical collars--2 each small, medium and large sizes (4) Cold packs (4) Heat packs (2) Bite sticks	Ambulance #1
First Aid Supplies	(2) Transfer sheets (2) Blankets	Ambulances #1 and #2

Equipment	Description and Capabilities	Location
First Aid Supplies	(2) #16g angiosets (2) #18g angiosets (2) #20g angiosets (1) 1000cc LR IV fluid (1) 500cc NS IV fluid	Ambulances #1 and #2, surface rescue truck
General Plant Emergency Equipment		
Emergency Lighting	For employee rescue and evacuation, and fire/spill containment; linked to main power supply, and selectively linked to back up diesel power supply and/or battery-backed power supply	Surface and underground
Backup Power Sources	Two diesel generators, and battery-powered uninterruptible power supply (UPS); use limited to essential loads; manual or remote starting 1,100-kilowatt diesel generators with on-site fuel for 62% load for 3 days for selected loads; 30-minute battery capacity for essential loads	Generators are east of Safety and Emergency Services Building; UPS is located at the essential loads
Hoists	Hoists in Waste Shaft, Air Intake Shaft, and SH Shaft	Waste Shaft, Air Intake Shaft, SH Shaft
Radiation Monitoring Equipment	(5) Portable alpha and beta survey meters, portable air samplers, and portable continuous air monitors	Building 412
Emergency Shower	For emergency flushing of contaminated individual	Surface
Eye Wash Fountains	For emergency flushing of affected eyes	Various locations on surface and in the underground
Decon Shower Equipment	Self-contained decon shower trailer, portable decon shower unit, disposable decon shower	Surface
Overpack containers	14-85 Gallon drums 4-SWBs 1-TDOP	Building 481 Building 481 Building 481
HEPA Vacuums	2 HEPA Vacuums to be utilized for removal of contamination.	Building 481
Aquaset or Cement	100 lbs. of aquaset or cement material for solidification of liquid waste generated as a result of fire fighting water or decontamination solutions.	Building 481
Polyvinyl Alcohol or Paint	1 - 5 gallon bucket of approved fixative to be used during recovery.	Building 481
TDOP Upender	Upender facilitates overpacking standard waste boxes	Building 481
Non hazardous Decontaminating Agents	4-1 Gallon bottles for decontamination of surfaces, equipment, and personnel	Building 481

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Table D-7
Types of Fire Suppression Systems by Location

Location	AS	AD	MPS	PFE
Waste Handling Building	*		*	*
Support Building	*		*	*
Exhaust Filter Building	*		*	*
Water Pumphouse	*		*	*
Underground Support Areas (also has rescue truck) (as illustrated in Figure D-5)		*	*	*
Station A Effluent Monitoring Shed			*	*
Station B Effluent Monitoring Shed			*	*

(1) Symbols for WIPP fire-protection systems:

AS = Automatic Wet Pipe Sprinkler System
AD = Automatic Dry Chemical Extinguishing System
MPS = Manual Pull Stations
PFE = Portable Fire Extinguishers

(2) The Waste Handling Building and the Support Building contain the following:

- Automatic wet pipe sprinklers
- Fire detection in the heating, ventilation, and air conditioning instrumentation (Support Building, only)
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Safety and Emergency Services Building contains the following:

- Automatic wet pipe sprinklers
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Core Storage Building contains the following:

- Automatic wet pipe sprinklers
- Portable fire extinguishers

(3) The Exhaust Filter Building, Underground Facilities, Warehouse/Shops Building, Water Pumphouse, and Salt Handling Hoist house also have portable fire extinguishers, manual pull stations, and automatic detectors.

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Table D-8
Hazardous Release Reporting, Federal

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA) (40 CFR Part 302)	"Reportable quantities" of CERCLA/SARA "hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Chemical identification; 2) what hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g., evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA). EPA may request a written report.
Emergency Planning and Community Right-to-Know Act (SARA Title III) (40 CFR Parts 302 and 355)	SARA Title III "extremely hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581.	1) Chemical identification; 2) what extremely hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g. evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA) for an address if a written report is requested by EPA.
Resource Conservation and Recovery Act (RCRA), 40 CFR §§264.56(a) and 265.56(a)	Any imminent or actual emergency situation.	State or local agencies with designated response roles, if their help is needed: Carlsbad Police Department: 885-2111; Carlsbad Fire Department: 885-2111; Eddy County Sheriff: 887-7551.	What assistance is required.	Not Applicable (NA)

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
RCRA, 40 CFR §§264.56(d), 264.56(i), 265.56(d), and 265.56(i)	RCRA "hazardous waste" release, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802 and State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response).	(1) Name and telephone number of reporter; (2) name and telephone number of facility; (3) time and type of incident; (4) name and quantity of materials involved; (5) extent of injuries, if any; and (6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: (1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and (2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
RCRA, 40 CFR §§264.56(i), 264.56(j), 265.56(i), and 265.56(j)	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	NA	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g. fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

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Table D-9
Hazardous Release Reporting, State of New Mexico

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
20.4.1.500 and 600 NMAC	RCRA "hazardous waste" releases, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802; State Emergency Response Commission and (505) 476-9620 (New Mexico State Police, Hazardous Materials Emergency Response)	1) Name and telephone number of reporter; 2) name and telephone number of facility; 3) time and type of incident; 4) name and quantity of material involved; 5) extent of injuries, if any; and 6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
20.4.1.500 and .600 NMAC	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	1) Name and telephone number of reporter; 2) name and address of facility; 3) name and quantity of materials involved, to extent known; 4) extent of injuries, if any; and 5) possible hazards to human health or the environment, outside the facility.	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g., fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; and 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Emergency Management Act, Section 74-4B-5	Any accident (spill) involving hazardous materials (including hazardous substances, radioactive substances, or a combination thereof) which may endanger human health or the environment.	New Mexico Environment Department: (505) 827-9329, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Name, address and telephone number of owner or operator; 2) name, address and telephone number of facility; 3) date, time and type of incident; 4) name and quantity of material(s) involved; 5) extent of any injuries; 6) assessment of actual or potential threat to environment or human health; and 7) estimated quantity and disposition of recovered material.	Written submission within one week of time permittees become aware of discharge. Same as oral and description of noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence. Send reports to New Mexico Environment Department, Chief, Ground Water Quality Bureau, P.O. Box 26110, Santa Fe, New Mexico, 87502, New Mexico State Emergency Response Commission Department of Public Safety, Title III Bureau, P.O. Box 1628 Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220.
New Mexico Water Quality Control Commission, Part 1, Section 203	Any discharge from any facility of oil or any other water contaminant in such quantities as may, with reasonable probability, injure or be detrimental to human health, animal or plant life, or property.	Chief, Ground Water Quality Bureau, New Mexico Environment Department, or his counterpart in any constituent agency delegated responsibility for enforcement of the rules as to any facility subject to such delegation (505) 827-2918.	Within 24 hours: 1) the name, address, and telephone number of the person or persons in charge of the facility; 2) the name, address, and telephone number of the owner/operator of the facility; 3) the date, time, location, and duration of the discharge; 4) the source and cause of the discharge; 5) a description of the discharge, including its chemical composition; and 6) the estimated volume of discharge, and immediate damage from the discharge.	Submit within seven days: verification of the prior oral notification, also provide any appropriate additions or corrections to the information contained in the prior oral notification. Within 15 days: submit a written report describing any corrective actions taken and/or to be taken relative to the discharge. Send reports to Chief, Ground Water Quality Bureau, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Underground Storage Tank Regulations-2	Any known or suspected release from an Underground Storage Tank (UST) system, any spill or any other emergency situation.	New Mexico Environment Department Petroleum Storage Tank Bureau (505) 984-1741.	Within 24 hours: 1) the name, address, and telephone number of the agent in charge of the site at which the UST system is located, as well as the owner/operator of the system; 2) the name and address of the site and the location of the UST system on that site; 3) the date, time, location, and duration of the spill, release, or suspected release; 4) the source and cause of the spill, release, or suspected release; 5) a description of the spill, release, or suspected release, including its chemical composition; 6) the estimated volume of the spill, release, or suspected release; and 7) action taken to mitigate immediate damage from the spill, release, or suspected release.	Mail or deliver within seven days of the incident, a written notice describing the spill, release, or suspected release and any investigation or follow-up action taken or to be taken. Send reports to Petroleum Storage Tank Bureau, New Mexico Environment Department, 2044 Galisteo Street, Santa Fe, New Mexico, 87504.

FIGURES

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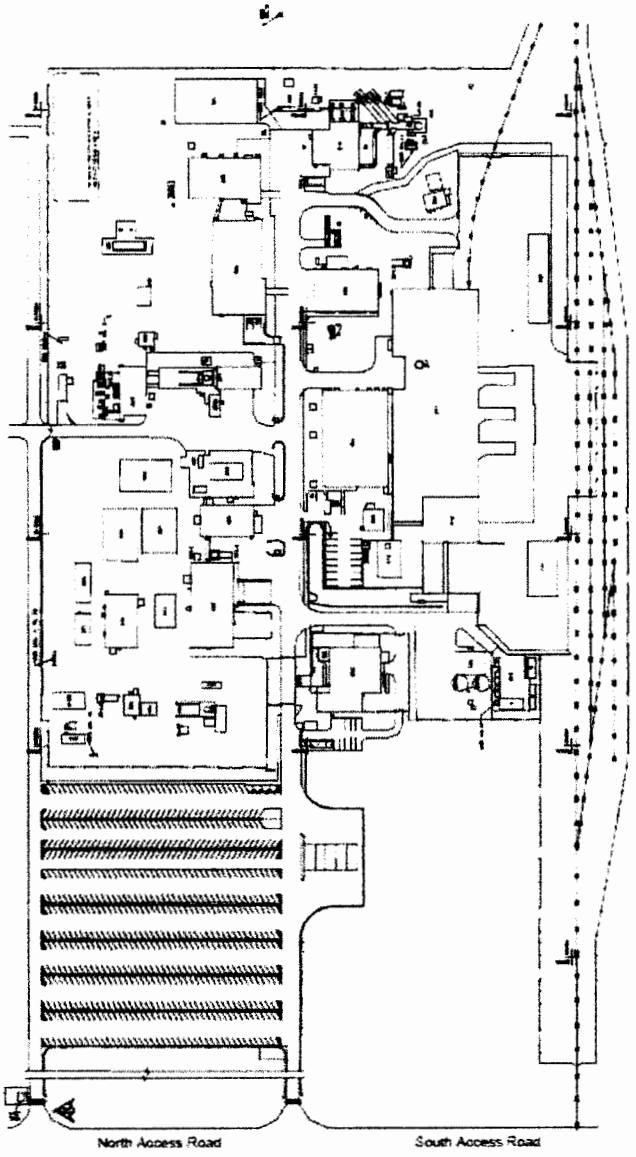

Figure D-1
WIPP Surface Structures

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BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION
#241	EQUIPMENT SHED	#384	SALT HANDLING SHAFT HOISTHOUSE	#475	GATEHOUSE
#242	GUARDSHACK	#384A	MINING OPERATIONS	#480	VEHICLE FUEL STATION
#243	SALT HAULING TRUCKS SHELTER	#411	WASTE HANDLING BUILDING	#481	WAREHOUSE ANNEX
#245	TRUPACT TRAILER SHELTER	#412	TRUPACT MAINTENANCE BUILDING	#482	EXHAUST SHAFT HOIST EQUIP. WAREHOUSE
#246	MgO STORAGE SHELTER	#413	EXHAUST SHAFT FILTER BUILDING	#485	SULLAIR COMPRESSOR BUILDING
#253	13.8 KV SWITCHGEAR 25p-SWG15/1	#413A	MONITORING STATION A	#486	ENGINEERING BUILDING
#254.1	AREA SUBSTATION NO. 1 25P-SW15.1	#413B	MONITORING STATION B	#489	TRAINING BUILDING
#254.2	AREA SUBSTATION NO. 2 25P-SW15.2	#414	WATER CHILLER FACILITY & BLDG	#H-16	SANDIA TEST WELL
#254.3	AREA SUBSTATION NO. 3 25P-SW15.3	#451	SUPPORT BUILDING	#917	AIS MONITORING
#254.4	AREA SUBSTATION NO. 4 25P-SW15.4	#452	SAFETY & EMERGENCY SERVICES FACILITY	#918	VOC TRAILER
#254.5	AREA SUBSTATION NO. 5 25P-SW15.5	#453	WAREHOUSE/SHOPS BUILDING	#918A	VOC AIR MONITORING STATION
#254.6	AREA SUBSTATION NO. 6 25P-SW15.6	#455	AUXILIARY WAREHOUSE BUILDING	#918B	VOC LAB TRAILER
#254.7	AREA SUBSTATION NO. 7 25P-SW15.7	#458	WATER PUMPHOUSE	#950	WORK CONTROL TRAILER
#254.8	AREA SUBSTATION NO. 8 25P-SW15.8	#457N	WATER TANK 25-D-001B	#951	PROCUREMENT/PURCHASING
#254.9	480V SWITCHGEAR (25P-SWGO4/9)	#457S	WATER TANK 25-D-001A	#952	TRAILER
#255.1	BACK-UP DIESEL GENERATOR #1 25-PE 503	#458	GUARD AND SECURITY BUILDING	#953	MODULAR OFFICE COMPLEX
#255.2	BACK-UP DIESEL GENERATOR #2 25-PE 504	#459	CORE STORAGE BUILDING	#971	HUMAN RESOURCES TRAILER
#256.4	SWITCHBOARD #4 (25P-SBD04/4)	#463	COMPRESSOR BUILDING	#986	PUBLICATIONS & PROCEDURES TRAILER
#311	WASTE SHAFT	#465	AUXILIARY AIR INTAKE	SWR NO. 6	SWITCHRACK NO. 6
#351	EXHAUST SHAFT	#468	TELEPHONE HUT	SWR NO. 7	7A, 7B SWITCHRACK NO. 7, 7A, 7B
#361	AIR INTAKE SHAFT	#473	ARMORY BUILDING	SWR NO. 7C	SWITCHRACK NO. 7C
#362	AIR INTAKE SHAFT/HOIST HOUSE	#474	HAZARDOUS WASTE STORAGE FACILITY	SWR NO. 10	SWITCHRACK NO. 10
#363	AIR INTAKE SHAFT/WINCH HOUSE	#474A	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 11	SWITCHRACK NO. 11
#364	EFFLUENT MONITORING INSTRUMENT SHED A	#474B	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 12	SWITCHRACK NO. 12
#365	EFFLUENT MONITORING INSTRUMENT SHED B	#474C	OIL & GREASE STORAGE BUILDING	SWR NO. 15	SWITCHRACK NO. 15
#366	AIR INTAKE SHAFT HEADFRAME	#474D	GAS BOTTLE STORAGE BUILDING		
#371	SALT HANDLING SHAFT	#474E	HAZARD MATERIAL STORAGE BUILDING		
#372	SALT HANDLING SHAFT HEADFRAME	#474F	WASTE OIL RETAINER		

Figure D-1a
Legend to Figure D-1

Field Code Changed

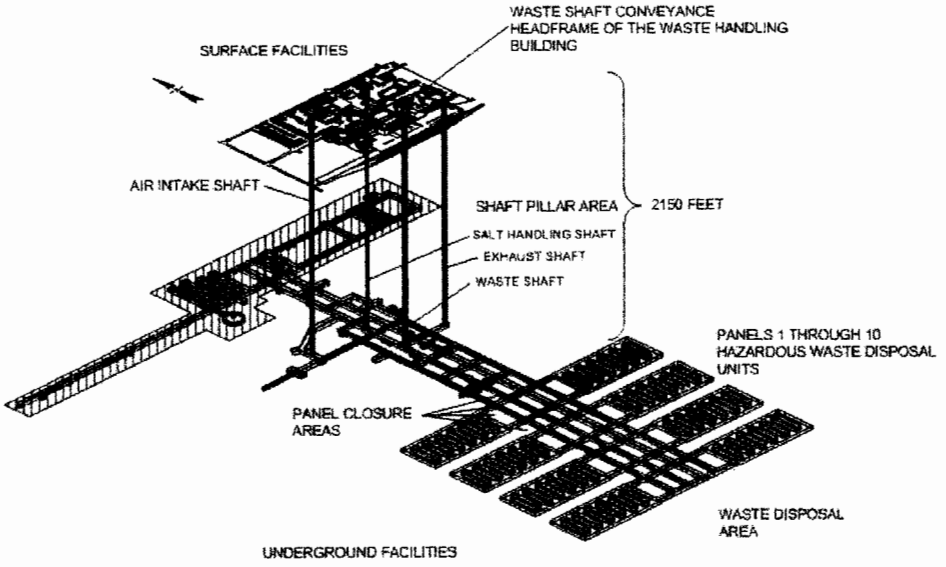

Figure D-2
Spatial View of the WIPP Facility

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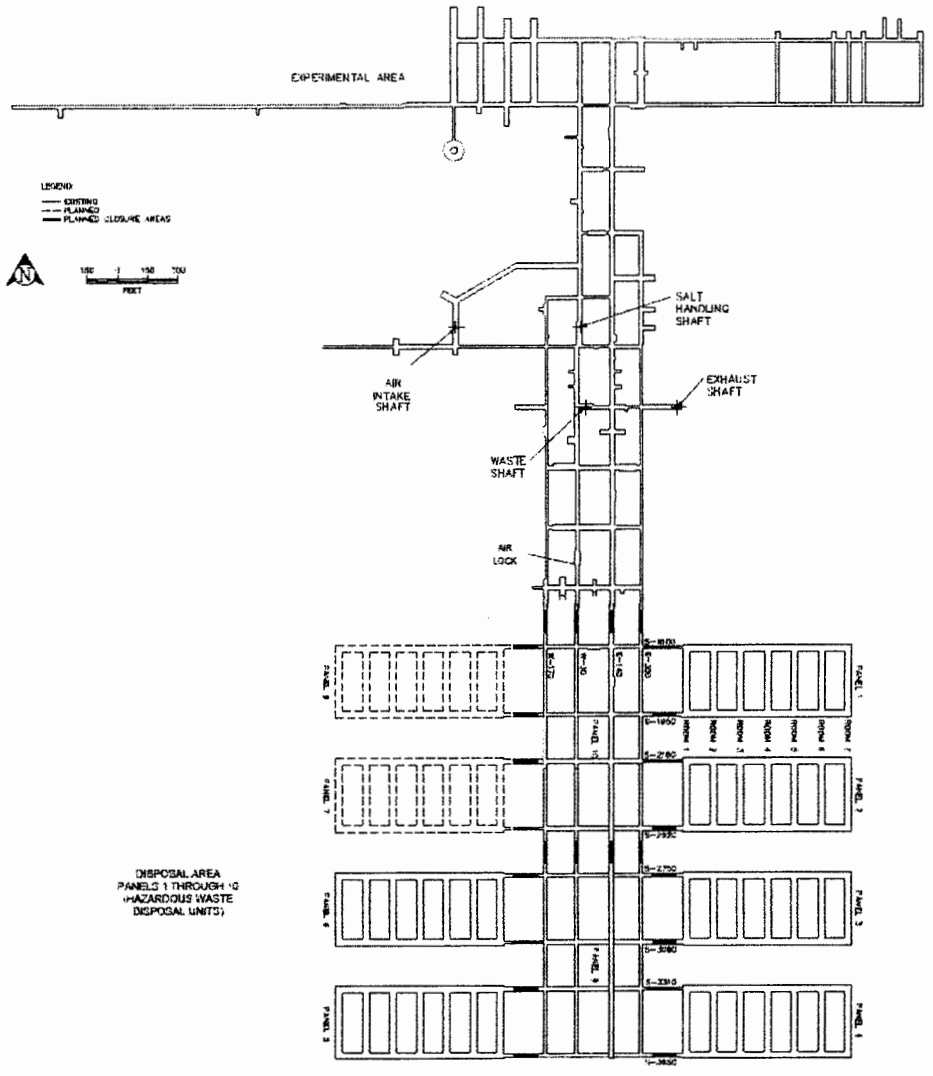

Figure D-3
WIPP Underground Facilities

Field Code Changed

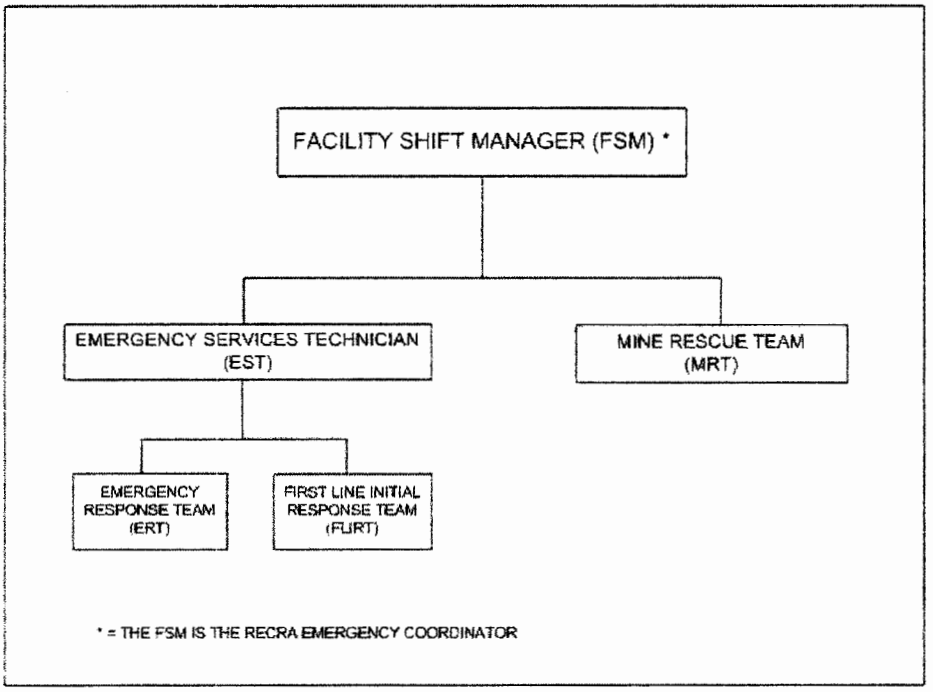

Figure D-4
Direction and Control Under Emergency Conditions in Which the Plan Has Been Implemented

Field Code Changed

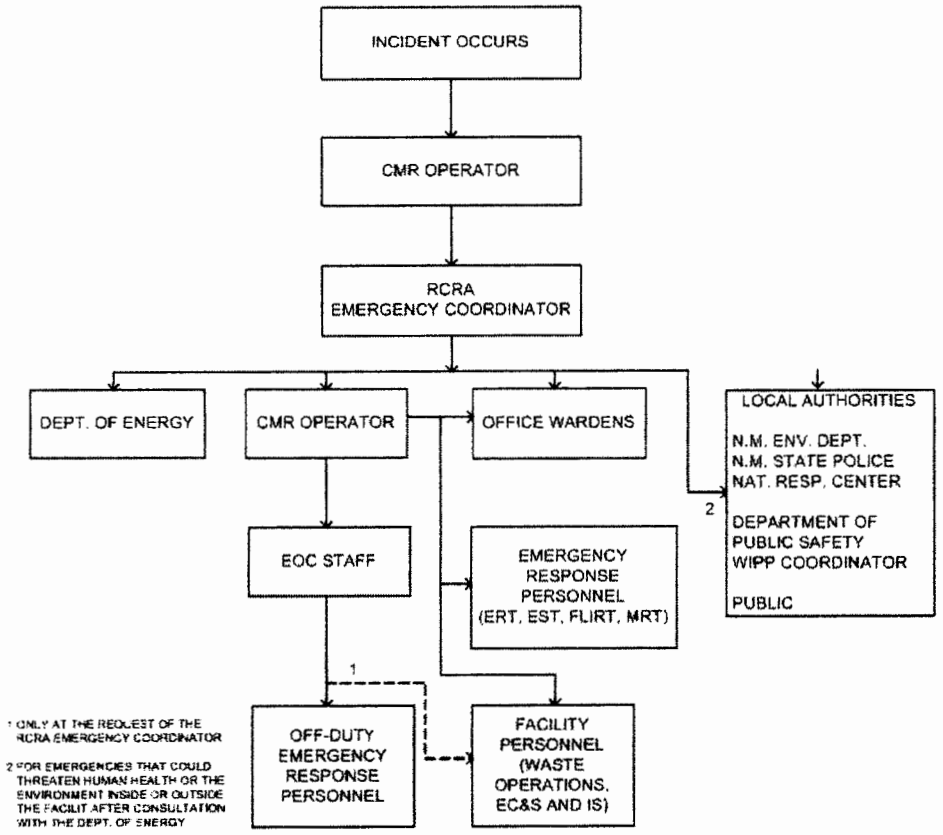

Figure D-4a
WIPP Facility Emergency Notifications

Field Code Changed

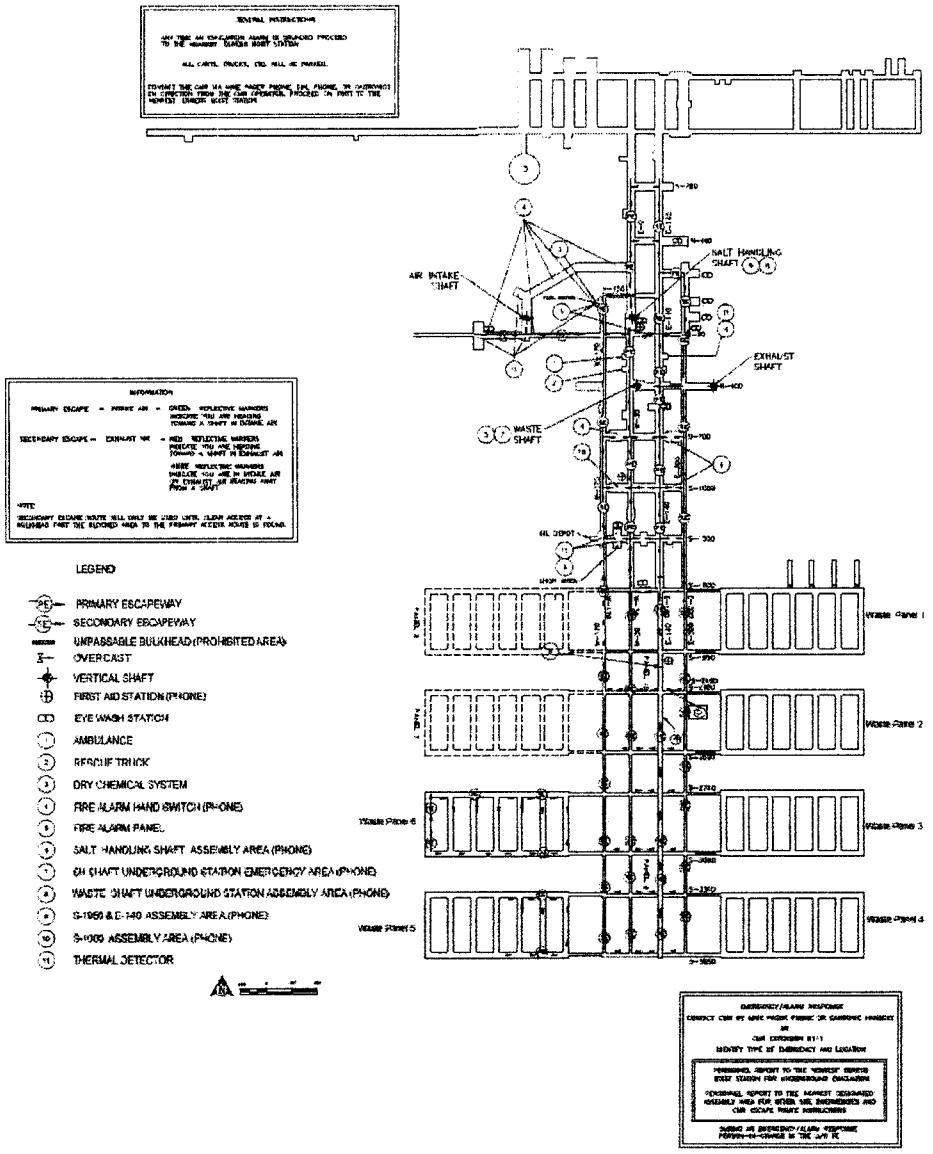

Figure D-5
Underground Emergency Equipment Locations and Underground Evacuation Routes

Field Code Changed

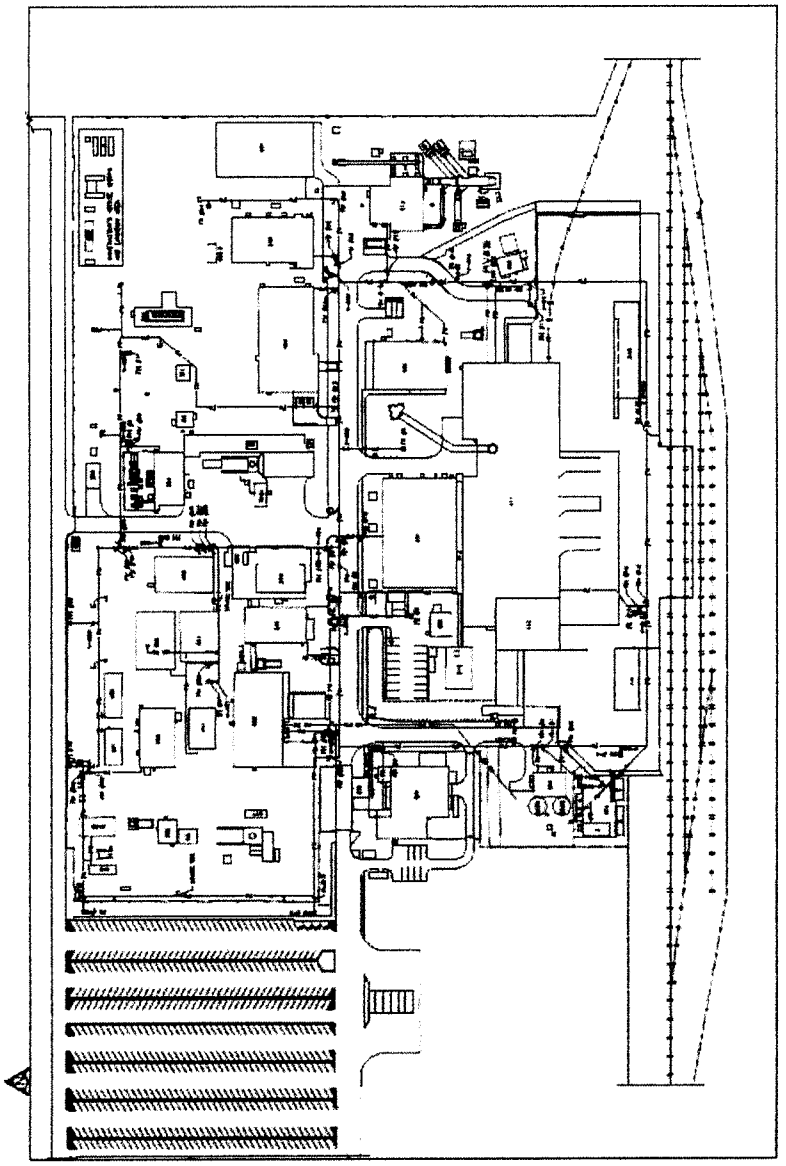

Figure D-6
Fire-Water Distribution System

Field Code Changed

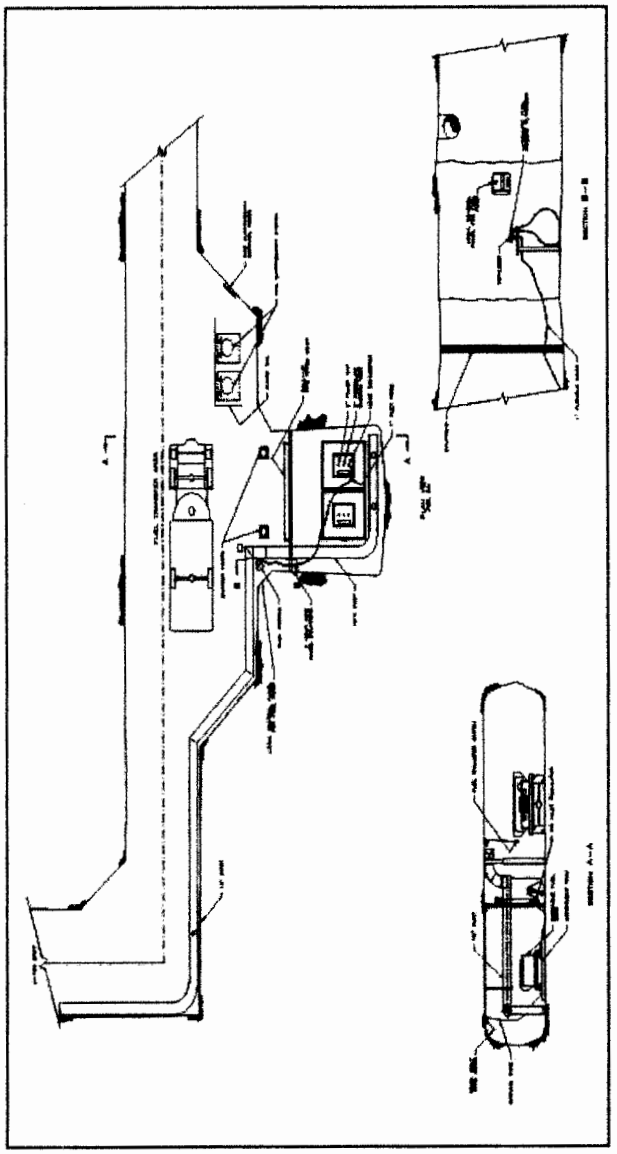

Figure D-7
Underground Diesel Fuel-Station Area Fire-Protection System

Field Code Changed

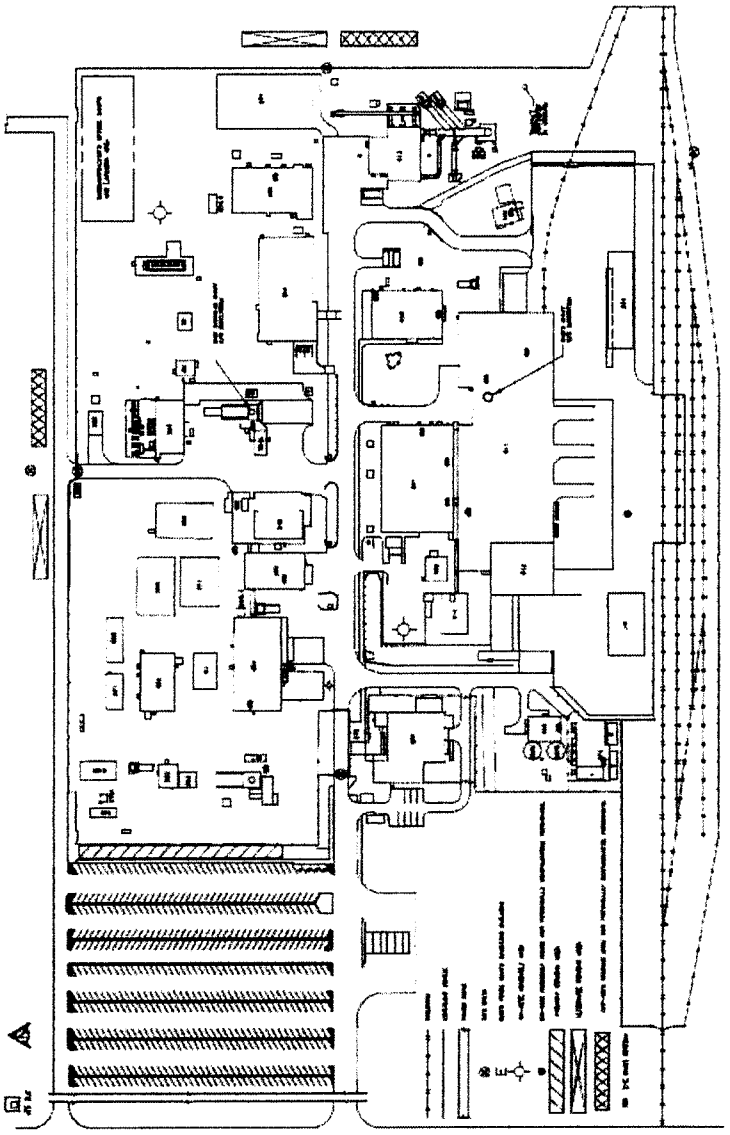

Figure D-8
WIPP On-Site Assembly Areas and WIPP Staging Areas

Field Code Changed

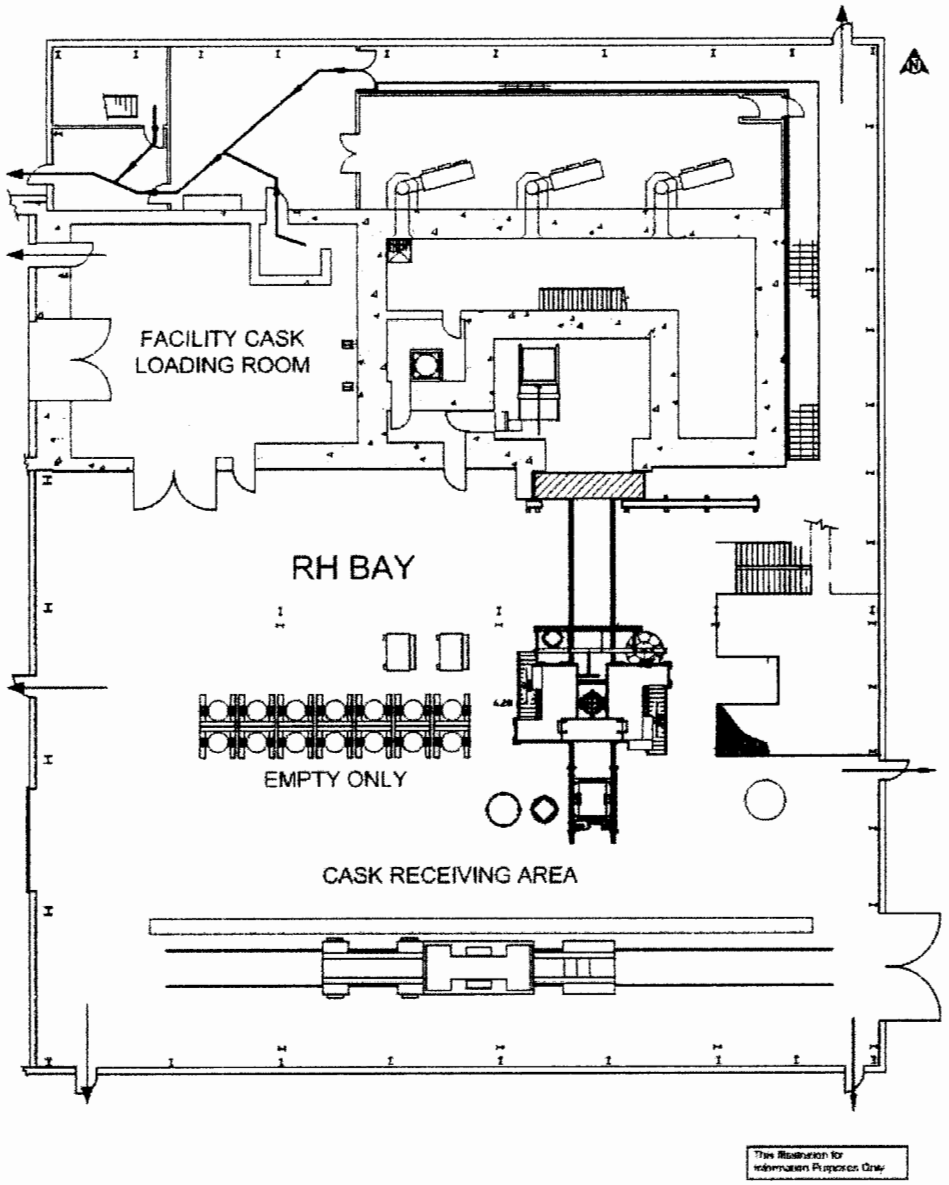

Figure D-8a
RH Bay Evacuation Routes

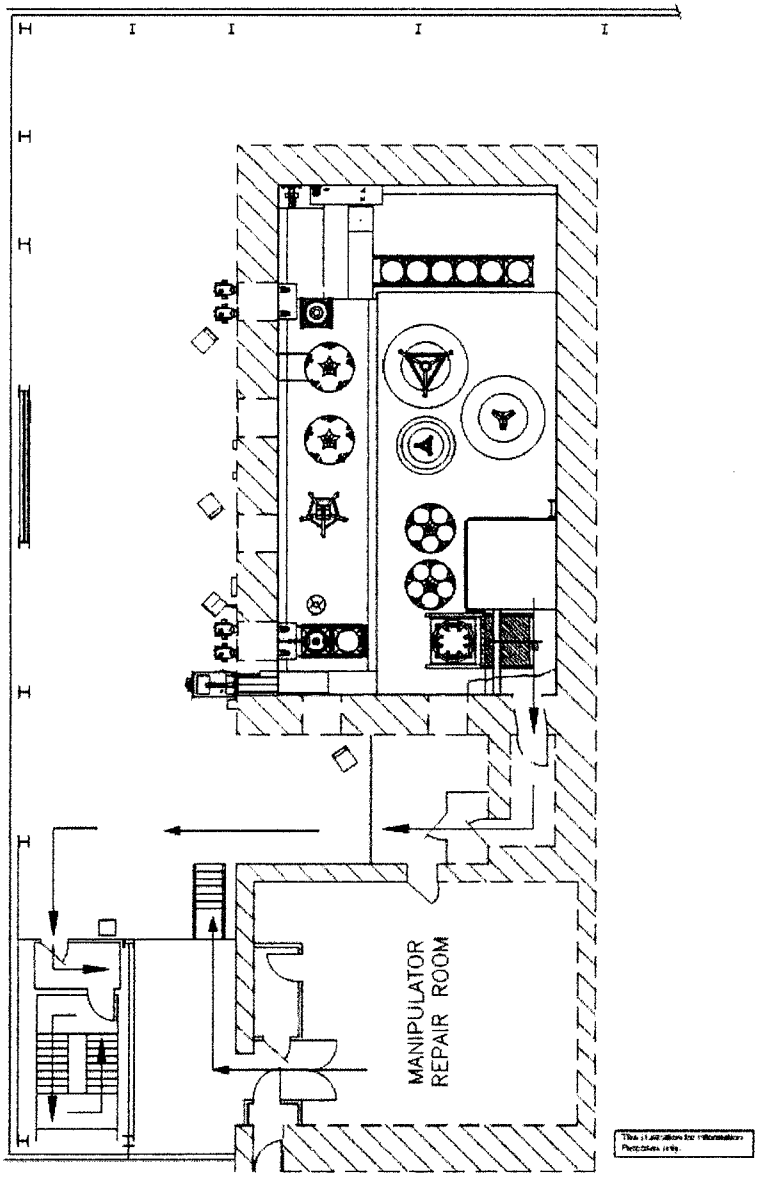

Figure D-8b
RH Bay Hot Cell Evacuation Route

Field Code Changed

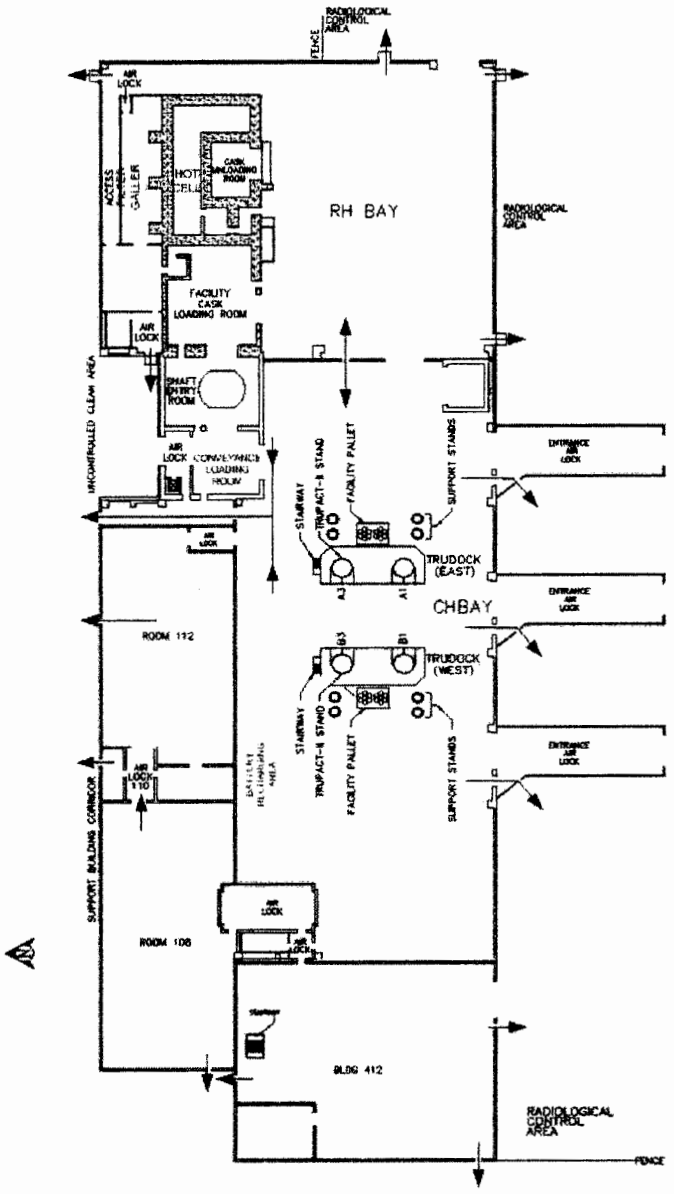

Figure D-8c
Evacuation Routes in the Waste Handling Building

Field Code Changed

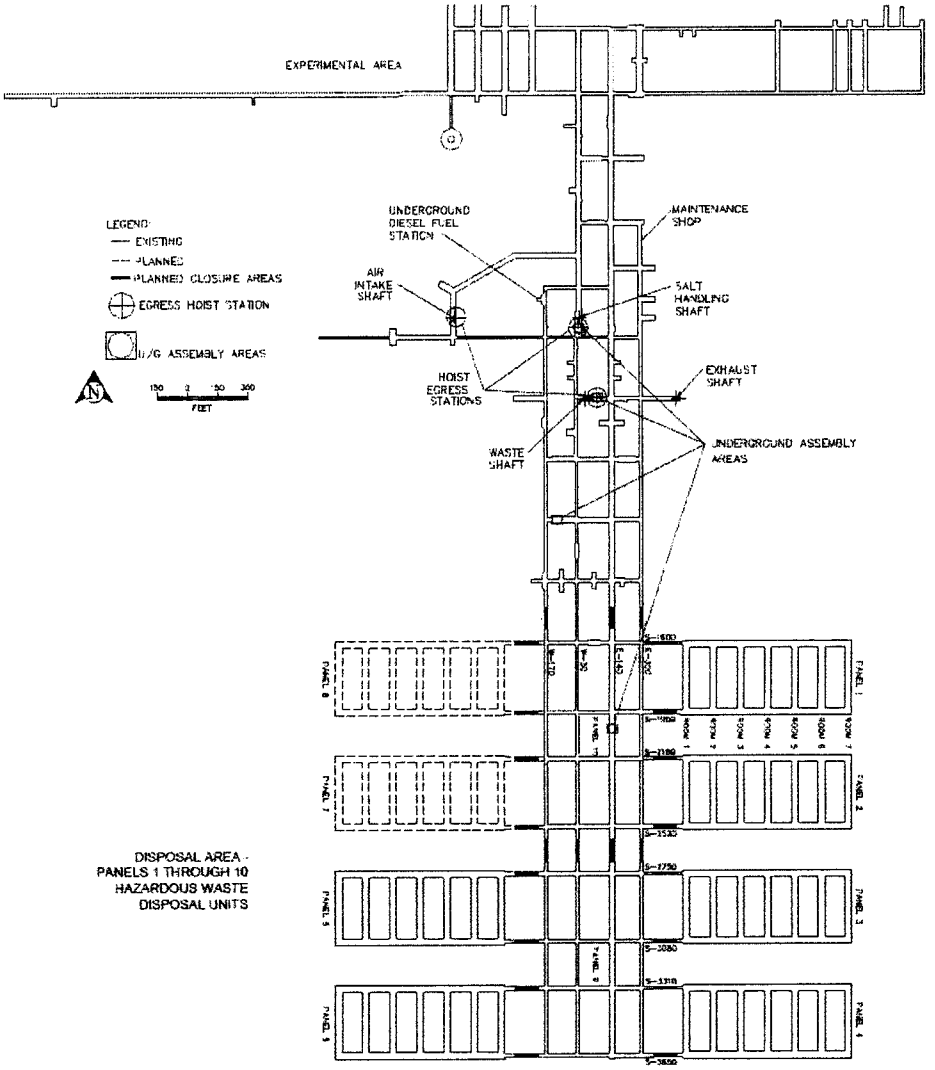

Figure D-9
Designated Underground Assembly Areas

Field Code Changed

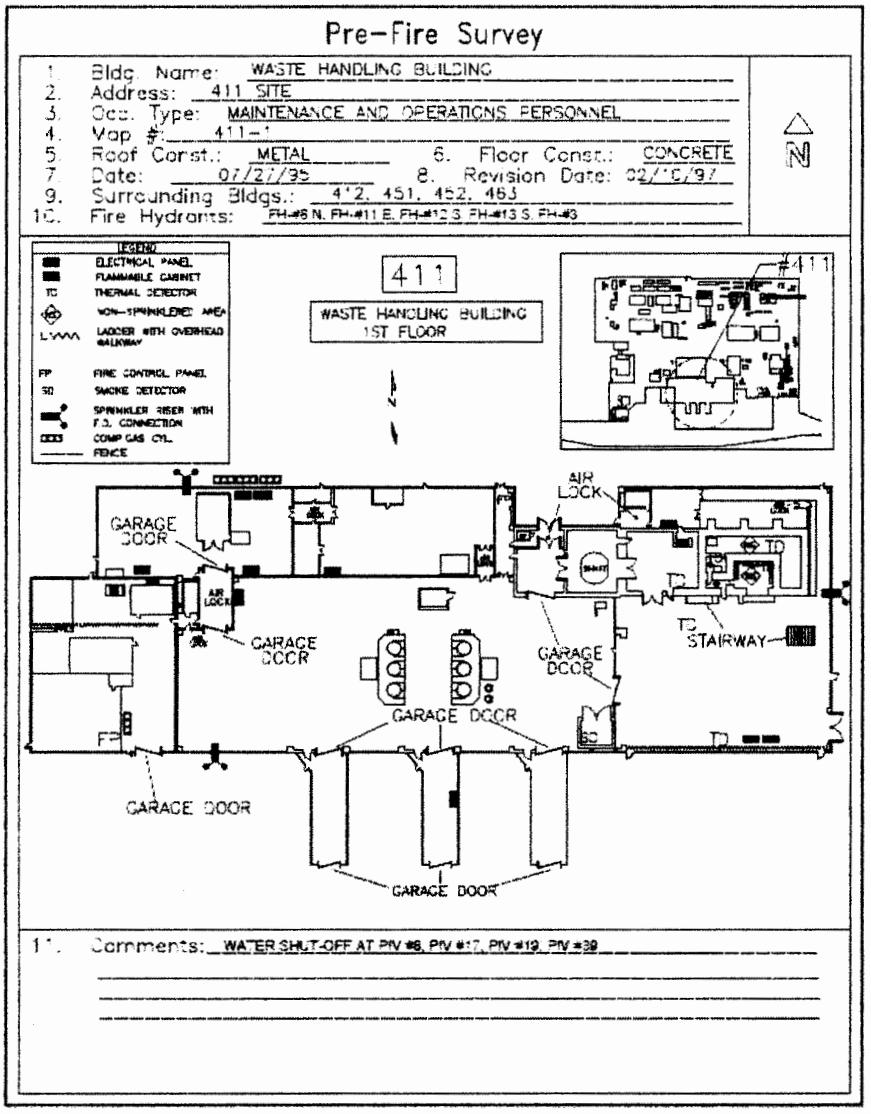

Figure D-10
Waste Handling Building Pre-Fire Survey (First Floor)

Field Code Changed

Pre-Fire Survey Cont.

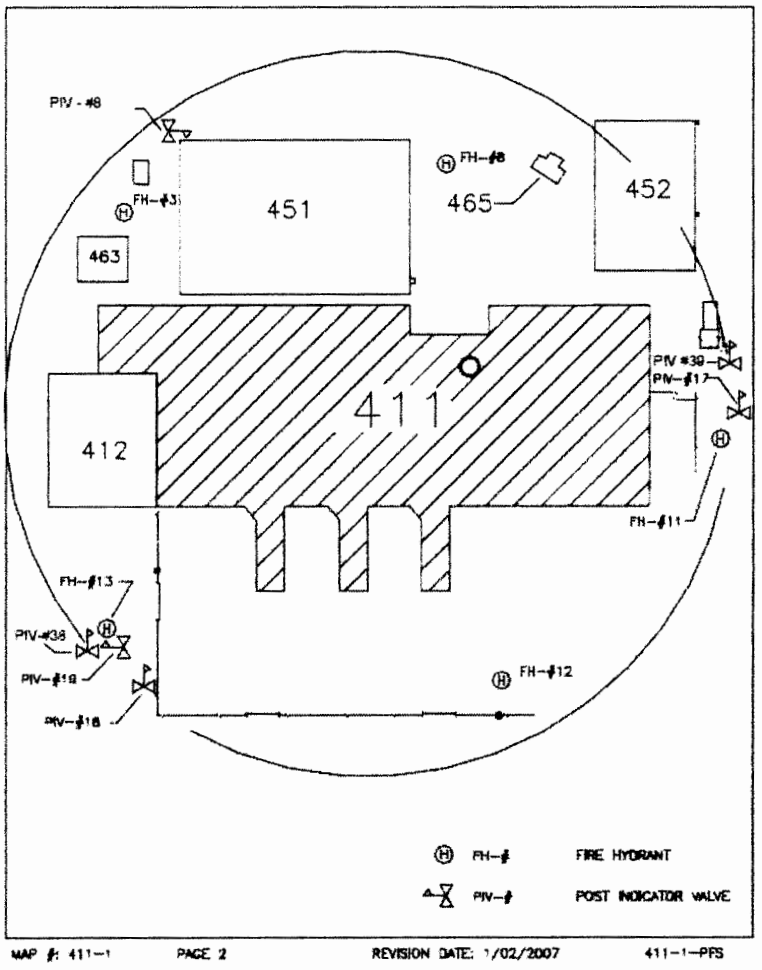

Figure D-10a
Waste Handling Building Pre-Fire Survey
(First Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

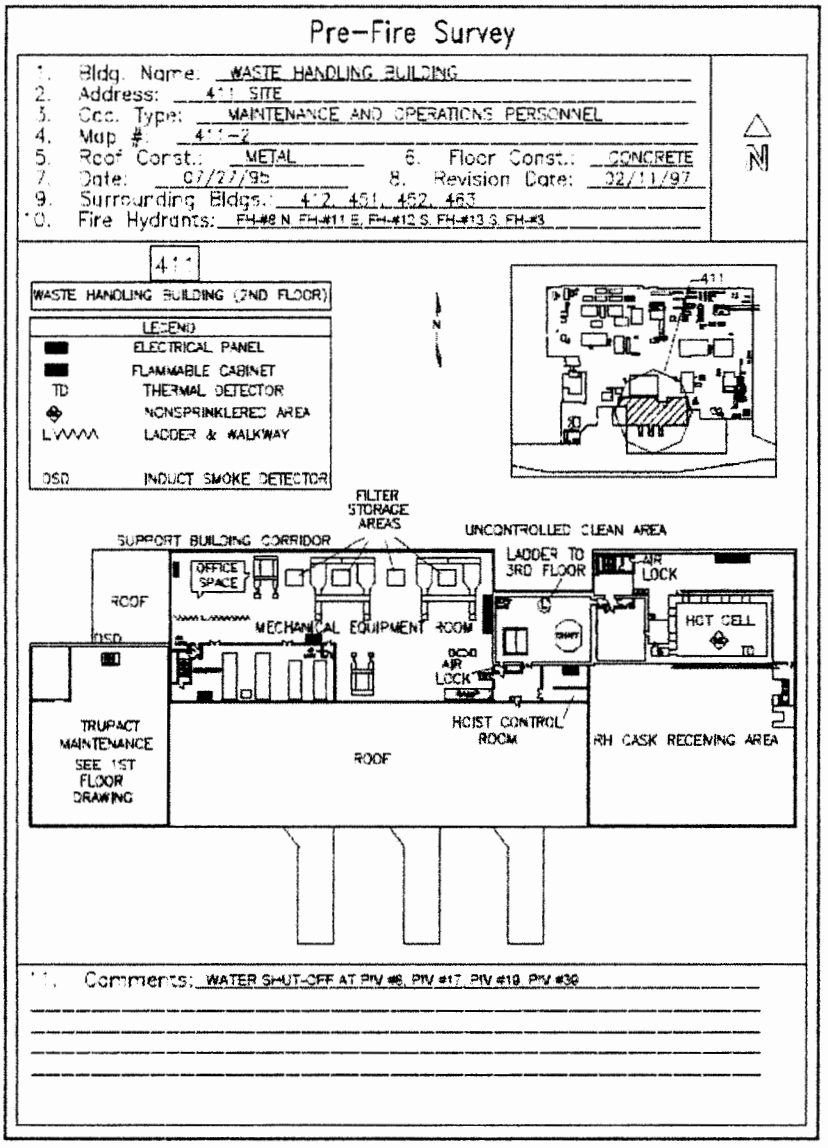

Figure D-11
Waste Handling Building Pre-Fire Survey (Second Floor)

Field Code Changed

Pre-Fire Survey Cont.

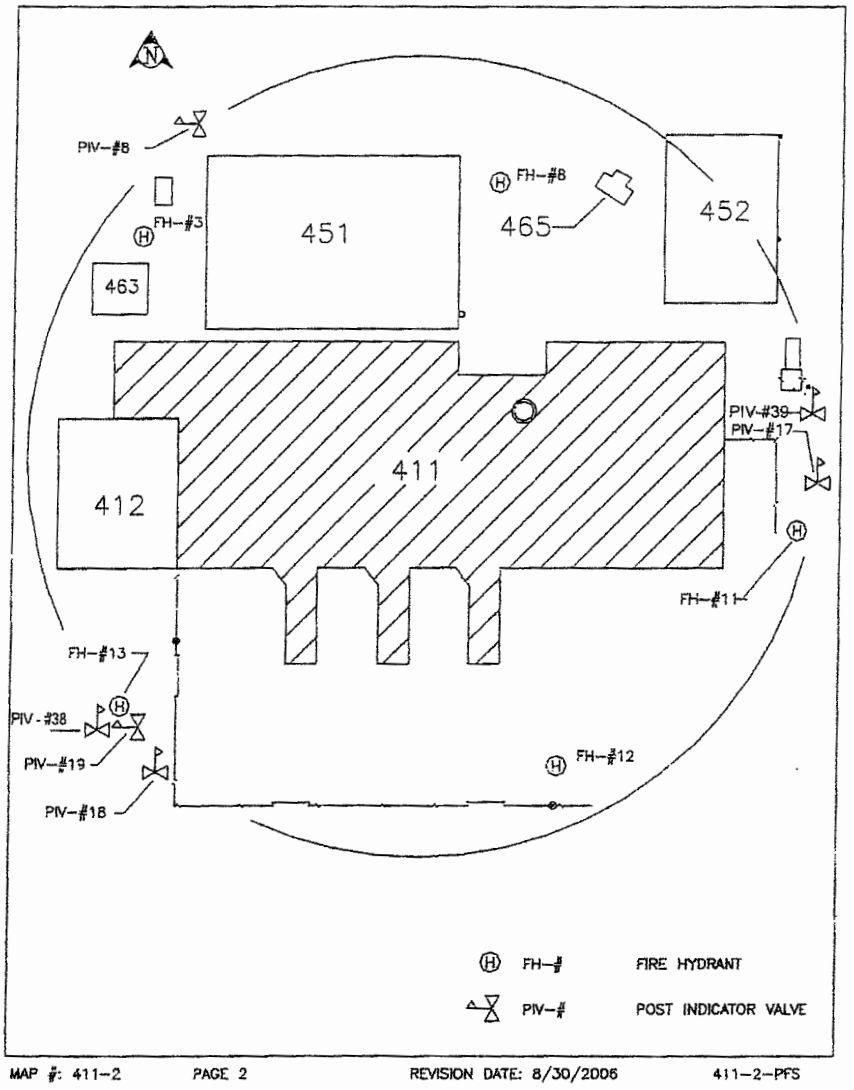

Figure D-11a
Waste Handling Building Pre-Fire Survey
(Second Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

I. INITIAL INFORMATION DATE:_____ TIME:_____
EST._____ REPORTED LOCATION:_____
REPORTED BY:_____DEPT.:_____
INITIALLY REPORTED TO:_____DEPT.:_____
RESPONSIBLE MANAGER:_____DEPT.:_____

II. WEATHER CONDITIONS WIND DIRECTION_____WIND SPEED:_____mph TEMP._____F
CONDITIONS (i.e.., icy, snowing, raining, cloudy, sunny):_____

III. TYPE OF INCIDENT (SPILL, LEAK, ETC.):_____Fire involved: [ ]YES [ ]NO
(If fire is involved attach a copy of the fire report)

MATERIALS INVOLVED	UN/NA NO.	QUANTITY	HAZARD CLASS	NFPA CLASS

IV. PERSONNEL INVOLVED IN CLEAN-UP ACTIVITIES

PERSONNEL/DEPT	DECON METHOD/MEDICAL TREATMENT

V. PERSONNEL CONTAMINATED NOT INVOLVED IN THE CLEANUP ACTIVITIES

PERSONNEL/DEPT.	MATERIAL CONTACTED	DECON/MEDICAL TREATMENT

Figure D-12
WIPP Hazardous Materials Incident Report, Page 1 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

VI. EQUIPMENT USED FOR CLEAN-UP AND CONTROL MEASURES

EQUIPMENT/MATERIAL/PPE	QUANTITY	DISPOSITION (decon or replacement)

VII. DESCRIPTION OF INCIDENT AND RESPONSE (including containment and control)

VIII. ENVIRONMENTAL COMPLIANCE

Date:_____ Time:_____of evaluation.

Waste Category_____

Disposition_____

ORGANIZATION	DATE	TIME

EC Representative:_____
Print name Signature Date

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 2 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

IX. INITIAL NOTIFICATION BY CMRO

DEPARTMENT	PERSON CONTACTED	TIME	NOTIFIED BY
Facility Ops (FSM)			
Emerg. Mgmt (EST)			
EC			
Industrial Safety			
Facility Ops. (FM/FMD)			

CMRO:_____
Print name Signature Date

FSM:_____
Print name Signature Date

X. CONTINGENCY PLAN IMPLEMENTATION

Contingency Plan implemented [ ]YES [ ]NO

FSM:_____
Print name Signature Date

XI. REVIEWS

Report submitted by:_____
Print name Signature Date

Emergency Management Manger:_____
Print name Signature Date

EC Manager:_____
Print name Signature Date

COMMENTS:_____

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 3 of 3

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DRAWINGS

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Field Code Changed

ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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  - E-1a(2) Frequency of Inspections 4
  - E-1a(3) Monitoring Systems 4
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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

Introduction

This Permit Attachment describes the facility inspections (including container inspections) that are conducted to detect malfunctions, deterioration, operator errors, and discharges that may cause or lead to releases of hazardous waste or hazardous waste constituents to the environment or that could be a threat to human health.

E-1 Inspection Schedule

Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as monitoring equipment, safety and emergency equipment, security devices, and operating or structural equipment are inspected. The equipment will be inspected for malfunctions, deterioration, potential for operator errors, and discharges which could lead to a release of hazardous waste constituents to the environment or pose a threat to human health.

The WIPP facility has developed and will maintain a series of written procedures that include all the detailed inspection procedures and forms necessary to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)), during the Disposal Phase. Tables E-1 and E-1a list each item or system requiring inspection under these regulations, the inspection frequency, the organization responsible for the inspection, the applicable inspection procedure, and what to look for during the inspection. 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(b), 264.174, and 264.602) list requirements that are applicable to the WIPP facility.

Operational procedures detailing the inspections required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(a) and (b)), are maintained in electronic format on the WIPP computer network, in the Operating Record and, as appropriate, in controlled document locations at the WIPP facility. Frequency of inspections is discussed in detail in Section E-1a(2). Inspections are conducted often enough to identify problems in time to correct them before they pose a threat to human health or the environment and are based on regulatory requirements. The operational procedures assign responsibility for conducting the inspection, the frequency of each inspection, the types of problems to be watched for, what to do if items fail inspection, directions on record keeping, and inspector signature, date, and time. The operational procedures are maintained at the WIPP facility. Tables E-1 and E-1a summarize inspections, frequencies, responsible organizations, personnel making the inspection (by job title), and the types of anticipated problems as well as the references for the operational procedures. Inspection records are maintained at the WIPP site for three years. Beginning with the effective date of this Permit, records that are over the three year retention period are either maintained at the WIPP site or transferred to the WIPP Records Archive located in Carlsbad, NM until closure. The records maintained at the WIPP Records Archive are stored in facilities that are temperature and humidity controlled especially for the long term storage of records and readily retrievable and available for inspection.

Waste handling equipment and area inspections are typically controlled through established procedures and the results are recorded in logbooks or on data sheets. Operators are trained to consult the logbook to identify the status of any piece of waste handling equipment prior to its

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use. Once a piece of equipment is identified to be operable, a preoperational inspection is initiated in accordance with the appropriate inspection procedure in Tables E-1, E-1a, or in operational procedures. Inspection results as described below are entered in the applicable logbook.

Inspections include identifying malfunctions or deteriorating equipment and structures. Inspection results and data, including deficiencies, discrepancies, or needed repairs are recorded. A negative inspection result does not necessarily lead to a repair. A deficiency, such as low fluid level, may be corrected by the inspector immediately. A discrepancy, such as an increasing trend of a data point, may necessitate additional inspection prior to the next scheduled frequency. The actions taken (corrected, additional inspection, or Action Request (**AR**) for repair submitted) are recorded on the inspection form, the WIPP automated Maintenance Management tracking program (**CHAMPS**) work order sheet, or the equipment logbook, whichever is applicable.

Items that are operational with restrictions are tagged with those restrictions. Items that are not operational are tagged and locked to prevent their use. Tagged and locked items are listed on the Tagout/Lockout Index. Once a scheduled repair or replacement is accomplished in accordance with the work authorization procedures, the tag or lock is removed from the item in accordance with the equipment tagout/lockout procedures. Normally, the individual inspecting the equipment/system is not qualified to make repairs and consequently, prepares an AR if repairs are needed. The AR is tracked by the CHAMPS system through the work control process. When parts are received and work instructions are completed, the work order can be scheduled on the Plan of the Day (**POD**). The POD is held daily to ensure facility configuration can support scheduled work items and to allocate and coordinate the resources necessary to complete the items.

Work orders are released for work by the responsible organization. When repairs are complete the responsible organization tests the equipment to ensure the repairs corrected the problem, then closes out the work order, to return the equipment to an operational status for normal operations to resume. Implementation of these procedures constitutes compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

Requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)), are met by the inspections for each item or system included in Tables E-1 and E-1a. Beginning with the effective date of this Permit, the results of the inspections are maintained in the operating record for three years and are then transferred to the WIPP Records Archive where they are maintained until closure. The inspection logs or summary records include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions. Major pieces of waste handling equipment are inspected using proceduralized inspections. Current copies of inspection forms are maintained in the Operating Record. Non-administrative changes (i.e., changes that affect the frequency or content of inspections) to inspection forms must be submitted to the NMED in accordance with the appropriate portions of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42). The status of these pieces of equipment is maintained in an equipment logbook that is separate from the checklist. The logbook contains information regarding the condition of the equipment. Equipment operators are required, by the inspection checklist, to consult the logbook as the first activity in the inspection procedure. This logbook is maintained in the operating record. CH transuranic (**TRU**) mixed waste equipment that is controlled by a logbook includes the waste handling forklifts, all waste handling cranes, the adjustable center of gravity lift fixture, the CH

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TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and emplacement equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

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E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**) or in standard large box 2s (**SLB2s**). The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

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As described in Permit Attachment A1, Section A1-1d(3), RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

RH TRU mixed waste is handled and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity of the shipping containers and the spacing between trailers carrying the Contact-Handled or Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Container inspections will be included as part of the surface TRU mixed waste handling areas (i.e. Parking Area Unit and WHB Unit) inspections described in Tables E-1 and E-1a. These inspections will also include the Derived Waste Storage Areas of the WHB Unit. The Derived Waste Storage Areas will consist of containers of 55 or 85-gallon drums or SWBs for CH TRU mixed waste and 55-gallon drums for RH TRU mixed waste. A Satellite accumulation area (**SAA**) may be required in an area adjacent to the TRUDOCKs for CH TRU mixed waste. A SAA may also be required in the RH Bay and Hot Cell for RH TRU mixed waste. These SAAs will be set up on an as needed basis at or near the point of generation and the derived waste will be discarded into the active derived waste container. All SAAs will be inspected in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34).

E-1b(2) Miscellaneous Unit Inspection

20.4.1.500 NMAC (incorporating 40 CFR §264.602), requires that inspections required in 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33), as well as any additional requirements needed to protect human health and the environment, be met. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33) are discussed in Section E-1 of this Permit Attachment, along with how the WIPP facility complies with those requirements for standard types of inspections. Inspection frequencies for geomechanical monitoring equipment are provided in Table E-1. The monitoring schedule for geomechanical instrumentation is given in Table E-2.

References

DOE, 1999. "WIPP Safety Analysis Report," DOE/WIPP-95-2065. Rev. 4, U.S. Department of Energy. Washington, D.C.

DOE, 2000. "WIPP Remote-Handled Waste Preliminary Safety Analysis" (RH PSAR), U.S. Department of Energy. Washington, D.C.

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FIGURES

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TYPICAL EQUIPMENT
WEEKLY CHECK LIST

_√_ OK _X_ Adjustment Made _O_ Repairs Required

AR Written [ ] Yes [ ] No AR # _____

(check or complete appropriate information)

ITEM INSPECTED	Condition	Comments/Corrective Action
Mechanical Checks: (examples)		
Oil level		
Radiator fluid level		
Automatic transmission fluid level		
Operate all valves/check gauges		
Emergency brake		
Fuel level (> ¾ full)		
Oil pressure (at warm idle)		
Tire Pressure		
Sirens, horn, & back-up alarm		
Deterioration Checks: (examples)		
Fan belts		
Battery (terminals, cables)		
Run generator 5 min.		
Hose, nozzles & valves		
Leaks/Spills Checks: (examples)		
Leaks around pump		
Foam tank level		
Required Equipment: (examples)		
Inspect SCBAs (> 4050 psi)		
Hand tools & equipment		
Trauma Kit		

Inspected by: _____
Print Name Signature Time/Date

Inspected by: _____
Print Name Signature Time/Date

Reviewed by: _____
Print Name Signature Time/Date

Comments: _____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-1
Typical Inspection Checklist

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HOUR METER READING _____ EQUIPMENT NO. _____

DEFICIENCIES NOTED: _____

_____

_____

_____

_____

PRE OPS COMPLETED PER __{Procedure Number}__ SAT _____ **PROBLEMS NOTED** _____

CORRECTIVE ACTIONS TAKEN: _____

_____

_____

_____

_____

_____

_____

OPERATOR SIGNATURE	**DATE**	**TIME**	**SUPERVISOR SIGNATURE/DATE**
_____	_____	_____	_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-2
Typical Logbook Entry

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TABLES

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Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	12-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[l]	Emergency Services	Monthly See List 11	12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[l] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030 and 12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

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Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
Senior Mining Technician *
Continuous Mining Specialist *
Senior Mining Specialist *
Mine OPS Supervisor *
b. Waste Hoist Operator
Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
Shaft Technician *
d. Operations Engineer
Supervisor U/G Services*
Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
Senior Safety Technician *
Safety Specialist *
Safety Engineer *
Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

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Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

Table E-1a
RH TRU Mixed Waste Inspection Schedule/Procedures

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Transfer Car(s)	Waste Operations	Pre-evolution [c,d,e] See List 1	WP05-WH1701 PM041187 (Semi-Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
RH Bay Overhead Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041232 (Quarterly) PM041117 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041201 (Annual) PM041203 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical PM.
RH Bay Cask Lifting Yoke	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041169 (Annual)	Yes	NA	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask Transfer Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1704 PM041186 (Quarterly) PM041195 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Cask Rotating Device	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041175 (Annual) PM041176 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Grapple	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041172 (Quarterly) PM041177 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear. Non-Destructive Examination
6.25-Ton Grapple Hoist	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041173 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Transfer Cell Shuttle Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1705 PM041184 (Semi-Annual) PM041222 (Annual)	Yes	Yes	Pre-evolution Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection.

System/ Equipment Name	Responsible Organization [J]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Unloading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell	Waste Operations	Preoperational [c,d,e,f,g,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell Overhead Powered Manipulator	Waste Operations	Preoperational [c,d,e,j] See List 1	WP05-WH1743 PM041215 (Annual) PM041216 (Annual) IC411037 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration
Hot Cell Bridge Crane	Waste Operations	Preoperational [c,d,e,j] See List 1	WP05-WH1742 PM041217 (Annual) PM041209 (Annual) IC411038 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.
Transfer Cell	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Facility Cask Loading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Closed Circuit Television Camera	Waste Operations	Preoperational [c,i] See List 1	WP05-WH1757	NA	NA	Operability
Radiation Monitoring Equipment	Radiation Control	Preoperational [c,d,e] See List 2	WP12-HP1245 IC240010 WP12-HP1307 IC240007 WP12-HP1314 (Annual)	Yes	NA	Operability Checks, Functional Checks, Instrument calibrations, Flow Calibration, Efficiency Checks.
Cask Unloading Room Crane	Waste Operations	Preoperational [c,d,e,j] See List 1	WP05-WH1719 PM041190 (Quarterly) PM041191 (Annual) PM041192 (Annual) IC411035 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [i] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer

Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts, and concrete walls.

[b] Deterioration includes: visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Pre-evolution" signifies that inspections are required prior to equipment use in the waste handling process. (An evolution is considered to be from the receipt of a cask into the RH Bay through canister emplacement in the underground.) For an area, preoperational inspection includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that functional components and emergency equipment are present and operational. When the equipment is not in use, no inspections are required.

[d] When equipment needs to be inspected while handling waste (i.e., during waste unloading or transfer operations), general cleanliness and functional components will be inspected to detect any problem that may harm human health or the environment. The inspection will verify that emergency equipment is present.

[e] Inspection of RH TRU mixed waste equipment and areas in the RH Complex applies only after RH TRU mixed waste receipt begins.

[f] The inspection/maintenance activities associated with these pieces of equipment are performed when the RH Complex is empty of RH TRU mixed waste. If contamination is present, a radiation work permit may be needed.

[g] For the Hot Cell and Transfer Cell, if RH TRU mixed waste is present, camera inspections will be performed in lieu of physical inspection.

[h] The integrity of the floor coating will be inspected weekly if RH TRU mixed waste is present.

[i] "Preoperational" signifies that inspections are required prior to the first use in a calendar day.

[j] Responsible organizations refers to the organization that owns the equipment. Preventive Maintenance (PM) procedures are conducted by either mine maintenance or surface operations maintenance personnel and Instrument Calibration (IC) procedures are conducted by instrument and calibration maintenance personnel.

[k] Inspection will be performed after 250 evolutions (actual and training emplacements), if such usage occurs prior to the semi-annual inspection.

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Table E-2
Monitoring Schedule

System/Equipment Name	Responsible Organization	Monitoring Frequency	Purpose
Geomechanical [b]	Geotechnical Engineering	Monthly	To evaluate the geotechnical performance of the underground facility and to detect ground conditions that could affect operational safety
Central Monitoring System	Facility Operations	System Dependent	Monitor and provide status for the following facility parameters: Electrical Power Status [d] Fire Alarm System [e] Ventilation System Status [f] Meteorological Data System [g] Facility Systems (compressors [g], pumps [h], water tank levels [i], waste hoists [j])

[b] Equipment is listed as Underground-Geomechanical Instrumentation System (GIS) in Table E-1.
[d] Equipment listed as Backup Power Supply Diesel Generator in Table E-1.
[e] Equipment listed as Fire Detection and Alarm System in Table E-1.
[f] Equipment listed as Ventilation Exhaust in Table E-1.
[g] Not RCRA equipment.
[h] Equipment listed as Fire Pumps in Table E-1.
[i] Equipment listed as Water Tank Level in Table E-1.
[j] Equipment listed as Waste Hoist in Table E-1.

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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LIST OF ABBREVIATIONS/ACRONYMS/UNITS

Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	chain of custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory control samples
LCSD	lab control sample duplicate
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler Formation
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department

QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
TDS	total dissolved solids
TOC	total organic carbon
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
µg/L	microgram(s) per liter
µm	micrometers

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

Groundwater monitoring at the WIPP facility focuses on the Culebra Member (**Culebra**) of the Rustler Formation (**Rustler**) because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. Groundwater movement in the Culebra, using results

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from the basin-scale groundwater model is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, (DOE, 2009).

This monitoring plan addresses requirements for sample collection, Culebra groundwater surface elevation monitoring, Culebra groundwater flow direction and rate determination, data management, and reporting of Culebra groundwater monitoring data. It also identifies indicator parameters and hazardous constituents selected to assess Culebra groundwater quality for the WIPP groundwater detection monitoring program (**DMP**). Because quality assurance is an integral component of the groundwater sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this DMP are provided in the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d)). Procedures are required for each aspect of the Culebra groundwater sampling process, including Culebra groundwater surface elevation measurement, Culebra groundwater flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection. Data required by this plan will be collected by qualified personnel in accordance with SOPs (Table L-3).

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP facility is situated within the Delaware Basin bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler's upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of

mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) Application (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the downward percolation of water into the evaporite units below. The Bell Canyon is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) (DOE, 2009)) and is confined above by the thick evaporite deposits of the Castile. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is approximately 2,200 pounds per square inch [$lb/in.^2$] or 14.9 megapascals [MPa]) and eventually deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) (DOE, 2009)).

L-1a(2) Groundwater Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional groundwater aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities

measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy.

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-5). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day.

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). Detailed cross-hole hydraulic testing has been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ten orders of magnitude from east to west in the vicinity of WIPP. Transmissivities have been calculated at 1×10^{-7}

square feet per day (1×10^{-13} square meters per second) at well SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east.

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in groundwater geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the groundwater in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 (DOE, 2009)).

The radiogenic ages of the Culebra groundwater and the geochemical differences provide information potentially relevant to the groundwater flow directions and groundwater interaction with other units and are important constraints on conceptual models of groundwater flow.

The Permittees have proposed a conceptualization of groundwater flow that explains observed geochemical facies and groundwater flow patterns. The conceptualization, referred to as the basin-scale groundwater model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. The model assumes that the groundwater system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on groundwater flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south.

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area. Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (**TDS**) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6 - 5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4 - 8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra groundwater was inconsistent with flow directions. This was based on the premise that facies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 (DOE, 2009)).

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Head distribution in the Culebra (see Amended Renewal Application Addendum L1 (DOE, 2009)) is consistent with basin-scale groundwater basin modeling results indicating that the generalized groundwater flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta Member (**Magenta**) of the Rustler across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale groundwater modeling.

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if groundwater monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that groundwater monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP

facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP Detection Monitoring Program (DMP)—Overview

L-3a Scope

This DMP plan governs groundwater sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264 Subpart F), and ensures that such data are gathered in accordance with these and other applicable requirements. Analytical results collected during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

Wells WQSP-1, WQSP-2, and WQSP-3 are located directly upgradient (north) of the WIPP shaft area.

WQSP-4, WQSP-5, and WQSP-6 are located downgradient (south) of the WIPP shaft area. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra. Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

Transport modeling suggests that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years. This assumes conditions where hazardous constituents migrate from the sealed repository (post closure) to the Culebra via the sealed shafts.

Potentiometric surfaces and groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

L-3b(1) Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

The six DMP Culebra wells were drilled between September 13 and October 16, 1994. The total depth of each well is shown in Table L-5. The wells were drilled through the Culebra and Los Medaños as shown in Table L-5. The wells were drilled to the top of the Culebra using compressed air as the drilling fluid and a 9⅞-in. drill bit. The wells were then cored using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, DMP wells were reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were cased from the surface to total depth with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval as shown in Table L-5 . The annulus between the borehole wall and the casing/screen is packed with sand and with 8/16 Brady gravel as indicated in Table L-5.

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

Groundwater surface elevations will be monitored in each of the six DMWs on a monthly basis. The groundwater surface elevation in each DMW will also be measured prior to each annual sampling event. The groundwater surface elevation measurements in the WLMP wells will also be monitored on a monthly basis when accessible. The characteristics of the DMW (sampling frequency, location) will be evaluated if significant changes are observed in the groundwater flow direction or gradient.

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b are measured as part of the DMP.

Additional hazardous constituents may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility. If hazardous constituents are identified, these will be added to Part 5, Table 5.4.b, unless the Permittees provide justification for their omission (e.g. hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

L-4c Groundwater Surface Elevation Measurement, Sample Collection and Laboratory Analysis

Groundwater surface elevations will be measured in each DMW prior to groundwater sample collection. Groundwater will be extracted using serial and final sampling methods. Serial samples will be collected until groundwater field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.

L-4c(1) Groundwater Surface Elevation Monitoring Methodology

The WIPP groundwater level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3.

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, groundwater surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, when accessible. Well locations are shown in Figure L-14. If a cumulative groundwater surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the Annual Culebra Groundwater Report specified in Permit Part 5. Abnormal, unexplained changes in groundwater surface elevation will be evaluated to determine if they indicate changes in site recharge/discharge which could affect the assumptions regarding DMW placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Groundwater surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual groundwater surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of groundwater surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density. To monitor the hydraulic gradients of the hydrologic flow systems accurately, actual groundwater surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 will be measured annually.

Measured Culebra water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho y h$$

where

p = freshwater head (length of freshwater head)
y = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)
p = freshwater density (mass/volume)
h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity.

Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate groundwater surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. An SOP will be used when making water-level measurements for this program. The SOP will specify the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records.

L-4c(1)(ii) Groundwater Surface Elevation Records and Document Control

Incoming data will be processed in a manner that ensures data integrity. The data management process for groundwater surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not possible (e.g., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to applicable SOPs (see Table L-3). These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program calculates groundwater surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet program adjusts groundwater surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent

of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. Groundwater surface elevation data and equivalent freshwater heads for the Culebra wells in Table L-4 will be transmitted to NMED by May 31 and November 30. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

L-4c(2) Groundwater Sampling

L-4c(2)(i) Groundwater Pumping and Sampling Systems

The groundwater pumping and sampling systems used to collect a groundwater sample from the six DMWs will provide continuous and adequate production of water so that a representative groundwater sample can be obtained.

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The DMWs are individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down-hole submersible pumps are controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged no more than three well bore volumes or until field parameters have stabilized, whichever comes first. Well purging will performed in accordance with an SOP in conjunction with serial sampling to determine when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater.

The DMWs are cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). An electric, submersible pump installation without the use of a packer is used in this instance. The largest amount of discharge from the submersible pump takes place from a discharge pipe. In addition to this main discharge pipe, a dedicated sample line running parallel to the discharge pipe is used. The sampling line is manufactured from a chemically inert material. Cumulative flow is measured using a totalizing flow meter. Flow from the discharge pipe is routed to a discharge tank for disposal.

The dedicated sampling line is used to collect the water sample that will undergo analysis. By using a dedicated sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow through the sample collection line is regulated by a flow-control valve. The sample line is insulated at the surface to minimize temperature fluctuations.

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. Each DMW will be purged to no more three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed

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parameter are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile filed laboratory for field indicator parameters. The Permittees will provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the groundwater as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the Permittees, but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: pH, temperature, specific conductance, and specific gravity.

The three field indicator parameters of temperature, specific conductance, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a sample line at atmospheric pressure. Specific conductance and specific gravity samples will be collected from the sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the sample line.

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. Unfiltered groundwater will be used when determining temperature, pH, specific conductance, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. Temperature, pH, and specific conductance, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. Standard Operating Procedures (see Table L-3) defines the protocols for the collection of final and serial samples and analysis.

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-6 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head.

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (**DI**) water and rinsed in DI water. Sample containers will be new, certified clean containers that will be discarded after one use. Groundwater surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed in accordance with SOPs after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a rinsate blank sample will be collected to verify cleanliness.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered sampling lines. Detailed protocols, in the form of SOPs (see Table L-3) define how final samples will be collected in a consistent and repeatable fashion for analyses.

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-6). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory **SOPs**). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs generated, approved, and maintained by the contract analytical laboratory.

Final samples will be sent to the analytical laboratories and analyzed for parameters and hazardous constituents specified in Part 5, table 5.4a and 5.4b.

Duplicates of the final sample will be provided to WIPP Project oversight agencies when requested.

Wastes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3).

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated as requested by the analytical laboratory.

The analytical laboratory receiving the samples will prescribe the type and amount of preservative, the container material type, the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the

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EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses uniquely numbered chain of custody/ request for analysis (CofC/RFA) forms. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes of interest. WIPP SOPs (see Table L-3) provides instructions to ensure proper sample tracking protocol.

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3).

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking data, and CofC/RFA form. An example form is shown in Figure L-13.

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, custody seals that are adhesive-backed strips are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking

Sample tracking information will be completed for each sample collected. The sample tracking information includes the following information: CofC/RFA form number; date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

WQ6[1]C[2]R2[3]N1[4]

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document.

Chain of Custody and Request for Analysis

A CofC/RFA form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The CofC/RFA form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the CofC/RFA form. The completed original (top page) of the CofC/RFA will be returned to the Permittees with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed using methods selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b present the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall demonstrate, through laboratory SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility Operating Record. Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in groundwater and the complexity of brines associated with the Culebra groundwater.

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The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (**QC**) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. A copy of the laboratory SOPs will be maintained in WIPP facility files. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record.

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration

The equipment used to collect data for this DMP will be calibrated in accordance with SOPs. The Permittees will be responsible for calibrating needed equipment on schedule and for maintaining current calibration records for each piece of equipment.

L-4d(2) Groundwater Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking groundwater surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). The Permittees will be responsible for ensuring equipment is calibrated on schedule in accordance with SOPs. The Permittees will also be responsible for maintaining copies of records of the most recent calibration for each piece of equipment.

L-4e Statistical Analysis of Laboratory Analytical Data

Analytical data collected as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees.

L-4e(1) Temporal and Spatial Analysis

Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

L-4e(2) Distributions and Descriptive Statistics

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (**UTLV**) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

L-4e(3) Action Levels

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the methodologies specified in "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities" (EPA, 2009).

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background groundwater quality hazardous constituent specified in Part 5, Table L-5.4b at every detection monitoring well during each of the ten background sampling events (with the exception of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed disposal began). These measurements serve as a statistical baseline (Part 5, Table 5.6) that is used for evaluating the significance of the results of subsequent sampling events during detection monitoring. Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)(4)). If the comparisons show that a constituent statistically exceeds the baseline of the DMWs (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)). The results of the statistical comparison will be reported annually to the NMED in the Annual Culebra Groundwater Report by November 30, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)).

L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality

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checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.

- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.

- Parameter and hazardous constituents, analytical results, reporting units, reporting limit, analytical method used.

- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specified in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from annual groundwater sampling activities will be compared and interpreted by the Permittees through generation of statistical analyses as specified in Section L-4e. The Permittees will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra Groundwater Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report. The report will include all applicable information that may affect the comparison of background groundwater quality and groundwater surface elevation data through time. This information will include but is not limited to:

- DMW and WLMP well configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).

- Pumping activities that may have taken place since publication of the last annual report (i.e., related to groundwater quality sampling, hydraulic testing, and shaft installation or grouting) that may have taken place since the last annual groundwater report.

- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

- The results of the annual measurements of densities.

- Annotated hydrographs.
- Groundwater flow rate and direction.
- Potentiometric surface map generated using the following steps:
  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.
  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.
  - Fit trend surface through freshwater heads.
  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (**PABCs**) and define initial fixed-head boundary conditions based on the trend surface.
  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.
  - Run MODFLOW with optimal boundary conditions fit.
  - Contour MODFLOW head results on WIPP site.
  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.
  - Data analysis that will accompany the potentiometric surface map will include:
    - Measured versus modeled scatter plot diagram
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).
- Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2.

The DMP data used in generating the Annual Culebra Groundwater Report will be maintained as part of the WIPP facility Operating Record and will be provided to NMED for review as specified in the permit.

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L-6 Records Management

Records generated during groundwater sampling and water level monitoring will be maintained in either project files at the Permittees facility or the Operating Record. Project files will include, but are not limited to:

- Sampling and Analysis Plans (**SAPs**)
- SOPs
- Field Data Entry Sheets
- CofC/RFA forms
- Analytical Laboratory Data Reports
- Variance Logs and Nonconformance Reports
- Corrective Action Reports.

Detection Monitoring Program monitoring, testing, and analytical data and WLMP data will be maintained in the WIPP facility Operating Record.

L-7 Quality Assurance Requirements

Quality Assurance (**QA**) requirements specific to the DMP are presented in this section.

L-7a Data Quality Objectives and Quality Assurance Objectives

L-7a(1) Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support project decisions. DQOs have been established to ensure that the data collected will be of a sufficient and known quality for their intended uses. The overall DQOs for this DMP are shown in the following sections.

L-7a(1)(i) Detection Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the groundwater underlying the WIPP facility.

L-7a(1)(ii) Water Level Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility.

L-7a(2) Quality Assurance Objectives

Quality Assurance Objectives (**QAOs**) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability.

L-7a(2)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-7a(2)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (SC), temperature, specific gravity and static groundwater surface elevation. Field measurement accuracy will be determined using calibration check standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ensure accuracy. Accuracy of groundwater surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs contains instructions that outline protocols for maintaining current calibration of groundwater surface elevation measurement instrumentation.

L-7a(2)(i)(B) Accuracy Objectives for Laboratory Measurements

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-7a(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)|}{average\ of\ measured\ samples\ 1+2} \times 100$$

L-7a(2)(ii)(A) Precision Objectives for Field Measurements

Specific conductance, pH, and temperature will be measured during well purging and after sampling. SC measurements will be precise to ±10% pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer and temperature to 0.10 degrees Celsius (°C). Water-level measurements will be precise to ± 0.01 ft. The precision of water density measurements, when measured in the

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field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than a ± 2 ft of error in the derived fresh-water head.

L-7a(2)(ii)(B) Precision Objectives for Laboratory Measurements

Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (**LCSD**) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results. Laboratory analytical precision is also parameter dependent and will be prescribed in laboratory SOPs.

L-7a(2)(iii) Contamination

In addition to measurements of precision and bias, QC checks for contamination will be performed. QC samples including trip blanks, field blanks, and method blanks will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents and glassware. Trip blanks will be used to assess volatile organic compound (**VOC**) sample contamination during shipment and handling and will be collected and analyzed at a frequency of 1 sample per sample shipment. Field blanks will be used to assess field sample collection methods and will be collected and analyzed at a minimum frequency of one sample per 20 samples (five percent of the samples collected). Method blanks will be used to assess contamination resulting from the analytical process and will be analyzed at a minimum frequency of one sample per 20 samples, or five percent of the samples collected. Evaluation of sample blanks will be performed following U.S. EPA "National Functional Guidelines for Organic Data Review" (EPA, 1999) and "National Functional Guidelines for Evaluating Inorganics Analyses" (EPA, 2004). Only method blanks will be analyzed via wet chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed method reporting limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in method blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

L-7a(2)(iv) Completeness

Completeness is a measure of the amount of usable valid data resulting from a data collection activity, given the sample design and analysis. Completeness may be affected by unexpected conditions that may occur during the data collection process.

Occurrences that reduce the amount of data collected include sample container breakage during sample shipment or in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for analysis of Part 5, Table 5.4a parameters will be 90 percent and 100 percent analysis of Part 5, Table 5.4.b hazardous constituents. If the completeness objective for Part 5 Table 5.4.b hazardous constituents is not met, the Permittees will determine the need for resampling on a case-by-case basis. Numerical expression of the completeness (**%C**) of data is as follows:

$$\%C = \frac{number\ of\ accepted\ samples}{total\ number\ of\ samples\ collected} \times 100$$

L-7a(2)(v) Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this DMP will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures will be designed to minimize factors affecting the integrity of the samples. Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected will be those that will most accurately and precisely represent the true concentration of analytes of interest.

For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions.

L-7a(2)(vi) Comparability

Comparability is the extent to which one data set can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measures dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (µg/L) for VOCs and semivolatile organic compounds (**SVOC**s).

Culebra groundwater surface elevation measurements will be expressed as equivalent freshwater elevation in feet above mean sea level.

L-7b Design Control

The approved design for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §§ 270.42).

L-7c Instructions, Procedures, and Drawings

The preparation and use of instructions and procedures at the WIPP facility are outlined in the WIPP facility document WP 13-1(see Table L-3). Activities performed for the DMP that may affect groundwater data quality will be performed in accordance with approved procedures which comply with the Permit.

L-7d Document Control

Permittees will ensure that the latest approved versions of WIPP facility SOPs will be used in performing groundwater monitoring functions and that obsolete materials will be adequately identified or removed from work areas.

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L-7e Inspection and Surveillance

Inspection and surveillance activities will be conducted as outlined in WIPP document WP 13-1 (see Table L-3). The Permittees will be responsible for performing the applicable WIPP facility SOPs.

L-7f Control of Monitoring and Data Collection Equipment

WIPP document WP 13-1 (see Table L-3) outlines the basic requirements for control and calibrating monitoring and data collection (**M&DC**) equipment. M&DC equipment shall be properly controlled, calibrated, and maintained according to WIPP facility SOPs (see Table L-3) to ensure continued accuracy of groundwater monitoring data. Results of calibrations, maintenance, and repair will be documented. Calibration records will identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records will be maintained to track uses of M&DC equipment. If M&DC equipment is found to be out of tolerance, the equipment will be tagged and it will not be used until corrections are made.

L-7g Control of Nonconforming Conditions

In accordance with WP 13-1 (see Table L-3), equipment that does not conform to specified requirements will be controlled to prevent use. The disposition of defective items will be documented on records traceable to the affected items. Prior to final disposition, faulty items will be tagged and segregated. Repaired equipment will be subject to the original acceptance inspections and tests prior to use.

L-7h Corrective Action

Requirements for the development and implementation of a system to determine, document, and initiate appropriate corrective actions after encountering conditions adverse to quality at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). Conditions adverse to acceptable quality will be documented and reported in accordance with corrective action procedures and corrected as soon as practical. Immediate action will be taken to control work performed under conditions adverse to acceptable quality and its results to prevent quality degradation.

L-7i Quality Assurance Records

WIPP document WP 13-1(see Table L-3) outlines the policy that will be used at the WIPP facility regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records.

Records to be generated in the DMP will be specified by procedure. QA and RCRA operating records will be identified. This will be the basis for the labeling of records as "QA" or "RCRA operating record" on the Environmental Monitoring Records Inventory and Disposition Schedule.

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L-8 References

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TABLES

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Table L-1
Hydrological Parameters for Rock Units above the Salado at WIPP

Unit		Hydraulic Conductivity	Storage	Thickness	Hydraulic Gradient
Santa Rosa		2×10^{-8} to 2×10^{-6} m/s (1) (2)		0 to 91 m	0.001 (5)
Dewey Lake		10^{-8} m/s	Specific storage 1×10^{-5} (1/m) (2)	152 m	0.001 (5)
Rustler	Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	13 to 23 m	NA (6)
	Magenta	$1 \times 10^{-8.5}$ to $1 \times 10^{-6.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	7 to 8.5 m	3 to 6
	Tamarisk	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	26 to 56 m	NA (6)
	Culebra	$1 \times 10^{-7.5}$ to $1 \times 10^{-5.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	4 to 11.6 m	0.003 to 0.007 (5)
	Los Medaños	6×10^{-15} to 1×10^{-13} m/s 1.5×10^{-11} to 1.2×10^{-11} m/s (basal interval)	Specific storage 1×10^{-5} (1/m) (2)	29 to 38 m	NA (6)

Matrix characteristics relevant to fluid flow include values used in this table such as permeability, hydraulic conductivity, gradient, etc.)

Table Notes:

(1) The Santa Rosa Formation is not present in the western portion of the WIPP site. It was combined with the Dewey Lake Red Beds in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996), and the range of values entered here are those used in that study for the Dewey Lake/Triassic hydrostratigraphic unit.

(2) Values or ranges of values given for these entries are the values used in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996). Values are estimated based on literature values for similar rock types, adjusted to be consistent with site-specific data where available. Ranges of values include spatial variation over the WIPP site and differences in values used in different simulations to test model sensitivity to the parameter.

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(3) Hydraulic gradient is a dimensionless term describing change in the elevation of hydraulic head divided by change in horizontal distance. Values given in these entries are determined from potentiometric surfaces. The range of values given for the Culebra reflects the highest and lowest gradients observed within the WIPP site boundary. Values for the Dewey Lake and Santa Rosa are assumed to be the same as the gradient determined from the water table. Note that the Santa Rosa Formation is absent or above the water table in most of the controlled area, and that the concept of a horizontal hydraulic gradient is not meaningful for these regions.

(4) Flow in units of very low hydraulic conductivity is slow, and primarily vertical. The concept of a horizontal hydraulic gradient is not applicable.

Sources: Beauheim, 1986; Domenico and Schwartz, 1990; Domski, Upton, and Beauheim, 1996; Earlough, 1977.

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Table L-2
WIPP Groundwater Detection Monitoring Program Sample Collection and Groundwater Surface Elevation Measurement Frequency

Installation	Frequency
Groundwater Quality Sampling	
DMWs	Annually
Groundwater Surface Elevation Monitoring	
DMWs	Monthly and prior to sampling events
WLMP Wells (see Table L-4)	Monthly

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1
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Table L-3
Standard Operating Procedures Applicable to the DMP

Number	Title/Description
WP 02-EM1005	Groundwater Serial Sample Analysis: This procedure provides general instructions necessary to perform field analyses of serial samples in support of the DMP. Serial samples are collected and analyzed at the field laboratory for field indicators. Serial sample results help determine if pumped groundwater is representative of undisturbed groundwater within the formation.
WP 02-EM1006	Final and Serial Sample Collection: This procedure describes the steps for collecting groundwater samples from the DMWs near the WIPP facility. Serial samples are collected and analyzed at the Field Laboratory until stabilization of the field parameters occurs. Final samples for Resource Conservation and Recovery Act (RCRA) analyses are collected and analyzed by a contract laboratory.
WP 02-EM1014	Groundwater Level Measurement: This document describes the method used for groundwater level measurements in support of groundwater monitoring at the WIPP facility using a portable electronic water-level probe.
WP 02-EM1021	Pressure Density Survey: This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at non-detection monitoring wells. Because most pressure densities are obtained by Sandia National Laboratories via pressure transducers installed in wells, this procedure is used to obtain pressure densities at wells not equipped with fixed transducers.
WP 02-EM1026	Water Level Data Handling and Reporting: This procedure provides instructions on handling water level data. Data are collected and recorded on field forms in accordance with WP 02-EM1014. This procedure is initiated when wells in the water surveillance program have been measured for a given month.
WP 02-EM3001	Administrative Processes for Environmental Monitoring and Hydrology Programs: This procedure provides the administrative guidance environmental monitoring personnel use to maintain quality control associated with environmental monitoring sampling and reporting activities. This administrative procedure does not pertain to volatile organic compound (VOC) monitoring, with the exception of Section 5.0 which pertains to the regulatory reporting review process.
WP 02-EM3003	Data Validation and Verification of RCRA Constituents: This procedure provides instructions on performing verification and validation of laboratory data containing the analytical results of groundwater monitoring samples. This procedure is applied only to the non-radiological analyses results for compliance data associated with the detection monitoring samples. The data reviewed for this procedure includes general chemistry parameters and RCRA constituents.
WP-02-RC.01	Hazardous and Universal Waste Management Plan: This plan describes the responsibilities and handling requirements for hazardous and universal wastes generated at the WIPP facility. It is meant to ensure that these wastes are properly handled, accumulated, and transported to an approved Treatment, Storage, Disposal Facility (TSDF) in accordance with applicable state and federal regulations, U.S. Department of Energy (DOE) Orders, and Washington TRU Solutions LLC (WTS) policies and procedures. This plan implements applicable sections of 20.4.1.100-1102 New Mexico Administrative Code (NMAC), *Hazardous Waste Management* (incorporating 40 *Code of Federal Regulations* [CFR] Parts 260-268 and 273).
WP 10-AD3029	Calibration and Control of Monitoring and Data Collection Equipment: This procedure provides direction for the control and calibration of Monitoring and Data Collection (M&DC) equipment at the WIPP facility, and ensures traceability to NIST (National Institute of Standards and Technology) standards, international standards, or intrinsic standards. This procedure also establishes requirements and responsibilities for identifying recall equipment, and for obtaining calibration services for WIPP facility M&DC equipment.
WP 13-1	Washington TRU Solutions LLC Quality Assurance Program Description: This document establishes the minimum quality requirements for Management and Operating Contractor (**MOC**) personnel and guidance for the development and implementation of QA programs by MOC

01241

Number	Title/Description
	organizations.

1

2

Table L-4
January 2011 Culebra WLMP

WELL ID	WELL ID	WELL ID
AEC-7	H-17	SNL-15
C-2737	H-19 pad*	SNL-16
ERDA-9	I-461	SNL-17
H-02b2	SNL-01	SNL-18
H-03b2	SNL-02	SNL-19
H-04bR	SNL-03	WQSP-1
H-05b	SNL-05	WQSP-2
H-06bR	SNL-06	WQSP-3
H-07b1	SNL-08	WQSP-4
H-9bR	SNL-09	WQSP-5
H-10c	SNL-10	WQSP-6
H-11b4	SNL-12	WIPP-11
H-12	SNL-13	WIPP-13
H-15R	SNL-14	WIPP-19
H-16		

*H-19b0 monthly

01213

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 through 16, 1994	737 (225)	15 (5)	696 (212)	696 to 737 (212 to 225)	737 (225)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 225)	699 to 722 (213 to 220)
WQSP-2 Figure L-8	September 6 through 12, 1994	846 (258)	12 (4)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.1 to 833.7 (247 to 254)
WQSP-3 Figure L-9	October 20 through 26, 1994	880 (268)	10 (3)	833 (254)	833 to 880 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 through 10, 1994,	800 (244)	9 (3)	740 (226)	740 to 798 (226 to 243)	800 (244)	764 to 789 (233 to 240)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 through 18, 1994,	681 (208)	7 (2)	648 (198)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205)
WQSP-6 Figure L-12	September 26 through October 3, 1994	616.6 (188)	10 (3)	568 (173)	568 to 617 (173 to 188)	617 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 174)	570 to 616.6 (174 to 188)	582 to 606.9 (177 to 185)

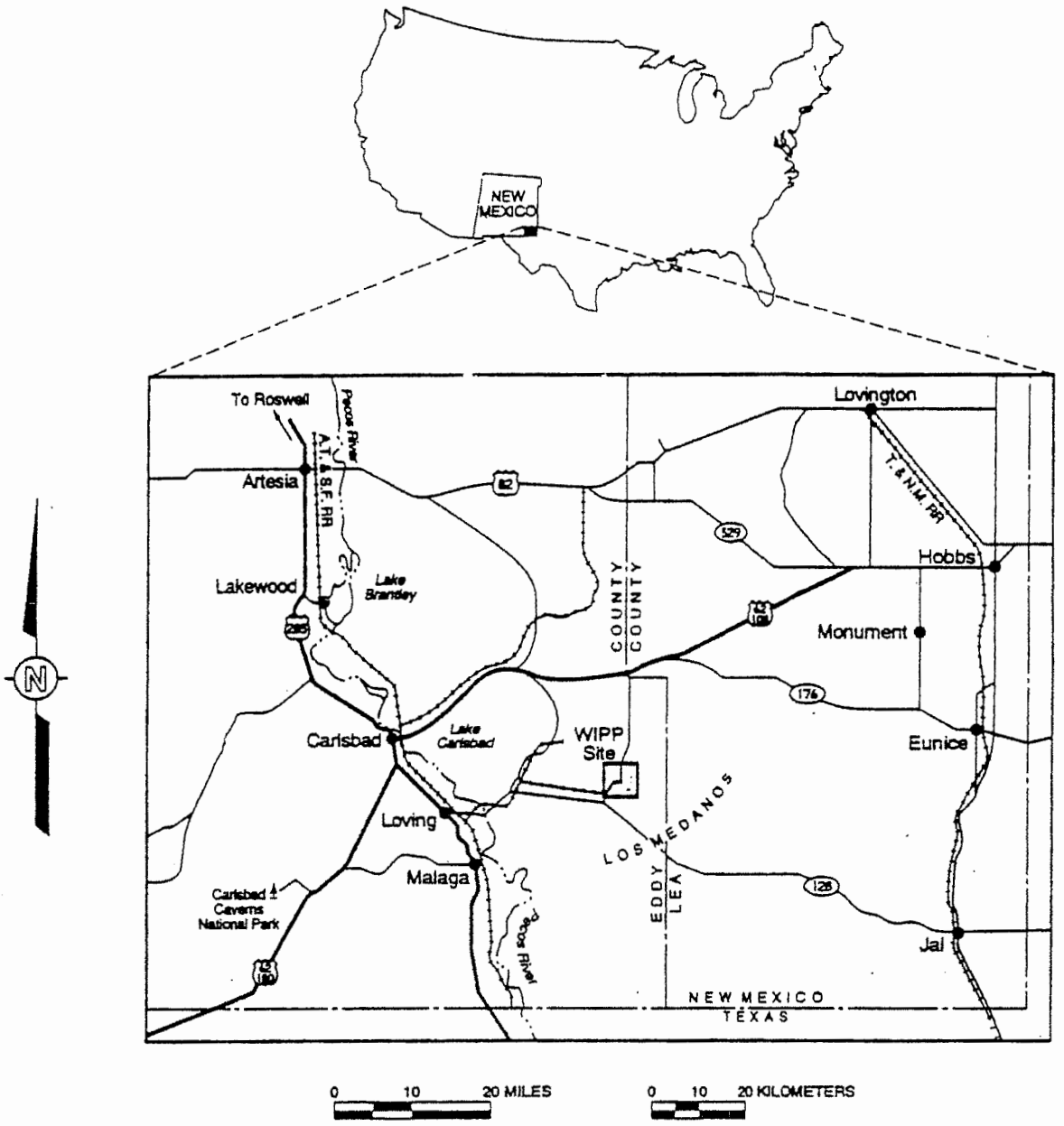

Figure L-1
General Location of the WIPP Facility

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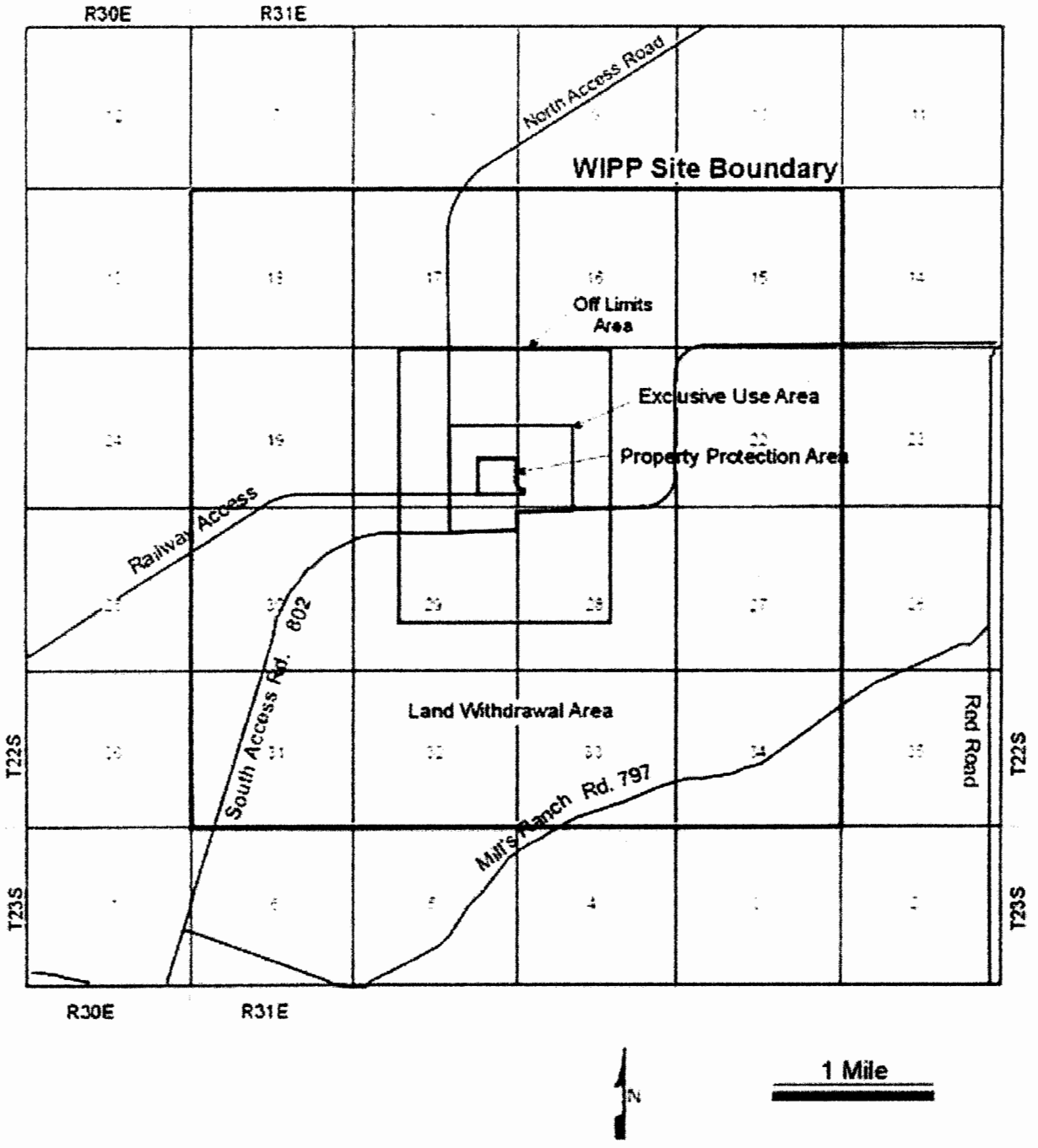

Figure L-2
WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary

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SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		DEWEY LAKE	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

Figure L-3
Site Geologic Column

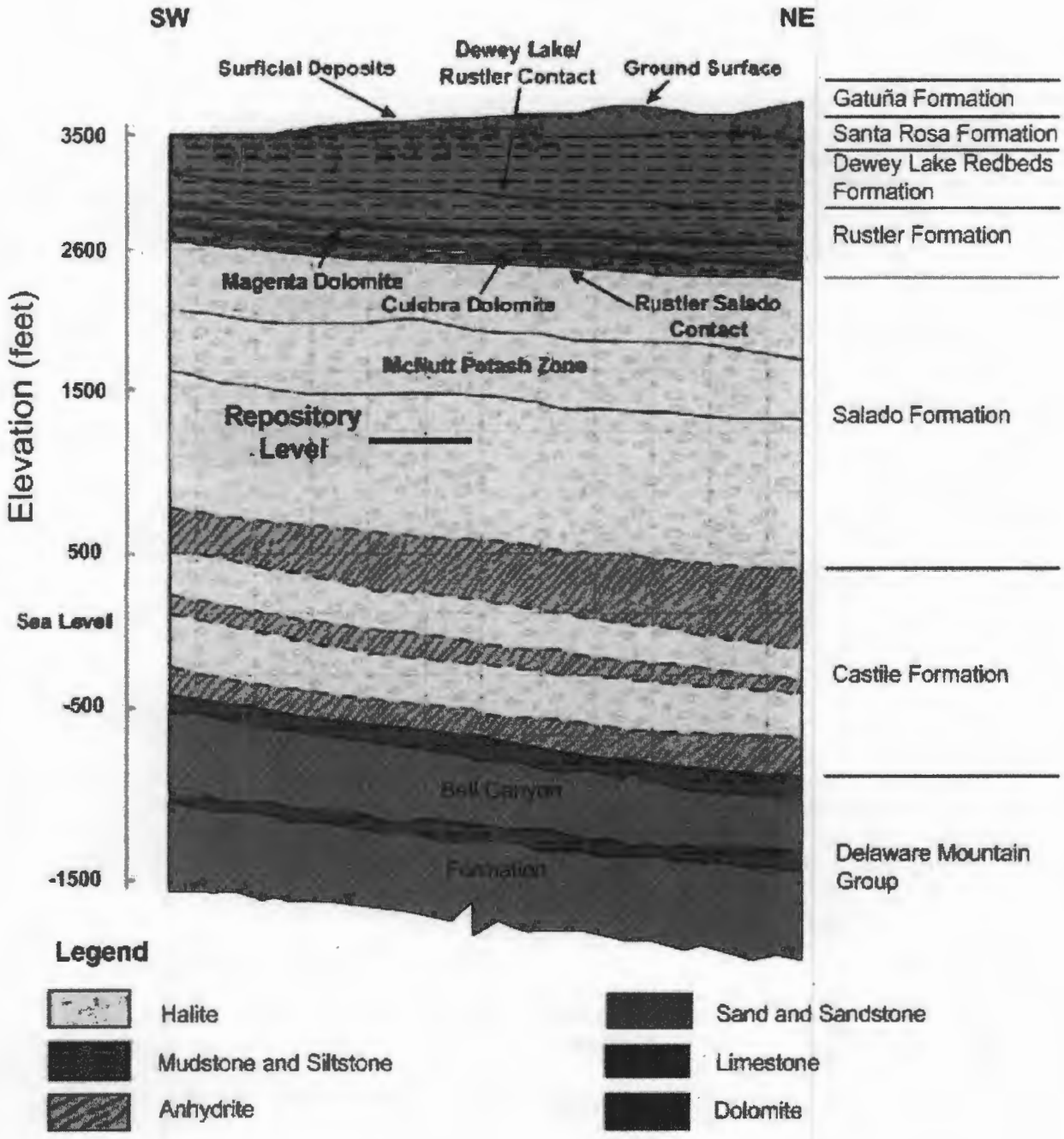


Figure L-4
Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site

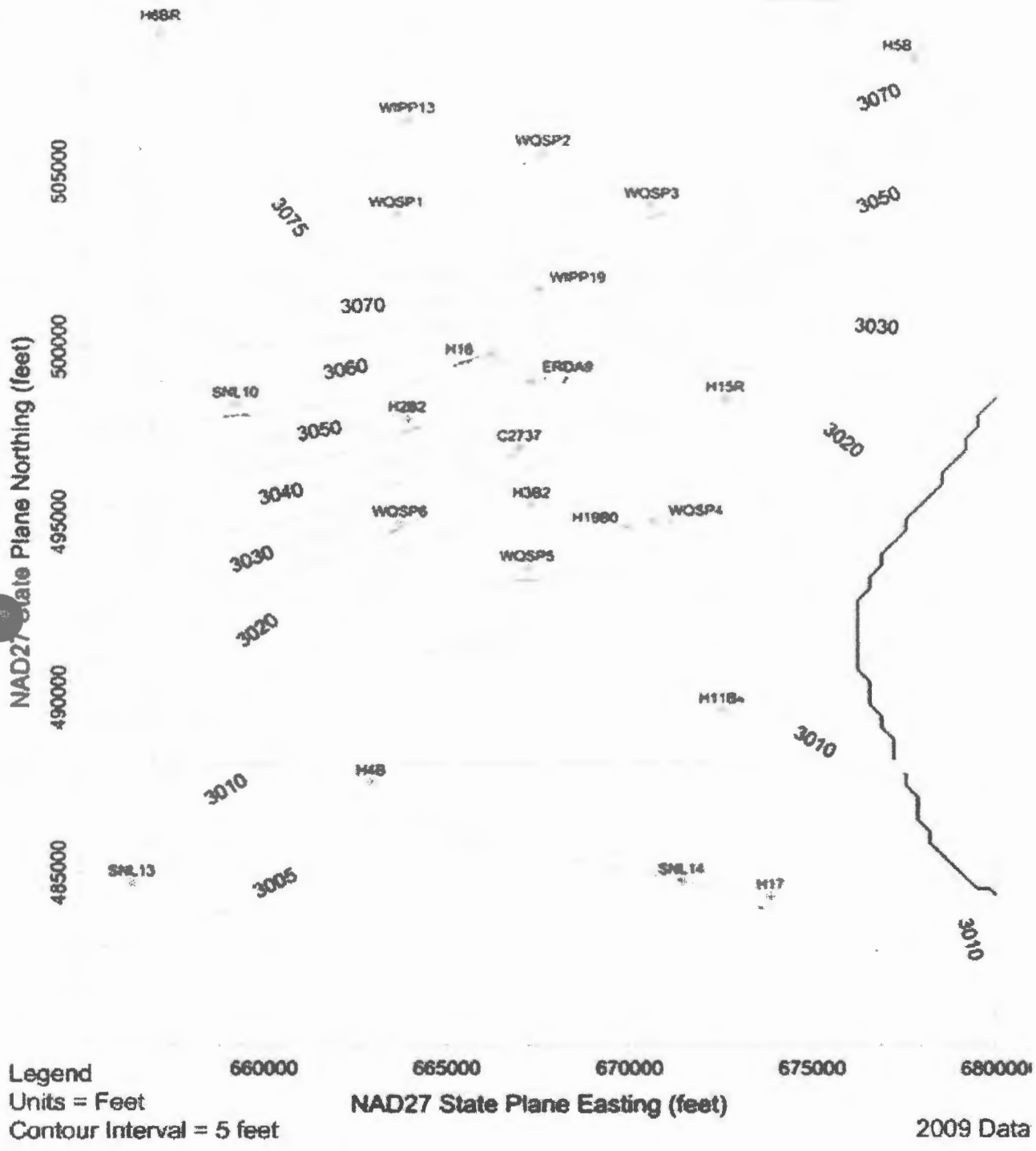
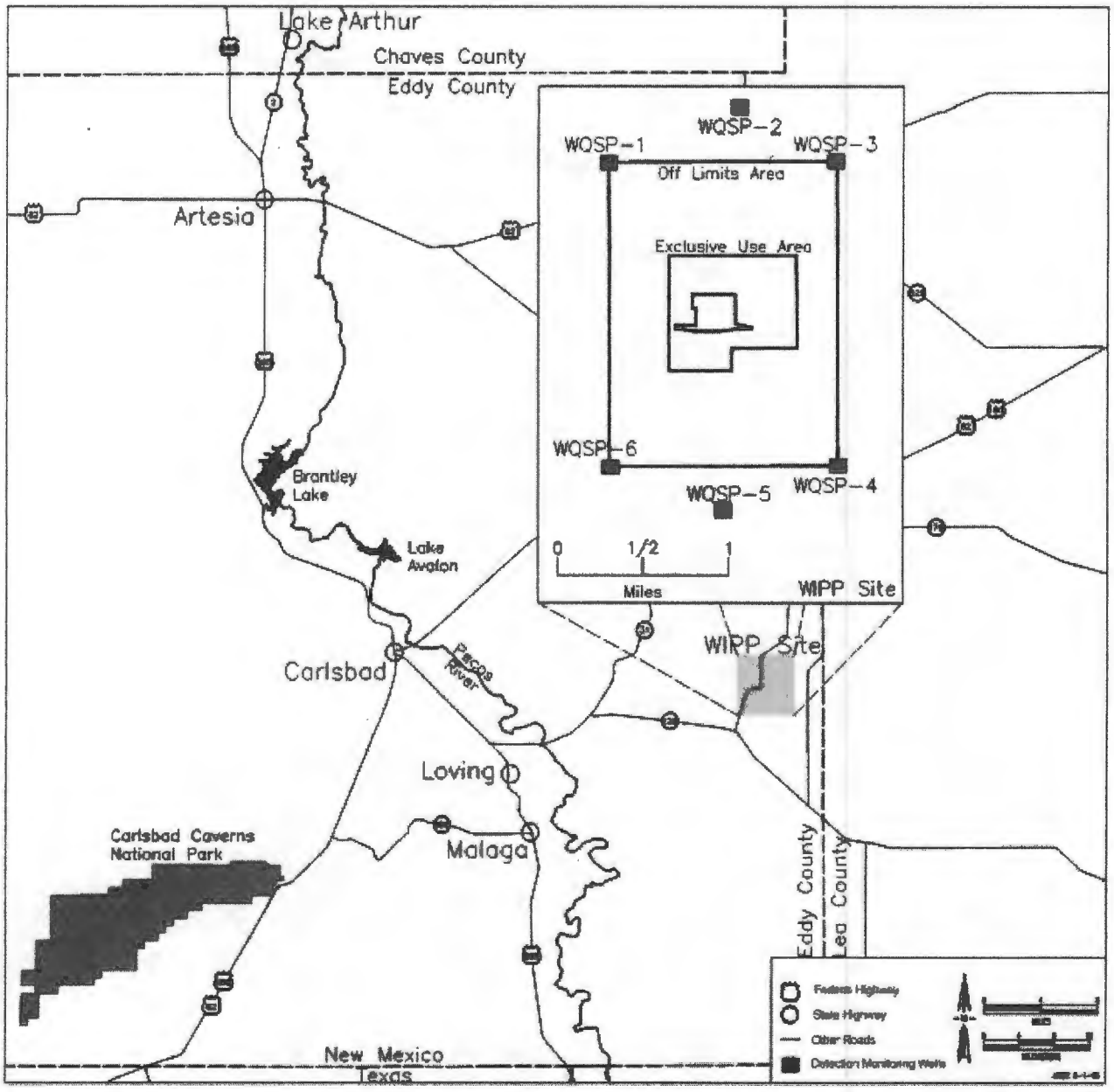


Figure L-5
Culebra Freshwater-Head Potentiometric Surface



NOTE: Point of compliance is defined in Part 5.3.1.

Figure L-6
Detection Monitoring Well Locations

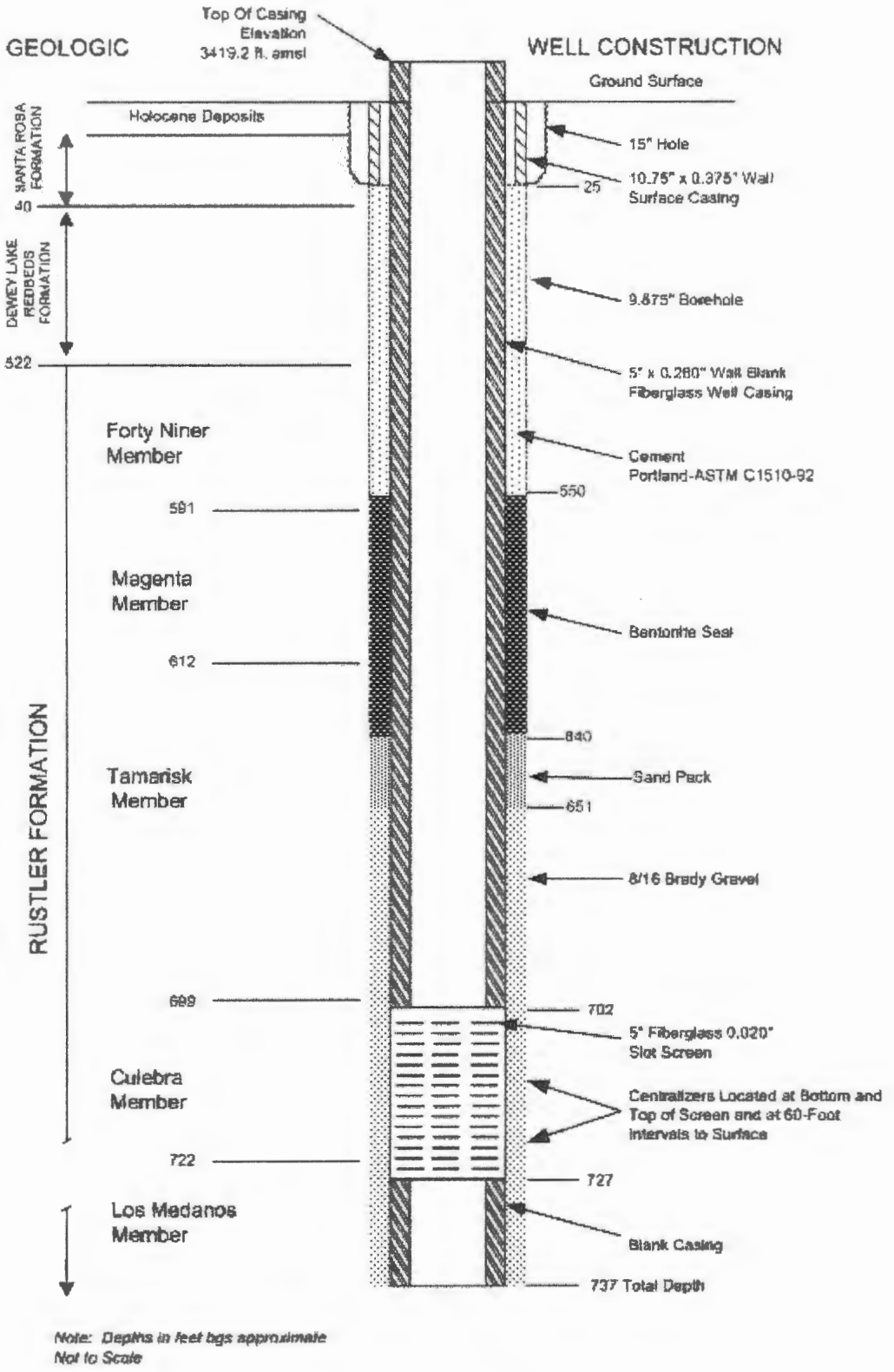


Figure L-7
As-Built Configuration of Well WQSP-1

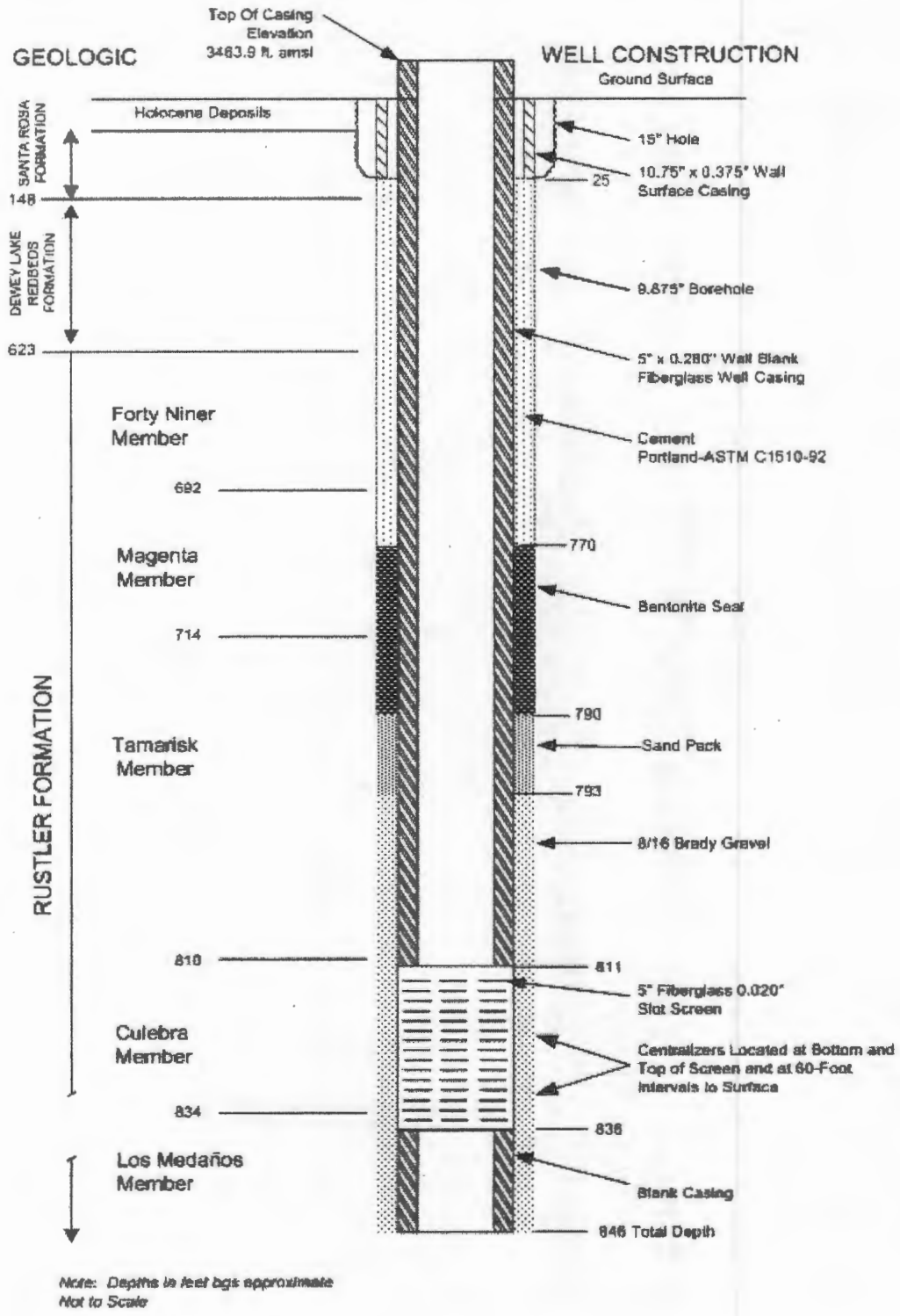


Figure L-8
As-Built Configuration of Well WQSP-2

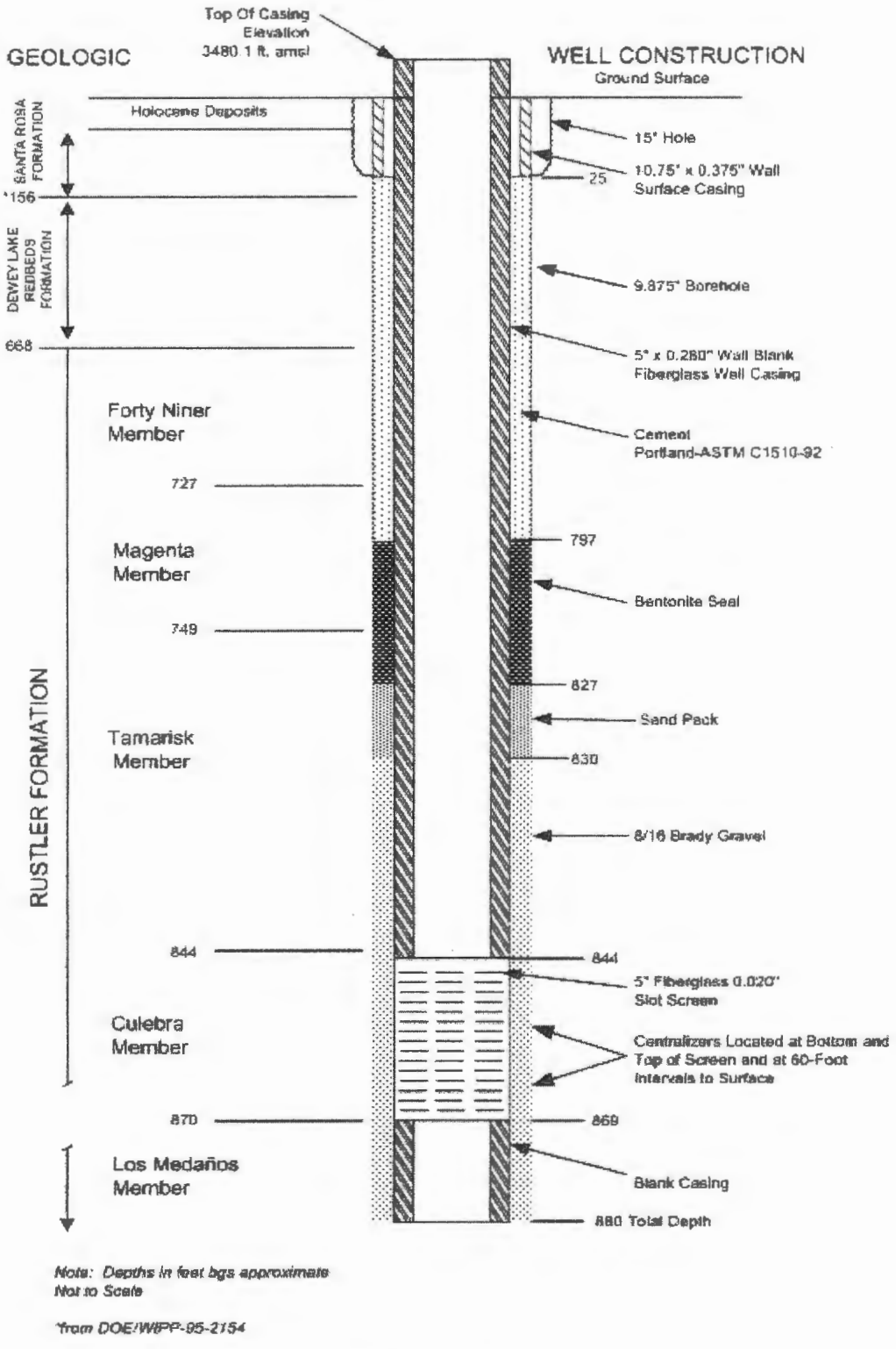


Figure L-9
As-Built Configuration of Well WQSP-3

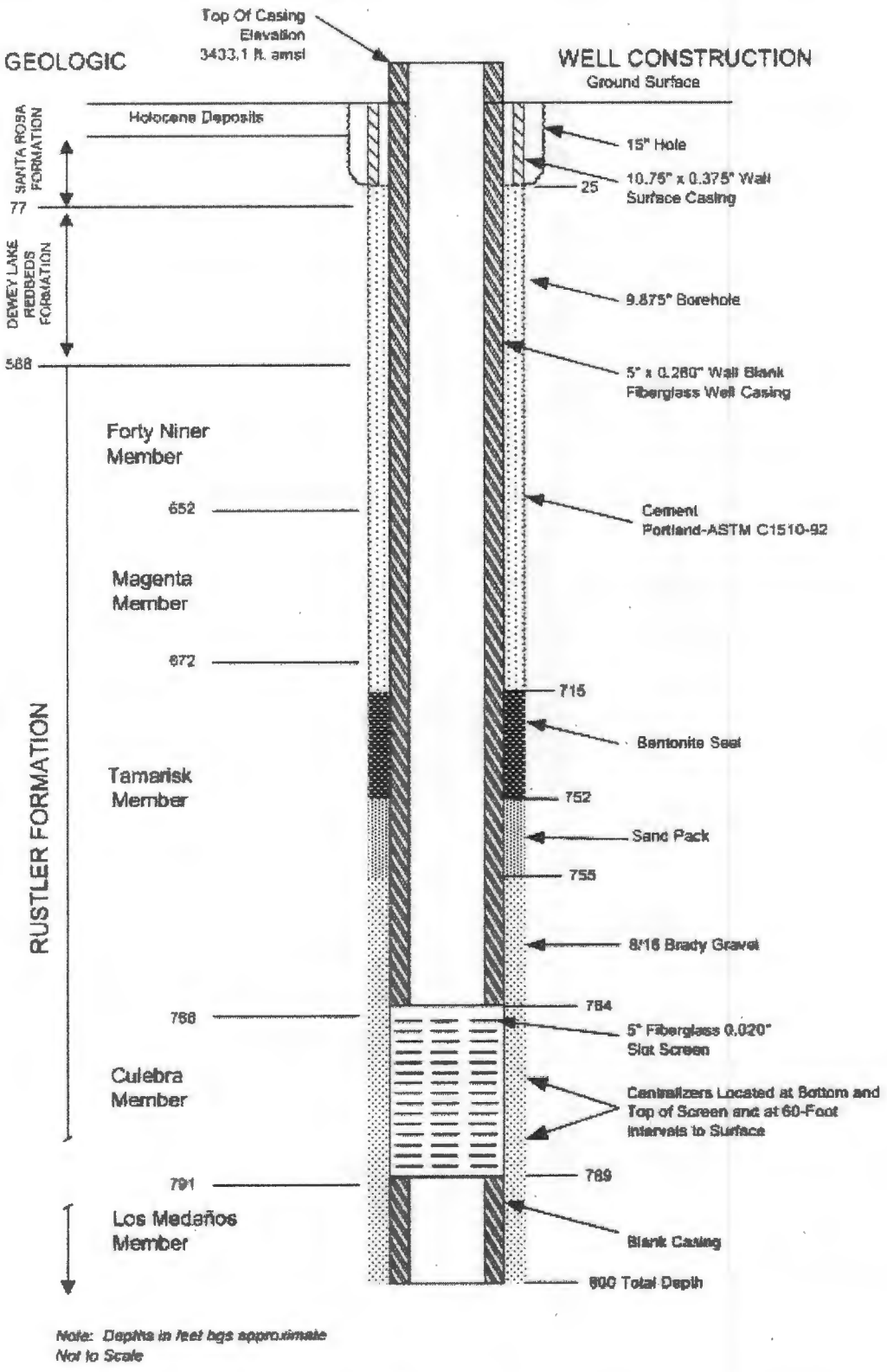


Figure L-10
As-Built Configuration of Well WQSP-4

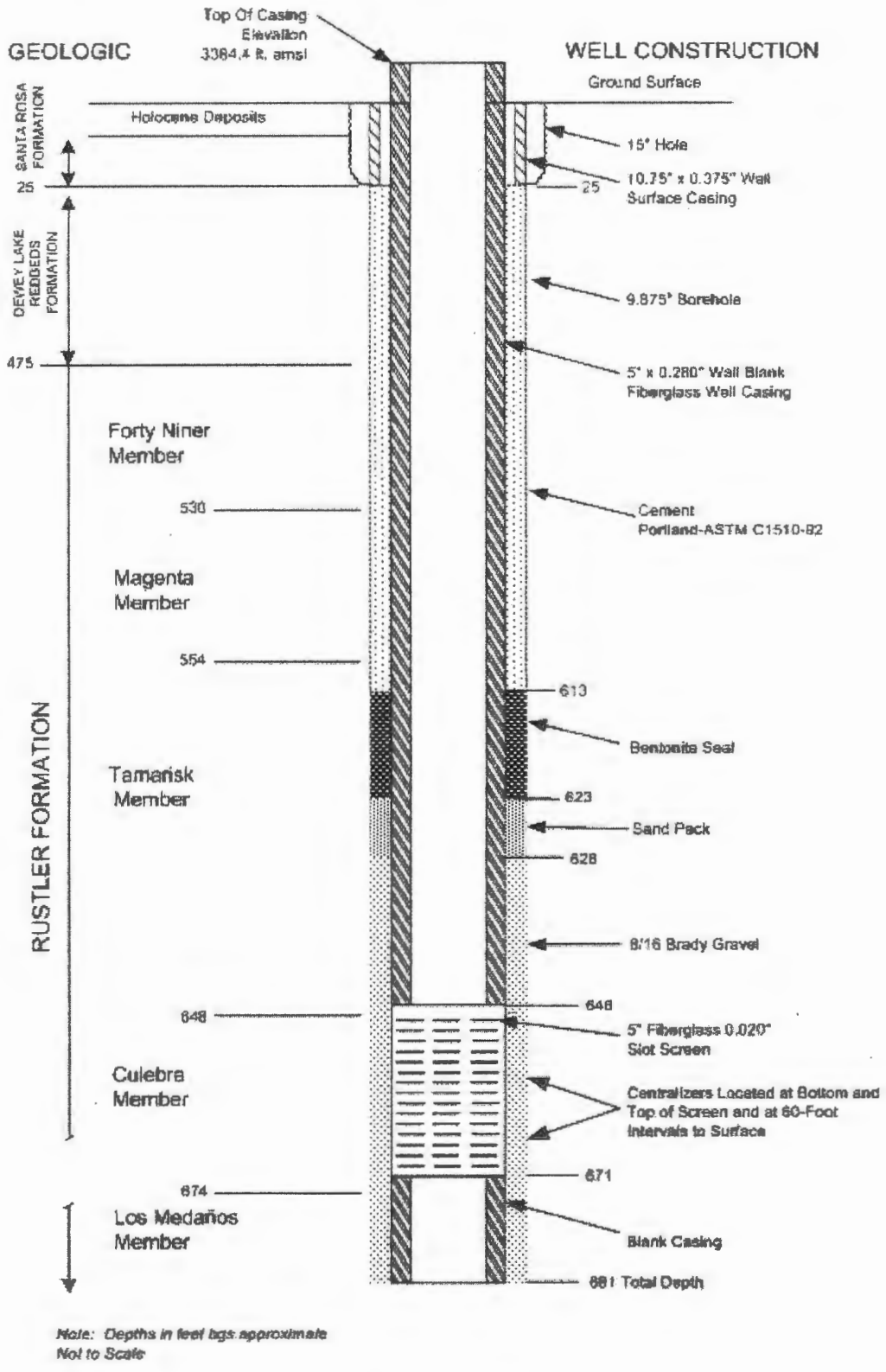


Figure L-11
As-Built Configuration of Well WQSP-5

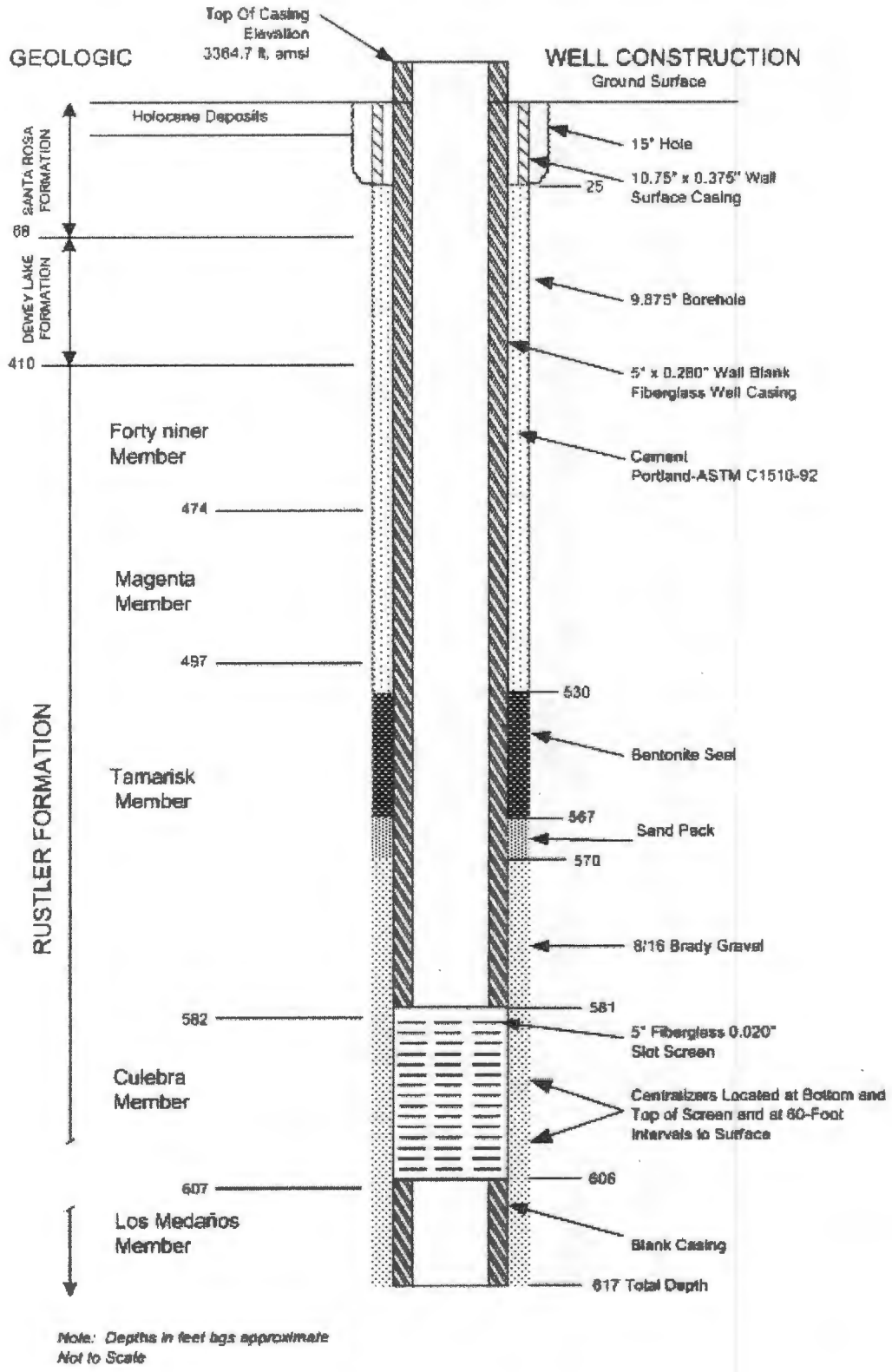


Figure L-12
As-Built Configuration of Well WQSP-6

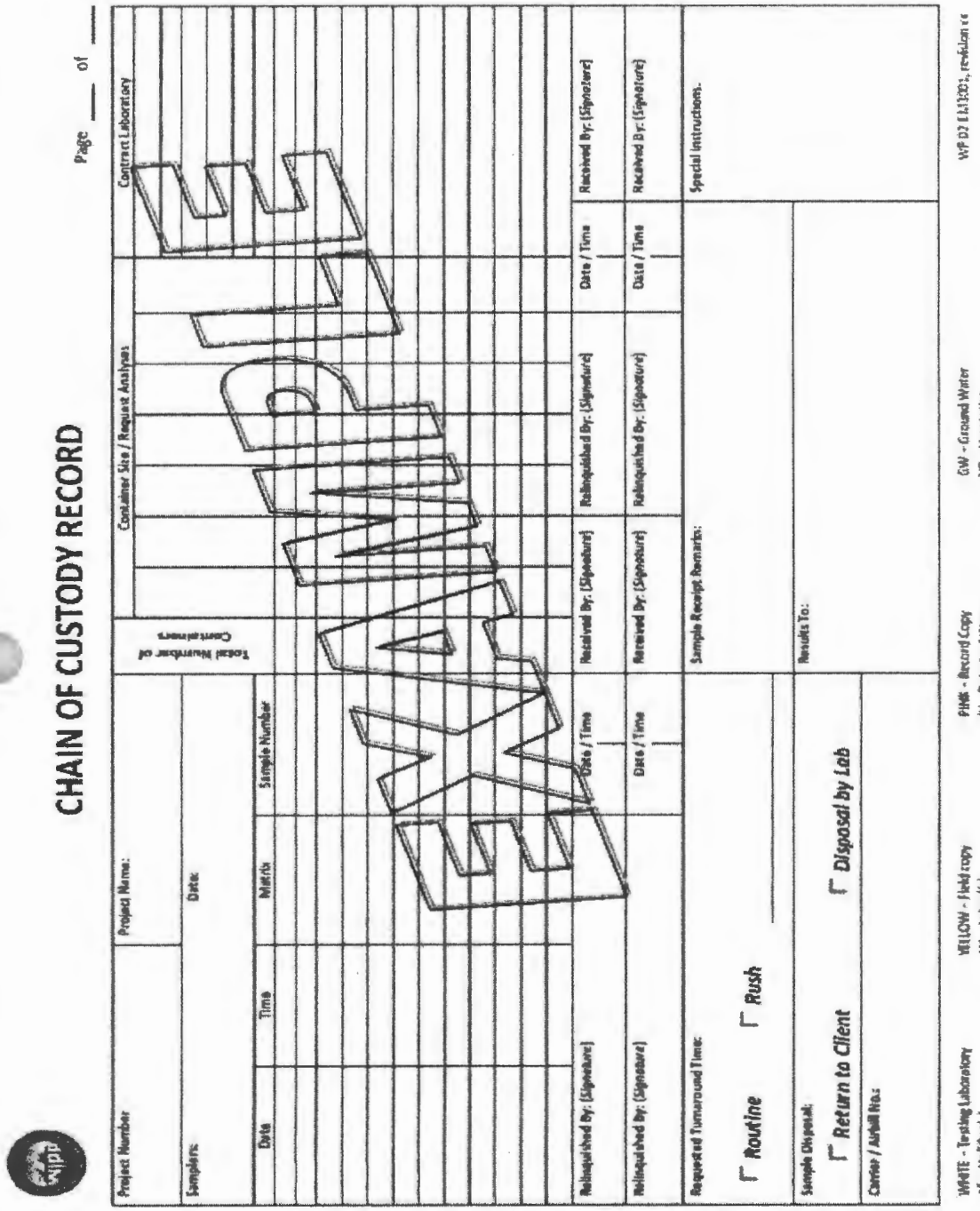


Figure L-13
Example Chain-of-Custody/Request for Analysis Form

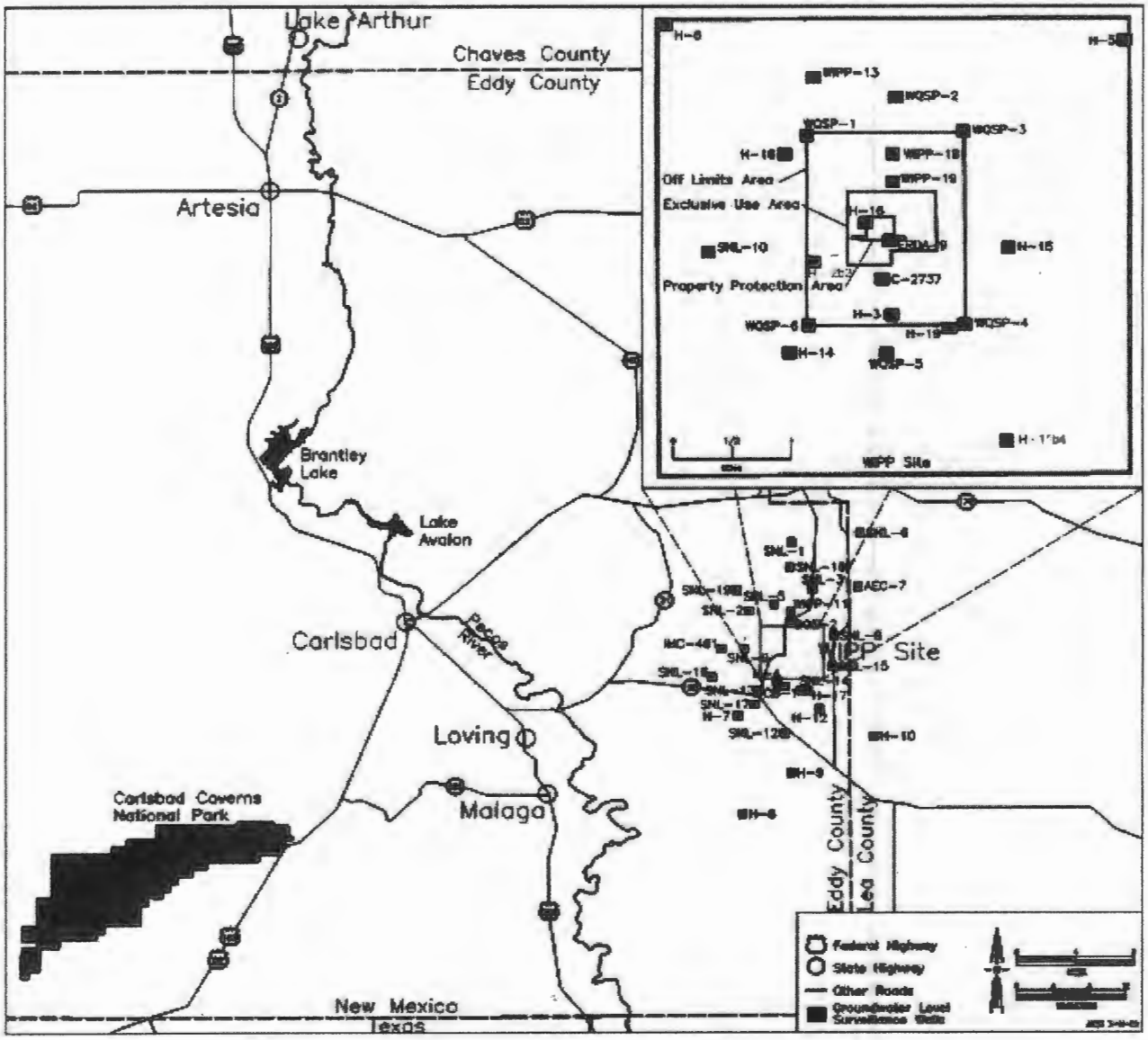


Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

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Field Code Changed

ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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N1-5b Sample Tubing 2
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Figure N1-5	Logic Diagram for Evaluating Sample Line Loss

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ATTACHMENT N1

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N1-1 Introduction

This Permit Attachment describes the monitoring plan for hydrogen and methane generated in Underground Hazardous Waste Disposal Units (**HWDUs**) 3 through 8, also referred to as Panels 3 through 8.

Monitoring for hydrogen and methane in Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed, may be an effective way to gather data to establish realistic gas generation rates. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N1-2 Parameters to be Analyzed and Monitoring Design

The Permittees will monitor for hydrogen and methane in filled Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed. A "filled panel" is an Underground HWDU that will no longer receive waste for emplacement.

Monitoring of a filled panel will commence after installation of the following items in each filled panel:

- substantial barriers
- bulkheads
- five additional monitoring locations.

The substantial barriers serve to protect the waste from events such as ground movement or vehicle impacts. The substantial barrier will be constructed from available non-flammable materials such as mined salt (Figure N1-1).

The bulkheads (Figure N1-2) serves to block ventilation at the intake and exhaust of the filled panel and prevent personnel access. The bulkhead is constructed as a typical WIPP bulkhead with no access doors or panels. The bulkhead will consist of a steel member frame covered with galvanized sheet metal, and will not allow personnel access. Flexible flashing will be used as a gasket to attach the steel frame to the salt, thereby providing an effective yet flexible blockage to ventilation air. Over time, it is possible that the bulkhead may be damaged by creep closure around it. If the damage is such as to indicate a possible loss of functionality, then the bulkhead will be repaired or an additional bulkhead will be constructed outside of the original one.

The existing VOC monitoring lines as specified in Attachment N, Section N-3a(2), "Sampling Locations for Disposal Room VOC Monitoring", will be used for sample collection in each disposal room for Panels 3 and 4. The sample lines and their construction are shown in Figure N1-3. In addition to the existing VOC monitoring lines, five more sampling locations will be used to monitor for hydrogen and methane. These additional locations include:

- the intake of room 1
- the waste side of the exhaust bulkhead,

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- the accessible side of the exhaust bulkhead,
- the waste side of the intake bulkhead,
- the accessible side of the intake bulkhead.

These additional sampling locations (Figure N1-4) will use a single inlet sampling point placed near the back (roof) of the panel access drifts. This will maximize the sampling efficiency for these lighter compounds.

N1-3 Sampling Frequency

Sampling frequency will vary depending upon the levels of hydrogen and methane that are detected.

- If monitored concentrations are at or below Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted monthly.

- If monitored concentrations exceed Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted weekly in the affected filled panel.

N1-4 Sampling

Samples for hydrogen and methane will be collected using subatmospheric pressure grab sampling as described in Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling method uses passivated stainless-steel sample canisters to collect integrated air samples at each sample location. Flow rates and sampling duration may be modified as necessary to meet data quality objectives.

Sample lines shall be purged prior to sample collection.

N1-5 Sampling Equipment

N1-5a SUMMA® Canisters

Stainless-steel canisters with passivated or equivalent interior surfaces will be used to collect and store gas samples for hydrogen and methane analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use in a manner similar to that described by Compendium Method TO-15 (EPA, 1999). The vacuum of certified clean canisters will be verified upon initiation of a sample cycle. Sampling will be conducted using subatmospheric pressure grab sampling techniques as described in TO-15.

N1-5b Sample Tubing

Treated stainless steel tubing shall be used as a sample path and treatment shall prevent the inner walls from absorbing contaminants.

Any loss of the ability to purge a sample line will be evaluated. The criteria used for evaluation are shown in Figure N1-5.

The Permittees will first suspect that a line is not useable when it is purged prior to sampling. If the line cannot be purged, then it will not be used for sampling unless the line is a bulkhead line

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that can be easily replaced. Replacement of bulkhead lines will occur before the next scheduled sample. Non-bulkhead lines will be evaluated by first determining if adjacent sampling lines are working. If the answer is no, then the previous sample from the failed line will be examined. If the previous sample was between the first and second action levels, then the explosion-isolation wall will be installed since without the ability to monitor it is unknown whether the area is approaching the second action level or decreasing. If the previous sample was below the first action level then continued sampling is acceptable without the lost sample.

If an adjacent line is working, the prior concentrations measured in that line will be evaluated to determine if it is statistically similar to the prior measurements from the lost line. If the prior sampling results are statistically similar, the lines can be grouped. Statistical similarity will be determined using the Student's "t" test to evaluate differences.

The magnitude of *t* will be compared to the critical *t* value from SW-846, Table 9-2 (EPA, 1996), for this statistical test.

If the lost line can be grouped with an adjacent line, no further action is necessary because the unmonitored area is considered to be represented by the adjacent areas. If the lost sample line cannot be grouped with an adjacent line, the previous concentration measurement will be compared to the Action Levels. If the concentration is below Action Level 1, monitoring will continue. If the concentration is between Action Level 1 and Action Level 2, the explosion-isolation wall will be installed in the panel.

N1-6 Sample Management

Sample containers shall be sealed and uniquely marked at the time of collection of the sample. A Request-for-Analysis Form shall be completed to identify the sample canister number(s), sample type, and type of analysis requested.

N1-7 Analytical Procedures

The samples will be analyzed using gas chromatography equipped with the appropriate detector under an established QA/quality control (**QC**) program. Analysis of samples shall be performed by a laboratory that the Permittees select and approve through established QA processes.

N1-8 Data Evaluation and Notifications

Analytical data from sampling events will be evaluated to determine whether the sample concentrations of flammable gases exceed the Action Levels.

If any Action Level is exceeded, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of obtaining validated analytical data.

If any sampling line loss occurs, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of learning of a sampling line loss. After the evaluation of the impact of sampling line loss as shown in Figure N1-5, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of completing the sampling line loss evaluation.

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N1-9 References

U.S. Environmental Protection Agency (EPA), 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1999. *Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry*, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

FIGURES

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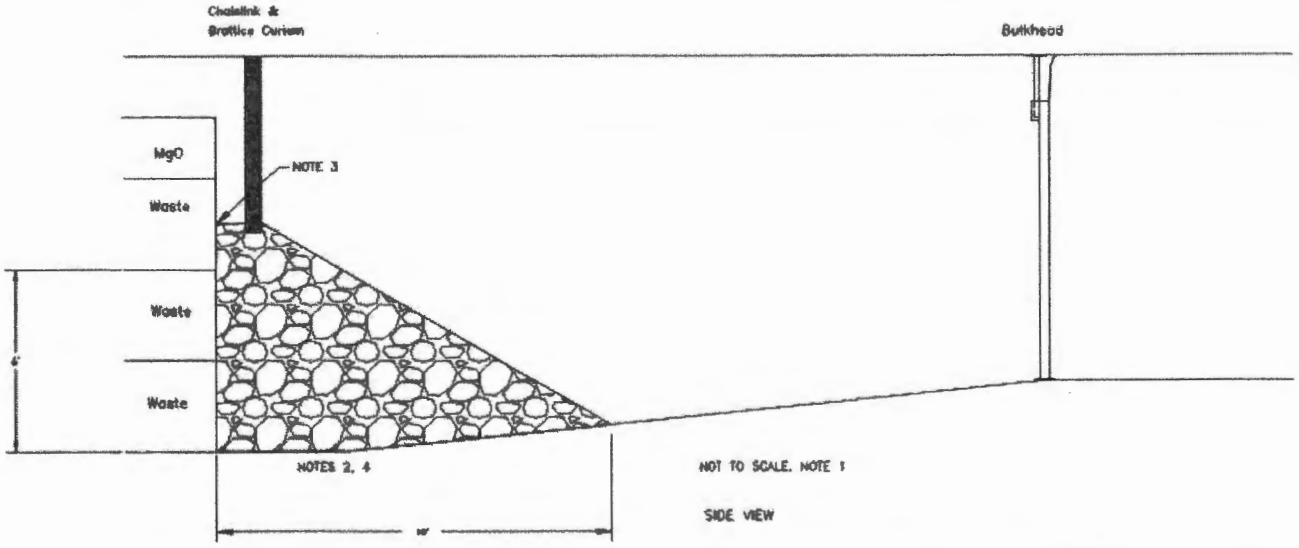

NOTES

1. CONFIGURATION AND PLACEMENT OF THE SUBSTANTIAL BARRIER AND THE BULKHEAD DICTATED BY AS-FOUND (FIELD) CONDITIONS, AS DESIGNATED BY THE COGNIZANT ENGINEER
2. SUBSTANTIAL BARRIER MATERIAL WILL CONSIST OF RUN-OF-MINE SALT OR OTHER SUITABLE NON-FLAMMABLE MATERIAL AS DESIGNATED BY THE COGNIZANT ENGINEER
3. SUBSTANTIAL BARRIER MATERIAL SHOULD BE AGAINST THE WASTE FACE. THE HEIGHT OF THE SUBSTANTIAL BARRIER NEAR THE WASTE WILL BE AT LEAST EQUAL TO THE HEIGHT OF THE BOTTOM OF THE TOP ROW OF WASTE
4. DIMENSIONS INDICATED ARE MINIMUMS. THE HEIGHT OF THE SUBSTANTIAL BARRIER IS MEASURED AT THE WASTE FACE. THE LENGTH OF THE SUBSTANTIAL BARRIER IS MEASURED FROM THE BOTTOM OF THE WASTE FACE TO THE TOE OF THE SUBSTANTIAL BARRIER MATERIAL.

Figure N1-1
Typical Substantial Barrier and Bulkhead

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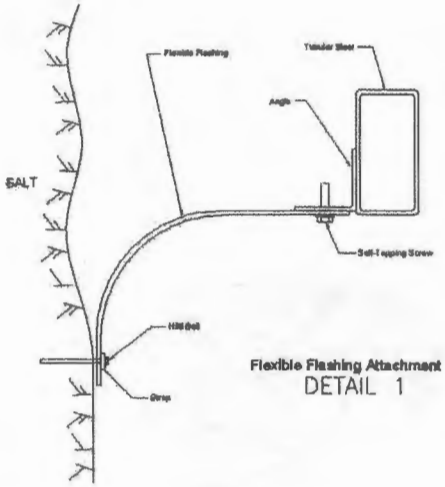

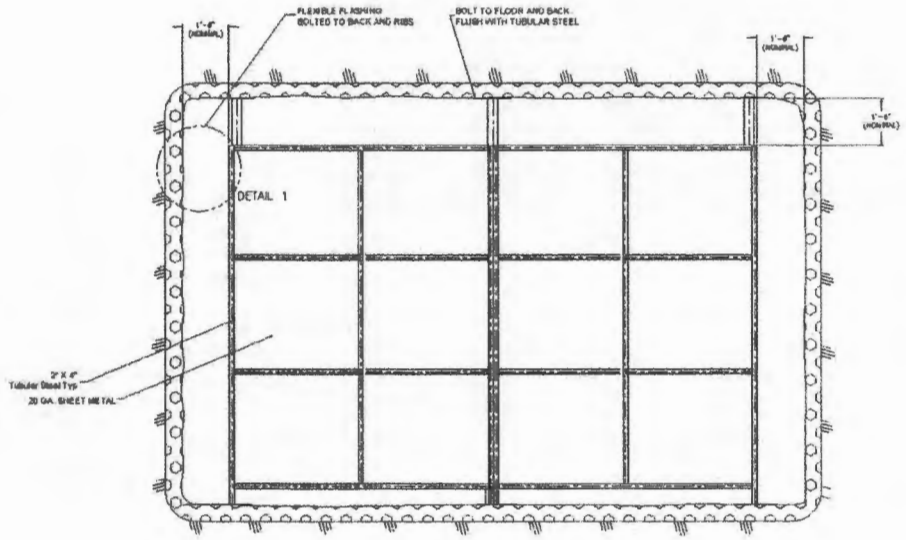

Not to Scale. All dimensions are nominal.

Figure N1-2
Typical Bulkhead

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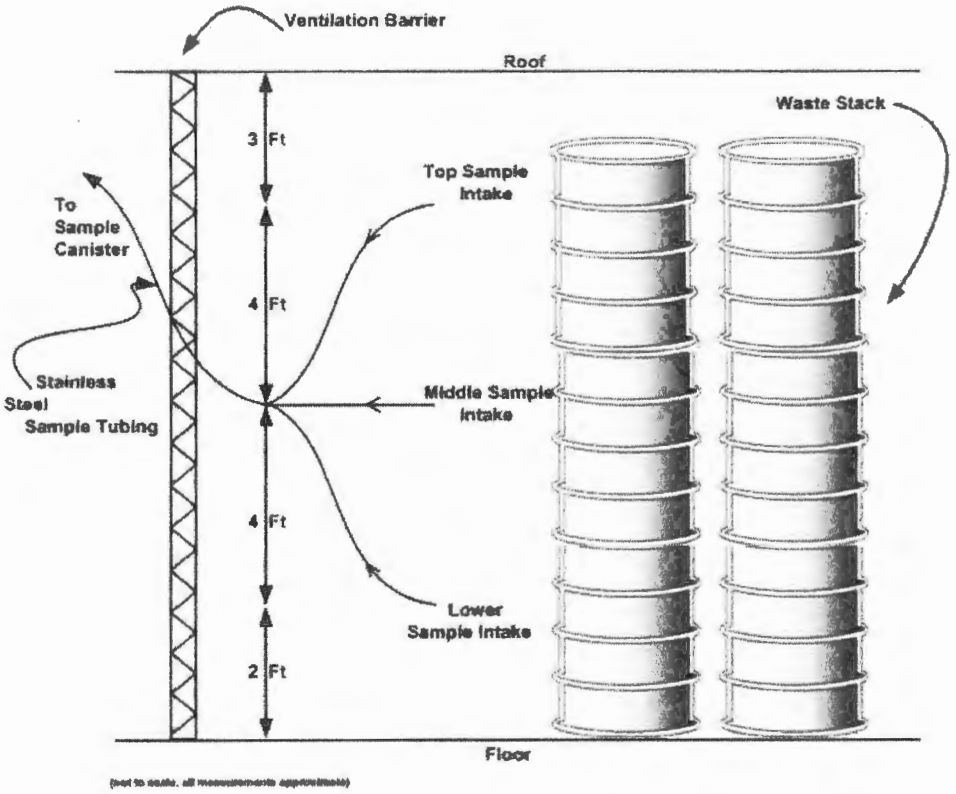

Figure N1-3
Typical Hydrogen and Methane Monitoring System

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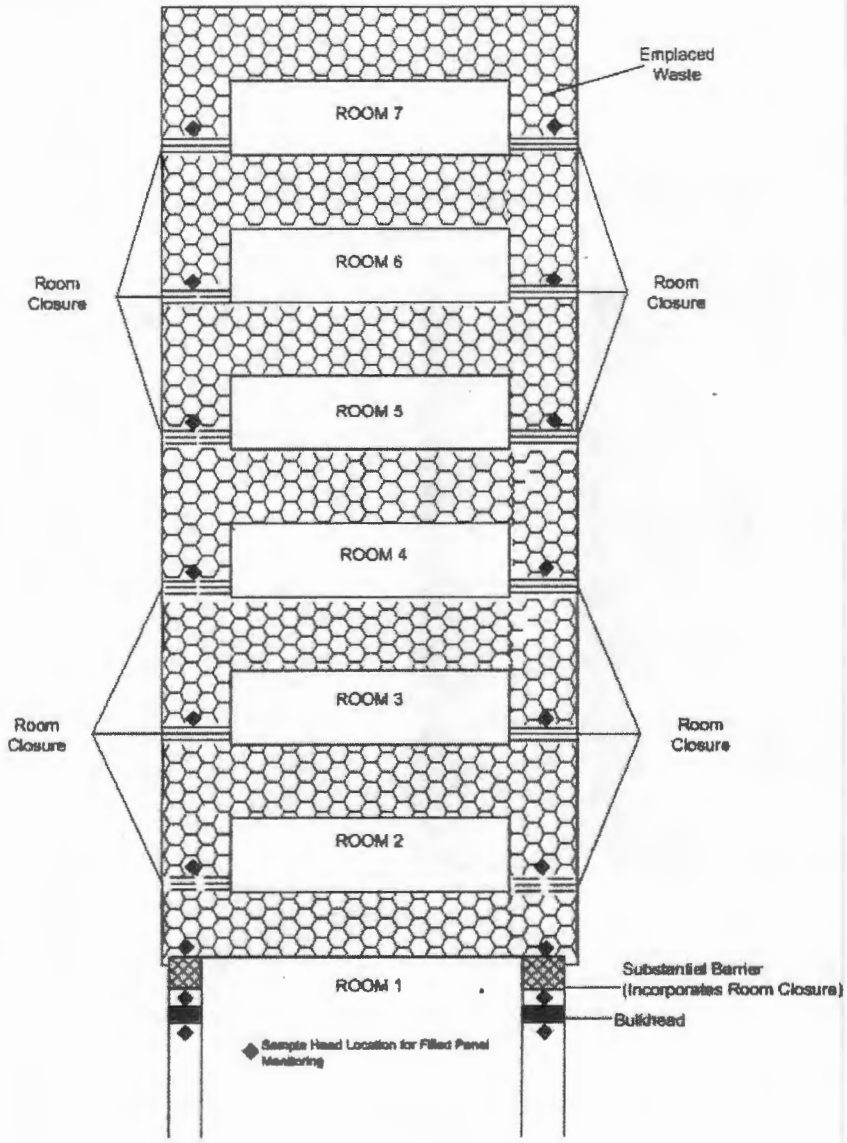

Figure N1-4
Typical Hydrogen and Methane Sampling Locations

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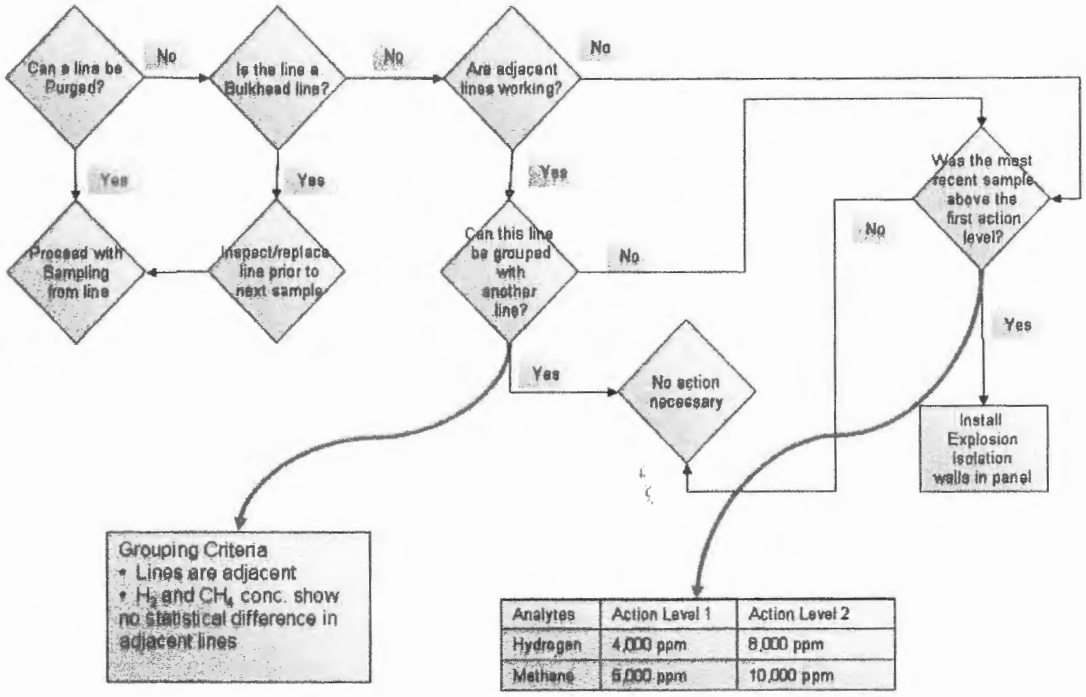

Analytes	Action Level 1	Action Level 2
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

Figure N1-5
Logic Diagram for Evaluating Sample Line Loss

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Field Code Changed

ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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Figure N-4	VOC Sample Head Arrangement

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ACRONYMS AND ABBREVIATIONS

BS/BSD	blank spike/blank spike duplicate
CH	Contact-handled
CLP	Contract Laboratory Program
COC	concentration of concern
CRQL	contract-required quantitation limit
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
GC/MS	gas chromatography/mass spectrometry
HWDU	Hazardous Waste Disposal Unit
LCS	laboratory control sample
m	meter
MDL	method detection limit
MOC	Management and Operating Contractor (Permit Section 1.5.3)
MRL	method reporting limit
NIST	National Institute of Standards and Testing
ppbv	parts per billion by volume
QA	quality assurance
QAPD	Quality Assurance Program Description
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
TIC	tentatively identified compound
TRU	Transuranic
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant

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ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N-1 Introduction

This Permit Attachment describes the monitoring plan for volatile organic compound (**VOC**) emissions from mixed waste that may be entrained in the exhaust air from the U.S. Department of Energy (**DOE**) Waste Isolation Pilot Plant (**WIPP**) Underground Hazardous Waste Disposal Units (**HWDUs**) during the disposal phase at the facility. The purpose of VOC monitoring is to ensure compliance with the VOC limits specified in Permit Part 4. This VOC monitoring plan consists of two programs as follows; (1) Repository VOC Monitoring, which assesses compliance with the environmental performance standards in Table 4.6.2.3; and (2) Disposal Room VOC Monitoring, which assesses compliance with the disposal room performance standards in Table 4.6.3.2. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N-1a Background

The Underground HWDUs are located 2,150 feet (ft) (655 meters [m]) below ground surface, in the WIPP underground. As defined for this Permit, an Underground HWDU is a single excavated panel consisting of seven rooms and two access drifts designated for disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste. Each room is approximately 300 ft (91 m) long, 33 ft (10 m) wide, and 13 ft (4 m) high. Access drifts connect the rooms and have the same cross section. The Permittees shall dispose of TRU mixed waste in Underground HWDUs designated as Panels 1 through 8.

This plan addresses the following elements:

1. Rationale for the design of the VOC monitoring programs, based on:
    - Possible pathways from WIPP during the active life of the facility
    - Demonstrating compliance with the disposal room performance standards by monitoring VOCs in underground disposal rooms
    - VOC sampling operations at WIPP
    - Optimum location of the ambient mine air monitoring stations
2. Descriptions of the specific elements of the VOC monitoring programs, including:
    - The type of monitoring conducted
    - The location of the monitoring stations
    - The monitoring interval
    - The specific hazardous constituents monitored
    - The implementation schedule for the VOC monitoring programs
    - The equipment used at the monitoring stations
    - Sampling and analytical techniques used

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- Data recording/reporting procedures
- Action levels for remedial action if limits are approached

The technical basis for Disposal Room VOC Monitoring is discussed in detail in the Technical Evaluation Report for Room-Based VOC Monitoring (WRES, 2003).

N-1b Objectives of the Volatile Organic Compound Monitoring Plan

The CH and RH TRU mixed waste disposed in the WIPP Underground HWDUs contain VOCs which could be released from WIPP during the disposal phase of the project. This plan describes how:

- VOCs released from waste panels will be monitored to confirm that the annual average concentration of VOCs in the air emissions from the Underground HWDUs do not exceed the VOC concentrations of concern (**COC**) identified in Permit Part 4, Table 4.6.2.3. Appropriate remedial action, as specified in Permit Section 4.6.2.4, will be taken if the limits in Permit Part 4, Table 4.6.2.3 are reached.

- VOCs released from waste containers in disposal rooms will be monitored to confirm that the concentration of VOCs in the air of closed and active rooms in active panels do not exceed the VOC disposal room limits identified in Permit Part 4, Table 4.4.1. Appropriate remedial action, as specified in Permit Section 4.6.3.3, will be taken if the Action Levels in Permit Part 4, Table 4.6.3.2 are reached.

N-2 Target Volatile Organic Compounds

The target VOCs for repository monitoring (Station VOC-A and VOC-B) and disposal room monitoring are presented in Table N-1.

These target VOCs were selected because together they represent approximately 99 percent of the risk due to air emissions.

N-3 Monitoring Design

Detailed design features of this plan are presented in this section. This plan uses available sampling and analysis techniques to measure VOC concentrations in air. Sampling equipment includes the WIPP VOC canister samplers used in both the Repository and Disposal Room VOC Monitoring Programs.

N-3a Sampling Locations

Air samples will be collected in the underground to quantify airborne VOC concentrations as described in the following sections.

N-3a(1) Sampling Locations for Repository VOC Monitoring

The initial configuration for the repository VOC monitoring stations is shown in Figure N-1. All mine ventilation air which could potentially be impacted by VOC emissions from the Underground HWDUs identified as Panels 1 through 8 will pass monitoring Station VOC-A, located in the E-300 drift as it flows to the exhaust shaft. Air samples will be collected at two

locations in the facility to quantify airborne VOC concentrations. VOC concentrations attributable to VOC emissions from open and closed panels containing TRU mixed waste will be measured by placing one VOC monitoring station just downstream from Panel 1 at VOC-A. The location of Station VOC-A will remain the same throughout the term of this Permit. The second station (Station VOC-B) will always be located upstream from the open panel being filled with waste (starting with Panel 1 at monitoring Station VOC-B (Figure N-1). In this configuration, Station VOC-B will measure VOC concentrations attributable to releases from the upstream sources and other background sources of VOCs, but not releases attributable to open or closed panels. The location of Station VOC-B will change when disposal activities begin in the next panel. Station VOC-B will be relocated to ensure that it is always upstream of the open panel that is receiving TRU mixed waste. Station VOC-A will also measure upstream VOC concentrations measured at Station VOC-B, plus any additional VOC concentrations resulting from releases from the closed and open panels. A sample will be collected from each monitoring station on designated sample days. For each quantified target VOC, the concentration measured at Station VOC-B will be subtracted from the concentration measured at Station VOC-A to assess the magnitude of VOC releases from closed and open panels.

The sampling locations were selected based on operational considerations. There are several different potential sources of release for VOCs into the WIPP mine ventilation air. These sources include incoming air from above ground and facility support operations, as well as open and closed waste panels. In addition, because of the ventilation requirements of the underground facility and atmospheric dispersion characteristics, any VOCs that are released from open or closed panels may be difficult to detect and differentiate from other sources of VOCs at any underground or above ground location further downstream of Panel 1. By measuring VOC concentrations close to the potential source of release (i.e., at Station VOC-A), it will be possible to differentiate potential releases from background levels (measured at Station VOC-B).

N-3a(2) Sampling Locations for Disposal Room VOC Monitoring

For purposes of compliance with Section 310 of Public Law 108-447, the VOC monitoring of airborne VOCs in underground disposal rooms in which waste has been emplaced will be performed as follows:

1. A sample head will be installed inside the disposal room behind the exhaust drift bulkhead and at the inlet side of the disposal room.

2. TRU mixed waste will be emplaced in the active disposal room.

3. When the active disposal room is filled, another sample head will be installed to the inlet of the filled active disposal room. (Figure N-3 and N-4)

4. The exhaust drift bulkhead will be removed and re-installed in the next disposal room so disposal activities may proceed.

5. A ventilation barrier will be installed where the bulkhead was located in the active disposal room's exhaust drift. Another ventilation barrier will be installed in the active disposal room's air inlet drift, thereby closing that active disposal room.

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6. Monitoring of VOCs will continue in the now closed disposal room. Monitoring of VOCs will occur in the active disposal room and all closed disposal rooms in which waste has been emplaced until commencement of panel closure activities (i.e., completion of ventilation barriers in Room 1).

This sequence for installing sample locations will proceed in the remaining disposal rooms until the inlet air ventilation barrier is installed in Room 1. An inlet sampler will not be installed in Room 1 because disposal room sampling proceeds to the next panel.

N-3a(3) Ongoing Disposal Room VOC Monitoring in Panels 3 through 8

The Permittees shall continue VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless an explosion-isolation wall is installed in the panel.

N-3b Analytes to Be Monitored

The nine VOCs that have been identified for repository and disposal room monitoring are listed in Table N-1. The analysis will focus on routine detection and quantification of these compounds in collected samples. As part of the analytical evaluations, the presence of other compounds will be investigated. The analytical laboratory will be directed to classify and report all of these compounds as Tentatively Identified Compounds (**TICs**).

TICs detected in 10% or more of any VOC monitoring samples (exclusive of those collected from Station VOC-B) that are VOCs listed in Appendix VIII of 20.4.1.200 NMAC (incorporating 40 CFR §261), collected over a running 12-month timeframe, will be added to the target analyte lists for both the repository and disposal room VOC monitoring programs, unless the Permittees can justify the exclusion from the target analyte list(s).

TICs detected in the repository and disposal room VOC monitoring programs will be placed in the WIPP Operating Record and reported to NMED in the Semi-Annual VOC Monitoring Report as specified in Permit Section 4.6.2.2.

N-3c Sampling and Analysis Methods

The VOC monitoring programs include a comprehensive VOC monitoring program established at the facility; equipment, training, and documentation for VOC measurements are already in place.

The method used for VOC sampling is based on the concept of pressurized sample collection contained in the U.S. Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling concept uses 6-liter SUMMA® passivated (or equivalent) stainless-steel canisters to collect integrated air samples at each sample location. This conceptual method will be used as a reference for collecting the samples at WIPP. The samples will be analyzed using gas chromatography/mass spectrometry (**GC/MS**) under an established QA/quality control (**QC**) program. Laboratory analytical procedures have been developed based on the concepts contained in both TO-15 and 8260B. Section N-5 contains additional QA/QC information for this project.

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The TO-15 method is an EPA-recognized sampling concept for VOC sampling and speciation. It can be used to provide integrated samples, or grab samples, and compound quantitation for a broad range of concentrations. The sampling system can be operated unattended but requires detailed operator training. This sampling technique is viable for use while analyzing the sample using other EPA methods such as 8260B.

The field sampling systems will be operated in the pressurized mode. In this mode, air is drawn through the inlet and sampling system with a pump. The air is pumped into an initially evacuated SUMMA® passivated (or equivalent) canister by the sampler, which regulates the rate and duration of sampling. The treatment of tubing and canisters used for VOC sampling effectively seals the inner walls and prevents compounds from being retained on the surfaces of the equipment. By the end of each sampling period, the canisters will be pressurized to about two atmospheres absolute. In the event of shortened sampling periods or other sampling conditions, the final pressure in the canister may be less than two atmospheres absolute. Sampling duration will be approximately six hours, so that a complete sample can be collected during a single work shift.

The canister sampling system and GC/MS analytical method are particularly appropriate for the VOC Monitoring Programs because a relatively large sample volume is collected, and multiple dilutions and reanalyses can occur to ensure identification and quantification of target VOCs within the working range of the method. The contract-required quantitation limits (**CRQL**) are 5 parts per billion by volume (**ppbv**) or less for the nine target compounds. Consequently, low concentrations can be measured. CRQLs are the EPA-specified levels of quantitation proposed for EPA contract laboratories that analyze canister samples by GC/MS. For the purpose of this plan, the CRQLs will be defined as the method reporting limits (**MRL**). The MRL is a function of instrument performance, sample preparation, sample dilution, and all steps involved in the sample analysis process.

Disposal room VOC monitoring system in open panels will employ the same canister sampling method as used in the repository VOC monitoring. Passivated or equivalent sampling lines will be installed in the disposal room as described in Section N-3a(2) and maintained once the room is closed until the panel associated with the room is closed. The independent lines will run from the sample inlet point to the individual sampler located in the access drift to the disposal panel. The air will pass through dual particulate filters to prevent sample and equipment contamination.

N-3d Sampling Schedule

The Permittees will evaluate whether the monitoring systems and analytical methods are functioning properly. The assessment period will be determined by the Permittees.

N-3d(1) Sampling Schedule for Repository VOC Monitoring

Repository VOC sampling at Stations VOC-A and VOC-B will begin with initial waste emplacement in Panel 1. Sampling will continue until the certified closure of the last Underground HWDU. Routine sampling will be conducted two times per week.

N-3d(2) Sampling Schedule for Disposal Room VOC Monitoring

The disposal room sampling in open panels will occur once every two weeks, unless the need to increase the frequency to weekly occurs in accordance with Permit Section 4.6.3.3.

Beginning with Panel 3, disposal room sampling in filled panels will occur monthly until final panel closure unless an explosion-isolation wall is installed. The Permittees will sample VOCs in Room 1 of each filled panel.

N-3e Data Evaluation and Reporting

N-3e(1) Data Evaluation and Reporting for Repository VOC Monitoring

When the Permittees receive laboratory analytical data from an air sampling event, the data will be validated as specified in Section N-5d. After obtaining validated data from an air sampling event, the data will be evaluated to determine whether the VOC emissions from the Underground HWDUs exceed the COCs. The COCs for each of the nine target VOCs are presented in Permit Part 4, Table 4.6.2.3. The values are presented in terms of micrograms per cubic meter ($\mu g/m^3$) and ppbv.

The COCs were calculated assuming typical operational conditions for ventilation rates in the mine. The typical operational conditions were assumed to be an overall mine ventilation rate of 425,000 standard cubic feet per minute and a flow rate through the E-300 Drift at Station VOC-A of 130,000 standard cubic feet per minute.

Since the mine ventilation rates at the time the air samples are collected may be different than the mine ventilation rates during typical operational conditions, the Permittees will measure and/or record the overall mine ventilation rate and the ventilation rate in the E-300 Drift at Station VOC-A that are in use during each sampling event. The Permittees shall also measure and record temperature and pressure conditions during the sampling event to allow all ventilation rates to be converted to standard flow rates.

If the air samples were collected under the typical mine ventilation rate conditions, then the analytical data will be used without further manipulation. The concentration of each target VOC detected at Station VOC-B will be subtracted from the concentration detected at Station VOC-A. The resulting VOC concentration represents the concentration of VOCs being emitted from the open and closed Underground HWDUs upstream of Station VOC-A (or the Underground HWDU VOC emission concentration).

If the air samples were not collected under typical mine ventilation rate operating conditions, the air monitoring analytical results from both Station VOC-A and Station VOC-B will be normalized to the typical operating conditions. This will be accomplished using the mine ventilation rates in use during the sampling event and the following equation:

$$NVOC_{AB} = VOC_{AB} * \left(\frac{425{,}000_{scfm} / 130{,}000_{scfm}}{V_{O\,scfm} / V_{E-300\,scfm}} \right) \qquad \text{(N-1)}$$

Where: $NVOC_{AB}$ = Normalized target VOC concentration from Stations VOC-A or VOC-B

VOC_{AB} = Concentration of the target VOC detected at Station VOC-A or VOC-B under non-typical mine ventilation rates

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scfm = Standard cubic feet per minute

Vo = Sampling event overall mine ventilation rate (in standard cubic feet per minute)

VE-300 = Sampling event mine ventilation rate through the E-300 Drift (in standard cubic feet per minute)

The normalized concentration of each target VOC detected at Station VOC-B will be subtracted from the normalized concentration detected at Station VOC-A. The resulting concentration represents the Underground HWDU VOC emission concentration.

The Underground HWDU VOC emission concentration for each target VOC that is calculated for each sampling event will be compared directly to its COC listed in Permit Part 4, Table 4.6.2.3. This will establish whether any of the concentrations of VOCs in the emissions from the Underground HWDUs exceeded the COCs at the time of the sampling.

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentrations of any target VOC listed in exceeds the concentration of concern specified in Permit Part 4, Table 4.6.2.3.

The Underground HWDU VOC emission concentration for each target VOC that is calculated for each sampling event will then be averaged with the Underground HWDU VOC emission concentrations calculated for the air sampling events conducted during the previous 12 months. This will be considered the running annual average concentration for each target VOC. For the first year of air sampling, the running annual average concentration for each target VOC will be calculated using all of the previously collected data.

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any target VOC exceeds the concentration of concern specified in Permit Part 4, Table 4.6.2.3.

If the results obtained from an individual air sampling event do not trigger the notification requirements of Permit Part 4, then the Permittees will maintain a database with the VOC air sampling data and the results will be reported to the Secretary as specified in Permit Part 4.

N-3e(2) Data Evaluation and Reporting for Disposal Room VOC Monitoring

When the Permittees receive laboratory analytical data from an air sampling event, the data will be validated as specified in Section N-5a, within 14 calendar days of receiving the laboratory analytical data. After obtaining validated data from an air sampling event, the data will be evaluated to determine whether the VOC concentrations in the air of any closed room, the active open room, or the immediately adjacent closed room exceeded the Action Levels for Disposal Room Monitoring specified in Permit Part 4, Table 4.6.3.2.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Permit Part 4, Table 4.4.1 exceeds the action levels specified in Permit Part 4, Table 4.6.3.2.

The Permittees shall submit to the Secretary the Semi-Annual VOC Monitoring Report specified in Permit Section 4.6.2.2 that also includes results from disposal room VOC monitoring.

N-4 Sampling and Analysis Procedures

This section describes the equipment and procedures that will be implemented during sample collection and analysis activities for VOCs at WIPP.

N-4a Sampling Equipment

The sampling equipment that will be used includes the following: 6-liter (L) stainless-steel SUMMA® canisters, VOC canister samplers, treated stainless steel tubing, and a dual filter housing. A discussion of each of these items is presented below.

N-4a(1) SUMMA® Canisters

Six-liter, stainless-steel canisters with SUMMA® passivated interior surfaces will be used to collect and store all ambient air and gas samples for VOC analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use, in a manner similar to that described by Compendium Method TO-15. The canisters will be certified clean to below the required reporting limits for the VOC analytical method for the target VOCs (see Table N-2). The vacuum of certified clean samplers will be verified at the sampler upon initiation of a sample cycle.

N-4a(2) Volatile Organic Compound Canister Samplers

A conceptual diagram of a VOC sample collection unit is provided in Figure N-2. Such units will be used at monitoring Stations VOC-A and VOC-B and at sampling locations for disposal room measurements. The sampling unit consists of a sample pump, flow controller, sample inlet, inlet filters in series to remove particulate matter, vacuum/pressure gauge, electronic timer, inlet purge vent, two sampling ports, and sufficient collection canisters so that any delays attributed to laboratory turnaround time and canister cleaning and certification will not result in canister shortages. Knowledge of sampler flow rates and duration of sampling will allow calculation of sample volume. The set point flow rate will be verified before and after sample collection from the mass flow indication. Prior to their initial use and annually thereafter, the sample collection units will be tested and certified to demonstrate that they are free of contamination above the reporting limits of the VOC analytical method (see Section N-5). Ultra-high purity humidified zero air will be pumped through the inlet line and sampling unit and collected in previously certified canisters as sampler blanks for analysis. The cleaning and certification procedure is derived from concepts contained in the EPA Compendium Method TO-15 (EPA, 1999).

N-4a(3) Sample Tubing

Treated stainless steel tubing is used as a sample path, from the desired sample point to the sample collection unit. This tubing is treated to prevent the inner walls from absorbing contaminants when they are pulled from the sample point to the sample collection unit.

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N-4b Sample Collection

Six-hour integrated samples will be collected on each sample day. Alternative sampling durations may be defined for experimental purposes. The VOC canister sampler at each location will sample ambient air on the same programmed schedule. The sample pump will be programmed to sample continuously over a six-hour period during the workday. The units will sample at a nominal flow rate of 33.3 actual milliliters per minute over a six-hour sample period. This schedule will yield a final sample volume of approximately 12 L. Flow rates and sampling duration may be modified as necessary for experimental purposes and to meet the data quality objectives.

Sample flow will be checked each sample day using an in-line mass flow controller. The flow controllers are initially factory-calibrated and specify a typical accuracy of better than 10 percent full scale. Additionally, each air flow controller is calibrated at a manufacturer-specified frequency using a National Institute of Standards and Testing (**NIST**) primary flow standard.

Upon initiation of waste disposal activities in Panel 1, samples will be collected twice each week (at Stations VOC-A and VOC-B). Samples collected at the panel locations should represent the same matrix type (i.e., elevated levels of salt aerosols). To verify the matrix similarity and assess field sampling precision, field duplicate samples will be collected (two canisters filled simultaneously by the same sampler) from each sampling station (Stations VOC-A and VOC-B) during the first sampling event and at an overall frequency of 5 percent thereafter (see Section N-5a).

Prior to collecting the active open disposal room and closed room samples, the sample lines are purged to ensure that the air collected is not air that has been stagnant in the tubing. This is important in regard to the disposal room sample particularly because of the long lengths of tubing associated with these samples. The repository samples do not require this action due to the short lengths of tubing required at these locations.

N-4c Sample Management

Field sampling data sheets will be used to document the sampler conditions under which each sample is collected. These data sheets have been developed specifically for VOC monitoring at the WIPP facility. The individuals assigned to collect the specific samples will be required to fill in all of the appropriate sample data and to maintain this record in sample logbooks. The program team leader will review these forms for each sampling event.

All sample containers will be marked with identification at the time of collection of the sample. A Request-for-Analysis Form will be completed to identify the sample canister number(s), sample type and type of analysis requested.

All samples will be maintained, and shipped if necessary, at ambient temperatures. Collected samples will be transported in appropriate containers. Prior to leaving the underground for analysis, sample containers may undergo radiological screening. No potentially contaminated samples or equipment will be transported to the surface. No samples will be accepted by the receiving laboratory personnel unless they are properly labeled and sealed to ensure a tamper free shipment.

An important component of the sampling program is a demonstration that collected samples were obtained from the locations stated and that they reached the laboratory without alteration. To satisfy this requirement, evidence of collection, shipment, laboratory receipt, and custody will be documented with a completed Chain-of-Custody Form. Chain-of-custody procedures will be followed closely, and additional requirements imposed by the laboratory for sample analysis will be included as necessary.

Individuals collecting samples will be responsible for the initiation of custody procedures. The chain of custody will include documentation as to the canister certification, location of sampling event, time, date, and individual handling the samples. Deviations from procedure will be considered variances. Variances must be preapproved by the program manager and recorded in the project files. Unintentional deviations, sampler malfunctions, and other problems are nonconformances. Nonconformances must be documented and recorded in the project files. All field logbooks/data sheets must be incorporated into WIPP's records management program.

N-4d Sampler Maintenance

Periodic maintenance for canister samplers and associated equipment will be performed during each cleaning cycle. This maintenance will include, but not be limited to, replacement of damaged or malfunctioning parts without compromising the integrity of the sampler, leak testing, and instrument calibration. Additionally, complete spare units will be maintained on-site to minimize downtime because of sampler malfunction. At a minimum, canister samplers will be certified for cleanliness initially and annually thereafter upon initial use, after any parts that are included in the sample flow path are replaced, or any time analytical results indicate potential contamination. All sample canisters will be certified prior to each usage.

N-4e Analytical Procedures

Analytical procedures used in the analysis of VOC samples from canisters are based on concepts contained in Compendium Method TO-15 (EPA, 1999) and in SW-846 Method 8260B (EPA, 1996).

Analysis of samples will be performed by a certified laboratory. Methods will be specified in procurement documents and will be selected to be consistent with Compendium Method TO-15 (EPA, 1999) or EPA recommended procedures in SW-846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in the appropriate Air Compendium or SW-846 method and that the laboratory follow EPA protocols. The selected laboratory shall demonstrate, through laboratory SOPs, that it will follow appropriate EPA SW-846 requirements and the requirements specified by the EPA Air Compendium protocols. The laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the facility operating record and will be available for review upon request by NMED.

The SOPs for the laboratory currently under contract will be maintained in the operating record by the Permittees. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis.

Data validation will be performed by the Permittees. Copies of the data validation report will be kept on file in the operating record for review upon request by NMED.

N-5 Quality Assurance

The QA activities for the VOC monitoring programs will be conducted in accordance with the documents: *EPA Guidance for Quality Assurance Project Plans QA/G-5* (EPA, 2002) and the *EPA Requirements for Preparing Quality Assurance Project Plans, QA/R-5* (EPA, 2001). The QA criteria for the VOC monitoring programs are listed in Table N-2. This section addresses the methods to be used to evaluate the components of the measurement system and how this evaluation will be used to assess data quality. The QA limits for the sampling procedures and laboratory analysis shall be in accordance with the limits set forth in the specific EPA Method referenced in standard operating procedures employed by either the Permittees or the laboratory. The Permittees standard operating procedures will be in the facility Operating Record and available for review by NMED at anytime. The laboratory standard operating procedures will also be in the facility Operating Record and will be supplied to the NMED as indicated in Section N-4e.

N-5a Quality Assurance Objectives for the Measurement of Precision, Accuracy, Sensitivity, and Completeness

QA objectives for this plan will be defined in terms of the following data quality parameters.

Precision. For the duration of this program, precision will be defined and evaluated by the RPD values calculated between field duplicate samples and between laboratory duplicate samples.

$$RPD = \left(\frac{(A - B)}{(A + B)/2} \right) * 100 \qquad \text{(N-2)}$$

where: A = Original sample result

B = Duplicate sample result

Accuracy. Analytical accuracy will be defined and evaluated through the use of analytical standards. Because recovery standards cannot reliably be added to the sampling stream, overall system accuracy will be based on analytical instrument performance evaluation criteria. These criteria will include performance verification for instrument calibrations, laboratory control samples, sample surrogate recoveries (when required by method or laboratory SOPs), and sample internal standard areas. Use of the appropriate criteria as determined by the analytical method performed, will constitute the verification of accuracy for target analyte quantitation (i.e., quantitative accuracy). Evaluation of standard ion abundance criteria for BFB will be used to evaluate the accuracy of the analytical system in the identification of targeted analytes, as well as the evaluation of unknown contaminants (i.e., qualitative accuracy).

Sensitivity. Sensitivity will be defined by the required MRLs for the program. Attainment of required MRLs will be verified by the performance of statistical method detection limit (**MDL**) studies in accordance with 40 *Code of Federal Regulations* § 136. The MDL represents the minimum concentration that can be measured and reported with 99 percent confidence that the

analyte concentration is greater than zero. An MDL study will be performed by the program analytical laboratory prior to sampling and analysis, and annually thereafter.

Completeness. Completeness will be defined as the percentage of the ratio of the number of valid sample results received (i.e., those which meet data quality objectives) versus the total number of samples collected. Completeness may be affected, for example, by sample loss or destruction during shipping, by laboratory sample handling errors, or by rejection of analytical data during data validation.

N-5a(1) Evaluation of Laboratory Precision

Laboratory sample duplicates and blank spike/blank spike duplicates (**BS/BSD**) will be used to evaluate laboratory precision. QA objectives for laboratory precision are listed in Table N-2, and are based on precision criteria proposed by the EPA for canister sampling programs (EPA, 1994). These values will be appropriate for the evaluation of samples with little or no matrix effects. Because of the potentially high level of salt-type aerosols in the WIPP underground environment, the analytical precision achieved for WIPP samples may vary with respect to the EPA criteria. RPDs for BS/BSD analyses will be tracked through the use of control charts. RPDs obtained for laboratory sample duplicates will be compared to those obtained for BS/BSDs to ascertain any sample matrix effects on analytical precision. BS/BSDs and laboratory sample duplicates will be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

N-5a(2) Evaluation of Field Precision

Field duplicate samples will be collected at a frequency of 5 percent for both monitoring locations. The data quality objective for field precision is 35 percent for each set of duplicate samples.

N-5a(3) Evaluation of Laboratory Accuracy

Quantitative analytical accuracy will be evaluated through performance criteria on the basis of (1) relative response factors generated during instrument calibration, (2) analysis of laboratory control samples (**LCS**), and (3) recovery of internal standard compounds. The criteria for the initial calibration (5-point calibration) is $\leq$ 30 percent relative standard deviation for target analytes. After the successful completion of the 5-point calibration, it is sufficient to analyze only a midpoint standard for every 24 hours of operation. The midpoint standard will pass a 30 percent difference acceptance criterion for each target compound before sample analysis may begin.

A blank spike or LCS is an internal QC sample generated by the analytical laboratory by spiking a standard air matrix (humid zero air) with a known amount of a certified reference gas. The reference gas will contain the target VOCs at known concentrations. Percent recoveries for the target VOCs will be calculated for each LCS relative to the reference concentrations. Objectives for percent recovery are listed in Table N-2, and are based on accuracy criteria proposed by the EPA for canister sampling programs (EPA, 1994). LCSs will be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

Internal standards will be introduced into each sample analyzed, and will be monitored as a verification of stable instrument performance. In the absence of any unusual interferences,

areas should not change by more than 40 percent over a 24-hour period. Deviations larger than 40 percent are an indication of a potential instrument malfunction. If an internal standard area in a given sample changes by more than 40 percent, the sample will be reanalyzed. If the 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a performance check and the midpoint standard will be reanalyzed to verify proper operation. Response and recovery of internal standards will also be compared between samples, LCSs, and calibration standards to identify any matrix effects on analytical accuracy.

N-5a(4) Evaluation of Sensitivity

The presence of aerosol salts in underground locations may affect the MDL of the samples collected in those areas. The intake manifold of the sampling systems will be protected sufficiently from the underground environment to minimize salt aerosol interference.

The MDL for each of the nine target compounds will be evaluated by the analytical laboratories before sampling begins. The initial and annual MDL evaluation will be performed in accordance with 40 *Code of Federal Regulations* §136 and with EPA/530-SW-90-021, as revised and retitled, "Quality Assurance and Quality Control" (Chapter 1 of SW-846) (1996).

N-5a(5) Completeness

The expected completeness for this program is greater than or equal to 90 percent. Data completeness will be tracked monthly.

N-5b Sample Handling and Custody Procedures

Sample packaging, shipping, and custody procedures are addressed in Section N-4c.

N-5c Calibration Procedures and Frequency

Calibration procedures and frequencies for analytical instrumentation are listed in Section N-4e.

N-5d Data Reduction, Validation, and Reporting

A dedicated logbook will be maintained by the operators. This logbook will contain documentation of all pertinent data for the sampling. Sample collection conditions, maintenance, and calibration activities will be included in this logbook. Additional data collected by other groups at WIPP, such as ventilation airflow, temperature, pressure, etc., will be obtained to document the sampling conditions.

Data validation procedures will include at a minimum, a check of all field data forms and sampling logbooks will be checked for completeness and correctness. Sample custody and analysis records will be reviewed routinely by the QA officer and the laboratory supervisor.

Electronic Data Deliverables (**EDDs**) are provided by the laboratory prior to receipt of hard copy data packages. EDDs will be evaluated within five calendar days of receipt to determine if VOC concentrations are at or above action levels in Table 4.6.3.2 for disposal room monitoring data or concentrations of concern in Table 4.6.2.3 for repository monitoring data. If the EDD indicates that VOC concentrations are at or above these action levels or concentrations, the hard copy

data package will be validated within five calendar days as opposed to the fourteen (14) calendar day time frame provided by Section N-3e(2).

Data will be reported as specified in Section N-3(e) and Permit Part 4.

Acceptable data for this VOC monitoring plan will meet stated precision and accuracy criteria. The QA objectives for precision, accuracy, and completeness as shown in Table N-2 can be achieved when established methods of analyses are used as proposed in this plan and standard sample matrices are being assessed.

N-5e Performance and System Audits

System audits will initially address start-up functions for each phase of the project. These audits will consist of on-site evaluation of materials and equipment, review of canister and sampler certification, review of laboratory qualification and operation and, at the request of the QA officer, an on-site audit of the laboratory facilities. The function of the system audit is to verify that the requirements in this plan have been met prior to initiating the program. System audits will be performed at or shortly after to the initiation of the VOC monitoring programs and on an annual basis thereafter.

Performance audits will be accomplished as necessary through the evaluation of analytical QC data by performing periodic site audits throughout the duration of the project, and through the introduction of third-party audit cylinders (laboratory blinds) into the analytical sampling stream. Performance audits will also include a surveillance/review of data associated with canister and sampler certification, a project-specific technical audit of field operations, and a laboratory performance audit. Field logs, logbooks, and data sheets will be reviewed weekly. Blind-audit canisters will be introduced once during the sampling period. Details concerning scheduling, personnel, and data quality evaluation are addressed in the QAPjP.

N-5f Preventive Maintenance

Sampler maintenance is described briefly in Section N-4d Maintenance of analytical equipment will be addressed in the analytical SOP.

N-5g Corrective Actions

If the required completeness of valid data (95 percent) is not maintained, corrective action may be required. Corrective action for field sampling activities may include recertification and cleaning of samplers, reanalysis of samples, additional training of personnel, modification to field and laboratory procedures, and recalibration of test equipment.

Laboratory corrective actions may be required to maintain data quality. The laboratory continuing calibration criteria indicate the relative response factor for the midpoint standard will be less than 30 percent different from the mean relative response factor for the initial calibration. Differences greater than 30 percent will require recalibration of the instrument before samples can be analyzed. If the internal standard areas in a sample change by more than 40 percent, the sample will be reanalyzed. If the 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a performance check and the midpoint standard reanalyzed to verify proper operation. Deviations larger than 40 percent are an indication of potential instrument malfunction.

The laboratory results for samples, duplicate analyses, LCSs, and blanks should routinely be within the QC limits. If results exceed control limits, the reason for the nonconformances and appropriate corrective action must be identified and implemented.

N-5h Records Management

The VOC Monitoring Programs will require administration of record files (both laboratory and field data collection files). The records control systems will provide adequate control and retention for program-related information. Records administration, including QA records, will be conducted in accordance with applicable DOE, MOC, and WIPP requirements.

Unless otherwise specified, VOC monitoring plan records will be retained as lifetime records. Temporary and permanent storage of QA records will occur in facilities that prevent damage from temperature, fire, moisture, pressure, excessive light, and electromagnetic fields. Access to stored VOC Monitoring Program QA Records will be controlled and documented to prevent unauthorized use or alteration of completed records.

Revisions to completed records (i.e., as a result of audits or data validation procedures) may be made only with the approval of the responsible program manager and in accordance with applicable QA procedures. Original and duplicate or backup records of project activities will be maintained at the WIPP site. Documentation will be available for inspection by internal and external auditors.

N-6 Sampling and Analysis Procedures for Disposal Room VOC Monitoring in Filled Panels

Disposal room VOC samples in filled panels will be collected using the subatmospheric pressure grab sampling technique described in Compendium Method TO-15 (EPA, 1999). This method uses an evacuated SUMMA® passivated canister (or equivalent) that is under vacuum (0.05 mm Hg) to draw the air sample from the sample lines into the canister. The sample lines will be purged prior to sampling to ensure that a representative sample is collected. The passivation of tubing and canisters used for VOC sampling effectively seals the inner walls and prevents compounds from being retained on the surfaces of the equipment. By the end of each sampling period, the canisters will be near atmospheric pressure.

The analytical procedures for disposal room VOC monitoring in filled panels are the same as specified in Section N-4e.

N-7 References

U.S. Environmental Protection Agency. 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency. 1999 *Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry*, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives Process*, QA/G-4. EPA 600/R-96/055, August 2000, Washington, D.C.

U.S. Environmental Protection Agency. 2001. *EPA Guidance for Quality Assurance Project Plans, QA/G*, EPA 240/B-01/003, March 2001, Washington, D.C.

U.S. Environmental Protection Agency. 2002. *EPA Requirements for Preparing Quality Assurance Project Plans*, QA/R-5, EPA 240/R-01/009, December 2002, Washington, D.C.

Washington Regulatory and Environmental Services, 2004. *Technical Evaluation Report for WIPP Room-Based VOC Monitoring*.

TABLES

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Table N-1
Target Analytes and Methods for Repository VOC (Station VOC-A and VOC-B) Monitoring and Disposal Room Monitoring

Target Analyte	EPA Standard Analytical Method
Carbon tetrachloride	EPA TO-15[a] EPA 8260B[b]
Chlorobenzene	
Chloroform	
1,1-Dichloroethylene	
1,2-Dichloroethane	
Methylene chloride	
1,1,2,2 -Tetrachloroethane	
Toluene	
1,1,1- Trichloroethane	

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air- Second Edition, http://www.epa.gov/ttn/amtic/airtox.html

[b] U.S. Environmental Protection Agency, SW-846 Test Methods for Evaluation Solid Wastes, Chemical and Physical Methods, http://www.epa.gov/epaoswer/hazwaste/test/main.htm

Table N-2
Quality Assurance Objectives for Accuracy, Precision, Sensitivity, and Completeness

Compound	Accuracy (Percent Recovery)	Precision (RPD) Laboratory	Precision (RPD) Field	Required MRL (ppbv)	Completeness (Percent)
Carbon tetrachloride	60 to 140	25	35	2	95
Chlorobenzene	60 to 140	25	35	2	95
Chloroform	60 to 140	25	35	2	95
1,1-Dichloroethylene	60 to 140	25	35	5	95
1,2-Dichloroethane	60 to 140	25	35	2	95
Methylene chloride	60 to 140	25	35	5	95
1,1,2,2-Tetrachloroethane	60 to 140	25	35	2	95
Toluene	60 to 140	25	35	5	95
1,1,1-Trichloroethane	60 to 140	25	35	5	95

MRL method reporting limit
RPD relative percent difference

FIGURES

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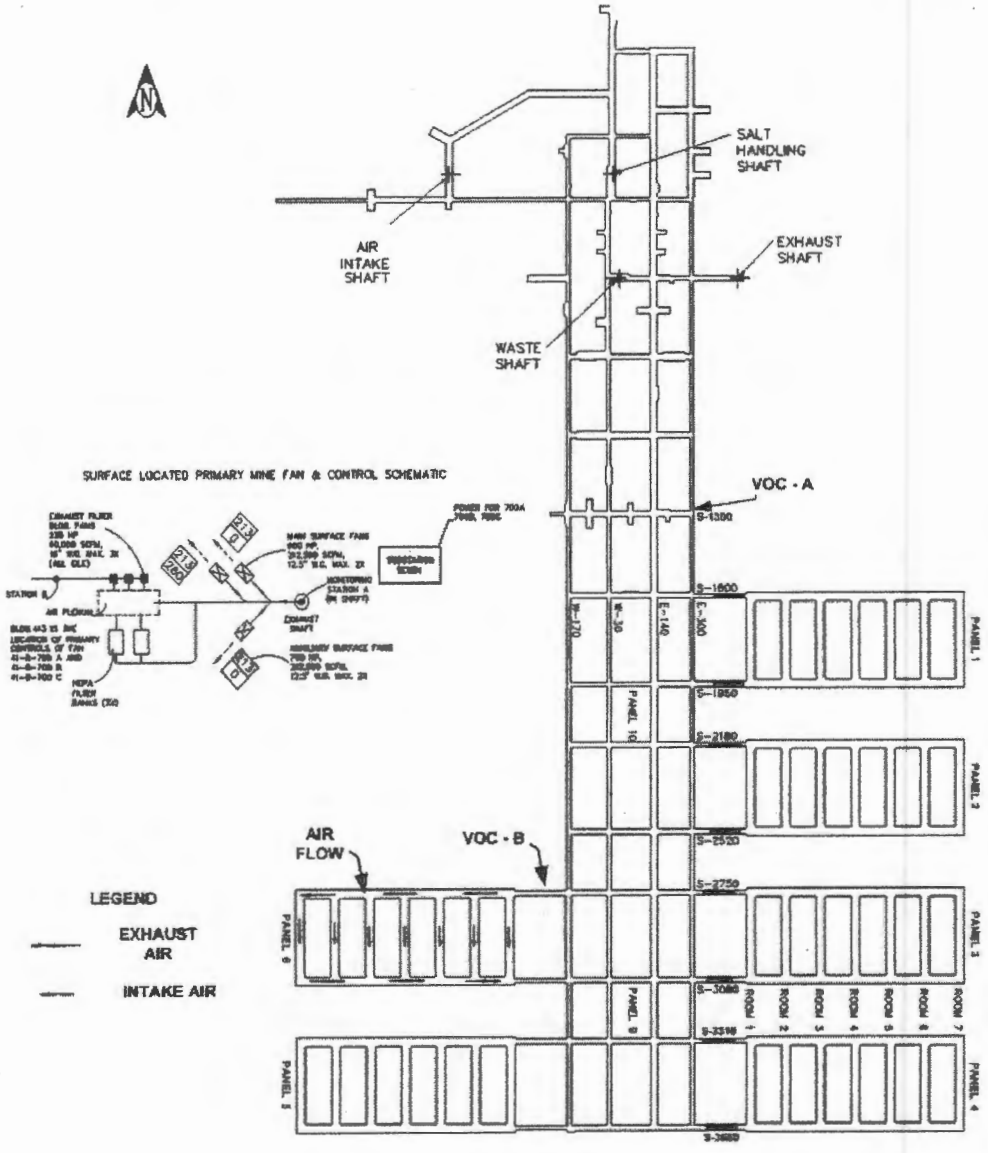
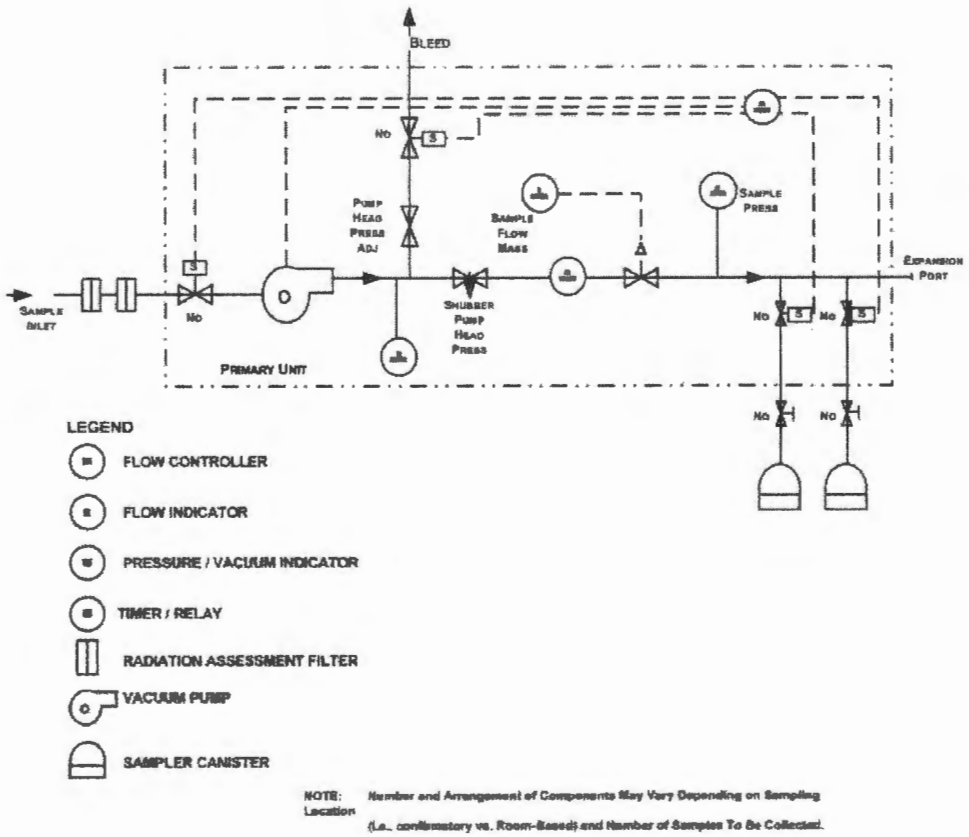


Figure N-1
Panel Area Flow

Field Code Changed



NOTE: Number and Arrangement of Components May Vary Depending on Sampling Location (i.e., confinement vs. Room-Based) and Number of Samples To Be Collected.

Figure N-2
VOC Monitoring System Design

Field Code Changed

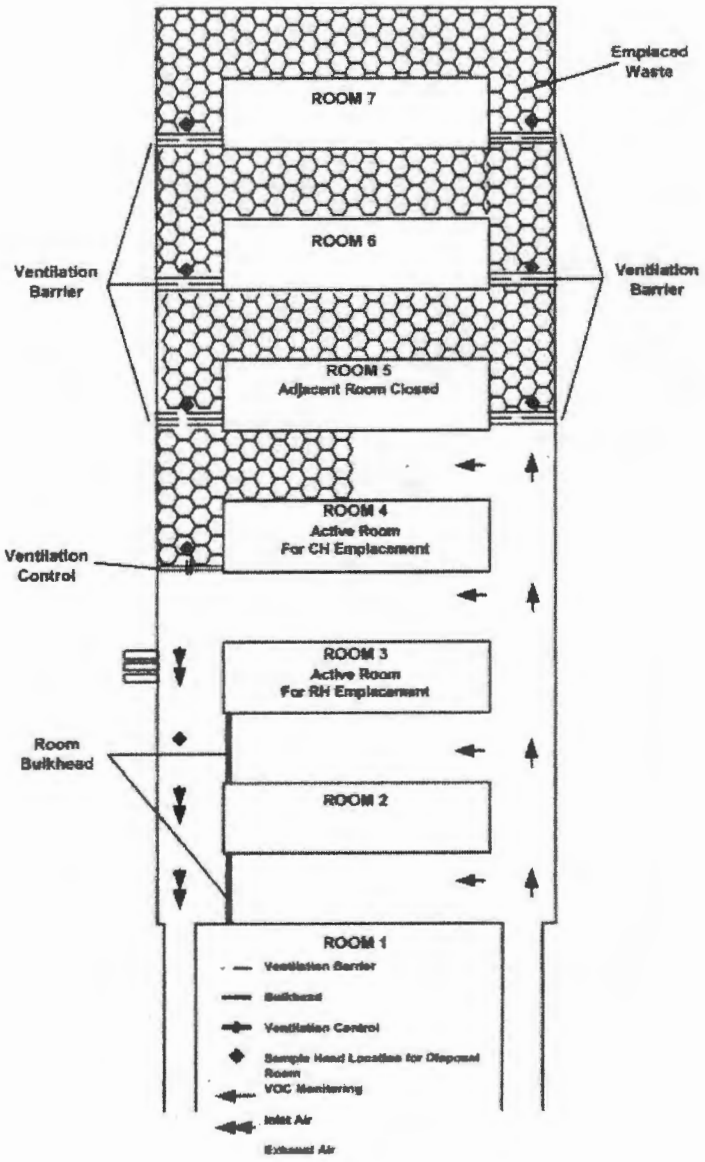


Figure N-3
Disposal Room VOC Monitoring

Field Code Changed

01308

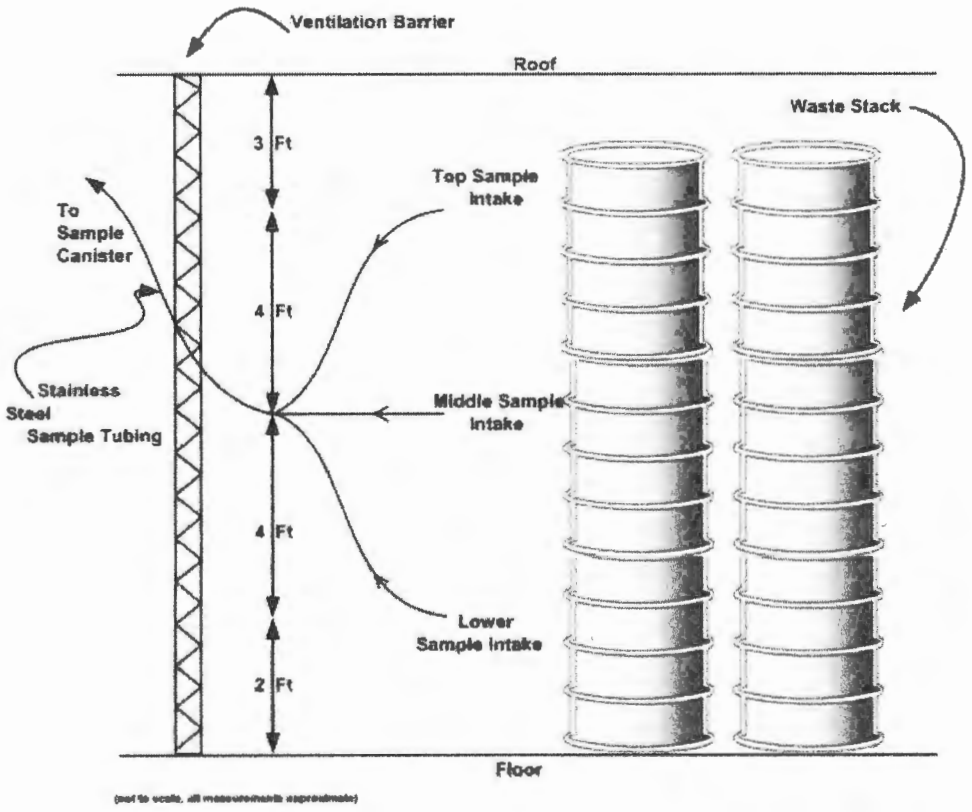


Figure N-4
VOC Sample Head Arrangement

1

Figure [illegible] System

Field Code Changed

ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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Figure N1-5	Logic Diagram for Evaluating Sample Line Loss

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ATTACHMENT N1

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N1-1 Introduction

This Permit Attachment describes the monitoring plan for hydrogen and methane generated in Underground Hazardous Waste Disposal Units (**HWDUs**) 3 through 8, also referred to as Panels 3 through 8.

Monitoring for hydrogen and methane in Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed, may be an effective way to gather data to establish realistic gas generation rates. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N1-2 Parameters to be Analyzed and Monitoring Design

The Permittees will monitor for hydrogen and methane in filled Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed. A "filled panel" is an Underground HWDU that will no longer receive waste for emplacement.

Monitoring of a filled panel will commence after installation of the following items in each filled panel:

- substantial barriers
- bulkheads
- five additional monitoring locations.

The substantial barriers serve to protect the waste from events such as ground movement or vehicle impacts. The substantial barrier will be constructed from available non-flammable materials such as mined salt (Figure N1-1).

The bulkheads (Figure N1-2) serves to block ventilation at the intake and exhaust of the filled panel and prevent personnel access. The bulkhead is constructed as a typical WIPP bulkhead with no access doors or panels. The bulkhead will consist of a steel member frame covered with galvanized sheet metal, and will not allow personnel access. Flexible flashing will be used as a gasket to attach the steel frame to the salt, thereby providing an effective yet flexible blockage to ventilation air. Over time, it is possible that the bulkhead may be damaged by creep closure around it. If the damage is such as to indicate a possible loss of functionality, then the bulkhead will be repaired or an additional bulkhead will be constructed outside of the original one.

The existing VOC monitoring lines as specified in Attachment N, Section N-3a(2), "Sampling Locations for Disposal Room VOC Monitoring", will be used for sample collection in each disposal room for Panels 3 and 4. The sample lines and their construction are shown in Figure N1-3. In addition to the existing VOC monitoring lines, five more sampling locations will be used to monitor for hydrogen and methane. These additional locations include:

- the intake of room 1
- the waste side of the exhaust bulkhead,

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- the accessible side of the exhaust bulkhead,
- the waste side of the intake bulkhead,
- the accessible side of the intake bulkhead.

These additional sampling locations (Figure N1-4) will use a single inlet sampling point placed near the back (roof) of the panel access drifts. This will maximize the sampling efficiency for these lighter compounds.

N1-3 Sampling Frequency

Sampling frequency will vary depending upon the levels of hydrogen and methane that are detected.

- If monitored concentrations are at or below Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted monthly.

- If monitored concentrations exceed Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted weekly in the affected filled panel.

N1-4 Sampling

Samples for hydrogen and methane will be collected using subatmospheric pressure grab sampling as described in Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling method uses passivated stainless-steel sample canisters to collect integrated air samples at each sample location. Flow rates and sampling duration may be modified as necessary to meet data quality objectives.

Sample lines shall be purged prior to sample collection.

N1-5 Sampling Equipment

N1-5a SUMMA® Canisters

Stainless-steel canisters with passivated or equivalent interior surfaces will be used to collect and store gas samples for hydrogen and methane analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use in a manner similar to that described by Compendium Method TO-15 (EPA, 1999). The vacuum of certified clean canisters will be verified upon initiation of a sample cycle. Sampling will be conducted using subatmospheric pressure grab sampling techniques as described in TO-15.

N1-5b Sample Tubing

Treated stainless steel tubing shall be used as a sample path and treatment shall prevent the inner walls from absorbing contaminants.

Any loss of the ability to purge a sample line will be evaluated. The criteria used for evaluation are shown in Figure N1-5.

The Permittees will first suspect that a line is not useable when it is purged prior to sampling. If the line cannot be purged, then it will not be used for sampling unless the line is a bulkhead line

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that can be easily replaced. Replacement of bulkhead lines will occur before the next scheduled sample. Non-bulkhead lines will be evaluated by first determining if adjacent sampling lines are working. If the answer is no, then the previous sample from the failed line will be examined. If the previous sample was between the first and second action levels, then the explosion-isolation wall will be installed since without the ability to monitor it is unknown whether the area is approaching the second action level or decreasing. If the previous sample was below the first action level then continued sampling is acceptable without the lost sample.

If an adjacent line is working, the prior concentrations measured in that line will be evaluated to determine if it is statistically similar to the prior measurements from the lost line. If the prior sampling results are statistically similar, the lines can be grouped. Statistical similarity will be determined using the Student's "t" test to evaluate differences.

The magnitude of *t* will be compared to the critical *t* value from SW-846, Table 9-2 (EPA, 1996), for this statistical test.

If the lost line can be grouped with an adjacent line, no further action is necessary because the unmonitored area is considered to be represented by the adjacent areas. If the lost sample line cannot be grouped with an adjacent line, the previous concentration measurement will be compared to the Action Levels. If the concentration is below Action Level 1, monitoring will continue. If the concentration is between Action Level 1 and Action Level 2, the explosion-isolation wall will be installed in the panel.

N1-6 Sample Management

Sample containers shall be sealed and uniquely marked at the time of collection of the sample. A Request-for-Analysis Form shall be completed to identify the sample canister number(s), sample type, and type of analysis requested.

N1-7 Analytical Procedures

The samples will be analyzed using gas chromatography equipped with the appropriate detector under an established QA/quality control (**QC**) program. Analysis of samples shall be performed by a laboratory that the Permittees select and approve through established QA processes.

N1-8 Data Evaluation and Notifications

Analytical data from sampling events will be evaluated to determine whether the sample concentrations of flammable gases exceed the Action Levels.

If any Action Level is exceeded, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of obtaining validated analytical data.

If any sampling line loss occurs, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of learning of a sampling line loss. After the evaluation of the impact of sampling line loss as shown in Figure N1-5, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of completing the sampling line loss evaluation.

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N1-9 References

U.S. Environmental Protection Agency (EPA), 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* 3rd Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1999. *Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry*, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

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FIGURES

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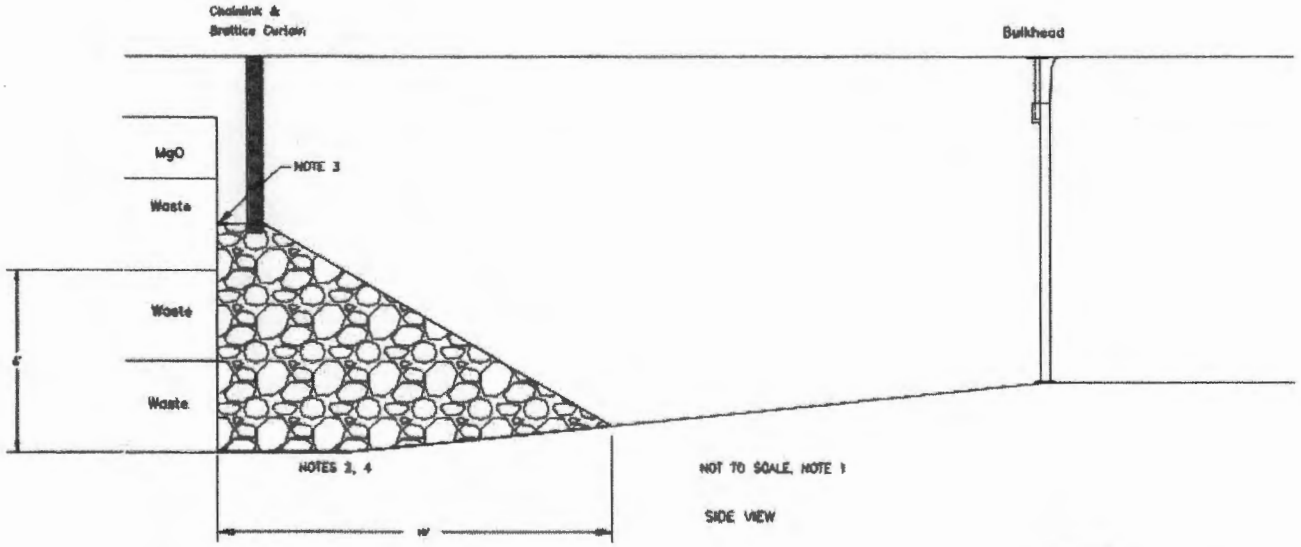

NOTES

1. CONFIGURATION AND PLACEMENT OF THE SUBSTANTIAL BARRIER AND THE BULKHEAD DICTATED BY AS-FOUND (FIELD) CONDITIONS, AS DESIGNATED BY THE COGNIZANT ENGINEER
2. SUBSTANTIAL BARRIER MATERIAL WILL CONSIST OF RUN-OF-MINE SALT OR OTHER SUITABLE NON-FLAMMABLE MATERIAL AS DESIGNATED BY THE COGNIZANT ENGINEER
3. SUBSTANTIAL BARRIER MATERIAL SHOULD BE AGAINST THE WASTE FACE. THE HEIGHT OF THE SUBSTANTIAL BARRIER NEAR THE WASTE WILL BE AT LEAST EQUAL TO THE HEIGHT OF THE BOTTOM OF THE TOP ROW OF WASTE.
4. DIMENSIONS INDICATED ARE MINIMUMS. THE HEIGHT OF THE SUBSTANTIAL BARRIER IS MEASURED AT THE WASTE FACE. THE LENGTH OF THE SUBSTANTIAL BARRIER IS MEASURED FROM THE BOTTOM OF THE WASTE FACE TO THE TOE OF THE SUBSTANTIAL BARRIER MATERIAL.

Figure N1-1
Typical Substantial Barrier and Bulkhead

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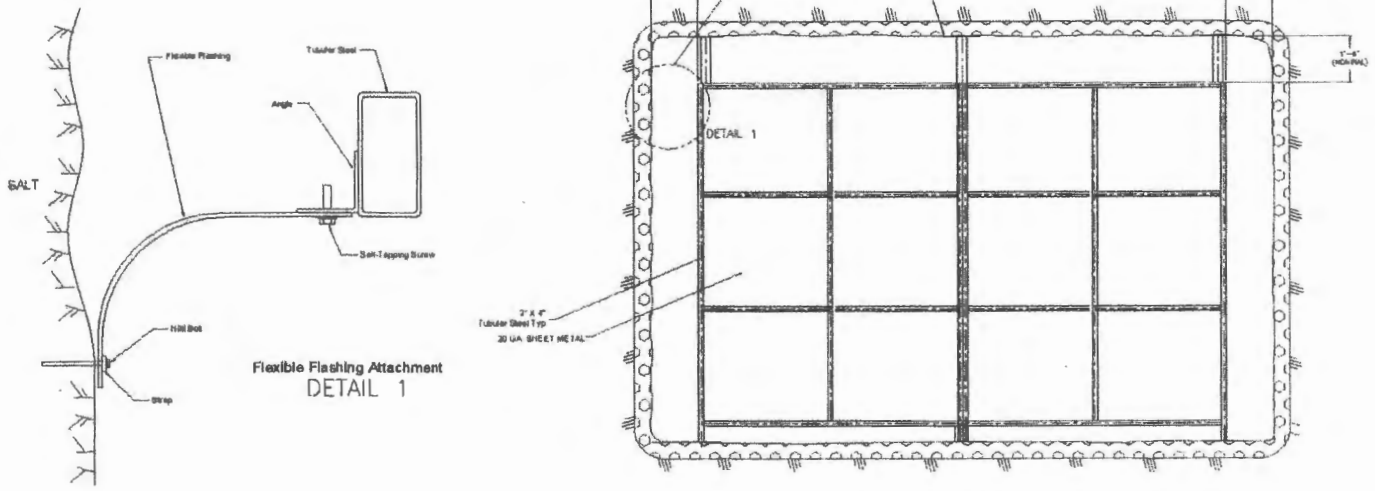

Not to Scale. All dimensions are nominal.

Figure N1-2
Typical Bulkhead

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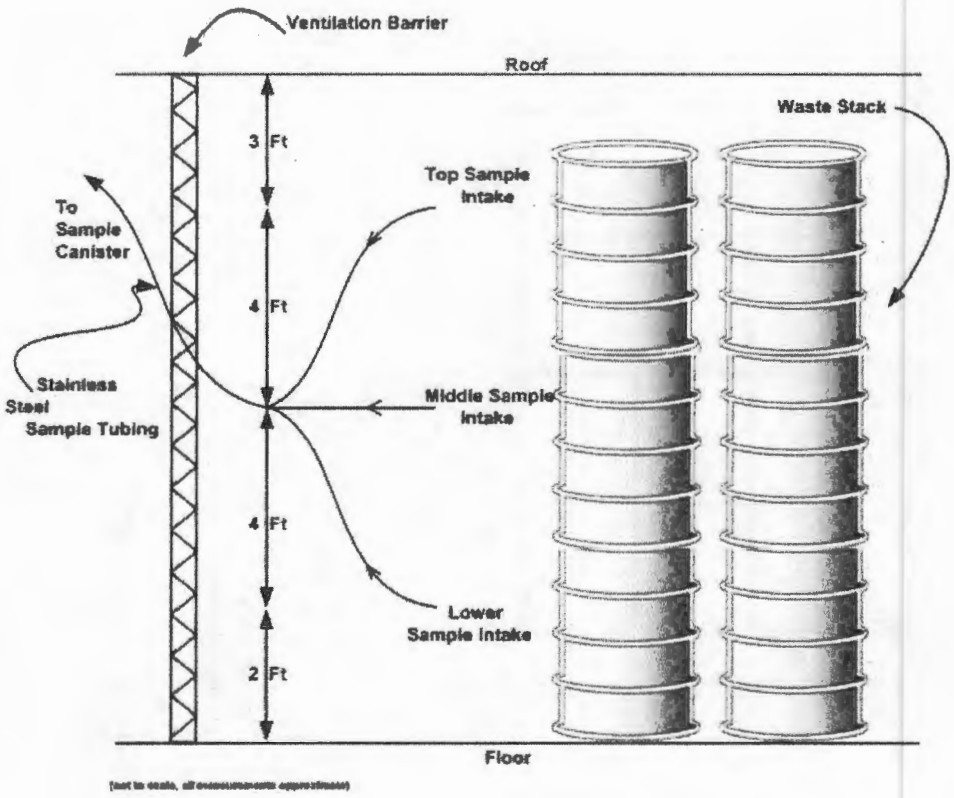

Figure N1-3
Typical Hydrogen and Methane Monitoring System

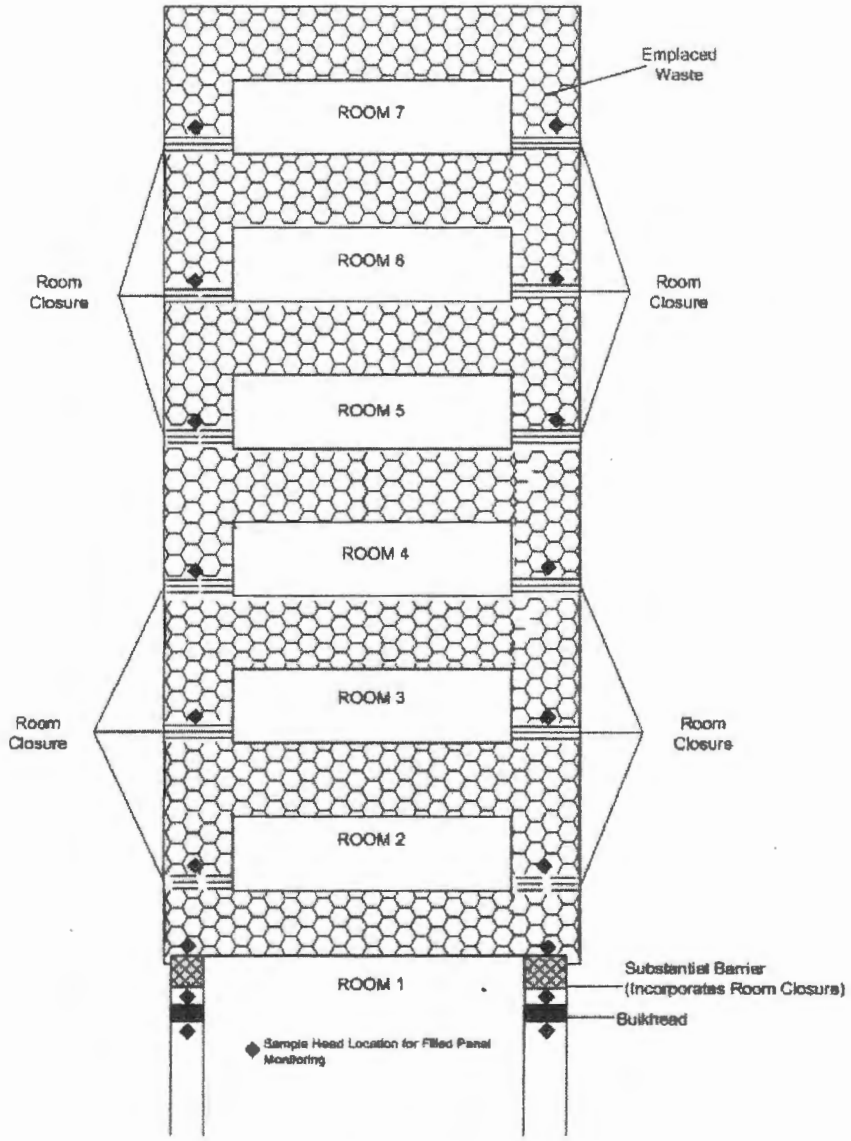

Figure N1-4
Typical Hydrogen and Methane Sampling Locations

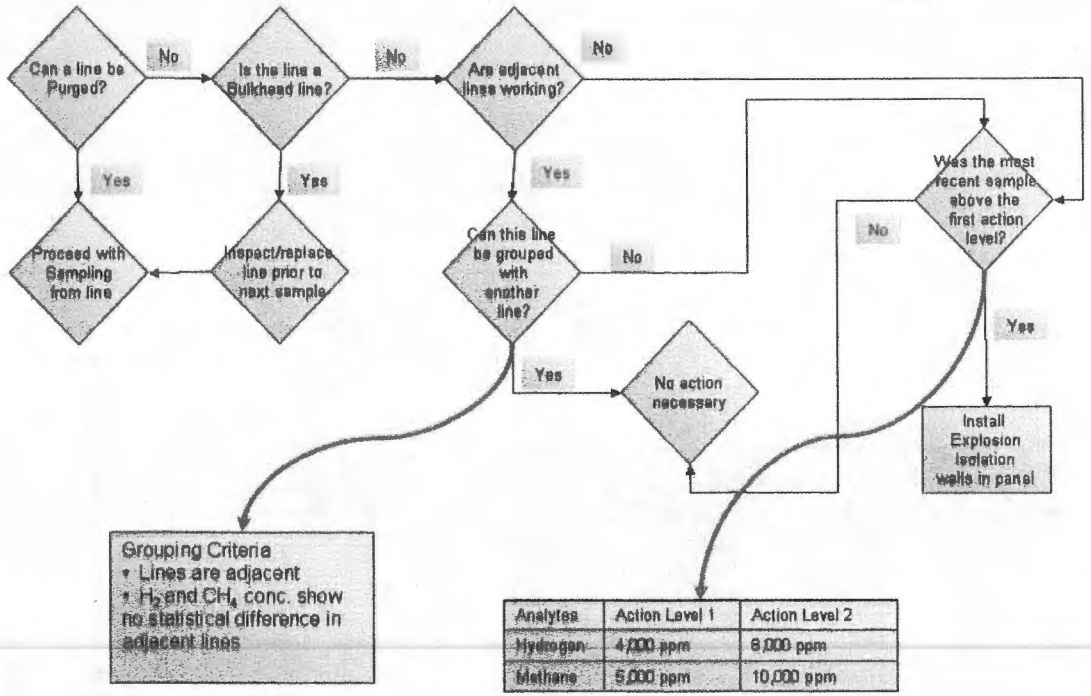

Figure N1-5
Logic Diagram for Evaluating Sample Line Loss

ENTERED

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGATE
Deputy Secretary

January 31, 2012

RE: SPECIFIC RESPONSE TO COMMENTS, CLASS 2 MODIFICATION REQUEST
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Commenter:

On January 31, 2012, the New Mexico Environment Department (**NMED**) took final administrative action on a Class 2 permit modification request (**PMR**) to the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit. The Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC (**the Permittees**) submitted this PMR to the Hazardous Waste Bureau on October 3, 2011 seeking to update ventilation language, to add the use of shielded containers, and revise the groundwater detection monitoring plan.

NMED approved the ventilation modifications and groundwater modifications of this PMR with changes and for the reasons specified in the attached response to comments. NMED denied the shielded container portion of the PMR. NMED was unable to approve the shielded container modification "with changes" as allowed under 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(6)(i)(A)) because none of the commenters, including the Permittees, proposed sufficiently detailed changes to rectify the technical inadequacies identified. Furthermore, NMED was unable to reclassify this modification request to follow the procedures for Class 3 modifications specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(6)(i)(C)) because the request was not approvable as submitted.

This Class 2 PMR was evaluated and processed in accordance with the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)). It was subject to a 60-day public comment period running from October 7, 2011 through December 5, 2011, during which NMED received written specific comments from eighty individuals and organizations. You are receiving this mailing because you provided public comment on this modification. The enclosed attachment incorporates NMED's specific response to all comments. Further information on this administrative action may be found on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/>.

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NMED appreciates your participation by submitting comments on these permit modification requests. Please contact Trais Kliphuis at (505) 476-6051 or via e-mail at <trais.kliphuis@state.nm.us> if you have further questions or need additional information.

Sincerely,

John E. Kieling
Acting Bureau Chief
Hazardous Waste Bureau

Attachment

cc: Trais Kliphuis, HWB
Laurie King, EPA Region 6
Edward Ziemianski, DOE/CBFO
M. Farok Sharif, Washington TRU Solutions LLC

Comment Number	Topic Area	Comment Summary	Response	Δ
1-1	Class 2 PMR - Update Ventilation Language	SRIC's primary concern is that adequate ventilation always be maintained in the Underground Hazardous Waste Disposal Units (HWDUs). The concern is reinforced by the measured levels of volatile organic compounds (VOCs) in the Underground HWDUs during the past three years, which have exposed workers to higher levels of carbon tetrachloride than were contemplated when the permit was issued in 1999. SRIC's concerns about the request and the Temporary Authorization are that they could allow instances in which adequate ventilation is not maintained and that any such instances would not be reported to NMED. SRIC also believes that changes in permit language need to be carefully crafted so as not to be confusing or inconsistent with other provisions of the Permit. Further, based on the discussion at the pre-submittal meeting on August 30, 2011 and the information in the request, SRIC believes that there are few situations in which the existing permit language is not appropriate. Thus, any modifications to the Permit regarding ventilation should be minimal and necessary and not result in workers being allowed to emplace CH or RH waste in rooms when ventilation is less than 35,000 scfm.	See response to comment 7.	No
1-2	Class 2 PMR - Update Ventilation Language	Regarding the proposed new definition is Part 1.5.19 Filled Room, SRIC agrees with the language of the November 18 comments, not the proposed language in the request. The language in the comment is consistent with that of Part 1.5.16 Filled Panel. Thus, the Permit would state: 1.5.19. Filled Room "Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.	Change incorporated.	Yes
1-3	Class 2 PMR - Update Ventilation Language	In the November 18 comments, the permittees also propose a new Part 1.5.20 Active Disposal Room that was not included in the request. SRIC believes that the practice of significantly revising a request with new language is undesireable for at least two reasons. First, it indicates that the request was not complete and accurate, which it must be. An incomplete request is grounds for denial by NMED, pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR 270.42(b)(7)(i)). Second, the permittees' comments on requests are not widely disseminated by the permittees, so they are not available to the general public that could comment on the request. In this particular instance, SRIC asked for and received the permittees' comments from NMED, so we can comment on the proposed change. SRIC also recognizes that if public comment or other factors result in the permittees recognizing the need to revise the request, the permittees may comment on their own request. In the future, SRIC requests that the permittees post their comments on modification requests in the Information Repository on the WIPP Home Page http://www.wipp.energy.gov. Such public dissemination would allow interested persons to be aware of such comments.	Comments noted.	No
1-4	Class 2 PMR - Update Ventilation Language	SRIC does not agree with all of the language of proposed Part 1.5.20 Active Disposal Room. Specifically, the word "Disposal" is unnecessary and not consistent with other language in the Permit. For example, Permit Part 4.4.1. Room-Based Limits specifies that an "open room" is "active." The request proposes new language in Part 4.5.3.2. Ventilation with the language of "active room," which the permittees do not propose to change in their comments. Thus, the comment and the request are inconsistent. Moreover, SRIC is not convinced that a further definition of "active room" is necessary and urges that NMED not include such a new provision. If NMED decides to incorporate a new definition, SRIC would support: 1.5.20. Active Room "Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.	Change incorporated. A definition for "Active Disposal Room" is warranted because it makes the Permit more clear and easy to interpret. NMED agrees that the term "Disposal" is not necessary or consistent with other sections of the Permit Modification Request (PMR) or the Permit. NMED also notes that other sections of the Permit use the phrases "open (active) room," "active disposal room," "active open room," and "active open disposal room." NMED interprets all of these to meet the definition of "Active Room" as incorporated into Permit Part 1, Section 1.5.20, and the Permittees should submit a Class 1 PMR to revise these sections to be consistent with this definition.	Yes

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Comment Number	Topic Area	Comment Summary	Response	Δ
1-5	Class 2 PMR - Update Ventilation Language	Regarding the specific proposed change to Part 4.5.3.2 in the request, SRIC could support the following language: 4.5.3.2. Ventilation The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft3/min and a minimum ventilation rate of 35,000 standard ft3/min when workers are present in an active room adjacent to a filled room or in Room 7 of any panel. as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR 264.601(c)).	Comment noted. NMED used the following language so as not to remove the ventilation requirement for the active RH rooms when workers are present but make language consistent throughout permit. "4.5.3.2. Ventilation -The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft3/min and a minimum active room ventilation rate of 35,000 standard ft3/min in each active room where waste disposal is taking place and when workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3) "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c))."	Yes
1-6	Class 2 PMR - Update Ventilation Language	The Permittees wish to include a definition for a Filled Room. 1.5.19 Filled Room "Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.	Change incorporated.	Yes
1-7	Class 2 PMR - Update Ventilation Language	The Permittees seek to clarify that the language proposed in this modification establishes minimum ventilation rates for any active disposal room that is receiving CH TRU waste and any active disposal room that is adjacent to a filled room only. Ventilation rates for other rooms (active RH TRU waste disposal rooms not adjacent to a filled room) are not subject to the same minimum ventilation rates. However, such rooms are subject to the general requirements in the Permit that invoke the ventilation standards of the Mine Health and Safety Administration (MSHA). This is protective of human health because the MSHA requirements are based on the amount of air needed to accommodate the types and quantity of equipment that is operating in an area of a mine. Furthermore, RH TRU active disposal rooms are only subject to negligible quantities of hazardous emissions from containers of emplaced waste. An analysis demonstrating that these emissions are negligible was included as Supplement 3 to the 2002 RH TRU Waste Permit Modification Request.	NMED did not incorporate the changes that would allow workers to emplace waste in RH TRU active rooms with less than 35,000 scfm. NMED determined that removal of the ventillation requirement did not meet the Class 2 PMR category specifically, Item A.4.b of Appendix 1 of 40 CFR 270.42 (incorporated by 20.4.1.900 NMAC). In order to qualify under this category, the changes must relate to monitoring, reporting, sampling or maintenance. Also, see response to comment 5.	No
1-8	Class 2 PMR - Update Ventilation Language	The Permittees wish to include a definition for an Active Disposal Room. 1.5.20 Active Disposal Room "Active Disposal Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.	See response to comment 4.	No
3-1	Class 2 PMR - Groundwater Detection Monitoring Program	Revised Table L-5 Page B-68 to correct table values so they match the values in the figures. Some editorial changes, such as rounding of numbers, were also made.	Change incorporated.	Yes
3-2	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial correction to delete the word "Suggested" from the title of Table L-6 in the Table of Contents, PMR page B-12, as it is not in the title of the associated table.	Change incorporated.	Yes
3-3	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial change to Figure L-4, Generalized Stratigraphic Cross Section Above Bell Canyon Formation at WIPP Site, to apply the correct color of sand and sandstone to the surficial deposits on the illustration.	Change incorporated.	Yes
3-4	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial change to Figure L-5,Culebra Freshwater-Head Potentiometric Surface, to add a legend item to identify the green dots on the potentiometric map as observation wells.	NMED has decided to incorporate the original Figure L-5 that was included in the September Class 2 PMR submittal. The contour lines in the revised figure that was submitted with the November public comment from the Permittees were not as clear as in the original. The dots in the incorperated figure are labeled with the name of the observation well that they are referring to.	No

Comment Number	Topic Area	Comment Summary	Response	Δ
3-5	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial change to delete the acronym "WQSP" from the title of Figure L-6, Detection Monitoring Well Locations.	Change incorporated.	Yes
3-6a	Class 2 PMR - Groundwater Detection Monitoring Program	There is controversy over direction of groundwater flow at WIPP; detection wells to the west and southwest of the site should not be abandoned.	Comment noted. There are six Detection Monitoring Wells in the WIPP Groundwater Monitoring Program, WQSP 1 through WQSP 6. WQSP 1, 2, and 3 are located directly up gradient or north of the WIPP shaft and WQSP 4, 5, and 6 are located down gradient or south of the WIPP shaft. Wells WQSP 4, 5, and 6 are situated to detect a release of waste constituents. There are no plans to abandon any of the six Detection Monitoring Wells and the Permittees will continue to maintain them as required in Permit section 5.3.1 and 5.3.2. The Permittees are only reporting on down gradient wells because they are the only ones that can trigger actions leading to compliance monitoring. The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR 246.95) as the vertical plane immediately down gradient of the hazardous waste management unit areas. Conceptual models and the Annual Culebra Groundwater Report will demonstrate groundwater flow rate and direction. Evaluations will be made to check if groundwater flow continues to be in the direction of these down gradient wells. Data will also be evaluated to determine if the detection wells continue to be located in the proper areas.	No
3-6b	Class 2 PMR - Groundwater Detection Monitoring Program	The 'Annual Culebra Groundwater Report' should be available to the public and should include information concerning individual wells.	The Annual Culebra Groundwater Report will be available to the public. The Permittees will be required to submit this annual report by November 30 of each year. The report will include information concerning individual Culebra monitoring wells. Monitoring data for the other water-bearing units will continue to be available to the public in the Department of Energy's Annual Site Environmental Report.	No
3-6c	Class 2 PMR - Groundwater Detection Monitoring Program	Magenta wells should not be abandoned; Dr. David T. Snow and Dr. Richard Phillips claim a connection between the Magenta and the Culebra.	Comment noted. The Culebra Member is currently used to determine compliance with groundwater monitoring in the WIPP Permit. Published studies have shown a connection between the Magenta and Culebra approximately 6 miles west of the WIPP Site near Nash Draw. Groundwater monitoring has demonstrated a general north to south in groundwater flow at the WIPP Site therefore there is no pathway for water to travel to the area to the west where there is a Magenta/Culebra connection. The Culebra formation has the lowest head making it the most likely hydrologic pathway and should continue to be the focus for the RCRA groundwater monitoring program.	No
3-6d	Class 2 PMR - Groundwater Detection Monitoring Program	Changing Analytical methods merits a permit modification. Without methods approved of by NMED and the public, results will not be easily accepted by the public.	The Permittees have submitted this Class 2 PMR to make changes that they seek to the WIPP Permit. The Class 2 PMR process includes a 60-day public comment period and requires NMED to consider public comments prior to approving the modifications. The Permittees have included language in section L-4c(3) in regards to laboratory analysis, "The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED."	No
3-6e	Class 2 PMR - Groundwater Detection Monitoring Program	Page 12, pa 1 states that there has been 'no significant change in the nature of the Culebra water' even though the inexplicable rise and fall of Culebra well heads was a major issue, debated by hydrologists and extensively commented upon by the public during the last EPA re-certification.	Comment noted. This PMR seeks to include enhanced interpretation of the Culebra water levels in the form of annotated hydrographs and trend analysis in the semi-annual groundwater report. This enhanced interpretation will include identification and discussion of rises and falls of well head levels and thereby provide greater understanding of unique phenomena.	No

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Comment Number	Topic Area	Comment Summary	Response	Δ
3-7	Class 2 PMR - Groundwater Detection Monitoring Program	SRIC recognizes that the Groundwater Detection Monitoring Program Plan must be revised to address concerns about the program and that NMED approved the Groundwater Permit Modification Work Plan on August 5, 2011. SRIC requests that the typographical error in the caption of Figure L-2 be corrected, as follows: Figure L-2 – WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary Table 1 on page 16 of the request correctly states that the Land Withdrawal Area (LWA) is 16 square miles. The List of Figures on page B-12 has the correct title. Section L-1 of the request, page B-16, correctly states that the LWA is 16 square miles. Existing Permit Figure L-2 caption is 16-square-miles, so the proposed caption in the request is clearly an erroneous typographical error that NMED should correct.	Comment noted and change incorporated.	Yes
3-8	Class 2 PMR - Groundwater Detection Monitoring	Editorial correction. PMR Item 3, Revise the WIPP Groundwater Detection Monitoring Program Plan, Table L-5, Details of Construction for the Six Culebra Detection Monitoring Wells, to provide consistency in unit conversions and rounding and to correct one value for WQSP-6 drilling depth with error.	Change incorporated.	Yes
3-9	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial correction. PMR Item 3, Revise the WIPP Groundwater Detection Monitoring Program Plan, Page B-31, Line 34. Insert, "or three well bore volumes, whichever occurs first," after "...parameters stabilize..." Either stabilization of field parameters or collection of three well bore volumes attains the sample quality required for laboratory analysis. This change makes this language consistent with the proposed text in Section L-4c(2)(ii).	Change incorporated.	Yes
3-10	Class 2 PMR - Groundwater Detection Monitoring Program	Editorial correction. PMR Item 3, Revise the WIPP Groundwater Detection Monitoring Program Plan, Page B-53, Lines 14 and 17. In line 14 move the "and" to be in front of "temperature" and delete the comma immediately after temperature. In Line 17 delete the text "and SC to 10 millivolts (mV)." The correct SC units are included earlier in the sentence and not needed here.	Change incorporated.	Yes

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

February 6, 2012

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RE: CORRECTION OF TYPOGRAPHIC ERRORS FOR CLASS 2 MODIFICATION REQUEST ISSUED JANUARY 31, 2012, WIPP HAZARDOUS WASTE FACILITY PERMIT EPA I.D. NUMBER NM4890139088

Dear Messrs. Ziemianski and Sharif:

On January 31, 2012 the New Mexico Environment Department (NMED) issued a final decision the Class 2 permit modification. NMED has since been notified and has identified several non-substantive typographical errors to the modified permit.

Enclosed are the revised pages of the modified permit in redline-strikeout to help identify the corrections. Enclosed is an electronic version in CD format of the corrected permit. An electronic version of the corrected permit has also been posted for the public on the Department's WIPP Information Page at http://www.nmenv.state.nm.us/wipp/download.html

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Please contact Trais Kliphuis at (505) 476-6051 or via e-mail at trais.kliphuis@state.nm.us if you have questions or need additional information.

Sincerely,

John E. Kieling
Acting Chief
Hazardous Waste Bureau

Enclosures:
Redline/strikeout pages showing corrections
Electronic version of corrected permit dated January 31, 2012

cc: C. de Saillan, NMED OGC
Trais Kliphuis, HWB
Don Hancock, SRIC

PART 1 - GENERAL PERMIT CONDITIONS

1.1. AUTHORITY

This Permit is issued pursuant to the authority of the Secretary of the New Mexico Environment Department (**Secretary**) under the New Mexico Hazardous Waste Act (**HWA**), NMSA 1978, §§74-4-1 through 74-4-14, in accordance with the New Mexico Hazardous Waste Management Regulations (**HWMR**), 20.4.1 NMAC.

Pursuant to the Resource Conservation and Recovery Act (**RCRA**), 42 U.S.C. §§6901 to 6992k, and 40 CFR Part 271 and Part 272 Subpart GG, the State of New Mexico, through the Secretary, is authorized to administer and enforce the state hazardous waste management program under the HWA in lieu of the federal program.

This Permit contains terms and conditions that the Secretary has determined are necessary to protect human health and the environment, pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)).

Any violation of a condition in this Permit may subject the Permittees or their officers, employees, successors, and assigns to:

1) A compliance order under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a));

2) An injunction under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

3) Civil penalties under §§74-4-10 and 74-4-10.1 of the HWA or §§3008(a) and (g) of RCRA (42 U.S.C. §§6928(a) and (g)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

4) Criminal penalties under §74-4-11 of the HWA or §§3008(d), (e), and (f) of RCRA (42 U.S.C. §§6928(d), (e), and (f)); or

5) Some combination of the foregoing.

The list of authorities in this paragraph is not exhaustive and the Secretary reserves the right to take any action authorized by law to enforce the requirements of this Permit.

1.2. EFFECT OF PERMIT

The Secretary issues this Permit to the United States Department of Energy (**DOE**), the owner and co-operator of the Waste Isolation Pilot Plant (**WIPP**) (EPA I.D. Number NM4890139088), and Washington TRU Solutions LLC, Management and Operating Contractor (**MOC**), the co-operator of WIPP. This Permit authorizes DOE and MOC (**the Permittees**) to manage, store, and dispose contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste at WIPP, and establishes the general and specific standards for these activities, pursuant to the HWA and HWMR.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room where waste disposal is taking place and workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report to the Secretary in the annual report specified in Permit Section 4.6.24.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

quality at each DMW specified in Table 5.3.1 to the background groundwater quality determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.9.4. Data Evaluation Timeframe

The Permittees shall perform the data evaluations specified in Permit Section 5.9.3 within 120 calendar days after completion of DMP sampling, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)(2)).

5.10. RECORDKEEPING AND REPORTING

5.10.1. Operating Record Requirements

The Permittees shall enter all DMP monitoring, testing, and analytical data in the operating record as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(6)). The Permittees shall enter these data, as measured and in a form appropriate for the determination of statistically significant evidence of contamination, into the operating record as specified in Permit Section 5.9.1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(c)).

5.10.2. Submittal of Results

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5.1 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, in the Annual Culebra Groundwater Report by November 30 of each year as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)).

Analytical results of a sampling round may be included in the report specified in Permit Section 5.10.2.3 if publication of the report coincides with the 120 calendar day report submittal schedule.

5.10.2.2. Groundwater Surface Elevation Results

The Permittees shall submit to the Secretary groundwater surface elevation data specified in Permit Section 5.7. This submittal shall include both groundwater surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be ~~submitted~~ reported semiannually by- May 31 and November 30~~within 30 calendar days after data are collected~~. The November water level data report shall be combined with the Annual Culebra Groundwater Report

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specified in Permit Part 5.10.2.3. ~~Water level data shall be submitted within 30 calendar days after data are collected.~~

5.10.2.3. Groundwater Flow and Radionuclide Sampling Results

The Permittees shall submit to the Secretary an evaluation of the ~~ground-water~~groundwater flow data (to include annotated hydrographs) specified in Permit Section 5.8 ~~and the results of radionuclide-specific analysis of groundwaters sampled from the DMWs~~ in the Annual Culebra Groundwater ~~Site Environmental~~ Report ~~by October 1~~ by November 30 of each calendar year.

~~The Permittees shall submit to the Secretary an evaluation of the groundwater flow data specified in Permit Section 5.8 and the results of radionuclide-specific analysis of groundwaters sampled from the DMWs in the Annual Site Environmental Report by October 1 of each calendar year.~~

5.10.3. Determination of Contamination

If the Permittees determine, pursuant to Permit Section 5.9 and 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)), that there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b, the Permittees shall comply with the following:

5.10.3.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days, indicating what hazardous constituents have shown statistically significant evidence of contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(1)).

5.10.3.2. Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the groundwater in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

5.10.3.3. Verification Sampling

As specified by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)), for any substances found in the initial analysis pursuant to

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power is returned. As specified in Part 2, all waste handling equipment will "fail safe," meaning that it will retain its load during a power outage.

Underground Ventilation Normal Mode Redundancy

The underground ventilation system has been provided redundancy in normal ventilation mode by the addition of a third main fan. Ductwork leading to that new fan ties into the existing main exhaust duct.

Electrical System

The WIPP facility uses electrical power (utility power) supplied by the regional electric utility company. If there is a loss of utility power, TRU mixed waste handling and related operations will cease.

Backup, alternating current power will be provided on site by two 1,100-kilowatt diesel generators. These units provide 480-volt power with a high degree of reliability. Each of the diesel generators can carry predetermined equipment loads while maintaining additional power reserves. Predetermined loads include lighting and ventilation for underground facilities, lighting and ventilation for the TRU mixed waste handling areas, and the Air Intake Shaft hoist. The diesel generator can be brought on line within 30 minutes either manually or from the control panel in the Central Monitoring Room (CMR).

Uninterruptible power supply (**UPS**) units are also on line providing power to predetermined monitoring systems. These systems ensure that the power to the radiation detection system for airborne contamination, the local processing units, the computer room, and the CMR will always be available, even during the interval between the loss of off-site power and initiation of backup diesel generator power.

A2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table A2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure A2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the Facility Cask is loaded, the Facility Cask Transfer Car moves onto the waste shaft conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste shaft conveyance to provide forklift access to the Facility Cask.

Horizontal Emplacement and Retrieval Equipment or Functionally Equivalent Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) or functionally equivalent equipment (Figure A2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

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mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) ~~Application~~ (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the downward percolation of water into the evaporite units below. The Bell Canyon is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) (DOE, 2009)) and is confined above by the thick evaporite deposits of the Castile. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is approximately 2,200 pounds per square inch [lb/in.^{2}] or 14.9 megapascals [MPa]) and eventually deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) (DOE, 2009)).

L-1a(2) Groundwater Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional groundwater aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities

Potentiometric surfaces and groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

L-3b(1) Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

The six DMP Culebra wells were drilled between September 13 and October 16, 1994. The total depth of each well is shown in Table L-5. The wells were drilled through the Culebra ~~and~~ into the Los Medaños as shown in Table L-5. The wells were drilled to the top of the Culebra using compressed air as the drilling fluid and a 9⅞-in. drill bit. The wells were then cored using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, DMP wells were reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were cased from the surface to total depth with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval as shown in Table L-5 . The annulus between the borehole wall and the casing/screen is packed with sand and with 8/16 Brady gravel as indicated in Table L-5.

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

Groundwater surface elevations will be monitored in each of the six DMWs on a monthly basis. The groundwater surface elevation in each DMW will also be measured prior to each annual sampling event. The groundwater surface elevation measurements in the WLMP wells will also be monitored on a monthly basis when accessible. The characteristics of the DMW (sampling frequency, location) will be evaluated if significant changes are observed in the groundwater flow direction or gradient.

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b are measured as part of the DMP.

Additional hazardous constituents may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility. If hazardous constituents are identified, these will be added to Part 5, Table 5.4.b, unless the Permittees provide justification for their omission (e.g. hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

Head distribution in the Culebra (see Amended Renewal Application Addendum L1 (DOE, 2009)) is consistent with basin-scale groundwater basin modeling results indicating that the generalized groundwater flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta Member (**Magenta**) of the Rustler across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale groundwater modeling.

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering.

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if groundwater monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that groundwater monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP

Potentiometric surfaces and groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

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Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-6 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head.

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (**DI**) water and rinsed in DI water. Sample containers will be new, certified clean containers that will be discarded after one use. Groundwater surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed in accordance with SOPs after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a rinsate blank sample will be collected to verify cleanliness.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered sampling lines. Detailed protocols, in the form of SOPs (see Table L-3) define how final samples will be collected in a consistent and repeatable fashion for analyses.

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-6). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory SOPs). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs generated, approved, and maintained by the contract analytical laboratory.

Final samples will be sent to the analytical laboratories and analyzed for parameters and hazardous constituents specified in Part 5, ~~table~~ Tables 5.4a and 5.4b.

Duplicates of the final sample will be provided to WIPP Project oversight agencies when requested.

Wastes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3).

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated as requested by the analytical laboratory.

The analytical laboratory receiving the samples will prescribe the type and amount of preservative, the container material type, the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the

EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses uniquely numbered chain of custody/ request for analysis (CofC/RFA) forms. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes of interest. WIPP SOPs (see Table L-3) provides instructions to ensure proper sample tracking protocol.

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3).

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking data, and CofC/RFA form. An example form is shown in Figure L-13.

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, custody seals that are adhesive-backed strips are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking

Sample tracking information will be completed for each sample collected. The sample tracking information includes the following information: CofC/RFA form number; date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

WQ6[1]C[2]R2[3]N1[4]

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document.

Chain of Custody and Request for Analysis

A CofC/RFA form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The CofC/RFA form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the CofC/RFA form. The completed original (top page) of the CofC/RFA will be returned to the Permittees with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed using methods selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall demonstrate, through laboratory SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility Operating Record. Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in groundwater and the complexity of brines associated with the Culebra groundwater.

L-7a(2)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-7a(2)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (SC), temperature, specific gravity and static groundwater surface elevation. Field measurement accuracy will be determined using calibration ~~check~~ standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ensure accuracy. Accuracy of groundwater surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs contains instructions that outline protocols for maintaining current calibration of groundwater surface elevation measurement instrumentation.

L-7a(2)(i)(B) Accuracy Objectives for Laboratory Measurements

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-7a(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{\left|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)\right|}{average\ of\ measured\ samples\ 1+2} \times 100$$

L-7a(2)(ii)(A) Precision Objectives for Field Measurements

Specific conductance, pH, and temperature will be measured during well purging and after sampling. SC measurements will be precise to ±10% pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer and temperature to 0.10 degrees Celsius (°C). Water-level measurements will be precise to ± 0.01 ft. The precision of water density measurements, when measured in the

The use of an average value of 730 hours per month in the monthly average calculation is reasonable, given that all the numbers involved are very large and that the final use of the monthly average flow is in an annual calculation.

O-3c Active ~~Disposal~~ Room Minimum Airflow

O-3c(1) Verification of Active Room Minimum Airflow

Whenever workers are present, the Permittees shall verify the minimum airflow through active room(s) where waste disposal is taking place of 35,000 scfm at the start of each shift, any time there is an operational mode change, or if there is a change in the ventilation system configuration.

O-3c(2) Measurement and Calculation of the Active Room Airflow

The Permittees shall measure the airflow rate and use the room cross-sectional area to calculate the volume of air flowing through a disposal room. The measurement of airflow shall use a calibrated anemometer and a moving traverse (McPherson, 1993). Airflow measurements shall be collected at an appropriate location, chosen by the operator to minimize airflow disturbances, near the entrance of each active room. The excavation dimensions at the measurement location are taken and the cross-sectional area is calculated. The flow rate is the product of the air velocity and the cross-section area. The value shall be entered on a log sheet (see Table O-3) and compared to the required minimum. The format and content of the log sheet may vary, but will always contain the data and information shown on Table O-3. Working values are in acfm and the conversion to scfm is described in section O-1 above. Measurements shall be collected, recorded, and verified by qualified operators.

The operator shall compare the recorded acfm value with the minimum acfm value provided at the top of the log sheet. The airflow shall be re-checked and recorded whenever there is an operational mode change or a change in ventilation system configuration. Once the ventilation rate has been recorded and verified to be at least the required minimum, personnel access to the room is unrestricted in accordance with normal underground operating procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room shall be restricted. Those periods when active disposal room access is restricted shall be documented on the log sheet for that active disposal room. Entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed. Such entry shall be documented on the log sheet including a reference to the SOP used for reentry,

O-3d Quarterly Verification of Total Mine Airflow

The Permittees shall perform a quarterly verification of the total mine airflow to ensure that rates established by the Test and Balance for various operational modes are reasonably maintained. These checks are identified in Permit Attachment E, Table E-1, and are performed as indicated in Table E-1.

O-4 Equipment Calibration and Maintenance

Equipment used for the periodic Test and Balance, quarterly flow verification checks, and daily verification of active disposal room flow rate shall be calibrated in accordance with appropriate WIPP calibration and data collection procedures. Work performed by subcontractors shall also

PART 1 - GENERAL PERMIT CONDITIONS

1.1. AUTHORITY

This Permit is issued pursuant to the authority of the Secretary of the New Mexico Environment Department (**Secretary**) under the New Mexico Hazardous Waste Act (**HWA**), NMSA 1978, §§74-4-1 through 74-4-14, in accordance with the New Mexico Hazardous Waste Management Regulations (**HWMR**), 20.4.1 NMAC.

Pursuant to the Resource Conservation and Recovery Act (**RCRA**), 42 U.S.C. §§6901 to 6992k, and 40 CFR Part 271 and Part 272 Subpart GG, the State of New Mexico, through the Secretary, is authorized to administer and enforce the state hazardous waste management program under the HWA in lieu of the federal program.

This Permit contains terms and conditions that the Secretary has determined are necessary to protect human health and the environment, pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)).

Any violation of a condition in this Permit may subject the Permittees or their officers, employees, successors, and assigns to:

1) A compliance order under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a));

2) An injunction under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

3) Civil penalties under §§74-4-10 and 74-4-10.1 of the HWA or §§3008(a) and (g) of RCRA (42 U.S.C. §§6928(a) and (g)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

4) Criminal penalties under §74-4-11 of the HWA or §§3008(d), (e), and (f) of RCRA (42 U.S.C. §§6928(d), (e), and (f)); or

5) Some combination of the foregoing.

The list of authorities in this paragraph is not exhaustive and the Secretary reserves the right to take any action authorized by law to enforce the requirements of this Permit.

1.2. EFFECT OF PERMIT

The Secretary issues this Permit to the United States Department of Energy (**DOE**), the owner and co-operator of the Waste Isolation Pilot Plant (**WIPP**) (EPA I.D. Number NM4890139088), and Washington TRU Solutions LLC, Management and Operating Contractor (**MOC**), the co-operator of WIPP. This Permit authorizes DOE and MOC (**the Permittees**) to manage, store, and dispose contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste at WIPP, and establishes the general and specific standards for these activities, pursuant to the HWA and HWMR.

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As to those activities specifically authorized or otherwise specifically addressed under this Permit, compliance with this Permit during its term shall constitute compliance, for purposes of enforcement, with Subtitle C of RCRA and the HWA, and the implementing regulations at 40 CFR Parts 264, 266, and 268 except for those requirements that become effective by statute after the Permit has been issued [20 4.1.900 NMAC (incorporating 40 CFR §270.4)]

Compliance with this Permit shall not constitute a defense to any order issued or any action brought under Sections 74-4-10.E or 74-4-13 of the HWA; Sections 3008(a), 3008(h), 3013, or 7003 of RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. §9601 et seq., commonly known as CERCLA) Sections 106(a), 104, or 107; or any other federal, state, or local law providing for protection of public health or the environment. This Permit does not convey any property rights of any sort or any exclusive privilege, nor authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local laws or regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.4, 270.30(g), and 270.32(b)(1))]

1.3. PERMIT ACTIONS

1.3.1. Permit Modification, Suspension, and Revocation

This Permit may be modified, suspended, and/or revoked for cause as specified in Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §§270.41, 270.42, and 270.43). The filing of a request by the Permittees for a permit modification, suspension, or revocation, or the notification of planned changes or anticipated noncompliance, shall not stay any permit condition. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(f))]

1.3.2. Permit Renewal

The Permittees may renew this Permit by submitting an application for a new Permit at least 180 calendar days before the expiration date of this Permit. In reviewing any application for a Permit renewal, the Secretary shall consider improvements in the state of control and measurement technology and changes in applicable regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h) and 270.30(b))]

1.3.3. Permit Review

The Secretary shall review this Permit no later than five (5) years after the effective date of this Permit, and shall modify this Permit as necessary pursuant to Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §270.41). Such modification(s) shall not extend the effective term of this Permit specified in Permit Section 1.7.2. [20.4.1.900 NMAC (incorporating 40 CFR §§270.41 and 270.50(b) and (d))]

1.4. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to

other circumstances and the remainder of this Permit shall not be affected thereby. [40 CFR §124.16(a)(1) and (2)]

1.5. DEFINITIONS

Unless otherwise expressly provided herein, the terms used in this Permit shall have the meaning set forth in RCRA, HWA, and/or their implementing regulations.

1.5.1. Contact-handled Transuranic Mixed Waste

"Contact-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate not greater than 200 millirem per hour. [Pub. L. 102-579 (1992)]

1.5.2. Remote-handled Transuranic Mixed Waste

"Remote-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate of 200 millirem per hour or greater. For WIPP, the surface dose rate shall not exceed 1,000 rems per hour. [Pub. L. 102-579 (1992)]

1.5.3. Facility

"Facility" or "permitted facility" means the Waste Isolation Pilot Plant (**WIPP**) owned by the DOE and located approximately twenty six (26) miles east of Carlsbad, New Mexico, EPA I.D. Number NM4890139088. The WIPP facility comprises the entire complex within the WIPP Site Boundary as specified in the WIPP Land Withdrawal Act of 1992, Pub. L. 102-579 (1992), including all contiguous land, and structures, other appurtenances, and improvements on the Permittees' land, used for management, storage, or disposal of TRU mixed waste.

1.5.4. Permittees

"Permittees" means the United States Department of Energy (**DOE**), an agency of the Federal government, and the owner and co-operator of the WIPP facility; and Washington TRU Solutions LLC, Management and Operating Contractor (**MOC**), the co-operator of the WIPP facility. References to actions taken by "the Permittees" indicate actions that may be taken by either co-Permittee.

1.5.5. Secretary

"Secretary" means the Secretary of the New Mexico Environment Department (**NMED**), or designee.

1.5.6. TRU Waste

"TRU Waste" means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (A) high-level radioactive waste; (B) waste that the DOE Secretary has determined, with the

concurrence of the EPA Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations. [Pub. L. 102-579 (1992)]

1.5.7. TRU Mixed Waste

"TRU Mixed Waste" means TRU waste that is also a hazardous waste as defined by the HWA and 20.4.1.200 NMAC (incorporating 40 CFR §261.3).

1.5.8. Contact Handled Packages

"Contact Handled Packages" means TRUPACT-II, HalfPACT, and TRUPACT-III shipping containers and their contents.

1.5.9. Remote-Handled Packages

"Remote-Handled Packages" means both CNS 10-160B and RH-TRU 72-B shipping containers and their contents.

1.5.10. Containment Pallet

"Containment pallet" means a device capable of holding a minimum of one 55-gallon drum, or 85-gallon drum, or 100-gallon drum or a standard waste box, or a ten-drum overpack and that has internal containment for up to ten percent of the volume of the containers on the containment pallet.

1.5.11. Waste Characterization

"Waste characterization" or "characterization" means the activities performed by or on behalf of the waste generator/storage sites (**sites**) to obtain information used by the Permittees to satisfy the general waste analysis requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)). Characterization occurs before waste containers have been certified for disposal at WIPP.

1.5.12. Waste Confirmation

"Waste confirmation" or "confirmation" means the activities performed by the Permittees or the co-Permittee DOE, pursuant to Permit Attachment C7 (TRU Waste Confirmation), to satisfy the requirements specified in Section 310 of Pub. L. 108-447. Confirmation occurs after waste containers have been certified for disposal at WIPP.

1.5.13. Substantial Barrier

"Substantial barrier" means salt or other non-combustible material installed between the waste face and the bulkhead to protect the waste from events such as ground movement or

vehicle impacts. The substantial barrier incorporates the chain link and brattice cloth room closure specified in Permit Attachment A2.

1.5.14. Bulkhead

"Bulkhead" means a steel structure, with flexible flashing, that is used to block ventilation as specified in Permit Attachment A2 (Geologic Repository).

1.5.15. Explosion-Isolation Wall

"Explosion-isolation wall" means the 12-foot wall intended as an explosion isolation device that is part of the approved panel-closure system specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System).

1.5.16. Filled Panel

"Filled panel" means an Underground Hazardous Waste Disposal Unit specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.17. Internal Container

"Internal container" means a container inside the outermost container examined during radiography or visual examination (**VE**). Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not designed to hold liquid at the time of original waste packaging are not internal containers.

1.5.18. Observable Liquid

"Observable liquid" means liquid that is observable using radiography or VE as specified in Permit Attachment C (Waste Analysis Plan).

1.5.19. Filled Room

"Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.20. Active Room

"Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.

1.6. EFFECT OF INACCURACIES IN PERMIT APPLICATION

This Permit is based on the assumption that all information contained in the permit application and the administrative record is accurate and that the Facility will be constructed and operated as specified in the application. The permit application consists of information submitted in September 2009 and supplementary technical documents.

Any inaccuracies found in the submitted information may be grounds for the termination or modification of this Permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.41, §270.42, and §270.43) and for potential enforcement action.

1.7. DUTIES AND REQUIREMENTS

1.7.1. Duty to Comply

The Permittees shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized in an emergency permit specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.61). Any Permit noncompliance, except under the terms of an emergency permit, constitutes a violation of RCRA and/or HWA and is grounds for enforcement action; for Permit modification, suspension, or revocation; or for denial of a Permit modification or renewal application. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(a))]

1.7.2. Permit Term

This Permit shall be effective for a fixed term not to exceed ten years from the effective date. The effective date of this Permit shall be 30 days after notice of the Secretary's decision has been served on the Permittees or such later time as the Secretary may specify. [20.4.1.900 NMAC (incorporating 40 CFR §270.50(a))]

1.7.3. Duty to Reapply

If the Permittees wish to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittees shall apply for and obtain a new Permit. The Permittees shall submit an application for a new Permit at least 180 calendar days before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h), 270.30(b))]

1.7.4. Continuation of Expiring Permits

If the Permittees have submitted a timely and complete application for renewal of this Permit as specified in 20.4.1.900 NMAC (incorporating 40 CFR §§270.10, 270.13 through 270.29), this Permit shall remain in effect until the effective date of the new Permit if, through no fault of the Permittees, the Secretary has not issued a new Permit on or before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.51)]

1.7.5. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for the Permittees in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(c))]

1.7.6. Duty to Mitigate

In the event of noncompliance with this Permit, the Permittees shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(d))]

1.7.7. Proper Operation and Maintenance

The Permittees shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this Permit. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(e))]

1.7.8. Duty to Provide Information

The Permittees shall furnish to the Secretary, within a reasonable time frame as specified by the Secretary, any relevant information which the Secretary may request to determine whether cause exists for modifying, suspending, or revoking this Permit, or to determine compliance with this Permit. The Permittees shall also furnish to the Secretary, upon request, copies of records required to be kept by this Permit. Information and records requested by the Secretary pursuant to this condition shall be provided in a paper or an electronic format acceptable to the Secretary. [20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.74(a) and 270.30(h))]

1.7.9. Inspection and Entry

The Permittees shall allow the Secretary, or authorized representatives, upon the presentation of credentials and other documents as may be required by law and at reasonable times, the following inspection and entry privileges specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(i)):

1.7.9.1. Entrance to Premises

To enter upon the Permittees' premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

1.7.9.2. Access to Records

To have access to and copy any records that must be kept under the conditions of this Permit;

1.7.9.3. Inspection

To have access to, inspect, and obtain photographs of any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

1.7.9.4. Sampling

To sample or monitor, for the purposes of assuring Permit compliance or as otherwise authorized by RCRA and/or HWA, any substances or parameters at any location. If the Secretary obtains any sample, prior to leaving the premises the Secretary shall give the Permittees a receipt describing the sample obtained and, if requested, a portion of each sample of equal weight or volume to the portion retained. If any analysis is made of the sample, the Secretary shall promptly furnish a copy of the results of the analysis to the Permittees.

Permit Section 1.7.9 shall not be construed to limit, in any manner, the Secretary's authority under Section 74-4-4.3 of the HWA.

1.7.10. Monitoring and Records

1.7.10.1. Representative Sampling

For the purposes of monitoring, the Permittees shall take samples and measurements representative of the monitored activity. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(1))]

1.7.10.2. Record Retention

Beginning with the effective date of this Permit, the Permittees shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, and copies of all reports and records required by this Permit until closure. If original strip chart recordings are more than three years old, copies are acceptable. The Permittees shall retain the waste minimization certification required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(9)), and records of all data used to complete the application for this Permit for a period of at least 3 years from the date of certification or application. The Secretary may extend these periods at any time, and these periods shall be automatically extended during the course of any unresolved enforcement action

regarding this facility. The Permittees shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations, during the active life of the facility and the post-closure period. [20.4.1.500 NMAC (incorporating 40 CFR §264.74(b)), 20.4.1.501 NMAC, and 20.4.1.900 (incorporating §270.30(j)(2))]

1.7.10.3. Monitoring Records Contents

As specified by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(3)), records of monitoring information shall include:

i. The dates, exact place, and times of sampling or measurements;

ii. The individuals who performed the sampling or measurements;

iii. The dates analyses were performed;

iv. The individuals who performed the analyses;

v. The analytical techniques or methods used; and

vi. The results of such analyses.

1.7.11. Reporting Requirements

1.7.11.1. Reporting Planned Changes

The Permittees shall give notice to the Secretary, as soon as possible, of any planned physical alterations or additions to the permitted facility. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(1))]

1.7.11.2. Reporting Anticipated Noncompliance

The Permittees shall give advance notice to the Secretary of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall not store or dispose TRU mixed waste in any modified portion of the facility (except as provided in 20.4.1.900 NMAC (incorporating 40 CFR §270.42)) until the following conditions specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(2)) are satisfied:

i. The Permittees have submitted to the Secretary, by certified mail or hand delivery, a letter signed by the Permittees and a New Mexico registered professional engineer stating that the facility has been constructed or modified in compliance with this Permit, and:

ii. The Secretary has either inspected the modified portion of the facility and finds it is in compliance with the conditions of this Permit; or waived the inspection or, within 15 calendar days of the date of submission of the letter required above, has not notified the Permittees of his intent to inspect.

1.7.12. Transfer of Permits

The Permittees shall not transfer this Permit to any person, unless the Secretary has approved a permit modification request for such transfer in writing. The Secretary shall require modification or revocation and reissuance of this Permit as specified by 20.4.1.900 NMAC (incorporating 40 CFR §§270.40 and 270.41(b)(2)) to identify the new Permittees and incorporate other applicable requirements under the HWA, RCRA, and their implementing regulations. The prospective new Permittee shall file a disclosure statement with the Secretary, if applicable and as specified at §74-4-4.7 of the HWA, prior to modification or revocation and re-issuance of the Permit.

Before transferring ownership or operation of the facility during its active life or post-closure care period, the Permittees shall notify the new owner or operator in writing as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.12(c) and 270.30(l)(3)).

1.7.13. 24 Hour and Subsequent Reporting

1.7.13.1. Oral Report

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(i)), within 24 hours from the time the Permittees become aware of the circumstances, the Permittees shall report orally to the Secretary any noncompliance which may endanger human health or the environment, including:

i. Information concerning release of any TRU mixed or hazardous waste that may cause an endangerment to public drinking water supplies; and

ii. Any information of a release or discharge of TRU mixed or hazardous waste, or of a fire or explosion from the facility, which could threaten the environment or human health outside the facility.

The oral report shall be made by calling the Hazardous Waste Bureau's main telephone number during regular business hours, or by calling the New Mexico Department of Public Safety dispatch telephone number during non-business hours, and requesting that the report be forwarded to the NMED spill number.

1.7.13.2. Description of Occurrence

The description of the occurrence and its cause shall include:

i. Name, address, and telephone number of the Permittees;

ii. Name, address, and telephone number of the facility;

iii. Date, time, and type of incident;

iv. Name and quantity of materials involved;

v. The extent of injuries, if any;

vi. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and

vii. Estimated quantity and disposition of recovered material that resulted from the incident. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(ii))]

1.7.13.3. Written Notice

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(iii)), the Permittees shall submit a written notice within five calendar days of the time the Permittees become aware of the circumstances. The written notice shall contain the information required in Permit Section 1.7.13.2 and the following information:

i. A description of the noncompliance and its cause;

ii. The period(s) of the noncompliance including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and

iii. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

The Secretary may waive the five-day written notice requirement in favor of a written report within 15 calendar days if justifiable cause is provided in advance. The Permittees shall post a link to the written notice or report

transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

1.7.13.4. Contingency Plan Implementation

If the Contingency Plan is implemented, the Permittees shall comply with the reporting requirements specified in Permit Attachment D (RCRA Contingency Plan). [20.4.1.500 NMAC (incorporating 40 CFR §264.56(j))]

1.7.14. Other Noncompliance

The Permittees shall report to the Secretary all other instances of noncompliance not otherwise required to be reported above, in Permit Sections 1.7.10 through 1.7.13, at the time monitoring reports are submitted annually in October. The reports shall contain the information specified in Permit Section 1.7.13 and 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(10)).

1.7.15. Other Information

Whenever the Permittees become aware that they failed to submit any relevant facts in the Permit application, or submitted incorrect information in the Permit application or in any report to the Secretary, the Permittees shall promptly submit such facts or information in writing to the Secretary. The Permittees shall post a link to the transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(11))]

1.8. ADMISSIBILITY OF DATA

The Permittees waive any objection to the admissibility as evidence of any data required by this Permit in any administrative or judicial action to enforce a condition of this Permit.

1.9. SIGNATORY REQUIREMENT

The Permittees shall sign and certify, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.11) all applications, reports required by this Permit, or information submitted to or requested by the Secretary. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(k))]

1.10. SUBMITTAL OF REPORTS, NOTIFICATIONS, AND INFORMATION TO THE SECRETARY

1.10.1. Information Submittal

The Permittees shall submit, by certified mail or hand delivery or by electronic transmittal with a subsequent hard copy, all reports, notifications, or other submissions which are submitted to or requested by the Secretary or required by this Permit, to:

Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Telephone Number: (505) 476-6000
Facsimile Number: (505) 476-6060

1.10.2. Approval of Submittals

All documents prepared by the Permittees under the terms of this Permit and submitted to the Secretary that are subject to the provisions of 20.4.2 NMAC shall be subject to the procedures set forth therein. Documents requiring the Secretary's approval that are not subject to the provisions of 20.4.2 NMAC may be reviewed and approved, approved with modifications or directions, disapproved, denied, or rejected by the Secretary.

Submittals and associated schedules, upon the Secretary's written approval, shall become enforceable as part of this Permit in accordance with the terms of the Secretary's written approval, and such documents, as approved, shall control over any contrary or conflicting requirements of this Permit. This provision does not affect any public process that is otherwise required by this Permit, the HWA, or its implementing regulations, including 40 CFR §270.42 and 20.4.1.901 NMAC.

1.10.3. Extension of Time

The Permittees may seek an extension of time in which to perform a requirement of this Permit, for good cause, by sending a written request for extension of time and proposed revised schedule to the Secretary. The request shall state the length of the requested extension and describe the basis for the request. The Secretary will respond in writing to any request for extension following receipt of the request. If the Secretary denies the request for extension, reasons for the denial will be stated.

1.11. PUBLIC E-MAIL NOTIFICATION LIST

The Permittees shall develop and maintain an e-mail list to notify members of the public concerning actions identified in this Permit requiring e-mail notification. The Permittees shall send e-mail notifications required by this Permit to the e-mail list within seven days of the submittal date to the Secretary and shall include in the e-mail a direct link to the specific document to which it relates. The Permittees shall provide a link on the WIPP Home Page <http://www.wipp.energy.gov> whereby members of the public may review the actions requiring e-mail notification and submit a request to be placed on this list.

1.12. CONFIDENTIAL INFORMATION

The Permittees may claim confidentiality for any information submitted to or requested by the Secretary or required by this Permit. Any such claim must be asserted at the time of submittal in the manner prescribed on the application form, or in the case of other submittals, by stamping the words

"confidential business information" on each page containing such information. If no claim is made, the Secretary may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information), to the extent authorized by Section 74-4-4.3(D) and (F) of the HWA and 20.4.1.100 and .900 NMAC (incorporating 40 CFR §260.2 and §270.12).

1.13. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The Permittees shall comply with the recordkeeping and reporting requirements specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.73(a)) and elsewhere in this Permit.

The Permittees shall maintain at the facility, until closed as specified in Part 6, the following documents and all amendments, revisions and modifications to these documents:

1. Waste Analysis Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(b)) and this Permit, and records and results of waste analyses performed as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.13).

2. Inspection schedules, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(2)) and this Permit, and records and results of inspections as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

3. Personnel training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d)) and this Permit.

4. Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53(a)) and this Permit, including summary reports and details of all incidents that require implementation of the contingency plan as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)).

5. Operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73) and this Permit.

6. Closure Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.112(a)) and this Permit.

7. Post-Closure Plan as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(a)) and this Permit.

8. Procedures for limiting air emissions, as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.601(c) and 270.23(a)(2)) and this Permit.

9. All other documents required by Part 1, Permit Section 1.7.10, and Part 2.

1.14. INFORMATION REPOSITORY

1.14.1. Requirement for Information Repository

The Permittees shall establish and maintain an electronic Information Repository (**IR**) in accordance with the requirements of 20.4.1.1102 NMAC (incorporating 40 CFR §§124.33(c) through (f)) and 20.4.1.900 NMAC (incorporating 40 §270.30(m)). The documents contained in the IR shall be accessible to the public from the WIPP Home Page.

The Permittees shall establish the IR no later than the effective date of this Permit.

1.14.2. Contents of Information Repository

The Permittees shall ensure that the IR contains the following documents:

1. The Permittees' Part A and Part B Permit Applications associated with the permit renewal;
2. A complete copy of this Permit, as it may be modified;
3. Permit modification notifications and requests associated with this Permit submitted pursuant to 20.4.1. 900 NMAC (incorporating 40 CFR §270.42) and any associated responses from the Secretary;
4. The Waste Minimization Report submitted pursuant to Permit Section 2.4;
5. Requests for extensions of time submitted pursuant to Permit Section 1.10.3;
6. Corrective action documents submitted pursuant to Permit Part 8;
7. Each report submitted pursuant to Permit Sections 1.7.11 and 1.7.13 if such report is required to be submitted in writing;
8. Notices of deficiency or disapproval (**NODs**), NOD responses, final approval letters, and directives from the Secretary associated with the documents identified in paragraphs 1, 3, and 6 above;
9. Notices of violation, administrative compliance orders, responses to these documents required by the Secretary, and directives from the Secretary associated with the Permit;
10. Biennial Report submitted pursuant to Permit Section 2.14.2.

1.14.3. Index of Information Repository

The Permittees shall ensure that the IR includes an index of the documents contained in the IR identifying all document titles, publications dates, and authors. This index shall be

accessible on the internet through the WIPP Home Page. The Permittees shall ensure that all documents are searchable and printable.

The Permittees shall add ~~new~~ documents to the IR within ten days after the new documents are submitted to, or received from, the Secretary.

1.14.4. Notification to Public of Information Repository

The Permittees shall inform the public of the existence of the IR and how it may be accessed by the following methods:

1. Written notice to all individuals on the facility mailing list 30 days after the IR becomes operational;

2. Public notice in area newspapers, including the Carlsbad Current-Argus, Albuquerque Journal, and Santa Fe New Mexican, when the IR becomes operational;

3. Continuous notice on the WIPP Home Page of the existence of the IR; and

4. In the public notice related to any permit modification notification or request submitted by the Permittees, including permit renewals.

1.15. COMMUNITY RELATIONS PLAN

1.15.1. Requirement for Community Relations Plan

The Permittees shall establish and implement a Community Relations Plan (**CRP**) to describe how the Permittees will keep communities and interested members of the public informed of Permit-related activities, including waste management, closure, post-closure, and corrective action, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)). The CRP shall explain how communities and interested members of the public can participate in Permit-related activities.

The Permittees shall implement and post the CRP on the WIPP Home Page within 180 days of the effective date of this Permit. The Permittees shall maintain the CRP until the termination of this Permit.

1.15.2. Contents of Community Relations Plan

The CRP must describe how the Permittees will accomplish the following elements:

1. Identify and establish an open working relationship with communities and interested members of the public;

2. Establish a productive government-to-government relationship between the Permittee DOE and affected tribes and pueblos;

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3. Keep communities and interested members of the public informed of permit actions of interest (e.g., implementation of the Contingency Plan, Permit modification requests, Permit compliance issues);

4. Minimize disputes and resolve differences with communities and interested members of the public;

5. Provide a mechanism for the timely dissemination of information in response to individual requests; and

6. Provide a mechanism for communities and interested members of the public to provide feedback and input to the Permittees.

1.15.3. Government to Government Consultation

DOE shall consult on a government-to-government basis with affected tribes and pueblos in New Mexico when developing the CRP in an effort to ensure the program is responsive to their needs. DOE shall document in the operating record of this Permit and post on the WIPP Home Page all consultations, communications, agreements, and disagreements between DOE and affected tribes and pueblos in New Mexico only with the express approval of those entities, regarding the development of the CRP. The CRP shall specify how DOE will consult on a government-to-government basis with affected tribes and pueblos annually concerning how they may be made better informed of the issues related to this Permit.

1.15.4. Initial Consultation on Community Relations Plan

The Permittees shall communicate with and solicit comments from communities and interested members of the public when developing the CRP in an effort to ensure the program is responsive to their needs. The Permittees shall document in the operating record of this Permit all consultations, communications, agreements, and disagreements between the Permittees and all participating entities, with the approval of those entities, regarding the development of the CRP.

1.15.5. Annual Compilation of Comments on Community Relations Plan

The CRP shall specify how the Permittees will solicit comments from communities and interested members of the public annually concerning how they may be made better informed of the issues related to this Permit. The CRP shall specify that the Permittees will annually post on the WIPP Home Page a compilation of all such comments, including any statements of disagreement, with the approval of those entities in a manner set forth in the CRP.

1.16. DISPUTE RESOLUTION

1.16.1. Applicability

In the event DOE disagrees, in whole or in part, with either an action on a final audit report by NMED (as specified in Permit Section 2.3.2.4) or an evaluation by NMED of DOE's provisional approval of an AK Sufficiency Determination Request for a particular waste stream (as specified in Permit Attachment C), DOE may seek dispute resolution. The dispute resolution procedure in this Permit Section shall be the exclusive mechanism for resolving disputes related to NMED's final audit report action or a determination that DOE's provisional approval for a particular waste stream is inadequate.

1.16.2. Notice to NMED

To invoke dispute resolution, DOE shall notify NMED in writing within seven calendar days of receipt of the action or determination in dispute. Such notice shall be sent to the Hazardous Waste Bureau Chief and must set forth the specific matters in dispute, the position DOE asserts should be adopted, a detailed explanation for DOE's position, and any other matters considered necessary for the dispute resolution. For AK Sufficiency Determination disputes, DOE shall also submit all factual data, analysis, opinion, and other documentation upon which they relied for their provisional approval, and any other information that supports their position. NMED shall acknowledge receipt of notification by e-mail sent to DOE's representative as designated in their written notification.

1.16.3. Tier I - Informal Negotiations

DOE and NMED shall make all reasonable, good faith efforts to informally resolve disputes related to NMED's determination. DOE and NMED shall meet or teleconference within 15 calendar days from NMED's receipt of notice to commence negotiations to resolve the dispute. DOE and NMED shall have 30 calendar days from NMED's receipt of notice to resolve the dispute. If an agreement is reached, NMED shall promptly inform DOE of the terms of the agreement in writing. DOE shall comply with the terms of such agreement or, if appropriate, submit a revised submittal and implement the same in accordance with such agreement. If an agreement is not reached, NMED shall promptly inform DOE in writing that an agreement has not been reached.

1.16.4. Tier II - Final Decision of the Secretary

In the event agreement is not reached within the 30 calendar day period, DOE may submit a written Request for Final Decision to the Secretary. The Request must be submitted within seven calendar days after receipt of notification from NMED that an agreement under Tier I was not reached. The Secretary will notify the Permittees in writing of the decision on the dispute, and the Permittees shall comply with the terms and conditions of the decision. Such decision shall be the final resolution of the dispute and shall be enforceable under this Permit.

1.16.5. Actions Not Affected by Dispute

With the exception of those matters under dispute, the Permittees shall proceed to take any action required by those portions of the submission and of this Permit that NMED determines are not affected by the dispute.

1.16.6. E-Mail Notifications

If DOE submits a notice to NMED pursuant to Permit Section 1.16.2, the Permittees shall post a link to the notice on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. After receipt of NMED's letter concerning the conclusion of any Tier I negotiations, the Permittees shall post a link to the NMED letter on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. If a Tier I agreement is not reached and DOE submits a Tier II request for final decision to the Secretary, the Permittees shall post a link to the request on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. After receiving notice of the final action by the Secretary, the Permittees shall post a link to the final action on the WIPP Home Page and shall inform those on the e-mail notification list as specified in Permit Section 1.11.

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PERMIT ATTACHMENTS

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" - Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter B).

Permit Attachment C7 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Permittee Level TRU Waste Confirmation Processes" - Appendix B7).

Permit Attachment D (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Contingency Plan" - Chapter F).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1)

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PART 4 - GEOLOGIC REPOSITORY DISPOSAL

4.1. DESIGNATED DISPOSAL UNITS

This Part authorizes the management and disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste containers in the Underground Hazardous Waste Disposal Units (**Underground HWDUs**) identified herein. Specific facility and process information for the management and disposal of CH and RH TRU mixed waste in the Underground HWDUs is incorporated in Permit Attachment A2 (Geologic Repository).

4.1.1. Underground Hazardous Waste Disposal Units

The Underground HWDUs are located at the WIPP facility approximately 2150 feet (665 meters) below the ground surface within the Salado formation. An Underground HWDU is a single excavated panel, consisting of seven rooms and two access drifts, designated for disposal of TRU mixed waste containers.

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.1.1.1. Disposal Containers

The Permittees shall dispose TRU mixed waste in containers specified in Permit Section 4.3.1.

4.1.1.2. Disposal Locations and Quantities

The Permittees shall dispose TRU mixed waste containers in eight Underground HWDUs, as specified in Table 4.1.1 below and depicted in Permit Attachment A2, Figure A2-1. The Permittees may dispose quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 4.1.1 below. The Permittees may increase these capacities subject to the following conditions:

i. The Permittees may submit a Class 1 permit modification requiring prior approval of the Secretary in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(a)) to increase the CH TRU mixed waste capacity by 35,300 ft^3 (1,000 m^3) or less, and the RH TRU mixed waste capacities in Panels 5 and 6 to a maximum of 22,950 ft^3 (650 m^3).

At least 15 calendar days before submittal to NMED, the Permittees shall post a link to the Class 1 permit modification on the WIPP Home Page and inform those on the e-mail notification list.

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ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	Container Equivalent	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	400 RH TRU Canisters	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)	500 RH TRU Canisters	8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	600 RH TRU Canisters	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	**2960 RH TRU Canisters**	

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

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capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

4.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

4.2.1. Permitted Waste

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

4.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

4.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

Derived waste may be disposed in the Underground HWDUs as specified in Permit Section 2.3.5.

4.2.2. Prohibited Waste

4.2.2.1. General Prohibition

The Permittees shall not dispose any TRU mixed waste that fails to comply with Permit Section 4.2.1.

4.2.2.2. Specific Prohibition

After this Permit becomes effective, the Permittees shall not dispose non-mixed TRU waste in any Underground HWDU unless such waste is characterized in accordance with the requirements of the WAP specified in Permit Section 2.3.1. The Permittees shall not dispose TRU mixed waste in any Underground HWDU if the Underground HWDU contains non-mixed TRU waste which was disposed of after this Permit became effective and was not characterized in accordance with the requirements of the WAP.

4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.2. Condition of Containers

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak prior to disposal in an Underground HWDU, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 4.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

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4.4. VOLATILE ORGANIC COMPOUND LIMITS

The Permittees shall limit releases to the air of volatile organic compound waste constituents (**VOCs**) as specified by the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)):

4.4.1. Room-Based Limits

The measured concentration of VOCs in any open (active) room and in each closed room in active panels within an Underground HWDU shall not exceed the limits specified in Table 4.4.1 below:

Table 4.4.1 - VOC Room-Based Limits

Compound	VOC Room-Based Concentration Limit (PPMV)
Carbon Tetrachloride	9625
Chlorobenzene	13000
Chloroform	9930
1,1-Dichloroethene	5490
1,2-Dichloroethane	2400
Methylene Chloride	100000
1,1,2,2-Tetrachloroethane	2960
Toluene	11000
1,1,1-Trichloroethane	33700

There are no maximum concentration limits for other VOCs.

4.4.2. Determination of VOC Room-Based Limits

The Permittees shall confirm the VOC concentration and emission rate limits identified in Permit Section 4.4.1 using the VOC Monitoring Plan specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan). The Permittees shall conduct monitoring of VOCs as specified in Permit Sections 4.6.2 and 4.6.3.

4.4.3. Ongoing Disposal Room VOC Monitoring in Panels 3 Through 8

The Permittees shall continue disposal room VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless the explosion-isolation wall specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System) is installed in the panel.

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4.5. DESIGN, CONSTRUCTION, AND OPERATION REQUIREMENTS

The Permittees shall design, construct, and operate the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601):

4.5.1. Repository Design

The Permittees shall construct each Underground HWDU in conformance with the requirements specified in Permit Attachment A2 and Permit Attachment A3 (Drawing Number 51-W-214-W, "Underground Facilities Typical Disposal Panel").

4.5.2. Repository Construction

4.5.2.1. Construction Requirements

Subject to Permit Section 4.5.1, the Permittees may excavate the following Underground HWDUs, as depicted in Permit Attachment A2, Figure A2-1, "Repository Horizon", and specified in Section A2-2a(3), "Subsurface Structures (Underground Hazardous Waste Disposal Units (HWDUs))":

- Panel 10 (Disposal area access drift)
- Panel 2
- Panel 9 (Disposal area access drift)
- Panel 3
- Panel 4
- Panel 5
- Panel 6
- Panel 7
- Panel 8

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.7.11.2.

4.5.2.2. Notification Requirements

At least 30 calendar days prior to the projected start date of excavation of each Underground HWDU, the Permittees shall provide written notification to the Secretary stating the projected start date of excavation, along with supporting rationale (e.g., projected waste receipt rate, etc.). The Permittees shall post a link to the notification transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

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Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room where waste disposal is taking place and workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

4.6.2.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the VOC Monitoring Plan.

4.6.2.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall post a link to any exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.2.3 - VOC Concentrations of Concern

Compound	Drift E-300 Concentration	
	ug/m3	ppbv
Carbon Tetrachloride	6040	960
Chlorobenzene	1015	220
Chloroform	890	180
1,1-Dichloroethene	410	100
1,2-Dichloroethane	175	45
Methylene Chloride	6700	1930
1,1,2,2-Tetrachloroethane	350	50
Toluene	715	190
1,1,1-Trichloroethane	3200	590

4.6.2.4. Remedial Action

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3, the

Permittees shall cease disposal in the active CH disposal room and install ventilation barriers as specified in Permit Section 4.5.3.3.

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 for six consecutive months, the Permittees shall close the affected Underground HWDU as specified in Permit Section 4.9.1.

For any remedial action taken under this Permit Section, the Permittees shall submit to the Secretary written quarterly status reports, beginning 30 calendar days after the Permittees submit the initial notification in Permit Section 4.6.2.3 which resulted in the remedial action. The quarterly status report shall analyze the cause of exceedance, describe the implementation and results of the remedial action, and describe measures taken to prevent future exceedances. The Permittees shall submit such reports until the Secretary determines the remedial action has been completed in accordance with all applicable requirements of this Permit.

4.6.3. Disposal Room Volatile Organic Compound Monitoring

4.6.3.1. Implementation of Disposal Room VOC Monitoring

The Permittees shall implement disposal room VOC monitoring as specified in Permit Attachment N and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.3.2. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 in any closed room in an active panel or in the immediately adjacent closed room exceeds the action levels specified in Table 4.6.3.2 below. The Permittees shall post a link to the exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring		
Compound	**50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv**	**95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv**
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report to the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

The Permittees shall post a link to the notification letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.5.3 - Action Levels for Hydrogen and Methane Monitoring		
Compound	**Action Level 1**	**Action Level 2**
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

4.6.5.4. Remedial Action

Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 1" in Table 4.6.5.3, the sampling frequency in that filled panel will increase to once per week. Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 2" in Table 4.6.5.3 in two consecutive weekly samples, the Permittees shall install in that panel the explosion-isolation wall specified in Permit Attachment G1.

4.6.5.5. Sampling Line Loss

The Permittees shall notify the Secretary in writing within seven calendar days of the discovery of loss of sampling line(s). The Permittees shall evaluate any loss of sampling lines as described in Permit Attachment N1, Section N1-5b, "Sample Tubing", and shall notify the Secretary in writing within seven calendar days the results of such evaluation. The Permittees shall also post a link to such notification letters on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11

4.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the Underground HWDUs at least weekly, as specified in Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15). The Permittees shall perform these inspections to detect malfunctions, signs of deterioration, operator errors, discharges, or any other factors which have caused or may cause a release of hazardous wastes or hazardous waste constituents to the environment or which may compromise the ability of any Underground HWDU to comply with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

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4.8. RECORDKEEPING

4.8.1. Underground HWDU Location Map

The Permittees shall maintain, in the operating record, a map containing the exact location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks.

4.8.2. Disposal Waste Type and Location

The Permittees shall maintain, in the operating record, a record identifying the types and quantities of TRU mixed waste in each Underground HWDU and the disposal location of each container or container assembly (e.g., a 7-pack of standard 55-gallons drums) within each Underground HWDU, using the following fields from the WWIS data dictionary:

1. Panel Number
2. Room Number or Drift Number
3. Row Number (for CH TRU mixed waste) or Borehole Number (for RH TRU mixed waste)
4. Column Number (for CH TRU mixed waste)
5. Column Height (for CH TRU mixed waste)
6. Container Type Code
7. Container Identification Number
8. Manifest Document Number
9. Disposal Date

The Permittees shall also maintain, in the operating record, a map or diagram depicting the location and quantity of each waste. The map or diagram shall include a cross reference to specific manifest document numbers, if the waste was accompanied by a manifest, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(2)).

4.8.3. Ventilation Rates

The Permittees shall maintain, in the operating record, a record identifying any non-conformance to the ventilation rates specified in Permit Section 4.5.3.2.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment A3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Underground Facilities Typical Disposal Panel" – Drawing Number 51-W-214-W, Appendix M3).

Permit Attachment A4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Traffic Patterns" – Chapter G).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, " Volatile Organic Compound Monitoring Plan" - Chapter N).

Permit Attachment N1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Hydrogen and Methane Monitoring Plan" - Appendix N1)

Permit Attachment O (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Mine Ventilation Rate Monitoring Plan" - Chapter Q).

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PART 5 - GROUNDWATER DETECTION MONITORING

5.1. DETECTION MONITORING PROGRAM

This Part specifies the requirements of the Detection Monitoring Program (**DMP**). The DMP shall establish background groundwater quality and monitor indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the groundwater, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98).

The DMP consists of six Detection Monitoring Wells (**DMWs**) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground Hazardous Waste Disposal Units (**Underground HWDUs**). The DMWs are screened in the Culebra Member of the Rustler Formation.

A DMP is necessary to demonstrate compliance with the environmental performance standard for the Underground HWDUs, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)). This environmental performance standard requires prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the groundwater or subsurface environment.

5.2. IDENTIFICATION OF POINT OF COMPLIANCE

The point of compliance is the vertical surface located perpendicular to the groundwater flow direction at the DMWs that extends to the Culebra Member of the Rustler Formation [20.4.1.500 NMAC (incorporating 40 CFR §§264.95, 264.601, and 264.602)]. The Permittees shall conduct the DMP at DMWs specified in Table 5.3.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.98 and 264.601).

5.3. WELL LOCATION, MAINTENANCE, AND PLUGGING AND ABANDONING

The Permittees shall conduct the DMP according to the requirements of this Permit and 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) for the DMWs in the Culebra Member of the Rustler Formation.

The Permittees shall maintain the DMP in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97), and as specified below:

5.3.1. Well Locations

The Permittees shall maintain the DMWs at the locations specified on the map in Figure L-6 of Permit Attachment L (WIPP Groundwater Detection Monitoring Program Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(a) and §264.98(b)), and as specified in Table 5.3.1 below:

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Table 5.3.1 - Well Locations				
Well Name	**State Plane Coordinates**	**Top of Casing Elevation (ft amsl)**	**Screen Interval ~~Depth~~ (ft below ground surface)**	**Sampled Unit**
WQSP-1	663595E, 503784N	3419.2	702 - 727	Culebra
WQSP-2	667580E, 505537N	3463.9	811 - 836	Culebra
WQSP-3	670573E, 503991N	3480.1	844 - 869	Culebra
WQSP-4	670645E, 494986N	3433.1	764 - 789	Culebra
WQSP-5	667165E, 493665N	3384.4	646 - 671	Culebra
WQSP-6	663681E, 494948N	3364.7	581 - 606	Culebra

5.3.2. Well Maintenance

The Permittees shall maintain the DMWs specified in Table 5.3.1 and in Permit Attachment L, Section L-3b and Figures L-7 through L-12, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(c) and §264.98(b)).

5.3.3. Well Plugging and Abandoning

The Permittees may propose to plug and abandon a DMW by submitting a permit modification request to the Secretary in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The Permittees shall plug and abandon any DMW in a manner which eliminates physical hazards, prevents groundwater contamination, conserves hydrostatic head, and prevents intermixing of subsurface water. The Permittees shall submit a report to the Secretary which summarizes and certifies DMW plugging and abandoning methods within 90 calendar days from the date a DMW is removed from the DMP.

5.4. DETECTION MONITORING PROGRAM PARAMETERS AND CONSTITUENTS

The Permittees shall conduct the DMP at the DMWs as specified in Table 5.3.1 for the indicator parameters listed in Table 5.4.a and the hazardous constituents listed in Table 5.4.b below and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(a)):

Table 5.4.a – Indicator Parameters	
pH	Specific conductance
Total organic carbon (**TOC**)	
Total dissolved solids (**TDS**)	Total suspended solids (**TSS**)
Specific Gravity	Calcium
Magnesium	Potassium
Chloride	

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Table 5.4.b – Hazardous Constituents	
Chloroform	1,2-dichloroethane
Carbon tetrachloride	Chlorobenzene
1,1-dichloroethylene	1,1-dichloroethane
Methylene chloride	1,1,2,2-tetrachloroethane
Toluene	1,1,1-trichloroethane
Cresols	1,4-dichlorobenzene
1,2-dichlorobenzene	trans-1,2-dichloroethylene
2,4-dinitrophenol	2,4-dinitrotoluene
Hexachloroethane	Hexachlorobenzene
Isobutanol	Methyl ethyl ketone
	Pentachlorophenol
Pyridine	Tetrachloroethylene
1,1,2-Trichloroethane	Trichloroethylene
Trichlorofluoromethane	Xylenes
Nitrobenzene	Vinyl chloride
Arsenic	Barium
Cadmium	Chromium
Lead	Mercury
Selenium	Silver
Antimony	Beryllium
Nickel	Thallium
Vanadium	

5.5. SAMPLING AND ANALYSIS PROCEDURES

Except as provided in Permit Section 5.6, the Permittees shall use the following techniques and procedures to obtain and analyze DMP samples from the DMWs specified in Table 5.3.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(d) and (e)):

5.5.1. Sample Collection Procedures

The Permittees shall collect one DMP sample and one DMP sample duplicate annually from each DMW using the procedures specified in Permit Attachment L, Section L-4c, as

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required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g)(2), 264.98(d), and 264.601(a)).

5.5.2. Sample Preservation and Shipment Procedures

The Permittees shall preserve and ship DMP samples using the procedures specified in Permit Attachment L, Section L-4c(2)(iv).

5.5.3. Analytical Procedures

The Permittees shall analyze DMP samples using the procedures specified in Permit Attachment L, Section L-4c(3).

5.5.4. Chain of Custody Procedures

The Permittees shall track and control DMP samples using the chain of custody procedures specified in Permit Attachment L, Section L-4c(2)(v).

5.6. BACKGROUND GROUNDWATER QUALITY

For those hazardous constituents listed in Table 5.4.b, and for all substances listed in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), the background groundwater quality values specified in Table 5.6 are established as specified in 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g) and 264.98(d)).

Table 5.6 – WQSP Well Background Values

Hazardous Constituent	WQSP-1	WQSP-2	WQSP-3	WQSP-4	WQSP-5	WQSP-6
Chloroform	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,2-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Carbon tetrachloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Chlorobenzene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Methylene chloride	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,1,2,2-tetrachloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Toluene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,1-trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Cresols	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,4-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,2-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
trans-1,2-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L

Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
2,4-dinitrophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
2,4-dinitrotoluene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachloroethane	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Isobutanol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Methyl ethyl ketone	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pentachlorophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pyridine	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Tetrachloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,2-Trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichlorofluoromethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Xylenes	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Nitrobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Vinyl chloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Arsenic	0.10 mg/L	0.06 mg/L	0.21 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L
Barium	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L
Cadmium	0.20 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.50 mg/L	0.50 mg/L	2.00 mg/L	2.00 mg/L	0.50 mg/L	0.50 mg/L
Lead	0.11 mg/L	0.17 mg/L	0.80 mg/L	0.53 mg/L	0.05 mg/L	0.15 mg/L
Mercury	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L
Selenium	0.15 mg/L	0.15 mg/L	2.00 mg/L	2.00 mg/L	0.10 mg/L	0.10 mg/L
Silver	0.50 mg/L	0.50 mg/L	0.31 mg/L	0.52 mg/L	0.50 mg/L	0.50 mg/L
Antimony	0.33 mg/L	0.50 mg/L	1.00 mg/L	0.80 mg/L	0.07 mg/L	0.14 mg/L
Beryllium	0.02 mg/L	1.00 mg/L	0.10 mg/L	0.25 mg/L	0.02 mg/L	0.02 mg/L
Nickel	0.50 mg/L	0.50 mg/L	5.00 mg/L	5.00 mg/L	0.10 mg/L	0.50 mg/L
Thallium	1.00 mg/L	1.00 mg/L	5.80 mg/L	1.00 mg/L	0.21 mg/L	0.56 mg/L
Vanadium	0.10 mg/L	0.10 mg/L	5.00 mg/L	5.00 mg/L	2.70 mg/L	0.10 mg/L

5.7. GROUNDWATER SURFACE ELEVATION DETERMINATION

5.7.1. DMP Groundwater Surface Elevation Determination

The Permittees shall determine the groundwater surface elevation at each DMW specified in Table 5.3.1 each time the groundwater is sampled in compliance with Permit Sections 5.5.1 and 5.9.2, using the methods specified in Permit Attachment L, Section L-4c(1), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)).

5.7.2. Regional Groundwater Surface Elevation Determination

The Permittees shall determine the groundwater surface elevation on a monthly basis for each well completed in the Culebra Member of the Rustler Formation in the WIPP Groundwater Level Monitoring Program, as specified in Permit Attachment L, Section L-4c(1).

5.8. GROUNDWATER FLOW DETERMINATION

The Permittees shall determine the groundwater flow rate and direction in the Culebra Member of the Rustler Formation at least annually, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(e)). The Permittees shall use groundwater surface elevation data specified in Permit Section 5.7 to determine groundwater flow.

5.9. DATA EVALUATION

5.9.1. Statistical Procedures

The Permittees shall use the statistical analysis methods specified in Permit Attachment L, Section L-4e, to evaluate DMP data for each hazardous constituent as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)). These statistical analysis methods shall comply with the appropriate performance standards specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.97(i)).

5.9.2. Groundwater Quality Determination

The Permittees shall sample DMWs as specified in Permit Section 5.5.1 and conduct statistical tests to determine whether there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b during the active life of the WIPP facility and post-closure care period as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90(c)).

5.9.3. Data Evaluation

The Permittees shall determine whether there is statistically significant evidence of contamination for any hazardous constituent identified in Table 5.4.b each time the DMWs are sampled as specified in Permit Section 5.9.2. In determining whether statistically significant evidence of contamination exists, the Permittees shall compare the groundwater

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quality at each DMW specified in Table 5.3.1 to the background groundwater quality determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.9.4. Data Evaluation Timeframe

The Permittees shall perform the data evaluations specified in Permit Section 5.9.3 within 120 calendar days after completion of DMP sampling, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)(2)).

5.10. RECORDKEEPING AND REPORTING

5.10.1. Operating Record Requirements

The Permittees shall enter all DMP monitoring, testing, and analytical data in the operating record as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(6)). The Permittees shall enter these data, as measured and in a form appropriate for the determination of statistically significant evidence of contamination, into the operating record as specified in Permit Section 5.9.1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(c)).

5.10.2. Submittal of Results

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5.1 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, in the Annual Culebra Groundwater Report by November 30 of each year as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)).

Analytical results of a sampling round may be included in the report specified in Permit Section 5.10.2.3 if publication of the report coincides with the 120 calendar day report submittal schedule.

5.10.2.2. Groundwater Surface Elevation Results

The Permittees shall submit to the Secretary groundwater surface elevation data specified in Permit Section 5.7. This submittal shall include both groundwater surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be reported semiannually by May 31 and November 30. The November water level data report shall be combined with the Annual Culebra Groundwater Report specified in Permit Part 5.10.2.3.

5.10.2.3. Groundwater Flow and Radionuclide Sampling Results

The Permittees shall submit to the Secretary an evaluation of the groundwater flow data (to include annotated hydrographs) specified in Permit Section 5.8 in the Annual Culebra Groundwater Report by November 30 of each calendar year.

5.10.3. Determination of Contamination

If the Permittees determine, pursuant to Permit Section 5.9 and 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)), that there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b, the Permittees shall comply with the following:

5.10.3.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days, indicating what hazardous constituents have shown statistically significant evidence of contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(1)).

5.10.3.2. Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the groundwater in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

5.10.3.3. Verification Sampling

As specified by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)), for any substances found in the initial analysis pursuant to Permit Section 5.10.3.2, the Permittees may resample within one month and repeat the analysis for those compounds detected. If the results of the second analysis confirm the initial analysis, these substances shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4. If the Permittees do not resample, the substances found during the initial analysis specified in Permit Section 5.10.3.2 shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4.

5.10.3.4. Submittal of Compliance Monitoring Program

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to establish a compliance monitoring program meeting the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.99). The application shall include the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(4)):

i. An identification of the concentration of any hazardous constituent specified in Table 5.4.b or any Appendix IX substance detected in the ground water at each DMW at the compliance point.

ii. Any proposed changes to the DMP necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iii. Any proposed additions or changes to the monitoring frequency, sampling and analysis procedures or methods, or statistical methods used necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iv. For each hazardous constituent detected at the compliance point, a proposed concentration limit or a notice of intent to seek an alternate concentration limit for a hazardous constituent required by 20.4.1.500 NMAC (incorporating 40 CFR §264.94).

5.10.3.5. Submittal of Additional Information

The Permittees shall, within 180 calendar days, submit to the Secretary the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(5)):

i. All data necessary to justify an alternate concentration limit proposed in compliance with Permit Section 5.10.3.4.iv.

ii. An engineering feasibility plan for corrective action required by 20.4.1.500 NMAC (incorporating 40 CFR §264.100), if necessary.

5.10.4. Demonstration of Outside Contamination

If the Permittees determine, pursuant to Permit Section 5.9, that there is a statistically significant difference for hazardous constituents specified in Table 5.4.b at any DMW at the compliance point, they may demonstrate that a source other than a regulated unit caused the increase or that the detection is an artifact caused by an error in sampling, analysis,

statistical evaluation, or natural variation in the ground water. In such cases, the Permittees shall comply with the following:

5.10.4.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days of determining statistically significant evidence of contamination at the compliance point that they intend to make a demonstration of outside contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(i)).

5.10.4.2. Submittal of Demonstration

The Permittees shall, within 90 calendar days, submit a report to the Secretary which demonstrates that a source other than a regulated unit caused the contamination, or that the contamination resulted from error in sampling, analysis, or evaluation, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(ii)).

5.10.4.3. Submittal of Modification Request

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to make any appropriate changes to the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iii)).

5.10.4.4. Continued Monitoring

The Permittees shall continue to monitor in compliance with the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iv)).

5.11. REQUEST FOR PERMIT MODIFICATION

If the Permittees or the Secretary determines that the DMP no longer satisfies the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) and this Permit Part, the Permittees shall, within 90 calendar days of the determination, submit an application for a permit modification to make any appropriate changes to the program in compliance with 20.4.1.500 and .900 NMAC (incorporating 40 CFR §264.98(h) and §270.42).

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

A2-1 Description of the Geologic Repository

Management, storage, and disposal of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) geologic repository is subject to regulation under 20.4.1.500 NMAC. The WIPP is a geologic repository mined within a bedded salt formation, which is defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10) as a miscellaneous unit. As such, HWMUs within the repository are eligible for permitting according to 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and are regulated under 20.4.1.500 NMAC, Miscellaneous Units.

As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the Underground Hazardous Waste Disposal Units (**HWDUs**) in the geologic repository, will be met.

The Disposal Phase will consist of receiving contact-handled (**CH**) and remote-handled (**RH**) TRU mixed waste shipping containers, unloading and transporting the waste containers to the Underground HWDUs, emplacing the waste in the Underground HWDUs, and subsequently achieving closure of the Underground HWDUs in compliance with applicable State and Federal regulations.

The WIPP geologic repository is mined within a 2,000-feet (ft) (610-meters (m))-thick bedded-salt formation called the Salado Formation. The Underground HWDUs (miscellaneous units) are located 2,150 ft (655 m) beneath the ground surface. TRU mixed waste management activities underground will be confined to the southern portion of the 120-acre (48.6 hectares) mined area during the Disposal Phase. During the term of this Permit, disposal of TRU mixed waste will occur only in the HWDUs designated as Panels 5 through 8 and in any currently active panel (See Figure A2-1). RH TRU mixed waste disposal began in Panel 4. The Permittees may also request in the future a Permit to allow disposal of containers of TRU mixed waste in the areas designated as Panels 9 and 10 in Figure A2-1. This Permit, during its 10-year term, authorizes the excavation of Panels 6 through 10 and the disposal of waste in Panels 1 through 8.

Panels 1 through 8 will consist of seven rooms and two access drifts each. Panels 9 and 10 have yet to be designed. Access drifts connect the rooms and have the same cross section (see Section A2-2a(3)). The closure system installed in each HWDU after it is filled will prevent anyone from entering the HWDU and will restrict ventilation airflow. The point of compliance for air emissions from the Underground is Sampling Station VOC-A, as defined in Permit Attachment N (Volatile Organic Compound Monitoring Plan). Sampling Station VOC-A is the location where the concentration of volatile organic compounds (VOCs) in the air emissions from the Underground HWDUs will be measured and then compared to the VOC concentration of concern as required by Permit Part 4.

Four shafts connect the underground area with the surface. The Waste Shaft Conveyance headframe and hoist are located within the Waste Handling Building (**WHB**) and will be used to transport containers of TRU mixed waste, equipment, and materials to the repository horizon. The waste hoist can also be used to transport personnel. The Air Intake Shaft and the Salt Handling Shaft provide ventilation to all areas of the mine except for the Waste Shaft Station.

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This area is ventilated by the Waste Shaft itself. The Salt Handling Shaft is also used to hoist mined salt to the surface and serves as the principal personnel transport shaft. The Exhaust Shaft serves as a common exhaust air duct for all areas of the mine. The relationship between the WIPP surface facility, the four shafts, and the geologic repository horizon is shown on Figure A2-2.

The HWDUs identified as Panels 1 through 8 (Figure A2-1) provide room for up to 5,244,900 cubic feet (ft^3) (148,500 cubic meters (m^3)) of CH TRU mixed waste. The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Panels 4 through 8 provide room for up to 93,050 ft^3 (2,635 m^3) of RH TRU mixed waste. RH TRU mixed waste may be disposed of in up to 730 boreholes per panel, subject to the limitations in Permit Part 4, Section 4.1.1.2.ii. These boreholes shall be drilled on nominal eight-foot centers, horizontally, about mid-height in the ribs of a disposal room. The thermal loading from RH TRU mixed waste shall not exceed 10 kilowatts per acre when averaged over the area of a panel, as shown in Permit Attachment A3, plus 100 feet of each of a Panel's adjoining barrier pillars.

The WIPP facility is located in a sparsely populated area with site conditions favorable to isolation of TRU mixed waste from the biosphere. Geologic and hydrologic characteristics of the site related to its TRU mixed waste isolation capabilities are discussed in Addendum L1 of the WIPP Hazardous Waste Facility Permit Amended Renewal Application (DOE, 2009). Hazard prevention programs are described in this Permit Attachment. Contingency and emergency response actions to minimize impacts of unanticipated events, such as spills, are described in Permit Attachment D. The closure plan for the WIPP facility is described in Permit Attachment G.

A2-2 Geologic Repository Design and Process Description

A2-2a Geologic Repository Design and Construction

The WIPP facility, when operated in compliance with the Permit, will ensure safe operations and be protective of human health and the environment.

As a part of the design validation process, geomechanical tests were conducted in SPDV test rooms. During the tests, salt creep rates were measured. Separation of bedding planes and fracturing were also observed. Consequently, a ground-control strategy was implemented. The ground-control program at the WIPP facility mitigates the potential for roof or rib falls and maintains normal excavation dimensions, as long as access to the excavation is possible.

A2-2a(1) CH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage CH TRU waste in the geologic repository. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A2-1.

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2

(**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, or four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Backfill

Magnesium oxide (**MgO**) will be used as a backfill in order to provide chemical control over the solubility of radionuclides in order to comply with the requirements of 40 CFR §191.13. The MgO backfill will be purchased prepackaged in the proper containers for emplacement in the underground. Purchasing prepackaged backfill eliminates handling and placement problems associated with bulk materials, such as dust creation. In addition, prepackaged materials will be easier to emplace, thus reducing potential worker exposure to radiation. Should a backfill container be breached, MgO is benign and cleanup is simple. No hazardous waste would result from a spill of backfill.

The MgO backfill will be managed in accordance with Specification D-0101 (MgO Backfill Specification) and WP05-WH1025 (CH Waste Downloading and Emplacement). These documents are kept on file at the WIPP facility by the Permittees.

Backfill will be handled in accordance with standard operating procedures. Typical emplacement configurations are shown in Figures A2-5 and A2-5a. Some emplacement configurations may include the use of MgO emplacement racks, as shown in Figure A2-5a.

Quality control will be provided within standard operating procedures to record that the correct number of sacks are placed and that the condition of the sacks is acceptable.

Backfill placed in this manner is protected until exposed when sacks are broken during creep closure of the room and compaction of the backfill and waste. Backfill in sacks utilizes existing techniques and equipment and eliminates operational problems such as dust creation and introducing additional equipment and operations into waste handling areas. There are no mine operational considerations (e.g. ventilation flow and control) when backfill is placed in this manner.

The Waste Shaft Conveyance

The hoist systems in the shafts and all shaft furnishings are designed to resist the dynamic forces of the hoisting system and to withstand a design-basis earthquake of 0.1 g. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided engineering design-basis earthquake report which provides the basis for seismic design of WIPP facility structures. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system (such as overtravel, overspeed, power loss, circuitry failure, or starting in a wrong direction) and will trigger an alarm that automatically shuts down the hoist.

The waste hoist moves the Waste Shaft Conveyance and is a multirope, friction-type hoist. A counterweight is used to balance the waste shaft conveyance. The waste shaft conveyance (outside dimensions) is 30 ft (9 m) high by 10 ft (3 m) wide by 15 ft (4.5 m) deep and can carry a payload of 45 tons (40,824 kg). During loading and unloading operations, it is steadied by fixed guides. The hoist's maximum rope speed is 500 ft (152.4 m) per min.

The Waste Shaft hoist system has two sets of brakes, with two units per set, plus a motor that is normally used to stop the hoist. The brakes are designed so that either set, acting alone, can stop a fully loaded conveyance under all emergency conditions.

The Underground Waste Transporter

The underground waste transporter is a commercially available diesel-powered tractor. The trailer was designed specifically for the WIPP for transporting facility pallets from the waste shaft conveyance to the Underground HWDU in use. This transporter is shown in Figure A2-6.

Underground Forklifts

CH TRU mixed waste containers loaded on slipsheets will be removed from the facility pallets using forklifts with a push-pull attachment (Figure A2-7) attached to the forklift-truck front carriage. The push-pull attachment grips the edge of the slipsheet (on which the waste containers sit) to pull the containers onto the platen. After the forklift moves the waste containers to the emplacement location, the push-pull attachment pushes the containers into position. The use of the push-pull attachment prevents direct contact between waste containers and forklift tines. SWBs and TDOPs may also be removed from the facility pallet by using forklifts equipped with special adapters for these containers. These special adapters will prevent direct contact between SWBs or TDOPs and forklift tines. In addition, the low clearance forklift that is used to emplace MgO may be used to emplace waste if necessary.

A forklift will be used to offload the SLB2 from the underground transporter and emplace the waste container in the waste stack.

A2-2a(2) Shafts

The WIPP facility uses four shafts: the Waste Shaft, the Salt Handling Shaft, the Air Intake Shaft, and the Exhaust Shaft. These shafts are vertical openings that extend from the surface to the repository level.

The Waste Shaft is located beneath the WHB and is 19 to 20 ft (5.8 to 6.1 m) in diameter. The Salt Handling Shaft, located north of the Waste Shaft beneath the salt handling headframe, is 10 to 12 ft (3 to 3.6 m) in diameter. Salt mined from the repository horizon is removed through the Salt Handling Shaft. The Salt Handling Shaft is the main personnel and materials hoist and also serves as a secondary-supply air duct for the underground areas. The Air Intake Shaft, northwest of the WHB, varies in diameter from 16 ft 7 in. (4.51 m) to 20 ft 3 in. (6.19 m) and is the primary source of fresh air underground. The Exhaust Shaft, east of the WHB, is 14 to 15 ft (4.3 to 4.6 m) in diameter and serves as the exhaust duct for the underground air.

Openings excavated in salt experience closure because of salt creep (or time-dependent deformation at constant load). The closure affects the design of all of the openings discussed in this section. Underground excavation dimensions, therefore, are nominal, because they change

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with time. The unlined portions of the shafts have larger diameters than the lined portions, which allows for closure caused by salt creep. Each shaft includes a shaft collar, a shaft lining, and a shaft key section. The Final Design Validation Report in Appendix D1 of the WIPP RCRA Part B Permit Application (DOE, 1997) discusses the shafts and shaft components in greater detail.

The reinforced-concrete shaft collars extend from the surface to the top of the underlying consolidated sediments. Each collar serves to retain adjacent unconsolidated sands and soils and to prevent surface runoff from entering the shafts. The shaft linings extend from the base of the collar to the top of the salt beds approximately 850 ft (259 m) below the surface. Grout injected behind the shaft lining retards water seeping into the shafts from water-bearing formations, and the liner is designed to withstand the natural water pressure associated with these formations. The shaft liners are concrete, except in the Salt Handling Shaft, where a steel shaft liner has been grouted in place.

The shaft key is a circular reinforced concrete section emplaced in each shaft below the liner in the base of the Rustler and extending about 50 ft (15 m) into the Salado. The key functions to resist lateral pressures and assures that the liner will not separate from the host rocks or fail under tension. This design feature also aids in preventing the shaft from becoming a route for groundwater flow into the underground facility.

On the inside surface of each shaft, excluding the Salt Handling Shaft, there are three water-collection rings: one just below the Magenta, one just below the Culebra, and one at the lowermost part of the key section. These collection rings will collect water that may seep into the shaft through the liner. The Salt Handling Shaft has a single water collection ring in the lower part of the key section. Water collection rings are drained by tubes to the base of the shafts where the water is accumulated.

WIPP shafts and other underground facilities are, for all practical purposes, dry. Minor quantities of water (which accumulate in some shaft sumps) are insufficient to affect the waste disposal area. This water is collected, brought to the surface, and disposed of in accordance with current standards and regulations.

The Waste Shaft is protected from precipitation by the roof of the waste shaft conveyance headframe tower. The Exhaust Shaft is configured at the top with a 14 ft- (4.3 m-) diameter duct that diverts air into the exhaust filtration system or to the atmosphere, as appropriate. The Salt Handling and Air Intake Shaft collars are open except for the headframes. Rainfall into the shafts is evaporated by ventilation air.

The waste hoist system in the Waste Shaft and all Waste Shaft furnishings are designed to resist the dynamic forces of the hoisting system, which are greater than the seismic forces on the underground facilities. In addition the Waste Shaft conveyance headframe is designed to withstand the design-basis earthquake (**DBE**). Maximum operating speed of the hoist is 500 ft (152.4 m) per minute. During loading and unloading operations, the waste hoist is steadied by fixed guides. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system, such as overtravel, overspeed, power loss, or circuitry failure. The control response is to annunciate the condition and shut the hoist down. Operator response is required to recover from the automatic shutdown. Waste hoist operation is continuously monitored by the CMS. A battery powered FM transmitter/receiver allows communication between the hoist conveyance and the hoist house.

The waste hoist has two pairs of brake calipers acting on independent brake paths. The hoist motor is normally used for braking action of the hoist. The brakes are used to hold the hoist in position during normal operations and to stop the hoist under emergency conditions. Each pair of brake calipers is capable of holding the hoist in position during normal operating conditions and stopping the hoist under emergency conditions. In the event of power failure, the brakes will set automatically.

The waste hoist is protected by a fixed automatic fire suppression system. Portable fire extinguishers are also provided on the hoist floor and in equipment areas.

A2-2a(3) Subsurface Structures

The subsurface structures in the repository, located at 2,150 ft (655 m) below the surface, include the HWDUs, the northern experimental areas, and the support areas. Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided details of the underground layout. Figure A2-8 shows the proposed waste emplacement configuration for the HWDUs.

The status of important underground equipment, including fixed fire-protection systems, the ventilation system, and contamination detection systems, will be monitored by a central monitoring system, located in the Support Building adjacent to the WHB. Backup power will be provided as discussed below. The subsurface support areas are constructed and maintained to conform to Federal mine safety codes.

Underground Hazardous Waste Disposal Units (HWDUs)

During the terms of this and the preceding Permit, the volume of CH TRU mixed waste emplaced in the repository will not exceed 5,244,900 ft^3 (148,500 m^3) and the volume of RH TRU mixed waste shall not exceed 93,050 ft^3 (2,635 m^3). CH TRU mixed waste will be disposed of in Underground HWDUs identified as Panels 1 through 8. RH TRU mixed waste may be disposed of in Panels 4 through 8.

Main entries and cross cuts in the repository provide access and ventilation to the HWDUs. The main entries link the shaft pillar/service area with the TRU mixed waste management area and are separated by pillars. Each of the Underground HWDUs labeled Panels 1 through 8 will have seven rooms. The locations of these HWDUs are shown in Figure A2-1. The rooms will have nominal dimensions of 13 ft (4.0 m) high by 33 ft (10 m) wide by 300 ft (91 m) long and will be supported by 100 ft- (30 m-) wide pillars.

As currently planned, future Permits may allow disposal of TRU mixed waste containers in two additional panels, identified as Panels 9 and 10. Disposal of TRU mixed waste in Panels 9 and 10 is prohibited under this Permit. If waste volumes disposed of in the eight panels fail to reach the stated design capacity, the Permittees may request a Permit to allow disposal of TRU mixed waste in the four main entries and crosscuts adjacent to the waste panels (referred to as the disposal area access drifts). These areas are labeled Panels 9 and 10 in Figure A2-1. A permit modification or future permit would be submitted describing the condition of those drifts and the controls exercised for personnel safety and environmental protection while disposing of waste in these areas. These areas have the following nominal dimensions:

- The E-140 waste transport route south of the Waste Shaft Station is mined to be 25 ft wide nominally and its height ranges from about 14 ft to 20 ft.

The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room where waste disposal is taking place and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. Flexible flashing attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. The filled rooms will be isolated from the ventilation system, while the active rooms that are actively being filled will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

Overall, there are six possible modes of exhaust fan operation:

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2 main fans in operation
1 main fan in operation
1 filtration fan in filtered operation
1 filtration fan in unfiltered operation
2 filtration fans in unfiltered operation
1 main and 1 filtration fan (unfiltered) in operation

Under some circumstances (such as power outages and maintenance activities, etc.), all mine ventilation may be discontinued for short periods of time.

In the normal mode, two main surface exhaust fans, located near the Exhaust Shaft, will provide continuous ventilation of the underground areas. All underground flows join at the bottom of the Exhaust Shaft before discharge to the atmosphere.

Outside air will be supplied to the mining areas and the waste disposal areas through the Air Intake Shaft, the Salt Handling Shaft, and access entries. A small quantity of outside air will flow down the Waste Shaft to ventilate the Waste Shaft station. The ventilation system is designed to operate with the Air Intake Shaft as the primary source of fresh air. Under these circumstances, sufficient air will be available to simultaneously conduct all underground operations (e.g., waste handling, mining, experimentation, and support). Ventilation may be supplied by operating fans in the configurations listed in the above description of the ventilation modes.

If the nominal flow of 425,000 cfm (12,028 m^3/min) is not available (i.e., only one of the main ventilation fans is available) underground operations may proceed, but the number of activities that can be performed in parallel may be limited depending on the quantity of air available. Ventilation may be supplied by operating one or two of the filtration exhaust fans. To accomplish this, the isolation dampers will be opened, which will permit air to flow from the main exhaust duct to the filter outlet plenum. The filtration fans may also be operated to bypass the HEPA plenum. The isolation dampers of the filtration exhaust fan(s) to be employed will be opened, and the selected fan(s) will be switched on. In this mode, underground operations will be limited, because filtration exhaust fans cannot provide sufficient airflow to support the use of diesel equipment.

In the filtration mode, the exhaust air will pass through two identical filter assemblies, with only one of the three Exhaust Filter Building filtration fans operating (all other fans are stopped). This system provides a means for removing the airborne particulates that may contain radioactive and hazardous waste contaminants in the reduced exhaust flow before they are discharged through the exhaust stack to the atmosphere. The filtration mode is activated manually or automatically if the radiation monitoring system detects abnormally high concentrations of airborne radioactive particulates (an alarm is received from the continuous air monitor in the exhaust drift of the active waste panel) or a waste handling incident with the potential for a waste container breach is observed. The filtration mode is not initiated by the release of gases such as VOCs.

If utility power fails, the exhaust filter system goes into the fail-safe position, and the system high-efficiency particulate-air filter dampers are placed into filtration position. When power is restored by the diesel generators, a decision is made whether to remain in filtration mode and energize a filtration fan or to realign the dampers into the minimum exhaust mode. Without any indication of a radiological release, the decision is usually the latter. TRU mixed waste handling and related operations cease upon loss of utility power and are not resumed until normal utility

power is returned. As specified in Part 2, all waste handling equipment will "fail safe," meaning that it will retain its load during a power outage.

Underground Ventilation Normal Mode Redundancy

The underground ventilation system has been provided redundancy in normal ventilation mode by the addition of a third main fan. Ductwork leading to that new fan ties into the existing main exhaust duct.

Electrical System

The WIPP facility uses electrical power (utility power) supplied by the regional electric utility company. If there is a loss of utility power, TRU mixed waste handling and related operations will cease.

Backup, alternating current power will be provided on site by two 1,100-kilowatt diesel generators. These units provide 480-volt power with a high degree of reliability. Each of the diesel generators can carry predetermined equipment loads while maintaining additional power reserves. Predetermined loads include lighting and ventilation for underground facilities, lighting and ventilation for the TRU mixed waste handling areas, and the Air Intake Shaft hoist. The diesel generator can be brought on line within 30 minutes either manually or from the control panel in the Central Monitoring Room (CMR).

Uninterruptible power supply (**UPS**) units are also on line providing power to predetermined monitoring systems. These systems ensure that the power to the radiation detection system for airborne contamination, the local processing units, the computer room, and the CMR will always be available, even during the interval between the loss of off-site power and initiation of backup diesel generator power.

A2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table A2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure A2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the Facility Cask is loaded, the Facility Cask Transfer Car moves onto the waste shaft conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste shaft conveyance to provide forklift access to the Facility Cask.

Horizontal Emplacement and Retrieval Equipment or Functionally Equivalent Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) or functionally equivalent equipment (Figure A2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

A2-2b Geologic Repository Process Description

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste shaft conveyance and is lowered to the waste shaft station underground. At the waste shaft station underground, the Facility Cask is moved from the waste shaft conveyance by the Facility Cask Transfer Car (Figure A2-16). A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU. There, the Facility Cask is placed on the HERE (Figure A2-17). The HERE is used to emplace the RH TRU mixed waste canister into the borehole. The borehole will be visually inspected for obstructions prior to aligning the HERE and emplacement of the RH TRU mixed waste canister. The Facility Cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear Facility Cask shield valve. The shield valves on the Facility Cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the Facility Cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the Facility Cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure A2-18). The transfer mechanism is retracted, the shield valves close on the Facility Cask, and the Facility Cask is removed from the HERE.

A shield plug is a concrete filled cylindrical steel shell (Figure A2-21) approximately 61 in. long and 29 in. in diameter, made of concrete shielding material inside a 0.24 in. thick steel shell with a removable pintle at one end. Each shield plug has integral forklift pockets and weighs approximately 3,750 lbs. The shield plug is inserted with the pintle end closest to the HERE to provide the necessary shielding , limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr . Additional shielding is provided at the direction of the Radiological Control Technician based on dose rate surveys following shield plug emplacement. This additional shielding is provided by the manual emplacement of one or more shield plug supplemental shielding plates and a retainer (Figures A2-19 and A2-20).

The amount of RH TRU mixed waste disposal in each panel is limited based on thermal and geomechanical considerations and shall not exceed 10 kilowatts per acre as described in Permit Attachment A2-1. RH TRU mixed waste emplacement boreholes shall be drilled in the ribs of the panels at a nominal spacing of 8 ft (2.4 m) center-to-center, horizontally.

Figures A1-26 and A1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and CNS 10-160B casks, respectively.

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers (e.g., TRUPACT-IIs or HalfPACTs), at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping

containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste shaft conveyance, and the facility pallet will be transferred from the waste shaft conveyance onto the transporter (see Figure A2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement. The underground waste transporter is equipped with a fire suppression system, rupture-resistant diesel fuel tanks, and reinforced fuel lines to minimize the potential for a fire involving the fuel system.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment or, in the case of an SLB2, the SLB2 will be lifted from the facility pallet and placed directly on the floor of the emplacement room. The waste will be emplaced room by room in Panels 1 through 8. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade and, if necessary, bulkheads will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

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The emplacement of CH TRU mixed waste into the HWDUs will typically be in the order received and unloaded from the Contact Handled Packaging. There is no specification for the amount of space to be maintained between the waste containers themselves, or between the waste containers and the walls. Containers will be stacked in the best manner to provide stability for the stack (which is up to three containers high) and to make best use of available space. It is anticipated that the space between the wall and the container could be from 8 to 18 in. (20 to 46 cm). This space is a function of disposal room wall irregularities, container type, and sequence of emplacement. Bags of backfill will occupy some of this space. Space is required over the stacks of containers to assure adequate ventilation for waste handling operations. A minimum of 16 in. (41 cm) was specified in the Final Design Validation Report (Appendix D1, Chapter 12 of the WIPP RCRA Part B Permit Application (DOE, 1997)) to maintain air flow. Typically, the space above a stack of containers will be 36 to 48 in. (90 to 122 cm). However 18 in. (0.45 m) will contain backfill material consisting of bags of Magnesium Oxide (MgO). Figure A2-8 shows a typical container configuration, although this figure does not mix containers on any row. Such mixing, while inefficient, will be allowed to assure timely movement of waste into the underground. No aisle space will be maintained for personnel access to emplaced waste containers. No roof maintenance behind stacks of waste is planned.

The anticipated schedule for the filling of each of the Underground HWDUs known as Panels 1 through 8 is shown in Permit Attachment G, Table G-1. Panel closure in accordance with the Closure Plan in Permit Attachment G and Permit Attachment G1 is estimated to require an additional 150 days.

Figure A2-12 is a flow diagram of the CH TRU mixed waste handling process.

A2-3 Waste Characterization

TRU mixed waste characterization is described in Permit Attachment C.

A2-4 Treatment Effectiveness

TRU mixed waste treatment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), for which a permit is required, will not be performed at the WIPP facility.

A2-5 Maintenance, Monitoring, and Inspection

A2-5a Maintenance

A2-5a(1) Ground-Control Program

The ground-control program at the WIPP facility will ensure that any room in an HWDU in which waste will be placed will be sufficiently supported to assure compliance with the applicable portions of the Land Withdrawal Act (**LWA**), which requires a regular review of roof-support plans and practices by the Mine Safety and Health Administration (**MSHA**). Support is installed to the requirements of 30 CFR §57, Subpart B.

A2-5b Monitoring

A2-5b(1) Groundwater Monitoring

Groundwater monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 5 and Permit Attachment L of this permit.

A2-5b(2) Geomechanical Monitoring

The geomechanical monitoring program at the WIPP facility is an integral part of the ground-control program (See Figure A2-13). HWDUs, drifts, and geomechanical test rooms will be monitored to provide confirmation of structural integrity. Geomechanical data on the performance of the repository shafts and excavated areas will be collected as part of the geotechnical field-monitoring program. The results of the geotechnical investigations will be reported annually. The report will describe monitoring programs and geomechanical data collected during the previous year.

A2-5b(2)(a) Description of the Geomechanical Monitoring System

The Geomechanical Monitoring System (**GMS**) provides in situ data to support the continuous assessment of the design for underground facilities. Specifically, the GMS provides for:

- Early detection of conditions that could affect operational safety
- Evaluation of disposal room closure that ensures adequate access
- Guidance for design modifications and remedial actions
- Data for interpreting the behavior of underground openings, in comparison with established design criteria

The instrumentation in Table A2-2 is available for use in support of the geomechanical program.

The minimum instrumentation for each of the eight panels will be one borehole extensometer installed in the roof at the center of each disposal room. The roof extensometers will monitor the dilation of the immediate salt roof beam and possible bed separations along clay seams. Additional instrumentation will be installed as conditions warrant.

Remote polling of the geomechanical instrumentation will be performed at least once every month. This frequency may be increased to accommodate any changes that may develop.

The results from the remotely read instrumentation will be evaluated after each scheduled polling. Documentation of the results will be provided annually in the Geotechnical Analysis Report.

Data from remotely read instrumentation will be maintained as part of a geotechnical instrumentation system. The instrumentation system provides for data maintenance, retrieval, and presentation. The Permittees will retrieve the data from the instrumentation system and verify data accuracy by confirming the measurements were taken in accordance with applicable instructions and equipment calibration is known. Next, the Permittees will review the data after

each polling to assess the performance of the instrument and of the excavation. Anomalous data will be investigated to determine the cause (instrumentation problem, error in recording, changing rock conditions). The Permittees will calculate various parameters such as the change between successive readings and deformation rates. This assessment will be reported to the Permittees' cognizant ground control engineer and operations personnel. The Permittees will investigate unexpected deformation to determine if remediation is needed.

The stability of an open panel excavation is generally determined by the rock deformation rate. The excavation may be unstable when there is a continuous increase in the deformation rate that cannot be controlled by the installed support system. The Permittees will evaluate the performance of the excavation. These evaluations assess the effectiveness of the roof support system and estimate the stand-up time of the excavation. If an open panel shows the trend is toward adverse (unstable) conditions, the results will be reported to determine if it is necessary to terminate waste disposal activities in the open panel. This report of the trend toward adverse conditions in an open HWDU will also be provided to the Secretary of the NMED within seven (7) calendar days of issuance of the report.

A2-5b(2)(b) System Experience

Much experience in the use of geomechanical instrumentation was gained as the result of performance monitoring of Panel 1, which began at the time of completion of the panel excavation in 1988. The monitoring system installed at that time involved simple measurements and observations (e.g., vertical and horizontal convergence rates, and visual inspections). Minimal maintenance of instrumentation is required, and the instrumentation is easily replaced if it malfunctions. Conditions throughout Panel 1 are well known. The monitoring program continues to provide data to compare the performance of Panel 1 with that established elsewhere in the underground. Panel 1 performance is characterized by the following:

The development of bed separations and lateral shifts at the interfaces of the salt and the clays underlying the anhydrites "a" and "b."

Room closures. A closure due only to the roof movement will be separated from the total closure.

The behavior of the pillars.

Fracture development in the roof and floor.

Distribution of load on the support system.

Roof conditions are assessed from observation boreholes and extensometer measurements. Measurements of room closure, rock displacements, and observations of fracture development in the immediate roof beam are made and used to evaluate the performance of a panel. A description of the Panel 1 monitoring program was presented to the members of the Geotechnical Experts Panel (in 1991) who concurred that it was adequate to determine deterioration within the rooms and that it will provide early warning of deteriorating conditions.

The assessment and evaluation of the condition of WIPP excavations is an interactive, continuous process using the data from the monitoring programs. Criteria for corrective action are continually reevaluated and reassessed based on total performance to date. Actions taken

are based on these analyses and planned utilization of the excavation. Because WIPP excavations are in a natural geologic medium, there is inherent variability from point to point. The principle adopted is to anticipate potential ground control requirements and implement them in a timely manner rather than to wait until a need arises.

A2-5b(3) Volatile Organic Compound Monitoring

The volatile organic compound monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 4 and Permit Attachment N of this permit.

A2-5c Inspection

The inspection of the WIPP Underground HWDUs will be conducted in accordance with Part 2 and Permit Attachment E of this permit.

References

DOE, 1997. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Revision 6.5, 1997.

DOE, 2009. WIPP Hazardous Waste Facility Permit Amended Renewal Application, Carlsbad, New Mexico, September 2009.

TABLES

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

Table A2-2
Instrumentation Used in Support of the Geomechanical Monitoring System

Instrument Type	Features	Parameter Measured	Range
Borehole Extensometer	The extensometer provides for monitoring the deformation parallel to the borehole axis. Units suitable for up to 5 measurements anchors in addition to the reference head. Maximum borehole depths shall be 50 feet.	Cumulative Deformation	0-2 inches
Borehole Television Camera	Closed circuit television may be used for monitoring areas otherwise inaccessible, such as boreholes or shafts.	Video Image	N/A
Convergence Points and Tape Extensometers	Mechanically anchored eyebolts to which a portable tape extensometer is attached.	Cumulative Deformation	2-50 feet
Convergence Meters	Includes wire and sonic meters. Mounted on rigid plates anchored to the rock surface.	Cumulative Deformation	2-50 feet
Inclinometers	Both vertical and horizontal inclinometers are used. Traversing type of system in which a probe is moved periodically through casing located in the borehole whose inclination is being measured.	Cumulative Deformation	0-30 degrees
Rock Bolt Load Cells	Spool type units suitable for use with rock bolts. Tensile stress is inferred from strain gauges mounted on the surface of the spool.	Load	0-300 kips
Earth Pressure Cells	Installed between concrete keys and rock. Preferred type is a hydraulic pressure plate connected to a vibrating wire transmitter.	Lithostatic Pressure	0-1000 psi
Piezometer Pressure Transducers	Located in shafts and of robust design and construction. Periodic checks on operability required.	Fluid Pressure	0-500 psi
Strain Gauges	Installed within the concrete shaft key. Suitably sealed for the environment. Two types used--surface mounted and embedded.	Cumulative Deformation	0-3000 µin/in (embedded) 0-2500 µin/in (surface)

Table A2-3
RH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
41-Ton Forklift	82,000 lbs
Maximum Gross Weights of RH TRU Containers	
RH TRU Facility Canister	10,000 lbs
55-Gallon Drum	1,000 lbs
RH TRU Canister	8,000 lbs
Maximum Net Empty Weights of Equipment	
Facility Cask	67,700 lbs

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FIGURES

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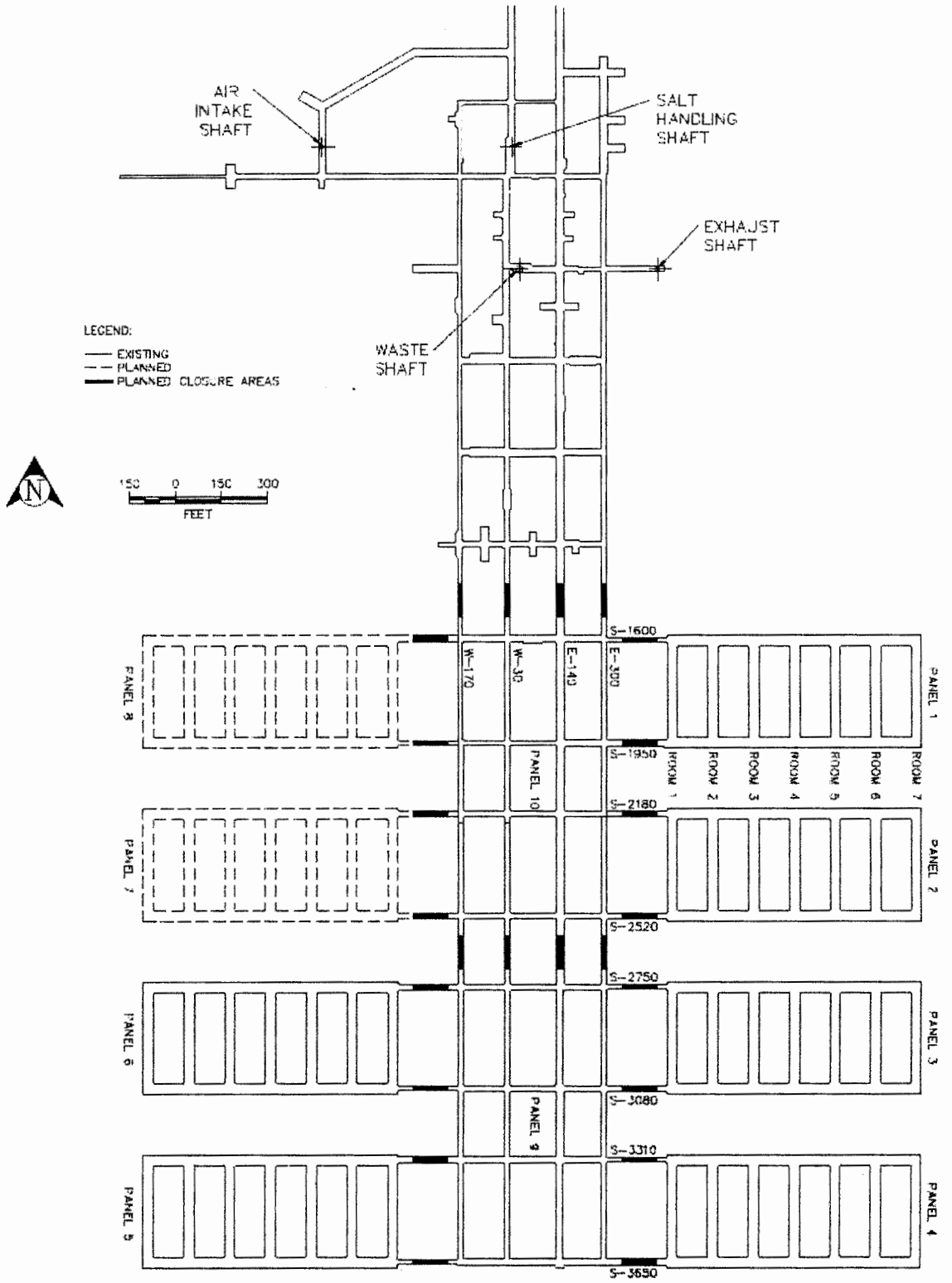

Figure A2-1
Repository Horizon

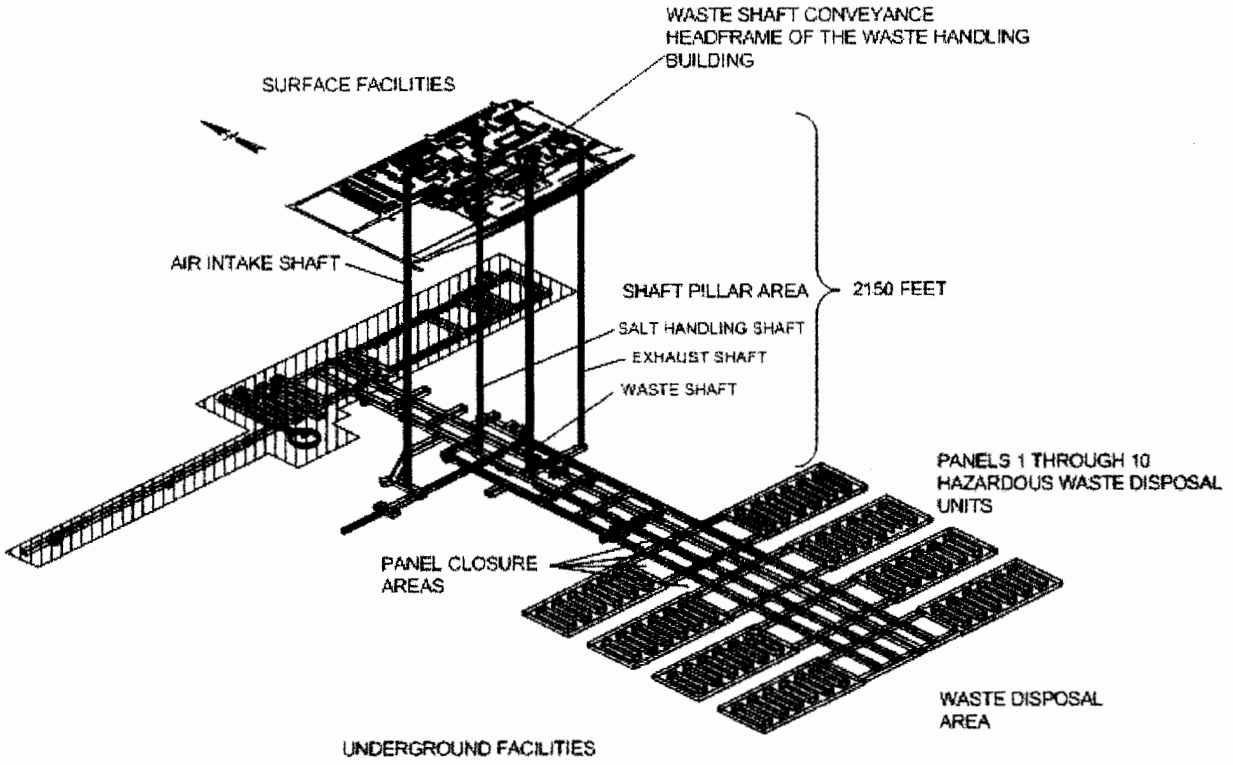

Figure A2-2
Spatial View of the Miscellaneous Unit and Waste Handling Facility

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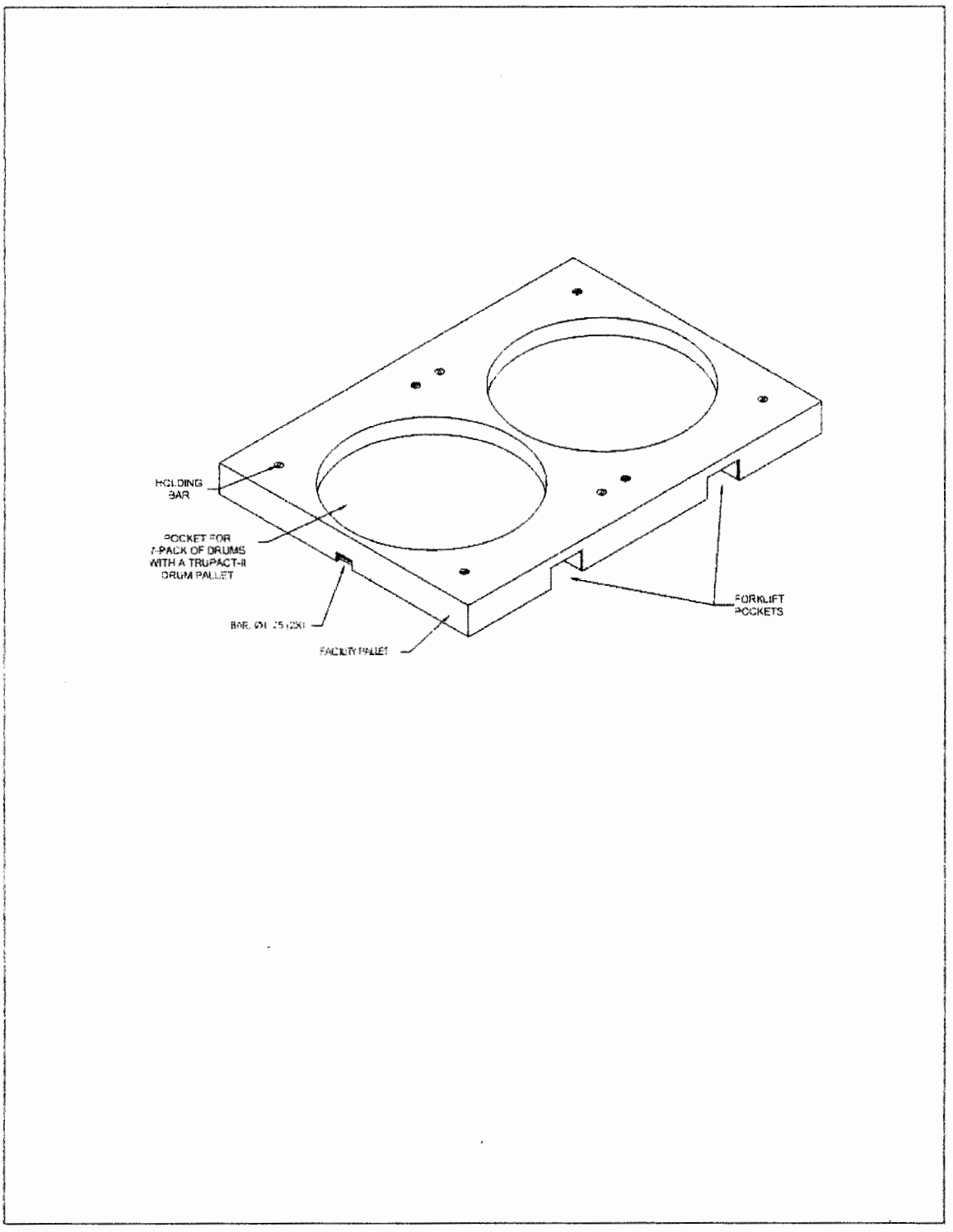

Figure A2-3
Facility Pallet for Seven-Pack of Drums

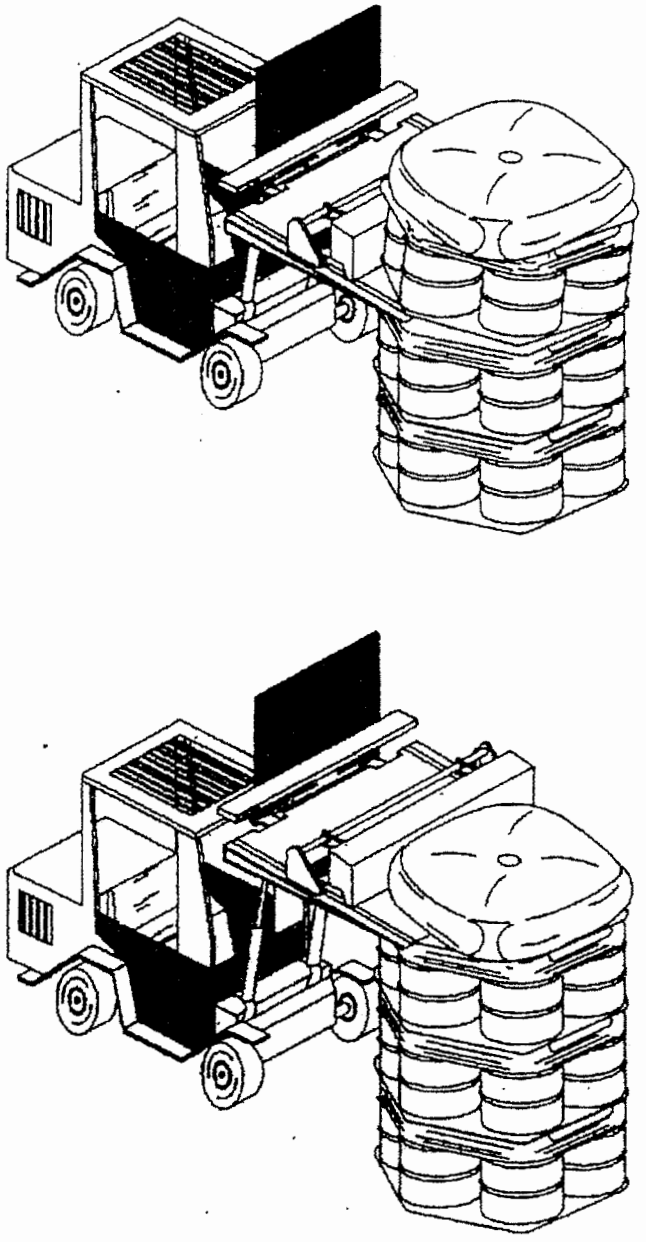

Figure A2-5
Typical Backfill Sacks Emplaced on Drum Stacks

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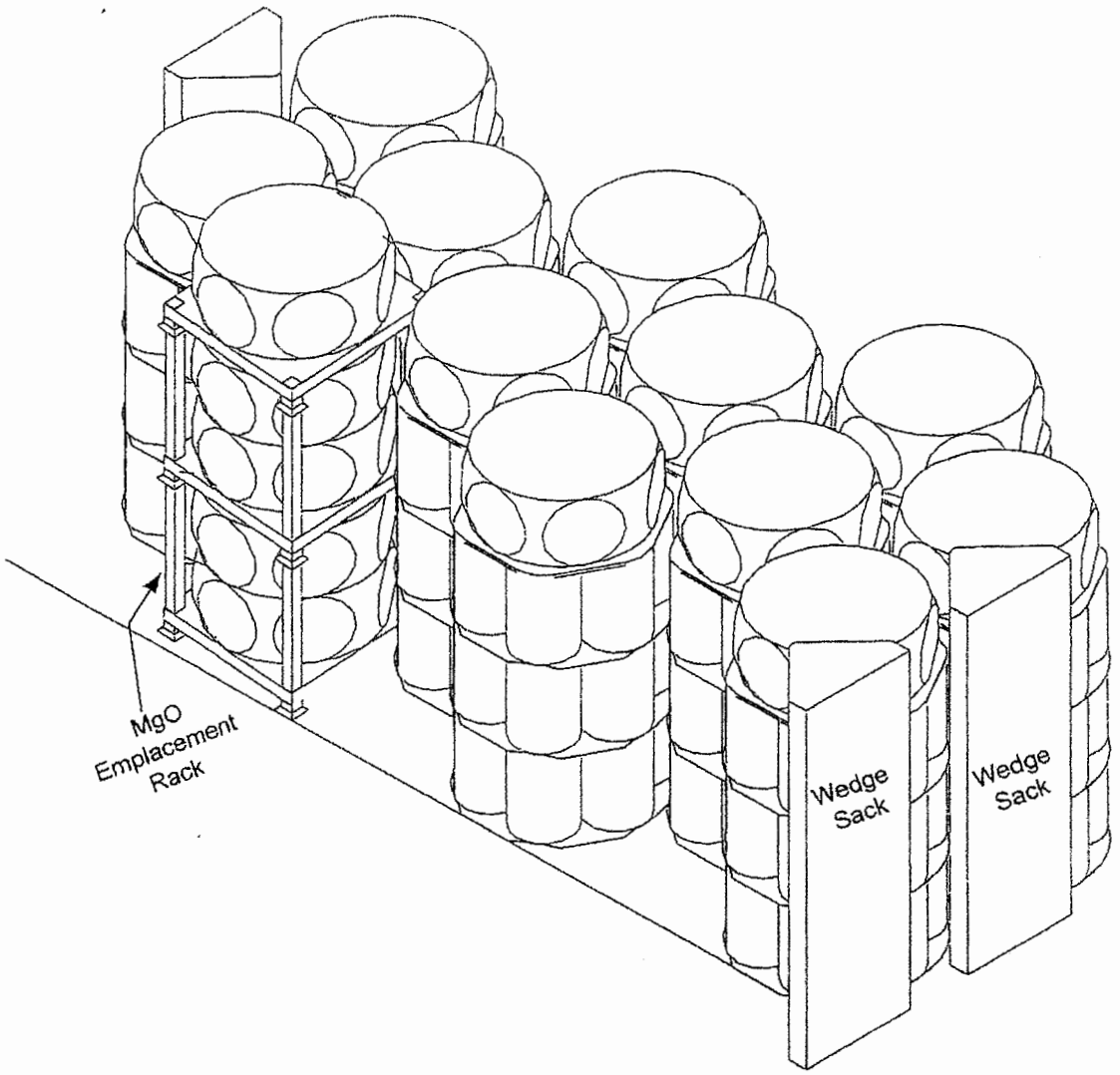

Figure A2-5a
Potential MgO Emplacement Configurations

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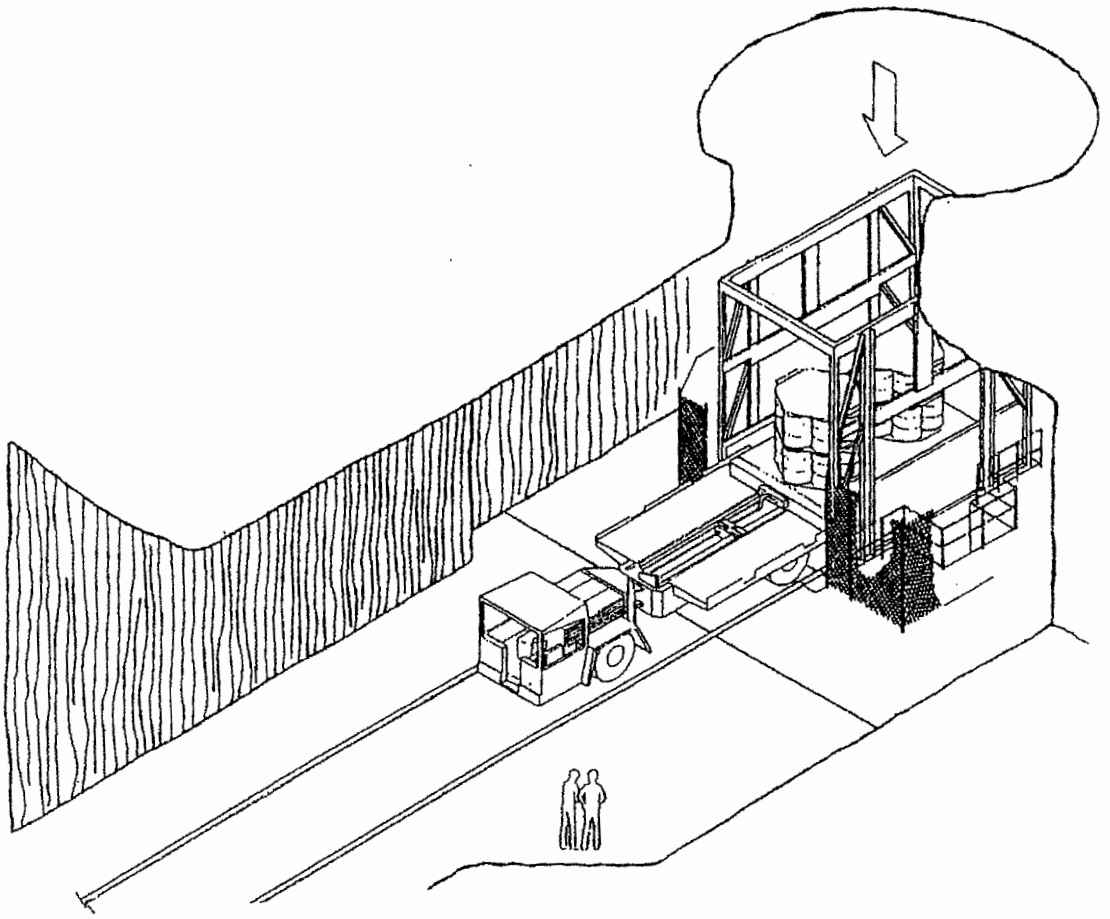

Figure A2-6
Waste Transfer Cage to Transporter

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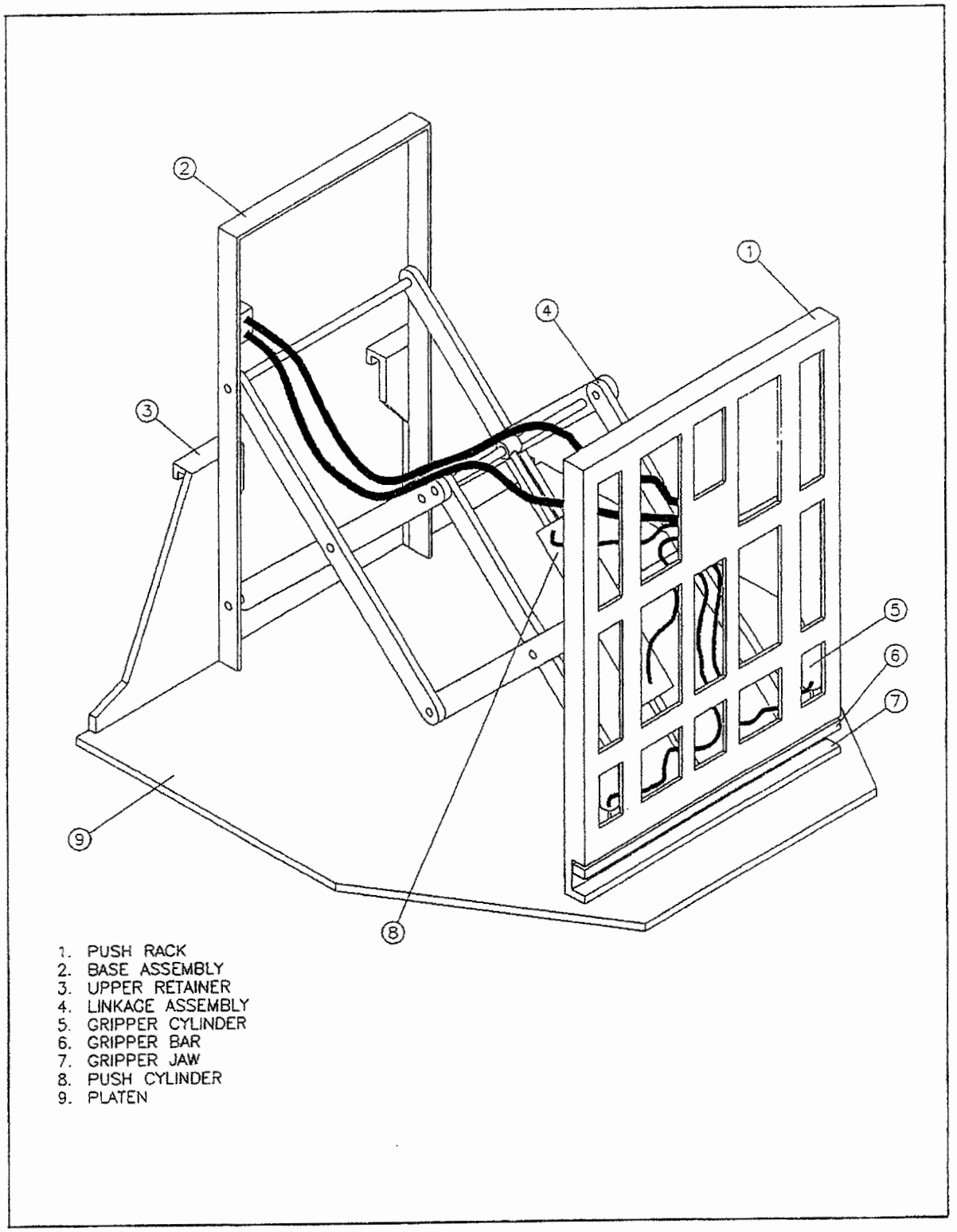

Figure A2-7
Push-Pull Attachment to Forklift to Allow Handling of Waste Containers

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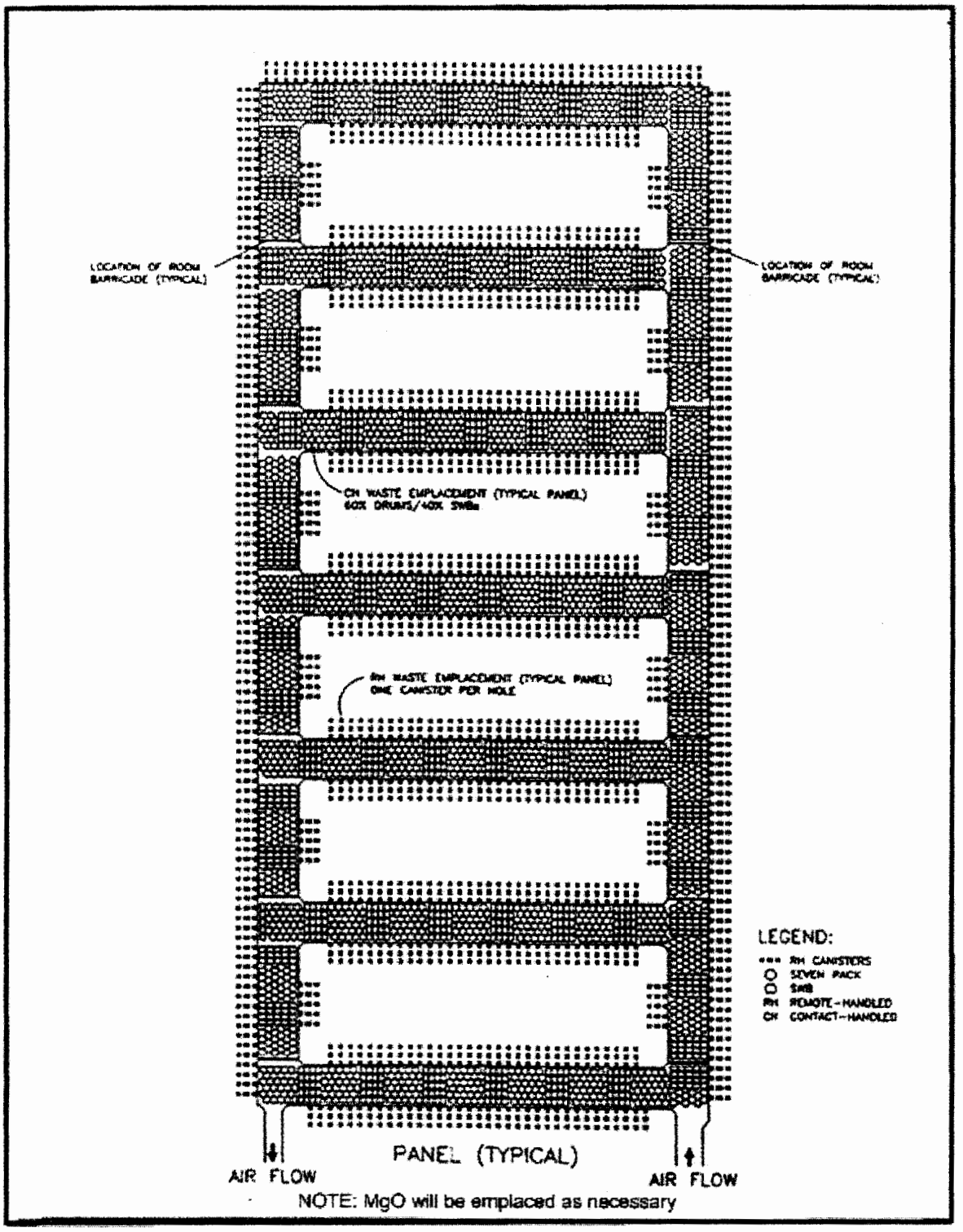

Figure A2-8
Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration

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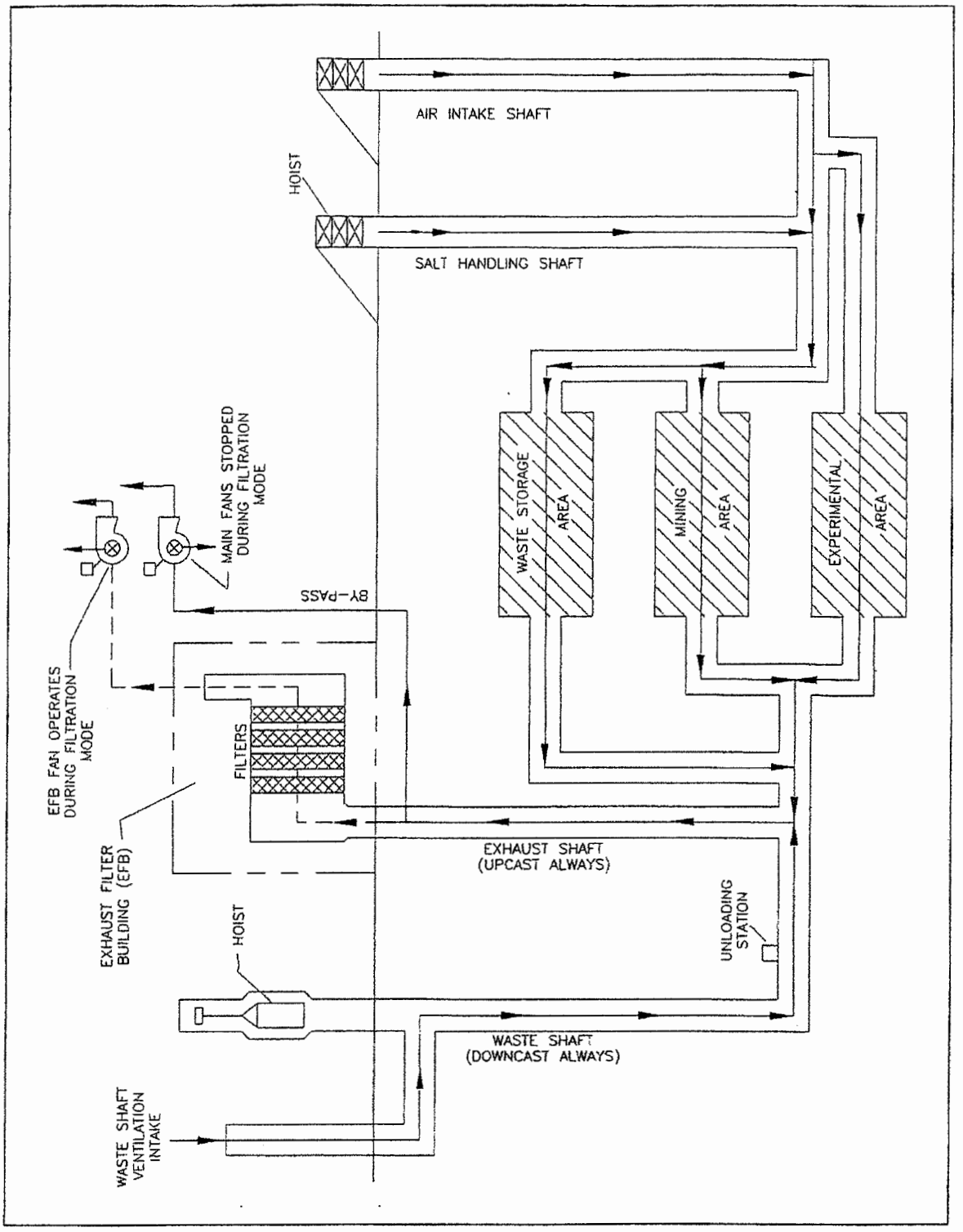

Figure A2-9
Underground Ventilation System Airflow

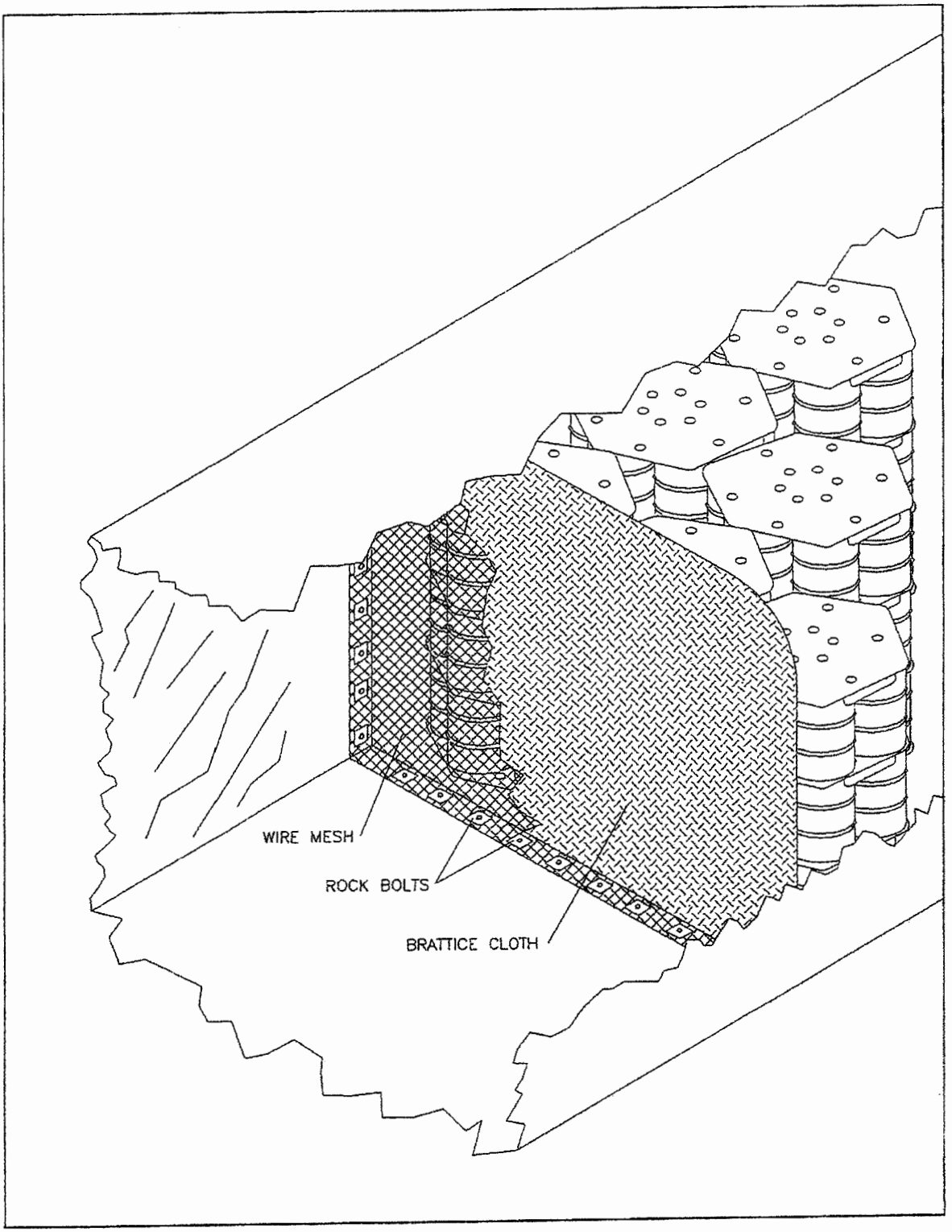

Figure A2-11
Typical Room Barricade

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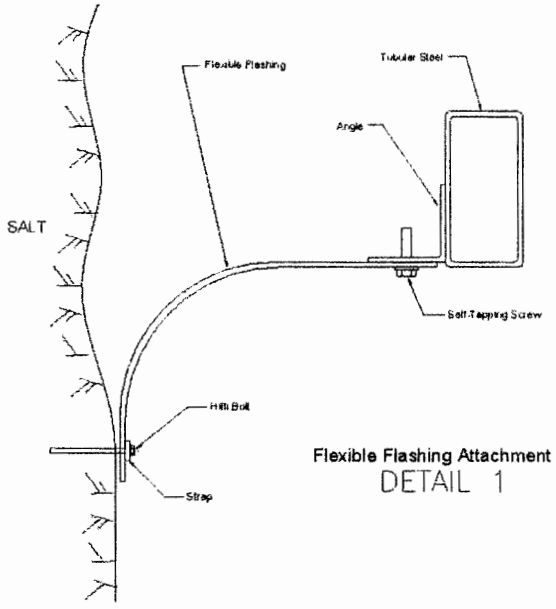
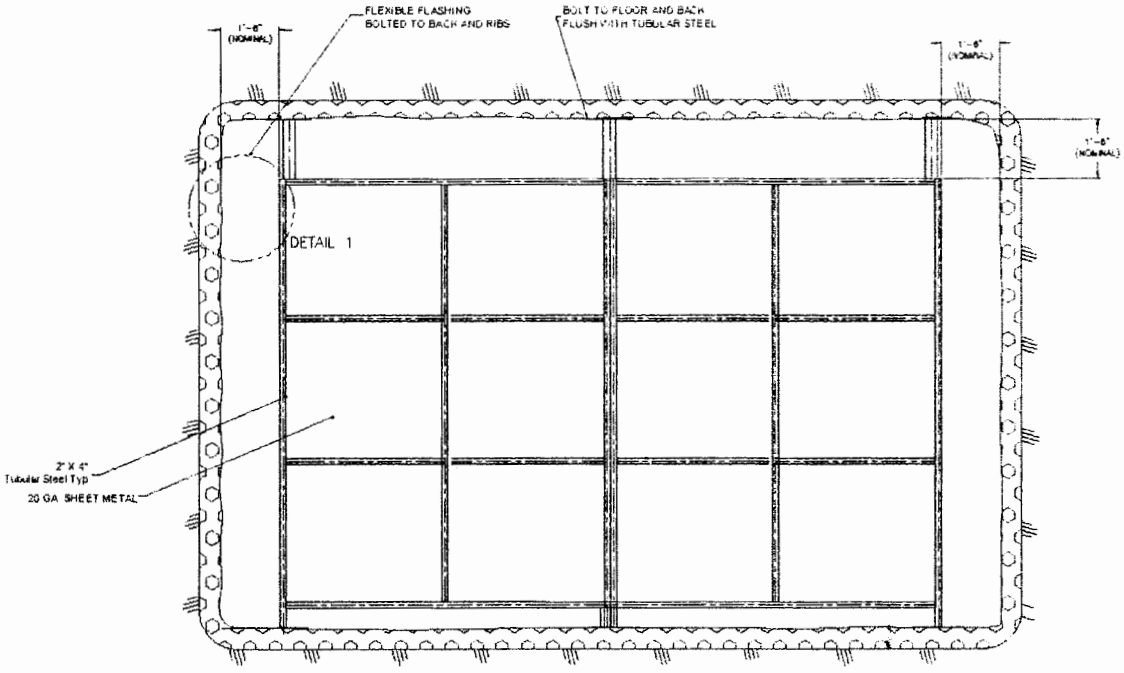


Flexible Flashing Attachment
DETAIL 1



Not to Scale. All dimensions are nominal.

Figure A2-11a
Typical Bulkhead

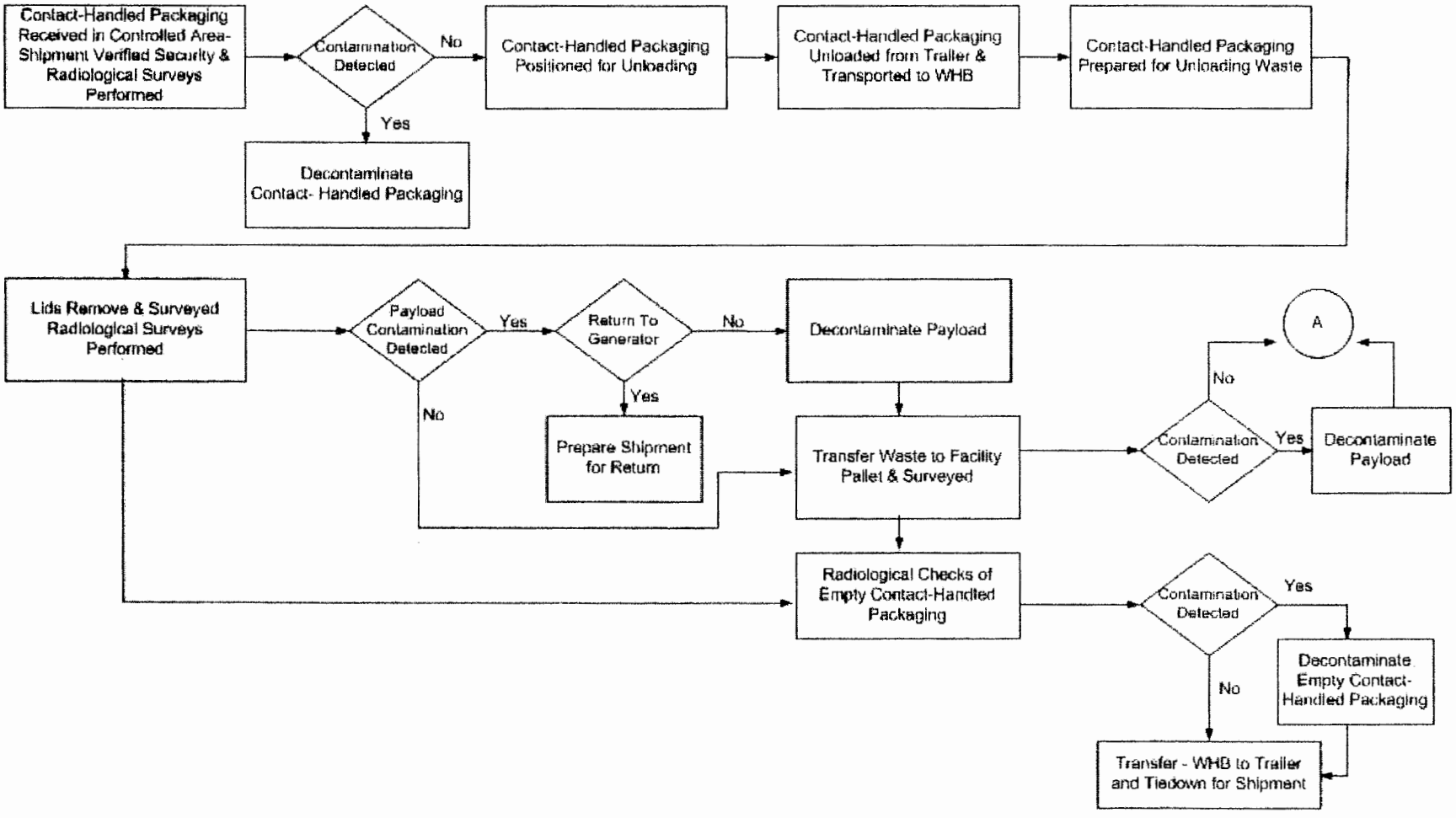


Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

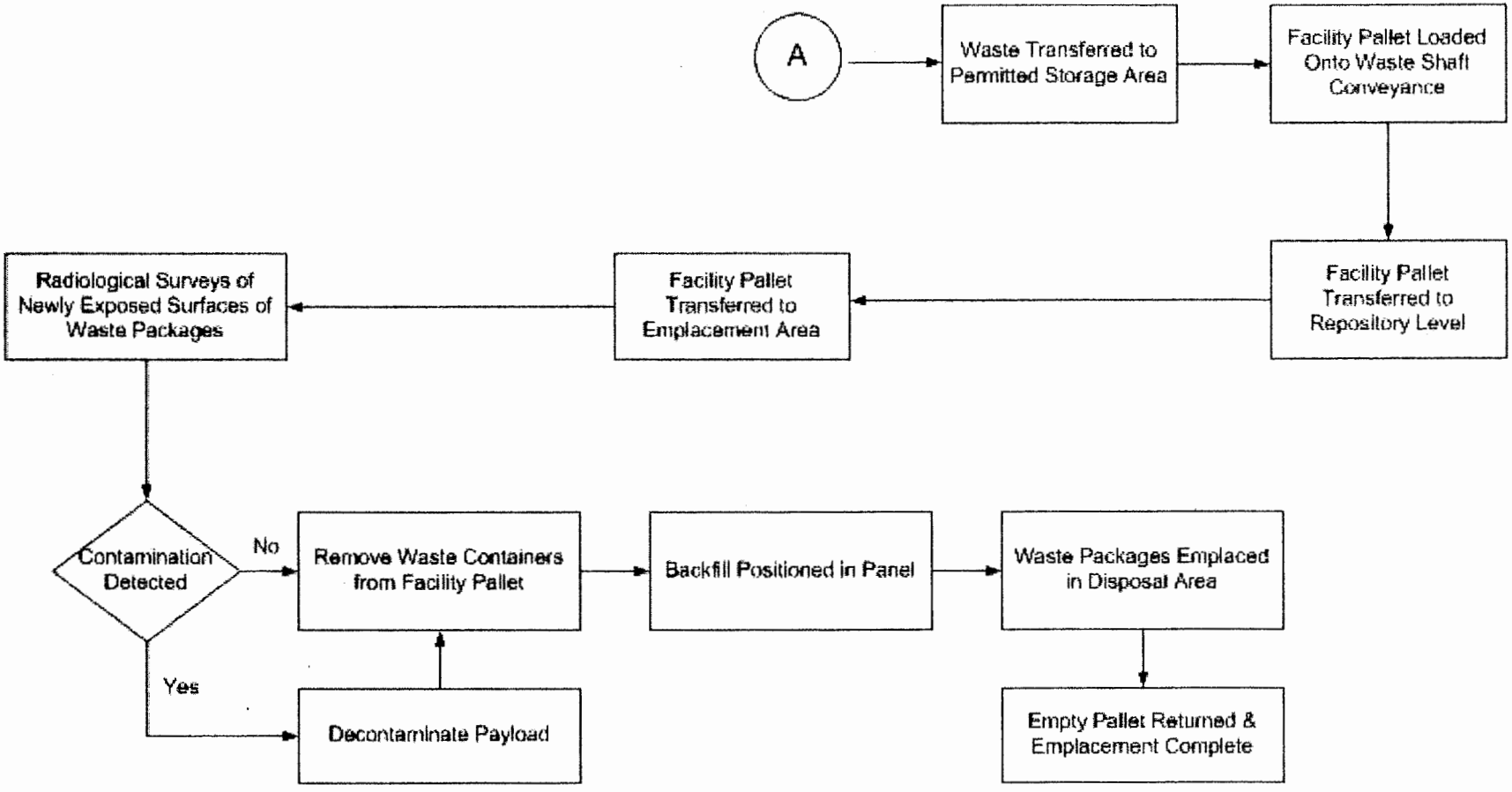


Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

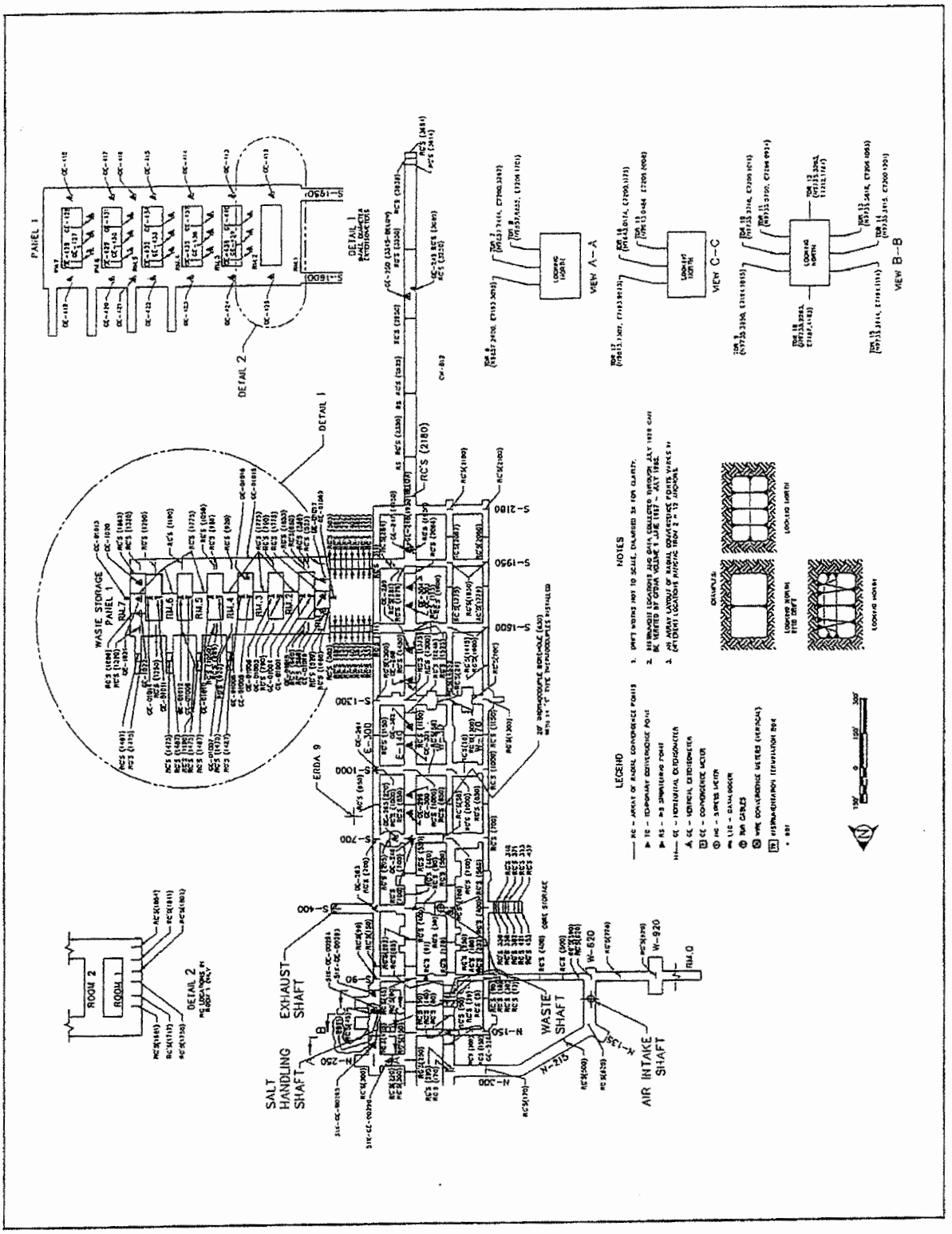


Figure A2-13
Layout and Instrumentation - As of 1/96

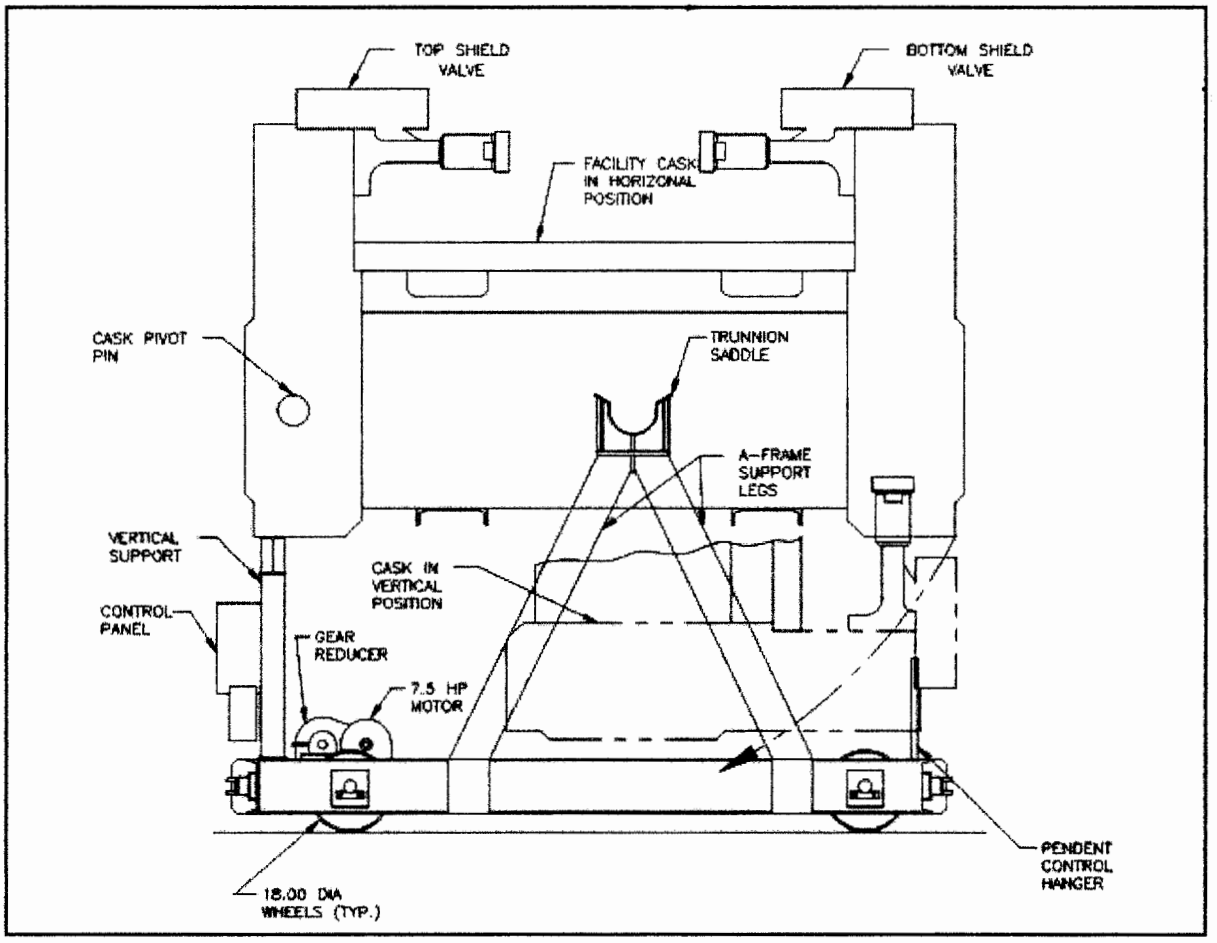


Figure A2-14
Facility Cask Transfer Car (Side View)

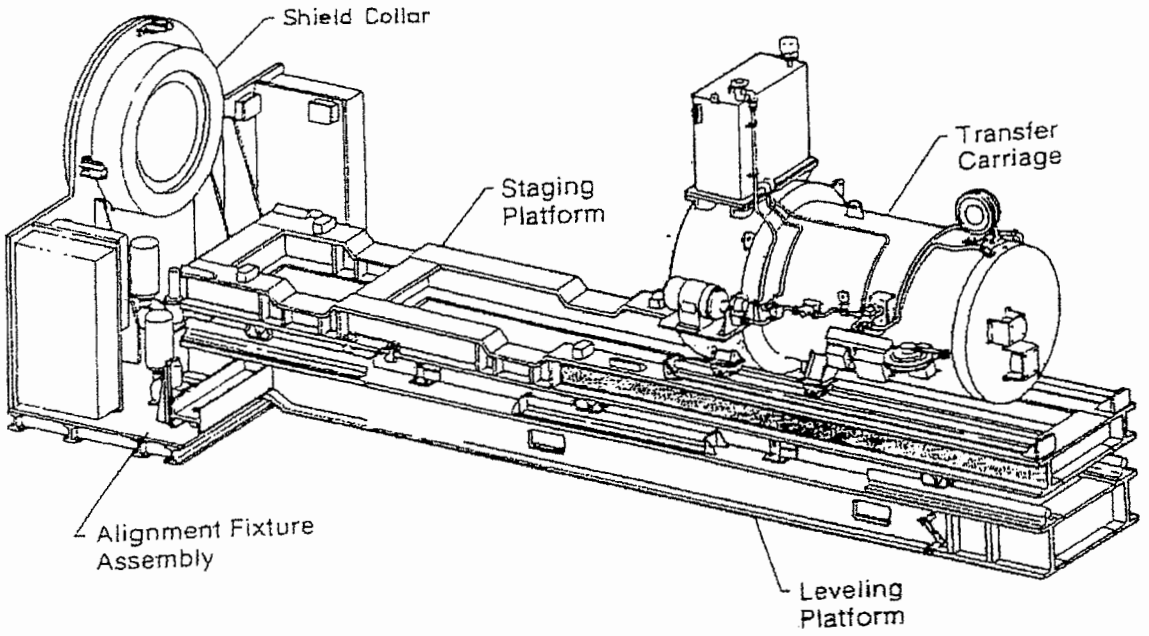


Figure A2-15
Typical Emplacement Equipment

1

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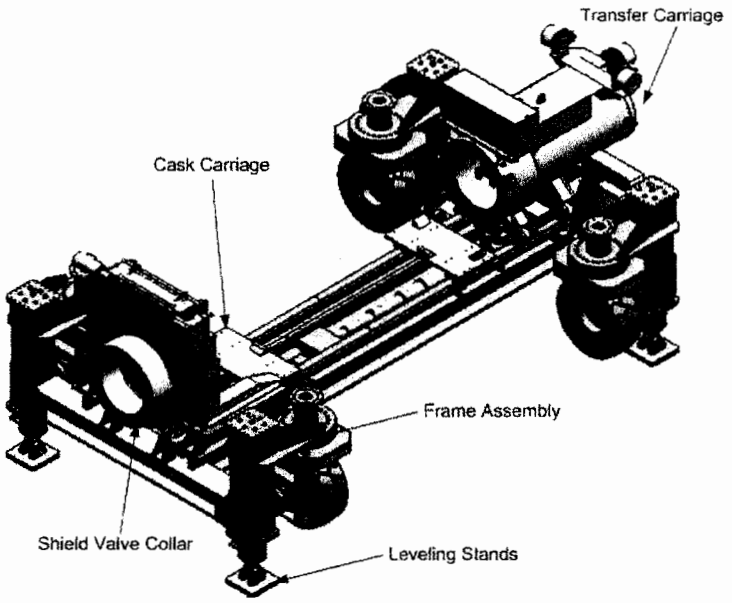

Figure A2-15a
Typical Emplacement Equipment

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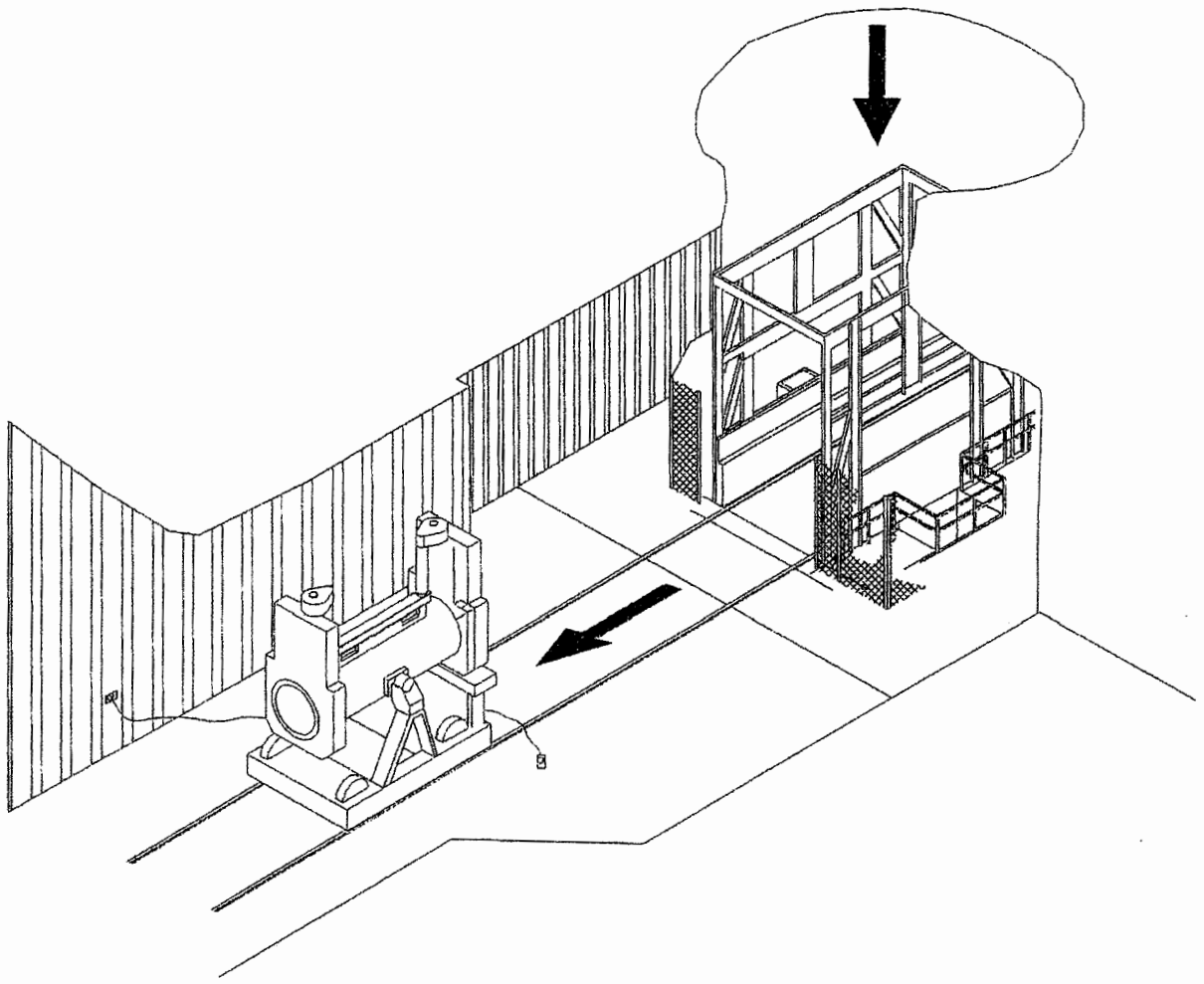

Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

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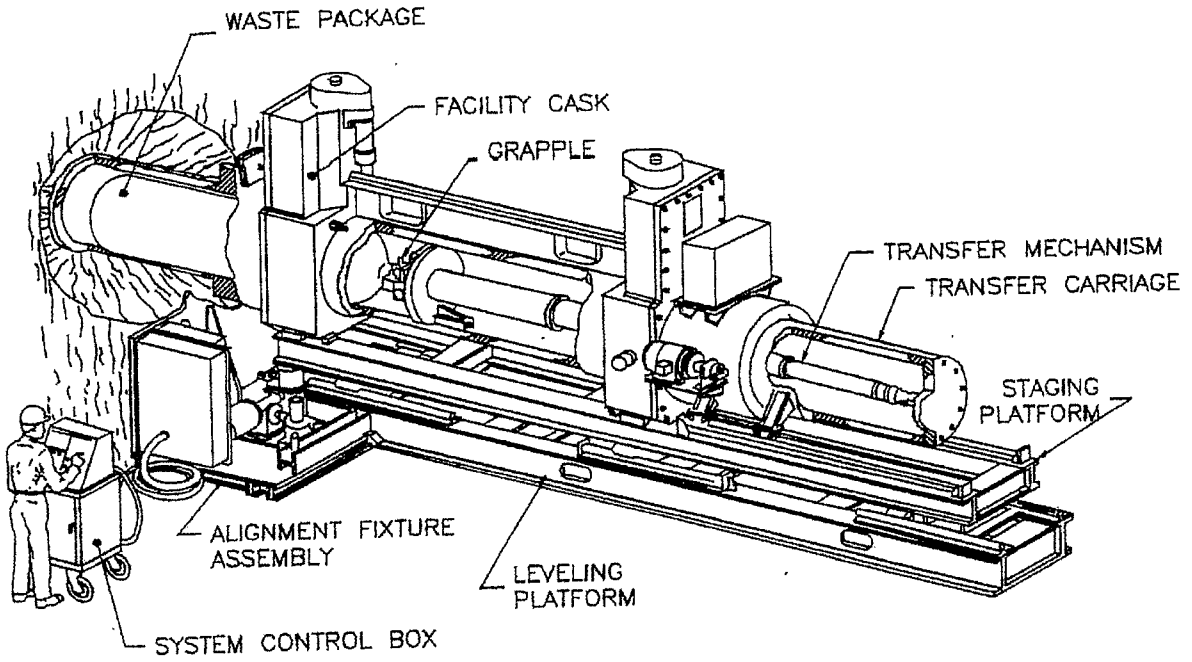

Figure A2-17
Facility Cask Installed on the Typical Emplacement Equipment

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FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

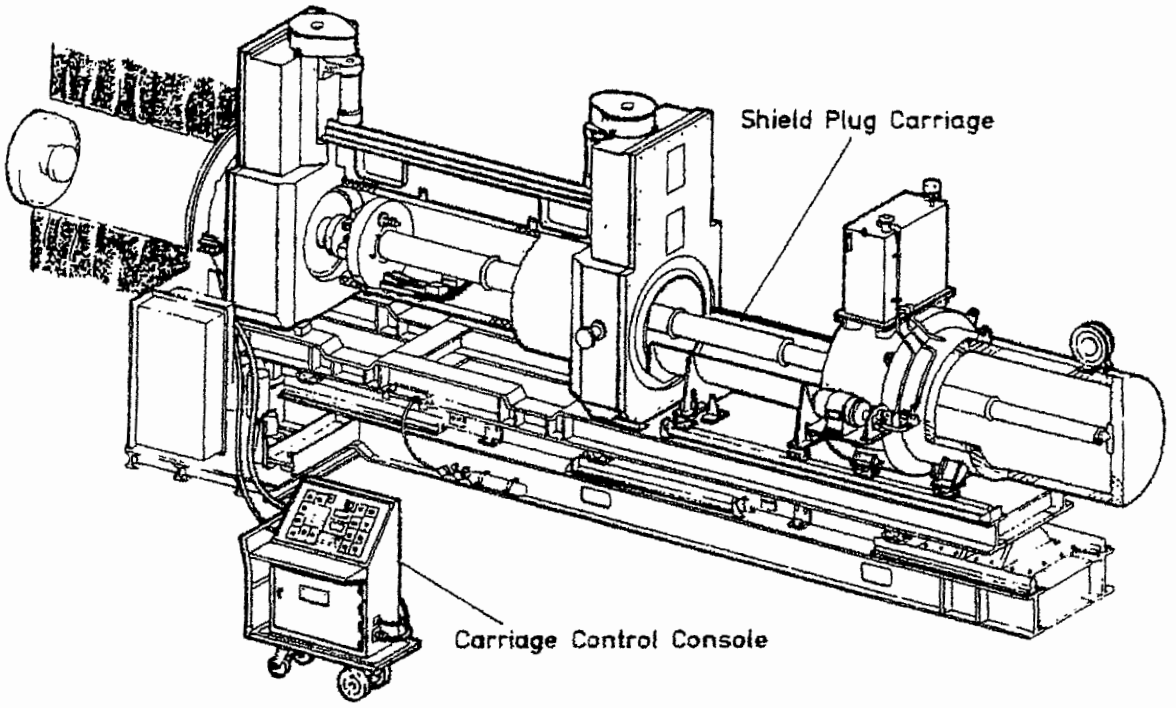

Figure A2-18
Installing Shield Plug

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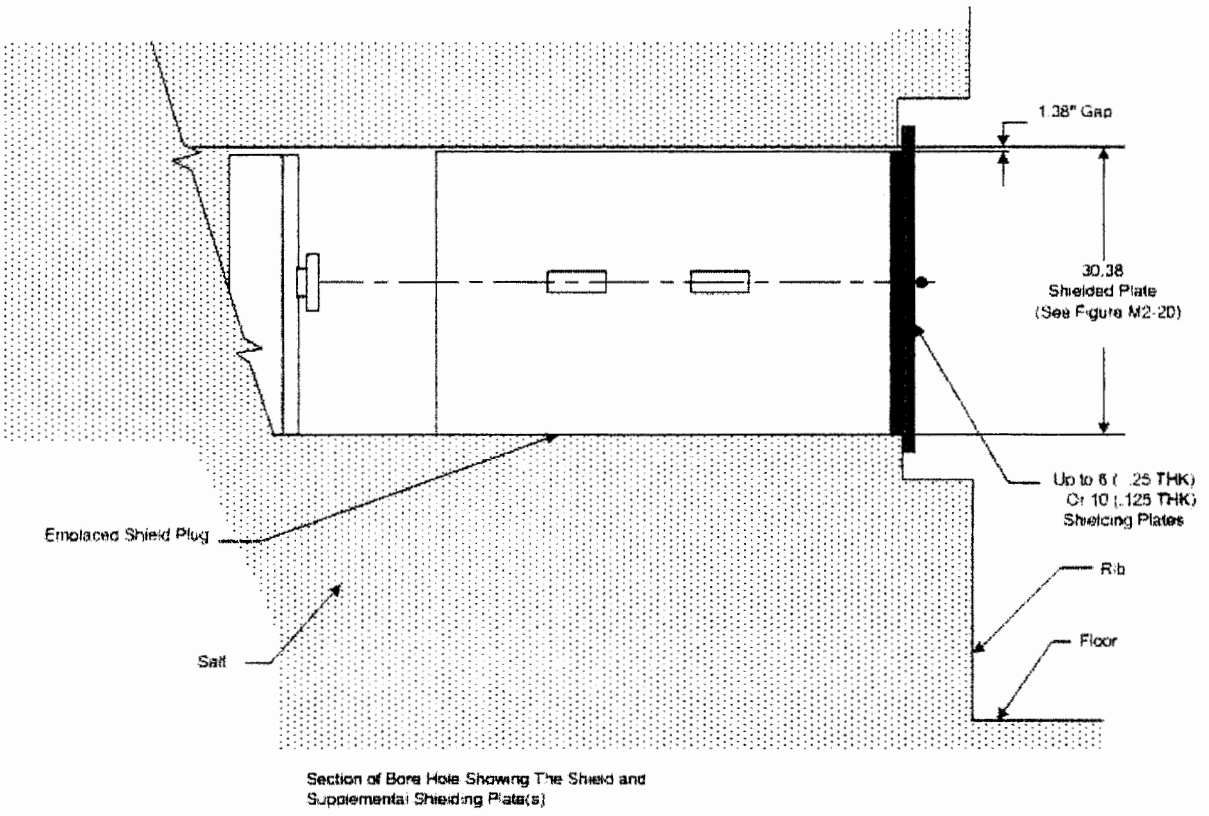

Section of Bore Hole Showing The Shield and Supplemental Shielding Plate(s)

Figure A2-19
Shield Plug Supplemental Shielding Plate(s)

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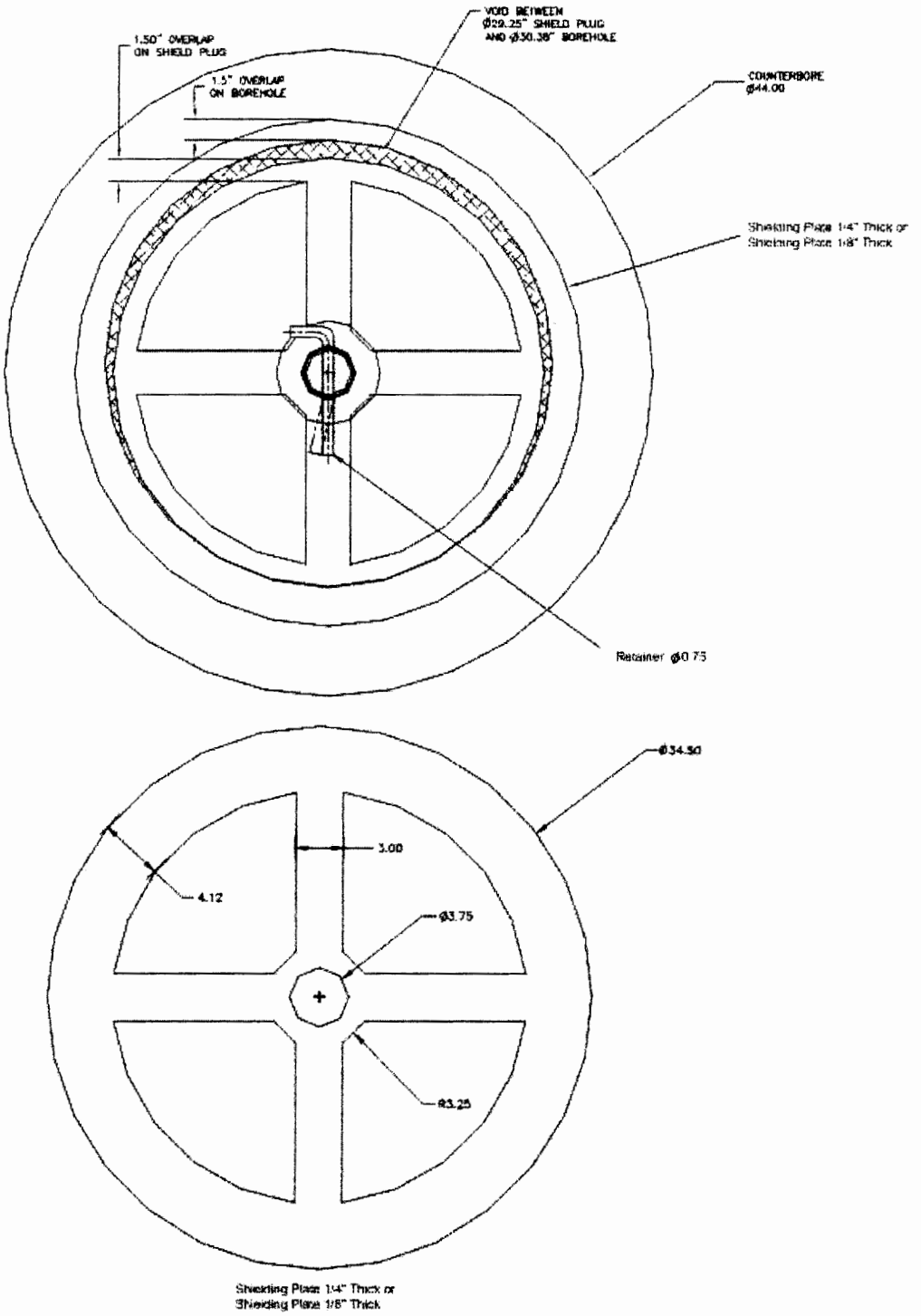

Figure A2-20
Shielding Layers to Supplement RH Borehole Shield Plugs

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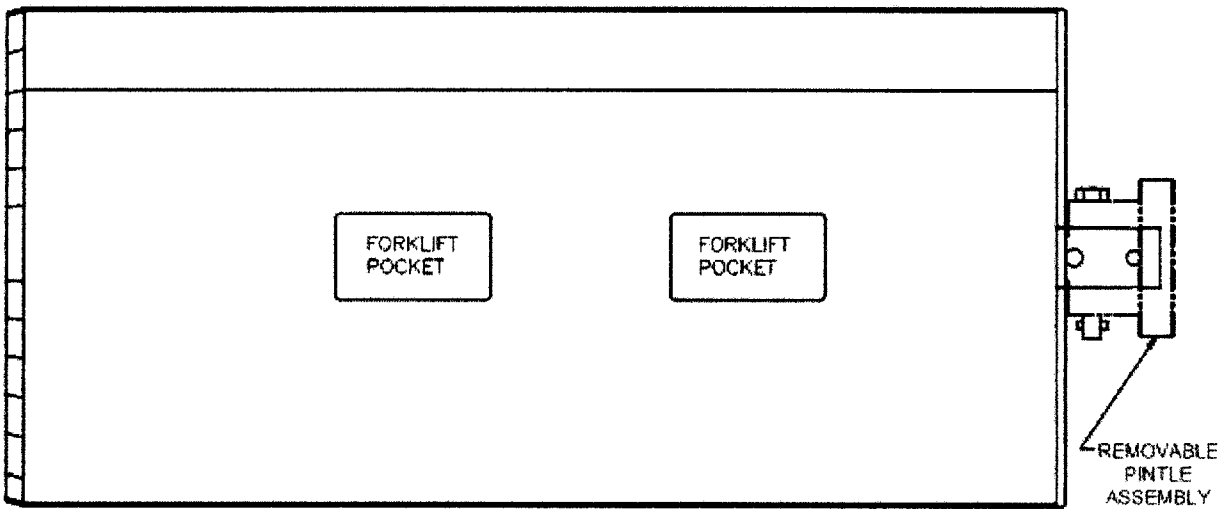

TYPICAL DIMENSION: APPROXIMATELY 29 INCHES DIAMETER X 61 INCHES SHIELDING LENGTH

Composition: Cylindrical steel shell filled with concrete
Weight: Approximately 3750 pounds

Figure A2-21
Shield Plug Configuration

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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LIST OF ABBREVIATIONS/ACRONYMS/UNITS

Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	chain of custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory control samples
LCSD	lab control sample duplicate
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler Formation
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department

QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
TDS	total dissolved solids
TOC	total organic carbon
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
µg/L	microgram(s) per liter
µm	micrometers

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

Groundwater monitoring at the WIPP facility focuses on the Culebra Member (**Culebra**) of the Rustler Formation (**Rustler**) because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. Groundwater movement in the Culebra, using results

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from the basin-scale groundwater model is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, (DOE, 2009).

This monitoring plan addresses requirements for sample collection, Culebra groundwater surface elevation monitoring, Culebra groundwater flow direction and rate determination, data management, and reporting of Culebra groundwater monitoring data. It also identifies indicator parameters and hazardous constituents selected to assess Culebra groundwater quality for the WIPP groundwater detection monitoring program (**DMP**). Because quality assurance is an integral component of the groundwater sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this DMP are provided in the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d)). Procedures are required for each aspect of the Culebra groundwater sampling process, including Culebra groundwater surface elevation measurement, Culebra groundwater flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection. Data required by this plan will be collected by qualified personnel in accordance with SOPs (Table L-3).

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP facility is situated within the Delaware Basin bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler's upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of

mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the downward percolation of water into the evaporite units below. The Bell Canyon is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) (DOE, 2009)) and is confined above by the thick evaporite deposits of the Castile. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is approximately 2,200 pounds per square inch [$lb/in.^2$] or 14.9 megapascals [MPa]) and eventually deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) (DOE, 2009)).

L-1a(2) Groundwater Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional groundwater aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities

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measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy.

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-5). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day.

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). Detailed cross-hole hydraulic testing has been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ten orders of magnitude from east to west in the vicinity of WIPP. Transmissivities have been calculated at 1×10^{-7}

square feet per day (1×10^{-13} square meters per second) at well SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east.

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in groundwater geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the groundwater in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 (DOE, 2009)).

The radiogenic ages of the Culebra groundwater and the geochemical differences provide information potentially relevant to the groundwater flow directions and groundwater interaction with other units and are important constraints on conceptual models of groundwater flow.

The Permittees have proposed a conceptualization of groundwater flow that explains observed geochemical facies and groundwater flow patterns. The conceptualization, referred to as the basin-scale groundwater model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. The model assumes that the groundwater system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on groundwater flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south.

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area. Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (**TDS**) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6 - 5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4 - 8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra groundwater was inconsistent with flow directions. This was based on the premise that facies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 (DOE, 2009)).

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Head distribution in the Culebra (see Amended Renewal Application Addendum L1 (DOE, 2009)) is consistent with basin-scale groundwater basin modeling results indicating that the generalized groundwater flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta Member (**Magenta**) of the Rustler across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale groundwater modeling.

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering.

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if groundwater monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that groundwater monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP

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facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP Detection Monitoring Program (DMP)—Overview

L-3a Scope

This DMP plan governs groundwater sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264 Subpart F), and ensures that such data are gathered in accordance with these and other applicable requirements. Analytical results collected during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

Wells WQSP-1, WQSP-2, and WQSP-3 are located directly upgradient (north) of the WIPP shaft area.

WQSP-4, WQSP-5, and WQSP-6 are located downgradient (south) of the WIPP shaft area. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra. Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

Transport modeling suggests that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years. This assumes conditions where hazardous constituents migrate from the sealed repository (post closure) to the Culebra via the sealed shafts.

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Potentiometric surfaces and groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

L-3b(1) Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

The six DMP Culebra wells were drilled between September 13 and October 16, 1994. The total depth of each well is shown in Table L-5. The wells were drilled through the Culebra into the Los Medaños as shown in Table L-5. The wells were drilled to the top of the Culebra using compressed air as the drilling fluid and a 9⅞-in. drill bit. The wells were then cored using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, DMP wells were reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were cased from the surface to total depth with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval as shown in Table L-5 . The annulus between the borehole wall and the casing/screen is packed with sand and with 8/16 Brady gravel as indicated in Table L-5.

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

Groundwater surface elevations will be monitored in each of the six DMWs on a monthly basis. The groundwater surface elevation in each DMW will also be measured prior to each annual sampling event. The groundwater surface elevation measurements in the WLMP wells will also be monitored on a monthly basis when accessible. The characteristics of the DMW (sampling frequency, location) will be evaluated if significant changes are observed in the groundwater flow direction or gradient.

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b are measured as part of the DMP.

Additional hazardous constituents may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility. If hazardous constituents are identified, these will be added to Part 5, Table 5.4.b, unless the Permittees provide justification for their omission (e.g. hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

L-4c Groundwater Surface Elevation Measurement, Sample Collection and Laboratory Analysis

Groundwater surface elevations will be measured in each DMW prior to groundwater sample collection. Groundwater will be extracted using serial and final sampling methods. Serial samples will be collected until groundwater field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.

L-4c(1) Groundwater Surface Elevation Monitoring Methodology

The WIPP groundwater level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3.

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, groundwater surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, when accessible. Well locations are shown in Figure L-14. If a cumulative groundwater surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the Annual Culebra Groundwater Report specified in Permit Part 5. Abnormal, unexplained changes in groundwater surface elevation will be evaluated to determine if they indicate changes in site recharge/discharge which could affect the assumptions regarding DMW placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Groundwater surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual groundwater surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of groundwater surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density. To monitor the hydraulic gradients of the hydrologic flow systems accurately, actual groundwater surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 will be measured annually.

Measured Culebra water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho y h$$

where

p = freshwater head (length of freshwater head)
y = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)
p = freshwater density (mass/volume)
h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity.

Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate groundwater surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. An SOP will be used when making water-level measurements for this program. The SOP will specify the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records.

L-4c(1)(ii) Groundwater Surface Elevation Records and Document Control

Incoming data will be processed in a manner that ensures data integrity. The data management process for groundwater surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not possible (e.g., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to applicable SOPs (see Table L-3). These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program calculates groundwater surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet program adjusts groundwater surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent

of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. Groundwater surface elevation data and equivalent freshwater heads for the Culebra wells in Table L-4 will be transmitted to NMED by May 31 and November 30. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

L-4c(2) Groundwater Sampling

L-4c(2)(i) Groundwater Pumping and Sampling Systems

The groundwater pumping and sampling systems used to collect a groundwater sample from the six DMWs will provide continuous and adequate production of water so that a representative groundwater sample can be obtained.

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The DMWs are individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down-hole submersible pumps are controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged no more than three well bore volumes or until field parameters have stabilized, whichever comes first. Well purging will performed in accordance with an SOP in conjunction with serial sampling to determine when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater.

The DMWs are cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). An electric, submersible pump installation without the use of a packer is used in this instance. The largest amount of discharge from the submersible pump takes place from a discharge pipe. In addition to this main discharge pipe, a dedicated sample line running parallel to the discharge pipe is used. The sampling line is manufactured from a chemically inert material. Cumulative flow is measured using a totalizing flow meter. Flow from the discharge pipe is routed to a discharge tank for disposal.

The dedicated sampling line is used to collect the water sample that will undergo analysis. By using a dedicated sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow through the sample collection line is regulated by a flow-control valve. The sample line is insulated at the surface to minimize temperature fluctuations.

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. Each DMW will be purged to no than more three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-

analyzed parameters are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile filed laboratory for field indicator parameters. The Permittees will provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the groundwater as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the Permittees, but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: pH, temperature, specific conductance, and specific gravity.

The three field indicator parameters of temperature, specific conductance, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a sample line at atmospheric pressure. Specific conductance and specific gravity samples will be collected from the sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the sample line.

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. Unfiltered groundwater will be used when determining temperature, pH, specific conductance, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. Temperature, pH, and specific conductance, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. Standard Operating Procedures (see Table L-3) defines the protocols for the collection of final and serial samples and analysis.

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

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Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-6 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head.

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (**DI**) water and rinsed in DI water. Sample containers will be new, certified clean containers that will be discarded after one use. Groundwater surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed in accordance with SOPs after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a rinsate blank sample will be collected to verify cleanliness.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered sampling lines. Detailed protocols, in the form of SOPs (see Table L-3) define how final samples will be collected in a consistent and repeatable fashion for analyses.

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-6). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory SOPs). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs generated, approved, and maintained by the contract analytical laboratory.

Final samples will be sent to the analytical laboratories and analyzed for parameters and hazardous constituents specified in Part 5, Tables 5.4a and 5.4b.

Duplicates of the final sample will be provided to WIPP Project oversight agencies when requested.

Wastes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3).

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated as requested by the analytical laboratory.

The analytical laboratory receiving the samples will prescribe the type and amount of preservative, the container material type, the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the

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EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses uniquely numbered chain of custody/ request for analysis (CofC/RFA) forms. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes of interest. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample tracking protocol.

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3).

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking data, and CofC/RFA form. An example form is shown in Figure L-13.

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, custody seals that are adhesive-backed strips are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking

Sample tracking information will be completed for each sample collected. The sample tracking information includes the following information: CofC/RFA form number; date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

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WQ6[1]C[2]R2[3]N1[4]

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document.

Chain of Custody and Request for Analysis

A CofC/RFA form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The CofC/RFA form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the CofC/RFA form. The completed original (top page) of the CofC/RFA will be returned to the Permittees with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed using methods selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall demonstrate, through laboratory SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility Operating Record. Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in groundwater and the complexity of brines associated with the Culebra groundwater.

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The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (**QC**) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. A copy of the laboratory SOPs will be maintained in WIPP facility files. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record.

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration

The equipment used to collect data for this DMP will be calibrated in accordance with SOPs. The Permittees will be responsible for calibrating needed equipment on schedule and for maintaining current calibration records for each piece of equipment.

L-4d(2) Groundwater Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking groundwater surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). The Permittees will be responsible for ensuring equipment is calibrated on schedule in accordance with SOPs. The Permittees will also be responsible for maintaining copies of records of the most recent calibration for each piece of equipment.

L-4e Statistical Analysis of Laboratory Analytical Data

Analytical data collected as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees.

L-4e(1) Temporal and Spatial Analysis

Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

L-4e(2) Distributions and Descriptive Statistics

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (**UTLV**) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

L-4e(3) Action Levels

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the methodologies specified in "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities" (EPA, 2009).

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background groundwater quality hazardous constituent specified in Part 5, Table L-5.4b at every detection monitoring well during each of the ten background sampling events (with the exception of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed disposal began). These measurements serve as a statistical baseline (Part 5, Table 5.6) that is used for evaluating the significance of the results of subsequent sampling events during detection monitoring. Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)(4)). If the comparisons show that a constituent statistically exceeds the baseline of the DMWs (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)). The results of the statistical comparison will be reported annually to the NMED in the Annual Culebra Groundwater Report by November 30, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)).

L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality

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checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.

- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.

- Parameter and hazardous constituents, analytical results, reporting units, reporting limit, analytical method used.

- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specified in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from annual groundwater sampling activities will be compared and interpreted by the Permittees through generation of statistical analyses as specified in Section L-4e. The Permittees will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra Groundwater Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report. The report will include all applicable information that may affect the comparison of background groundwater quality and groundwater surface elevation data through time. This information will include but is not limited to:

- DMW and WLMP well configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).

- Pumping activities that may have taken place since publication of the last annual report (i.e., related to groundwater quality sampling, hydraulic testing, and shaft installation or grouting) that may have taken place since the last annual groundwater report.

- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

- The results of the annual measurements of densities.

- Annotated hydrographs.
- Groundwater flow rate and direction.
- Potentiometric surface map generated using the following steps:
  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.
  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.
  - Fit trend surface through freshwater heads.
  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (**PABCs**) and define initial fixed-head boundary conditions based on the trend surface.
  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.
  - Run MODFLOW with optimal boundary conditions fit.
  - Contour MODFLOW head results on WIPP site.
  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.
  - Data analysis that will accompany the potentiometric surface map will include:
    - Measured versus modeled scatter plot diagram
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).
- Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2.

The DMP data used in generating the Annual Culebra Groundwater Report will be maintained as part of the WIPP facility Operating Record and will be provided to NMED for review as specified in the permit.

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L-6 Records Management

Records generated during groundwater sampling and water level monitoring will be maintained in either project files at the Permittees facility or the Operating Record. Project files will include, but are not limited to:

- Sampling and Analysis Plans (**SAPs**)
- SOPs
- Field Data Entry Sheets
- CofC/RFA forms
- Analytical Laboratory Data Reports
- Variance Logs and Nonconformance Reports
- Corrective Action Reports.

Detection Monitoring Program monitoring, testing, and analytical data and WLMP data will be maintained in the WIPP facility Operating Record.

L-7 Quality Assurance Requirements

Quality Assurance (**QA**) requirements specific to the DMP are presented in this section.

L-7a Data Quality Objectives and Quality Assurance Objectives

L-7a(1) Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support project decisions. DQOs have been established to ensure that the data collected will be of a sufficient and known quality for their intended uses. The overall DQOs for this DMP are shown in the following sections.

L-7a(1)(i) Detection Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the groundwater underlying the WIPP facility.

L-7a(1)(ii) Water Level Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility.

L-7a(2) Quality Assurance Objectives

Quality Assurance Objectives (**QAOs**) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability.

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L-7a(2)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-7a(2)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (SC), temperature, specific gravity and static groundwater surface elevation. Field measurement accuracy will be determined using calibration standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ensure accuracy. Accuracy of groundwater surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs contains instructions that outline protocols for maintaining current calibration of groundwater surface elevation measurement instrumentation.

L-7a(2)(i)(B) Accuracy Objectives for Laboratory Measurements

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-7a(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{\left|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)\right|}{average\ of\ measured\ samples\ 1+2} \times 100$$

L-7a(2)(ii)(A) Precision Objectives for Field Measurements

Specific conductance, pH, and temperature will be measured during well purging and after sampling. SC measurements will be precise to ±10% pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer and temperature to 0.10 degrees Celsius (°C). Water-level measurements will be precise to ± 0.01 ft. The precision of water density measurements, when measured in the

field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than a ± 2 ft of error in the derived fresh-water head.

L-7a(2)(ii)(B) Precision Objectives for Laboratory Measurements

Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (**LCSD**) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results. Laboratory analytical precision is also parameter dependent and will be prescribed in laboratory SOPs.

L-7a(2)(iii) Contamination

In addition to measurements of precision and bias, QC checks for contamination will be performed. QC samples including trip blanks, field blanks, and method blanks will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents and glassware. Trip blanks will be used to assess volatile organic compound (**VOC**) sample contamination during shipment and handling and will be collected and analyzed at a frequency of 1 sample per sample shipment. Field blanks will be used to assess field sample collection methods and will be collected and analyzed at a minimum frequency of one sample per 20 samples (five percent of the samples collected). Method blanks will be used to assess contamination resulting from the analytical process and will be analyzed at a minimum frequency of one sample per 20 samples, or five percent of the samples collected. Evaluation of sample blanks will be performed following U.S. EPA "National Functional Guidelines for Organic Data Review" (EPA, 1999) and "National Functional Guidelines for Evaluating Inorganics Analyses" (EPA, 2004). Only method blanks will be analyzed via wet chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed method reporting limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in method blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

L-7a(2)(iv) Completeness

Completeness is a measure of the amount of usable valid data resulting from a data collection activity, given the sample design and analysis. Completeness may be affected by unexpected conditions that may occur during the data collection process.

Occurrences that reduce the amount of data collected include sample container breakage during sample shipment or in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for analysis of Part 5, Table 5.4a parameters will be 90 percent and 100 percent analysis of Part 5, Table 5.4.b hazardous constituents. If the completeness objective for Part 5 Table 5.4.b hazardous constituents is not met, the Permittees will determine the need for resampling on a case-by-case basis. Numerical expression of the completeness (**%C**) of data is as follows:

$$\%C = \frac{number\ of\ accepted\ samples}{total\ number\ of\ samples\ collected} \times 100$$

L-7a(2)(v) Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this DMP will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures will be designed to minimize factors affecting the integrity of the samples. Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected will be those that will most accurately and precisely represent the true concentration of analytes of interest.

For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions.

L-7a(2)(vi) Comparability

Comparability is the extent to which one data set can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measures dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (µg/L) for VOCs and semivolatile organic compounds (**SVOC**s).

Culebra groundwater surface elevation measurements will be expressed as equivalent freshwater elevation in feet above mean sea level.

L-7b Design Control

The approved design for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §§ 270.42).

L-7c Instructions, Procedures, and Drawings

The preparation and use of instructions and procedures at the WIPP facility are outlined in the WIPP facility document WP 13-1(see Table L-3). Activities performed for the DMP that may affect groundwater data quality will be performed in accordance with approved procedures which comply with the Permit.

L-7d Document Control

Permittees will ensure that the latest approved versions of WIPP facility SOPs will be used in performing groundwater monitoring functions and that obsolete materials will be adequately identified or removed from work areas.

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L-7e Inspection and Surveillance

Inspection and surveillance activities will be conducted as outlined in WIPP document WP 13-1 (see Table L-3). The Permittees will be responsible for performing the applicable WIPP facility SOPs.

L-7f Control of Monitoring and Data Collection Equipment

WIPP document WP 13-1 (see Table L-3) outlines the basic requirements for control and calibrating monitoring and data collection (**M&DC**) equipment. M&DC equipment shall be properly controlled, calibrated, and maintained according to WIPP facility SOPs (see Table L-3) to ensure continued accuracy of groundwater monitoring data. Results of calibrations, maintenance, and repair will be documented. Calibration records will identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records will be maintained to track uses of M&DC equipment. If M&DC equipment is found to be out of tolerance, the equipment will be tagged and it will not be used until corrections are made.

L-7g Control of Nonconforming Conditions

In accordance with WP 13-1 (see Table L-3), equipment that does not conform to specified requirements will be controlled to prevent use. The disposition of defective items will be documented on records traceable to the affected items. Prior to final disposition, faulty items will be tagged and segregated. Repaired equipment will be subject to the original acceptance inspections and tests prior to use.

L-7h Corrective Action

Requirements for the development and implementation of a system to determine, document, and initiate appropriate corrective actions after encountering conditions adverse to quality at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). Conditions adverse to acceptable quality will be documented and reported in accordance with corrective action procedures and corrected as soon as practical. Immediate action will be taken to control work performed under conditions adverse to acceptable quality and its results to prevent quality degradation.

L-7i Quality Assurance Records

WIPP document WP 13-1(see Table L-3) outlines the policy that will be used at the WIPP facility regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records.

Records to be generated in the DMP will be specified by procedure. QA and RCRA operating records will be identified. This will be the basis for the labeling of records as "QA" or "RCRA operating record" on the Environmental Monitoring Records Inventory and Disposition Schedule.

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L-8 References

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TABLES

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Table L-1
Hydrological Parameters for Rock Units above the Salado at WIPP

Unit		Hydraulic Conductivity	Storage	Thickness	Hydraulic Gradient
Santa Rosa		2×10^{-8} to 2×10^{-6} m/s (1) (2)		0 to 91 m	0.001 (5)
Dewey Lake		10^{-8} m/s	Specific storage 1×10^{-5} (1/m) (2)	152 m	0.001 (5)
Rustler	Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	13 to 23 m	NA (6)
	Magenta	$1 \times 10^{-8.5}$ to $1 \times 10^{-6.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	7 to 8.5 m	3 to 6
	Tamarisk	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	26 to 56 m	NA (6)
	Culebra	$1 \times 10^{-7.5}$ to $1 \times 10^{-5.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	4 to 11.6 m	0.003 to 0.007 (5)
	Los Medaños	6×10^{-15} to 1×10^{-13} m/s 1.5×10^{-11} to 1.2×10^{-11} m/s (basal interval)	Specific storage 1×10^{-5} (1/m) (2)	29 to 38 m	NA (6)

Matrix characteristics relevant to fluid flow include values used in this table such as permeability, hydraulic conductivity, gradient, etc.)

Table Notes:

(1) The Santa Rosa Formation is not present in the western portion of the WIPP site. It was combined with the Dewey Lake Red Beds in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996), and the range of values entered here are those used in that study for the Dewey Lake/Triassic hydrostratigraphic unit.

(2) Values or ranges of values given for these entries are the values used in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996). Values are estimated based on literature values for similar rock types, adjusted to be consistent with site-specific data where available. Ranges of values include spatial variation over the WIPP site and differences in values used in different simulations to test model sensitivity to the parameter.

(3) Hydraulic gradient is a dimensionless term describing change in the elevation of hydraulic head divided by change in horizontal distance. Values given in these entries are determined from potentiometric surfaces. The range of values given for the Culebra reflects the highest and lowest gradients observed within the WIPP site boundary. Values for the Dewey Lake and Santa Rosa are assumed to be the same as the gradient determined from the water table. Note that the Santa Rosa Formation is absent or above the water table in most of the controlled area, and that the concept of a horizontal hydraulic gradient is not meaningful for these regions.

(4) Flow in units of very low hydraulic conductivity is slow, and primarily vertical. The concept of a horizontal hydraulic gradient is not applicable.

Sources: Beauheim, 1986; Domenico and Schwartz, 1990; Domski, Upton, and Beauheim, 1996; Earlough, 1977.

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Table L-2
WIPP Groundwater Detection Monitoring Program Sample Collection and Groundwater Surface Elevation Measurement Frequency

Installation	Frequency
Groundwater Quality Sampling	
DMWs	Annually
Groundwater Surface Elevation Monitoring	
DMWs	Monthly and prior to sampling events
WLMP Wells (see Table L-4)	Monthly

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1
2

Table L-3
Standard Operating Procedures Applicable to the DMP

Number	Title/Description
WP 02-EM1005	Groundwater Serial Sample Analysis: This procedure provides general instructions necessary to perform field analyses of serial samples in support of the DMP. Serial samples are collected and analyzed at the field laboratory for field indicators. Serial sample results help determine if pumped groundwater is representative of undisturbed groundwater within the formation.
WP 02-EM1006	Final and Serial Sample Collection: This procedure describes the steps for collecting groundwater samples from the DMWs near the WIPP facility. Serial samples are collected and analyzed at the Field Laboratory until stabilization of the field parameters occurs. Final samples for Resource Conservation and Recovery Act (RCRA) analyses are collected and analyzed by a contract laboratory.
WP 02-EM1014	Groundwater Level Measurement: This document describes the method used for groundwater level measurements in support of groundwater monitoring at the WIPP facility using a portable electronic water-level probe.
WP 02-EM1021	Pressure Density Survey: This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at non-detection monitoring wells. Because most pressure densities are obtained by Sandia National Laboratories via pressure transducers installed in wells, this procedure is used to obtain pressure densities at wells not equipped with fixed transducers.
WP 02-EM1026	Water Level Data Handling and Reporting: This procedure provides instructions on handling water level data. Data are collected and recorded on field forms in accordance with WP 02-EM1014. This procedure is initiated when wells in the water surveillance program have been measured for a given month.
WP 02-EM3001	Administrative Processes for Environmental Monitoring and Hydrology Programs: This procedure provides the administrative guidance environmental monitoring personnel use to maintain quality control associated with environmental monitoring sampling and reporting activities. This administrative procedure does not pertain to volatile organic compound (VOC) monitoring, with the exception of Section 5.0 which pertains to the regulatory reporting review process.
WP 02-EM3003	Data Validation and Verification of RCRA Constituents: This procedure provides instructions on performing verification and validation of laboratory data containing the analytical results of groundwater monitoring samples. This procedure is applied only to the non-radiological analyses results for compliance data associated with the detection monitoring samples. The data reviewed for this procedure includes general chemistry parameters and RCRA constituents.
WP-02-RC.01	Hazardous and Universal Waste Management Plan: This plan describes the responsibilities and handling requirements for hazardous and universal wastes generated at the WIPP facility. It is meant to ensure that these wastes are properly handled, accumulated, and transported to an approved Treatment, Storage, Disposal Facility (TSDF) in accordance with applicable state and federal regulations, U.S. Department of Energy (DOE) Orders, and Washington TRU Solutions LLC (WTS) policies and procedures. This plan implements applicable sections of 20.4.1.100-1102 New Mexico Administrative Code (NMAC), *Hazardous Waste Management* (incorporating 40 *Code of Federal Regulations* [CFR] Parts 260-268 and 273).
WP 10-AD3029	Calibration and Control of Monitoring and Data Collection Equipment: This procedure provides direction for the control and calibration of Monitoring and Data Collection (M&DC) equipment at the WIPP facility, and ensures traceability to NIST (National Institute of Standards and Technology) standards, international standards, or intrinsic standards. This procedure also establishes requirements and responsibilities for identifying recall equipment, and for obtaining calibration services for WIPP facility M&DC equipment.
WP 13-1	Washington TRU Solutions LLC Quality Assurance Program Description: This document establishes the minimum quality requirements for Management and Operating Contractor (**MOC**) personnel and guidance for the development and implementation of QA programs by MOC

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Number	Title/Description
	organizations.

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Table L-4
January 2011 Culebra WLMP

WELL ID	WELL ID	WELL ID
AEC-7	H-17	SNL-15
C-2737	H-19 pad*	SNL-16
ERDA-9	I-461	SNL-17
H-02b2	SNL-01	SNL-18
H-03b2	SNL-02	SNL-19
H-04bR	SNL-03	WQSP-1
H-05b	SNL-05	WQSP-2
H-06bR	SNL-06	WQSP-3
H-07b1	SNL-08	WQSP-4
H-9bR	SNL-09	WQSP-5
H-10c	SNL-10	WQSP-6
H-11b4	SNL-12	WIPP-11
H-12	SNL-13	WIPP-13
H-15R	SNL-14	WIPP-19
H-16		

*H-19b0 monthly

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Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 through 16, 1994	737 (225)	15 (5)	696 (212)	696 to 737 (212 to 225)	737 (225)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 225)	699 to 722 (213 to 220)
WQSP-2 Figure L-8	September 6 through 12, 1994	846 (258)	12 (4)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.1 to 833.7 (247 to 254)
WQSP-3 Figure L-9	October 20 through 26, 1994	880 (268)	10 (3)	833 (254)	833 to 880 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 through 10, 1994,	800 (244)	9 (3)	740 (226)	740 to 798 (226 to 243)	800 (244)	764 to 789 (233 to 240)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 through 18, 1994,	681 (208)	7 (2)	648 (198)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205)
WQSP-6 Figure L-12	September 26 through October 3, 1994	616.6 (188)	10 (3)	568 (173)	568 to 617 (173 to 188)	617 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 174)	570 to 616.6 (174 to 188)	582 to 606.9 (177 to 185)

Table L-6
Analytical Parameter and Sample Requirements

(10) PARAMETERS	(12) NO. OF BOTTLES	(13) VOLUME	(14) TYPE	(15) ACID WASH	(16) SAMPLE FILTER	(17) PRESERVATIVE	(18) HOLDING TIME
Indicator[1] Parameters: • pH • SC • TOC	 - - 4	 25 ml[2] 100 ml[2] 15 ml[2]	 Glass Glass Glass	 Field determined Field determined yes	 No? No No	 Field determined Field determined HCl	 None None 28 days[2]
General Chemistry	1	1 Liter	Plastic	Yes	No	HNO_3,4pH<2	not specified in DMP
Phenolics	1	1 Liter	Amber Glass	Yes	No	H_2SO_4, pH<2	not specified in DMP
Metals/Cations	2	1 Liter	Plastic	Yes	No	HNO_3, pH<2	6 months[2,3]
VOC	4	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Non-Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
BN/As	1	½ Gallon	Amber Glass	Yes	No	None	
TCLP	1	1 Liter	Plastic	Yes	No	HNO_3, pH<2	7 days[2]
Cyanide (Total)	1	1 Liter	Plastic	Yes	No	NaOH, pH>12	14 days[2]
Sulfide	1	250 ml	Amber Glass	Yes	No	NaOH + Zn Acetate	28 days[2]
Radionuclides	1	1 Gallon	Plastic Cube	Yes	Yes	HNO_3, pH<2	6 months[2]

1 = RCRA Detection Monitoring Analytes

2 = As specified in Table 4-1 of the RCRA TEGD

3 = Reduced holding time of 1 week for WIPP-specific Divalent cation 2 samples noted in the GMD

Note: Unless otherwise indicated, data are from DOE Procedure WP 02-EM1006 methods and are provided as information only.

Note: Deviations from this table are allowed with prior approval by the NMED.

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FIGURES

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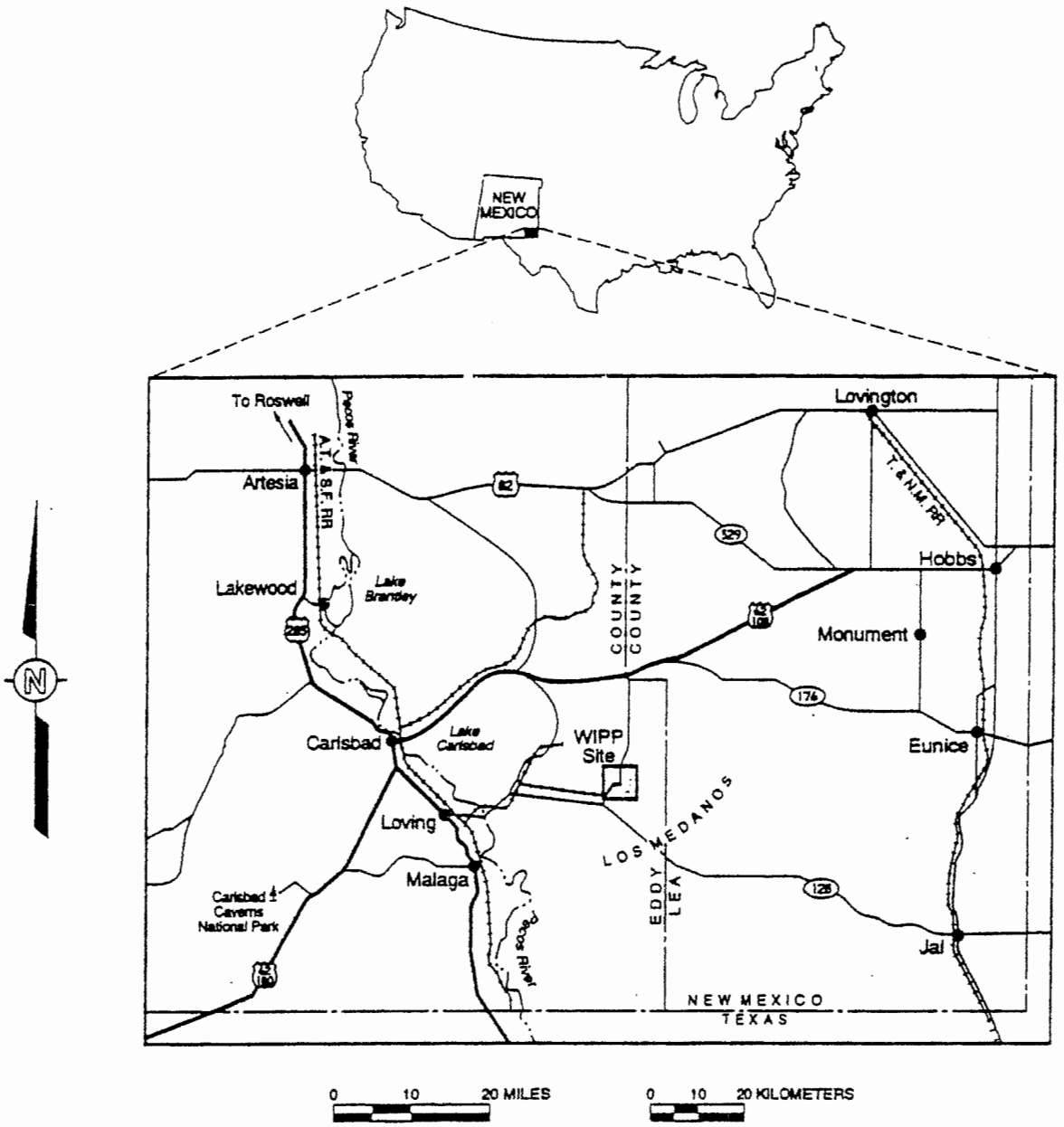

Figure L-1
General Location of the WIPP Facility

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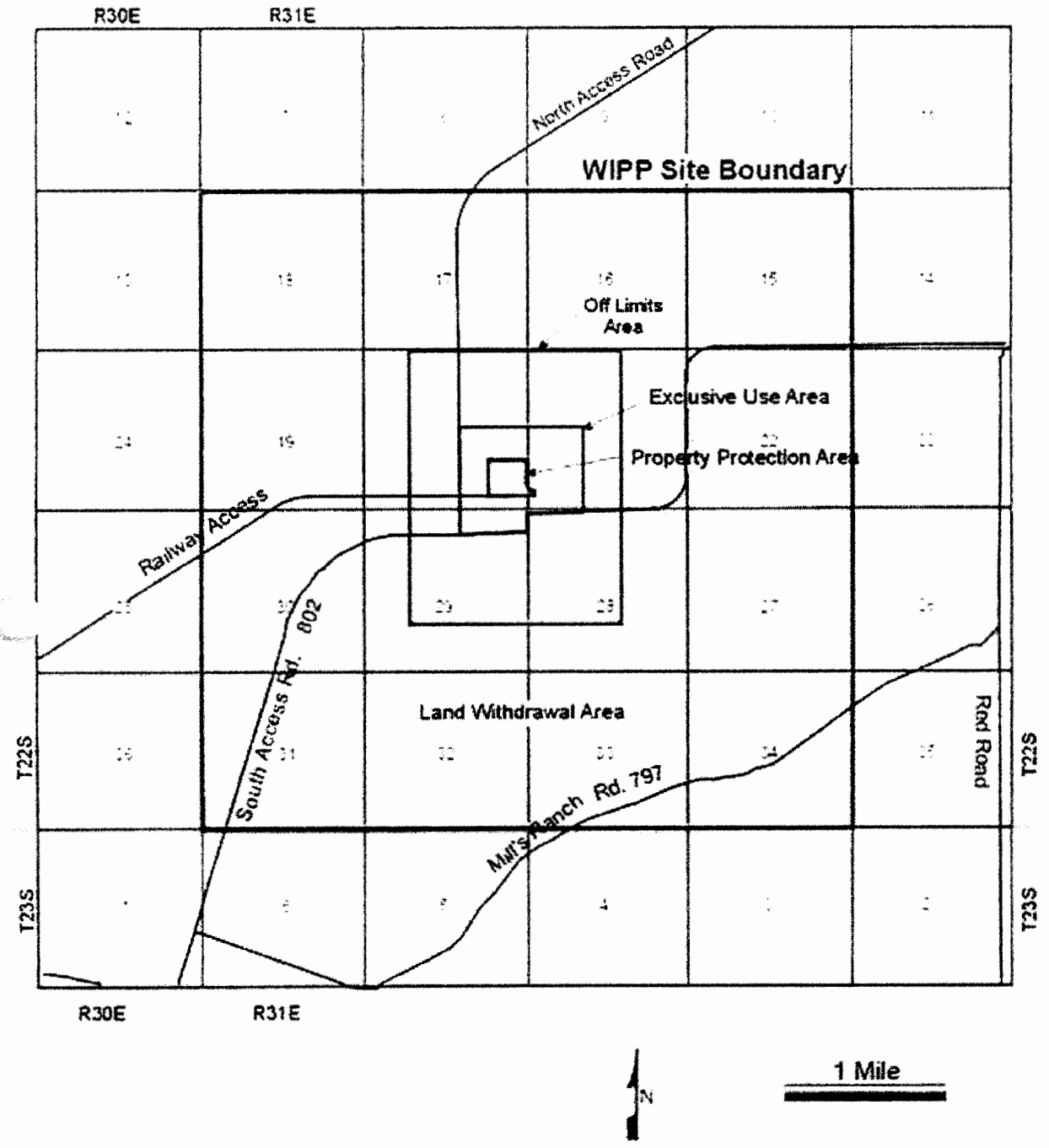

Figure L-2
WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary

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SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		DEWEY LAKE	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

Figure L-3
Site Geologic Column

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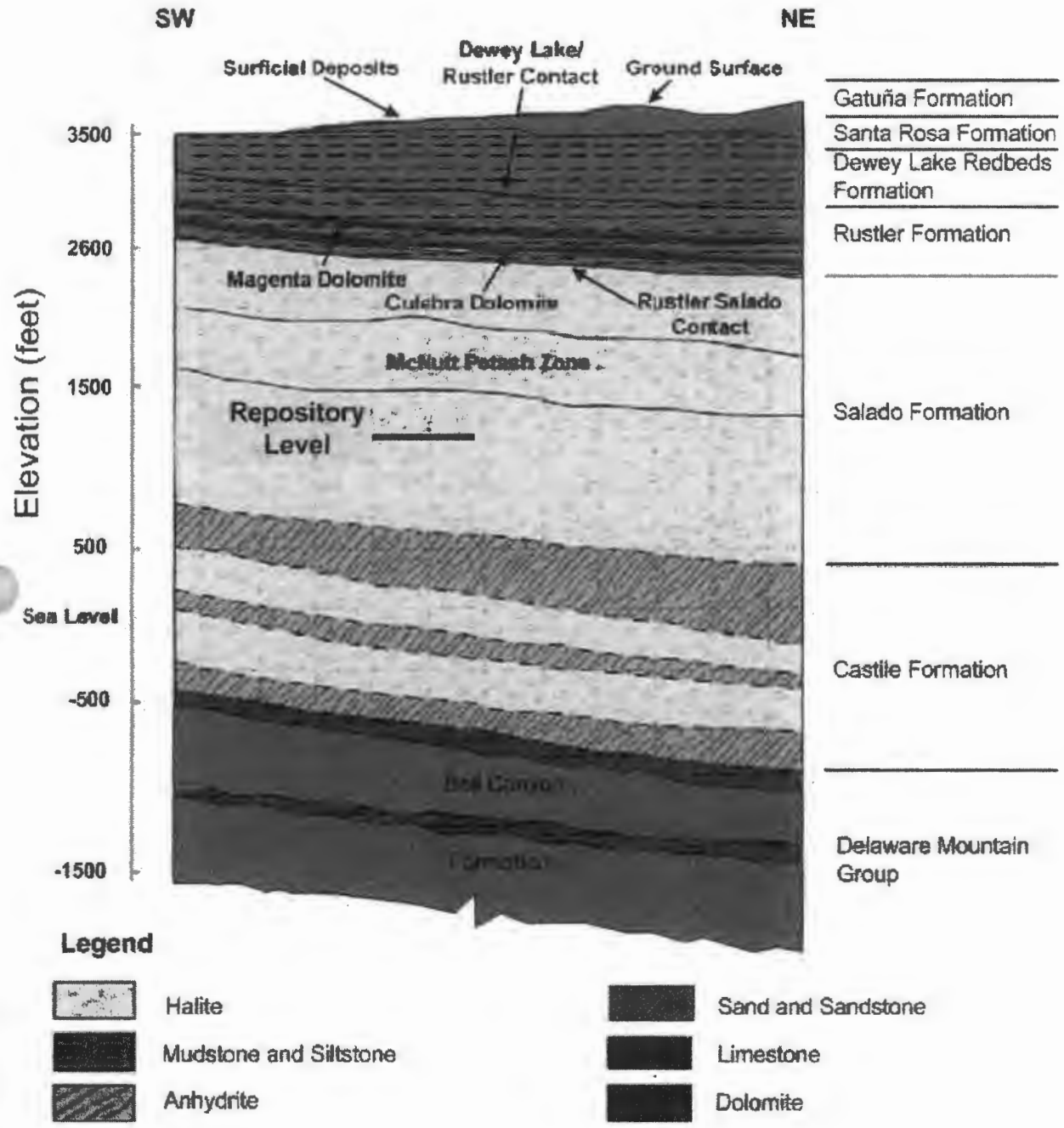


Figure L-4
Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site

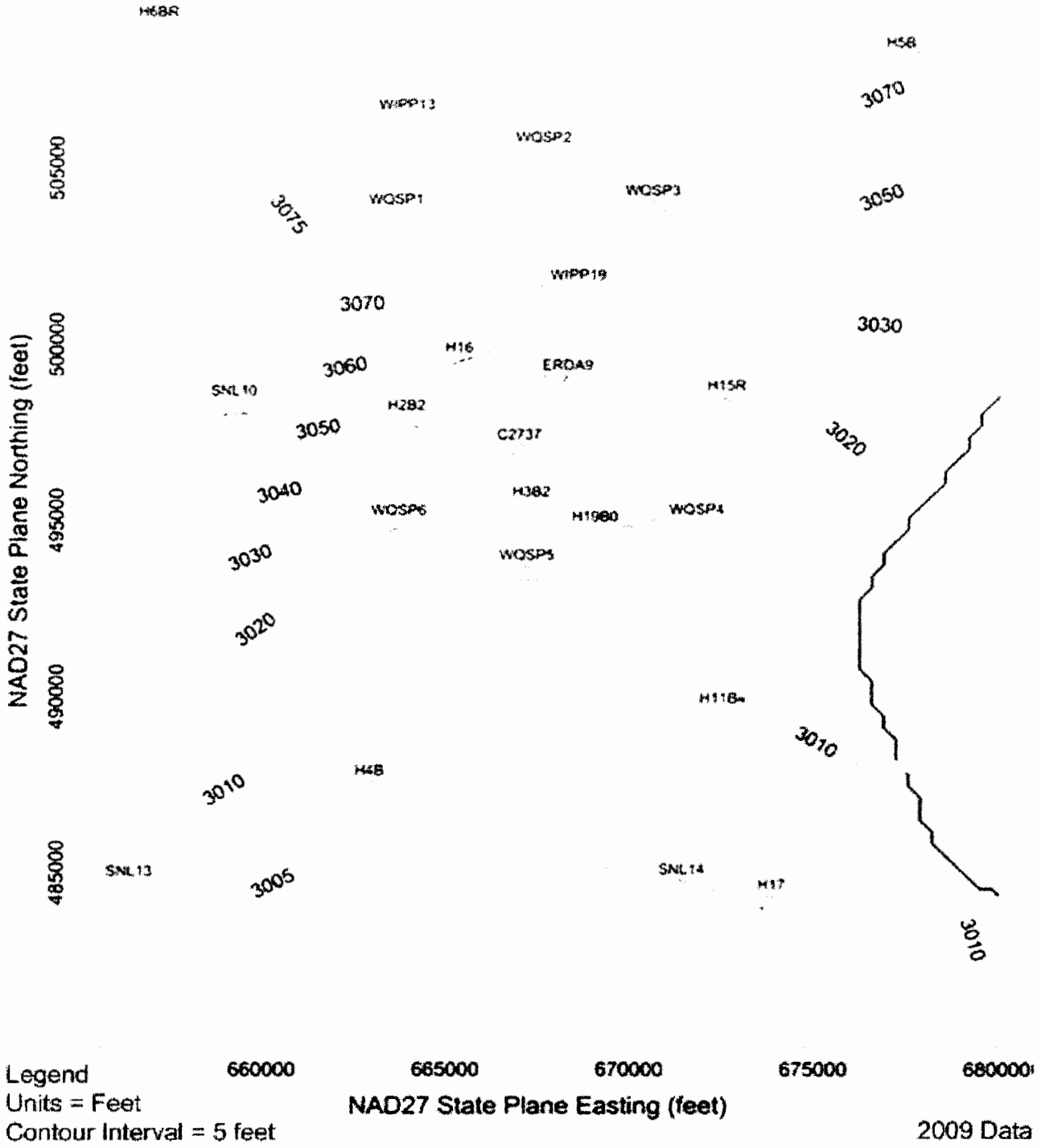
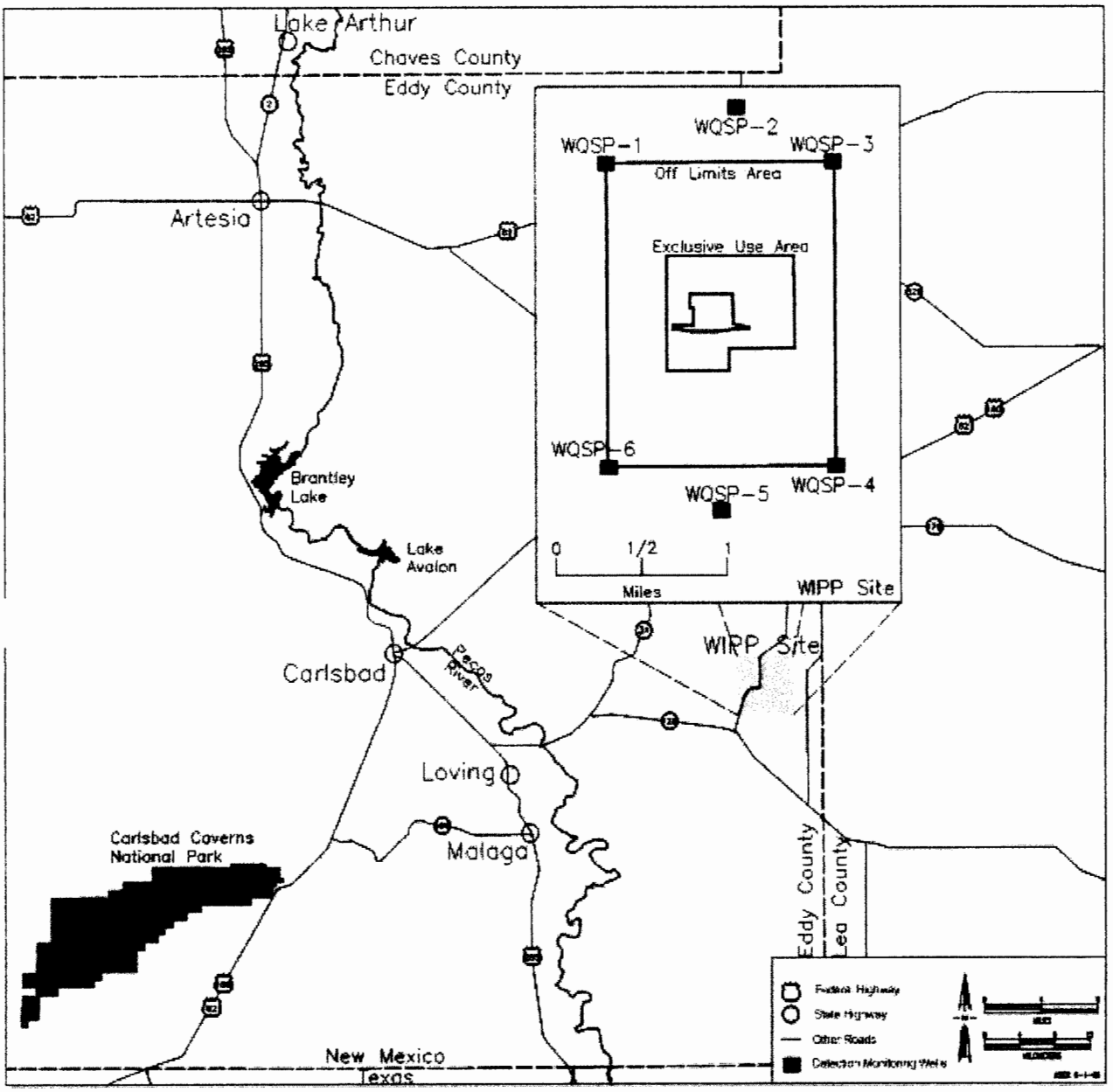
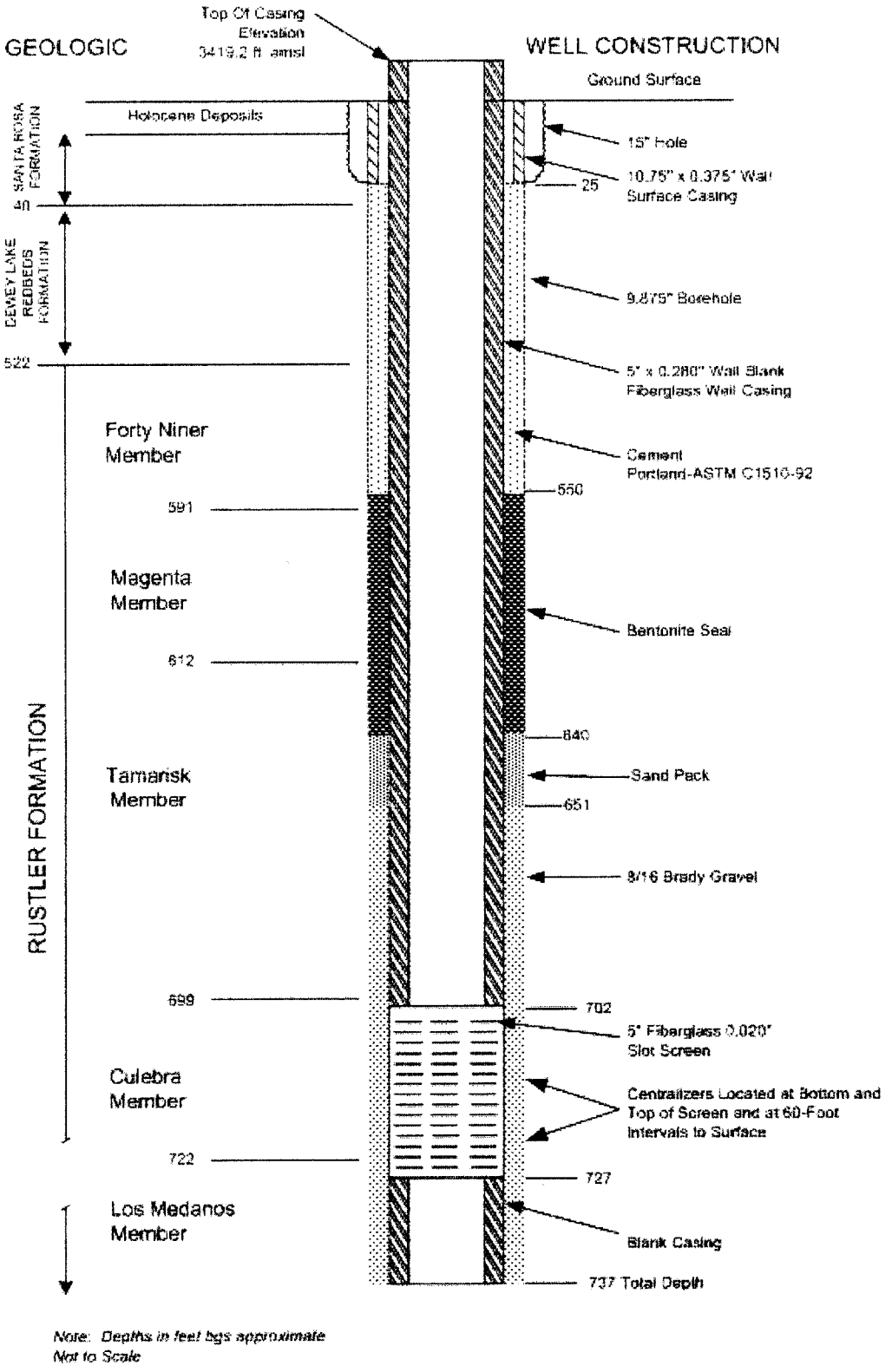


Figure L-5
Culebra Freshwater-Head Potentiometric Surface



NOTE: Point of compliance is defined in Part 5.3.1.

Figure L-6
Detection Monitoring Well Locations



Note: Depths in feet bgs approximate
Not to Scale

Figure L-7
As-Built Configuration of Well WQSP-1

01507

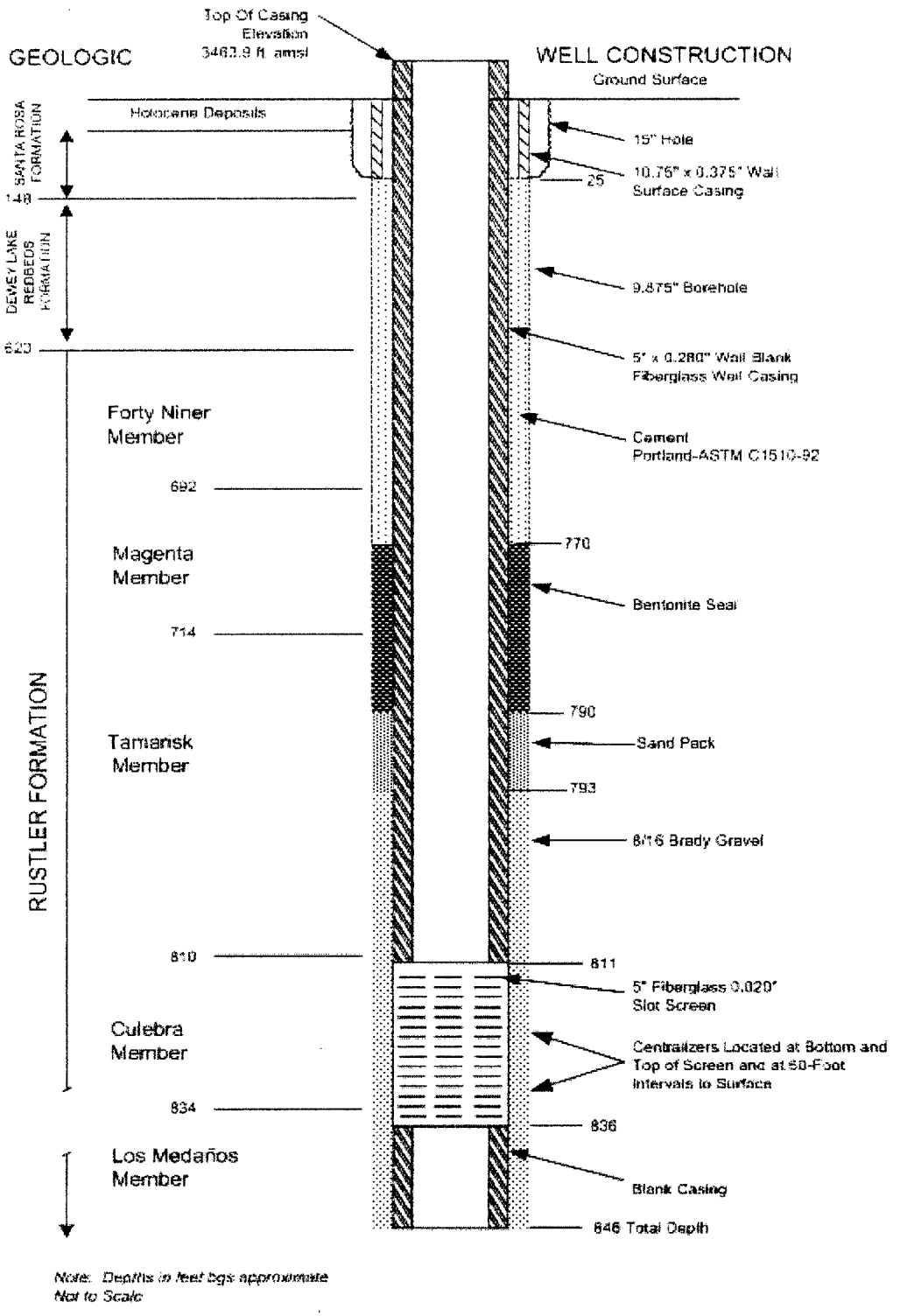
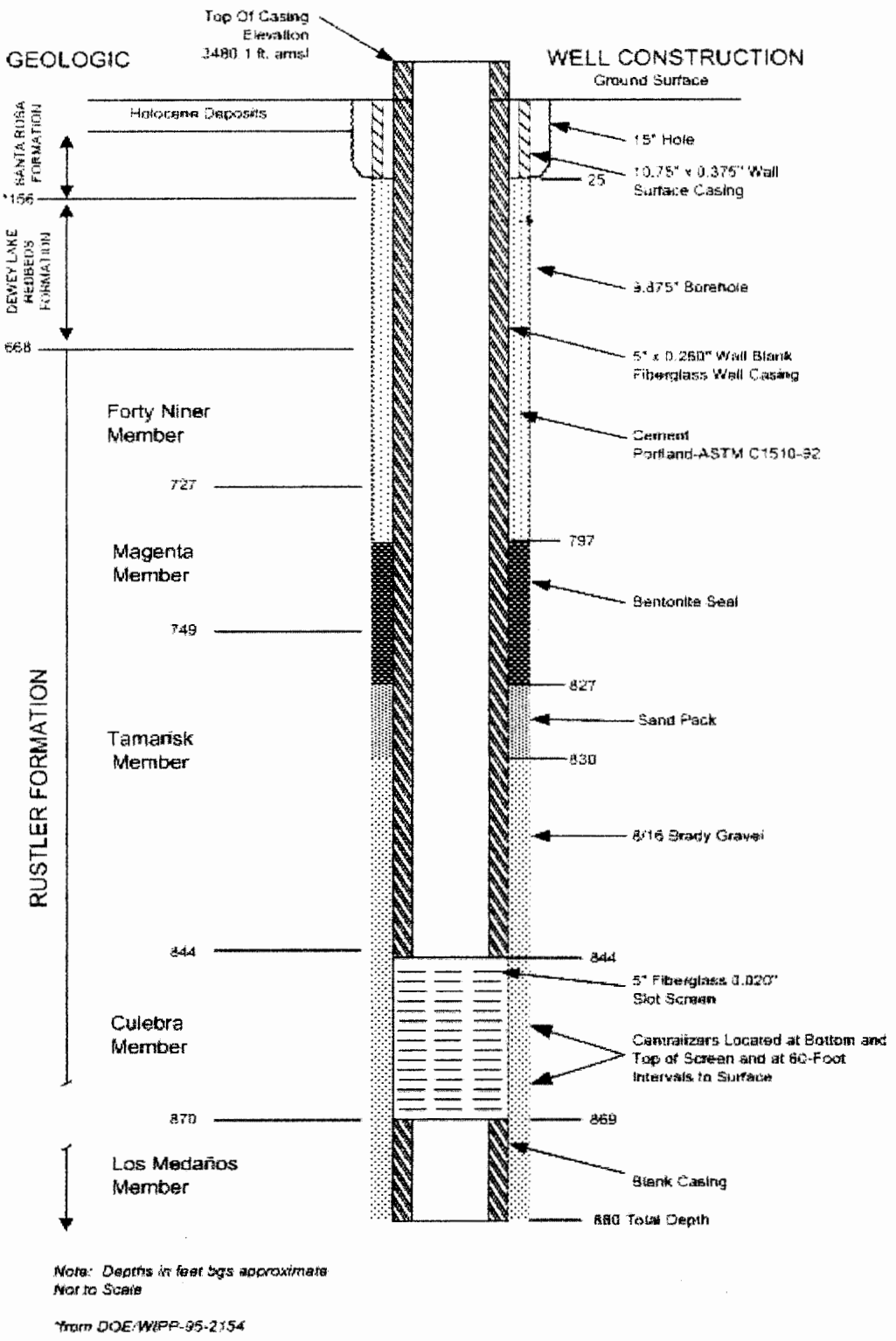


Figure L-8
As-Built Configuration of Well WQSP-2



Note: Depths in feet bgs approximate
Not to Scale

**from DOE/WIPP-95-2154*

Figure L-9
As-Built Configuration of Well WQSP-3

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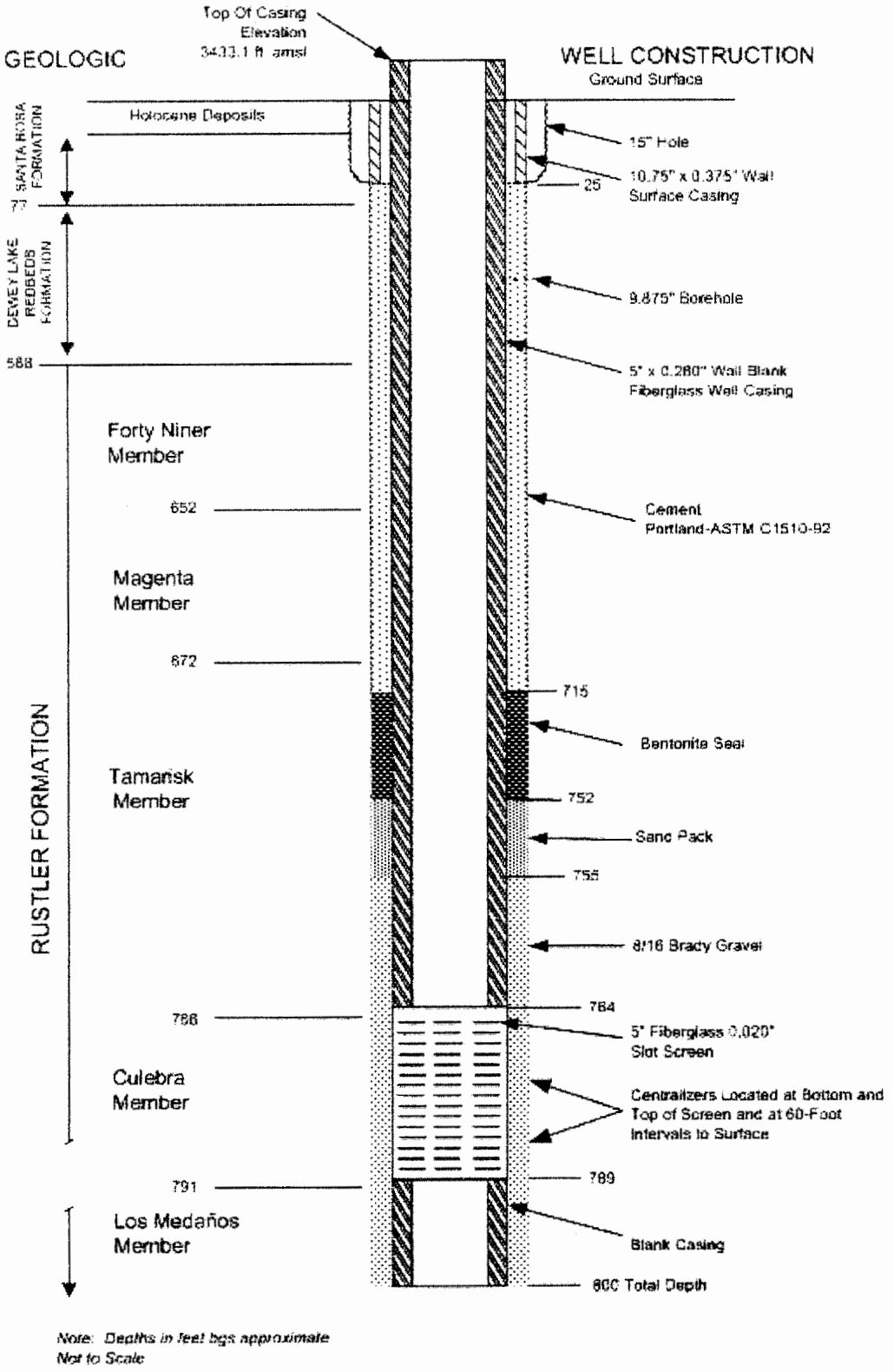

Note: Depths in feet bgs approximate
Not to Scale

Figure L-10
As-Built Configuration of Well WQSP-4

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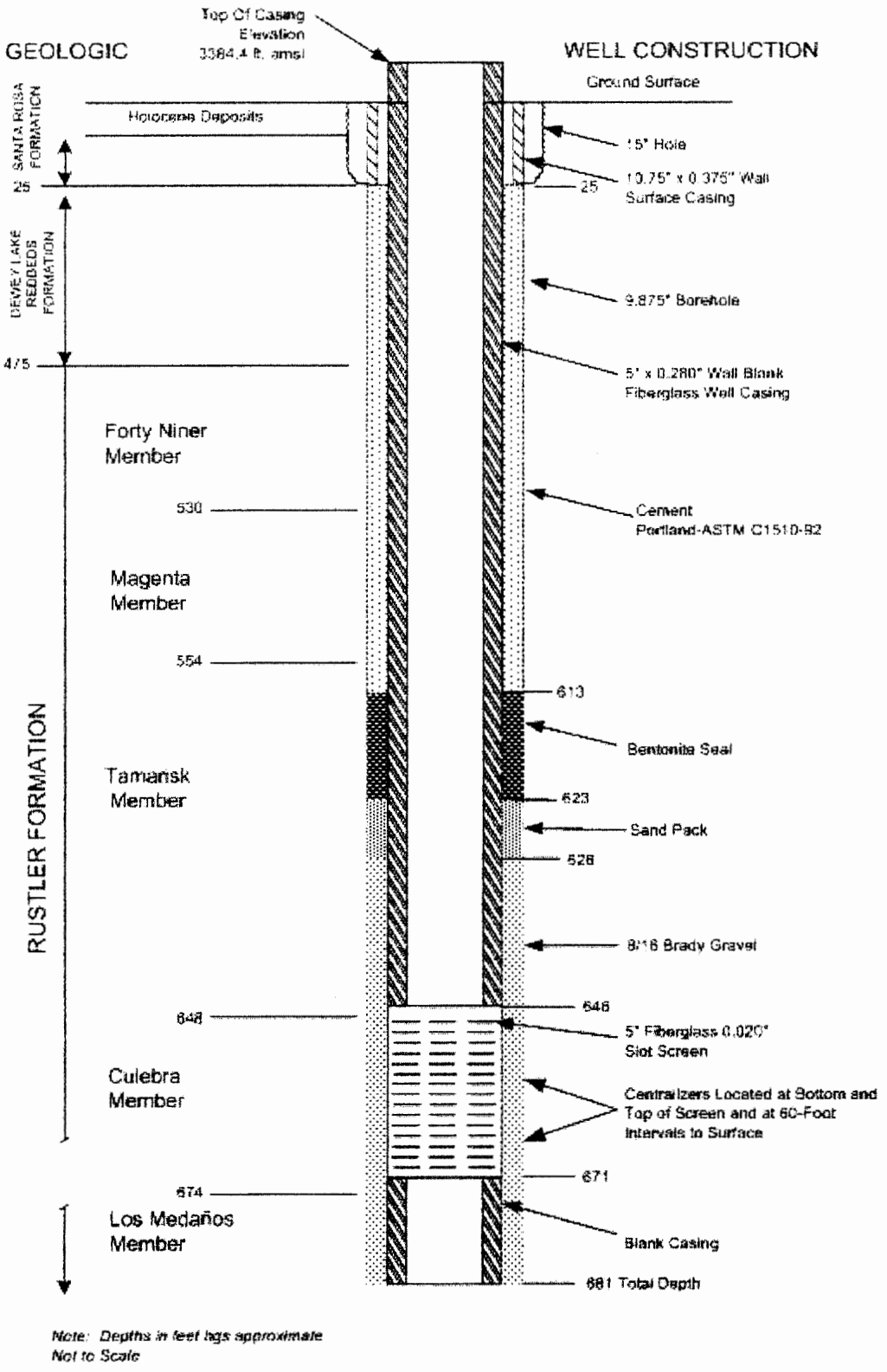

Note: Depths in feet bgs approximate
Not to Scale

Figure L-11
As-Built Configuration of Well WQSP-5

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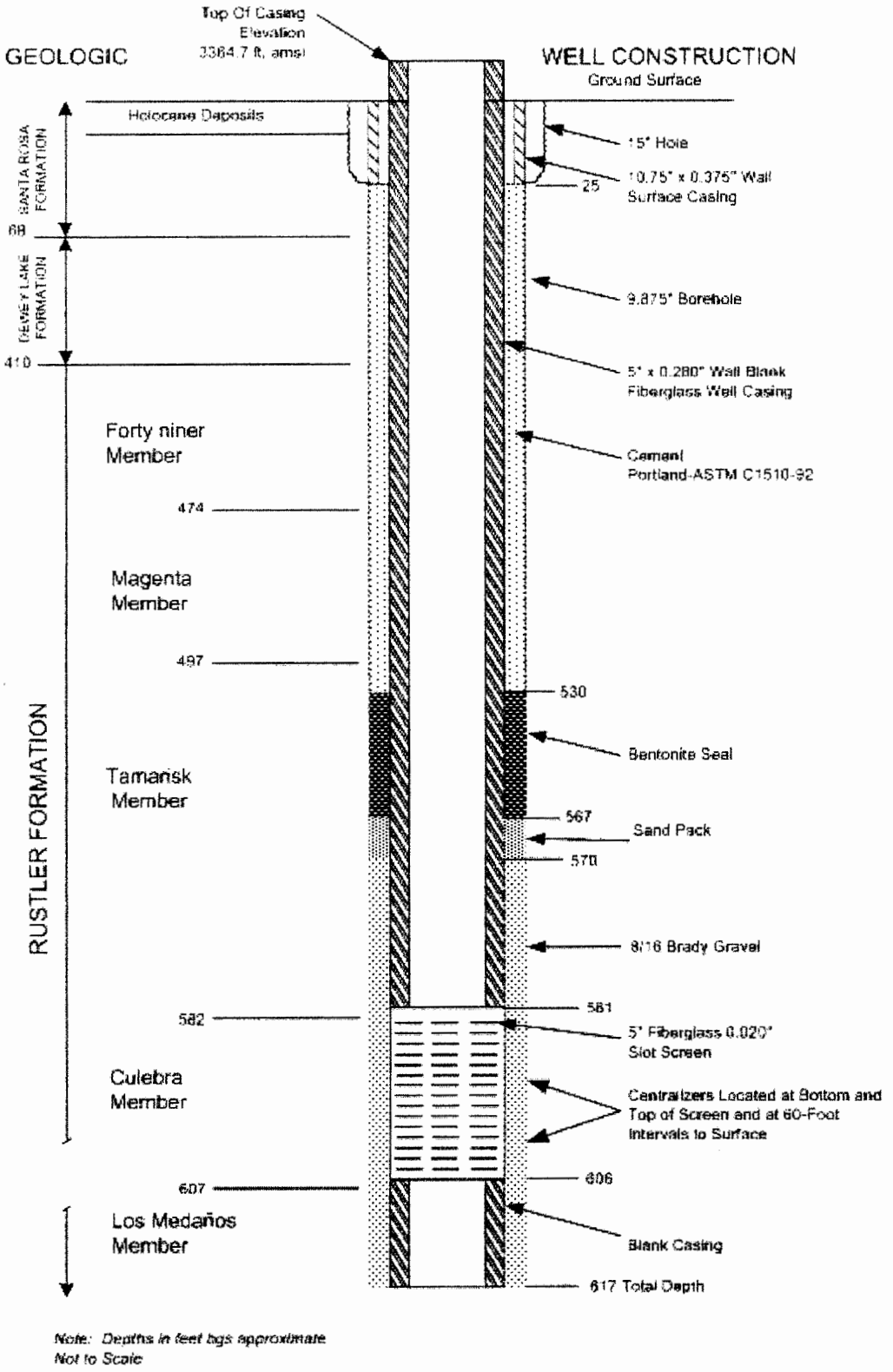

Note: Depths in feet bgs approximate
Not to Scale

Figure L-12
As-Built Configuration of Well WQSP-6

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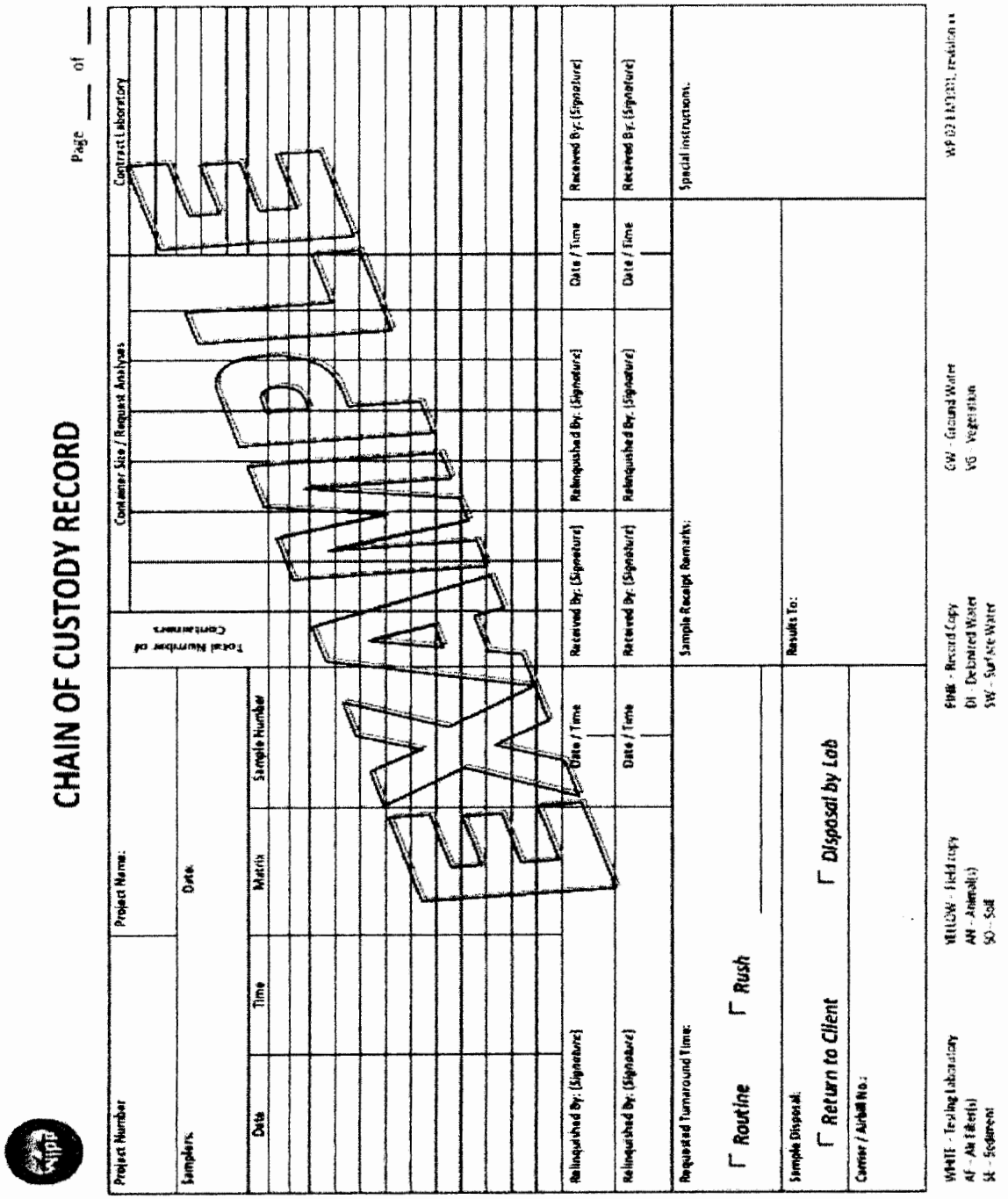

Figure L-13
Example Chain-of-Custody/Request for Analysis Form

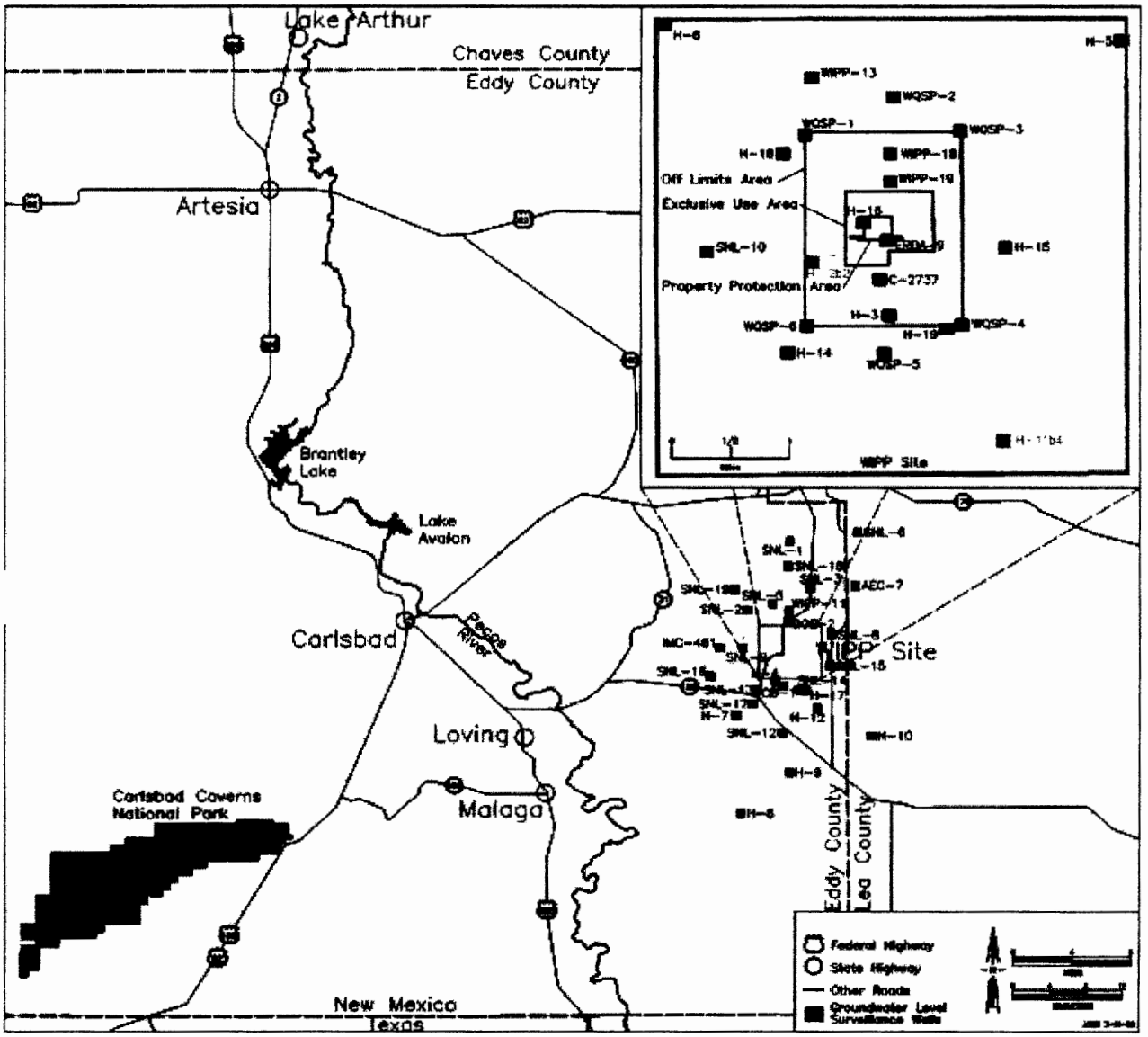

Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

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ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

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ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

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LIST OF TABLES

Table	Title
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O-2	Mine Ventilation Rate Testing Equipment
O-3	Active Disposal Room Ventilation Rate Log Sheet (Example)

ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

O-1 Definitions

Compliance with the mine ventilation requirements set forth in Permit Part 4 and Permit Attachment A2 requires the use and definition of the following terms:

Actual cubic feet per minute (**acfm**): The volume of air passing a fixed point in an excavation, normally determined as the product of the cross section of the excavation and the mean velocity of the air.

Standard cubic feet per minute (**scfm**): The actual cubic feet per minute passing a fixed point adjusted to standard conditions. In the Imperial measurement system, the standard condition for pressure is 14.7 pounds per square inch (**psi**) (sea level) and the standard condition for temperature is 492 degrees Rankine (freezing point of water or 32 degrees Fahrenheit). The greatest difference between acfm and scfm occurs in the summer when the pressure at the repository horizon is about 14.2 psi and the temperature is about 560 degrees Rankine (100 degrees Fahrenheit). Then

$$1 \text{ scfm} \times (560/492) \times (14.7/14.2) = 1.2 \text{ acfm}$$

A reasonably conservative conversion factor, therefore, is 1.2. Using this factor, 35,000 scfm is very nearly 35,000 x 1.2 or 42,000 acfm.

Restricted Access: If the required ventilation rate in an active room where waste disposal is taking place cannot be achieved or cannot be supported due to operational needs, access is restricted by the use of barriers, signs and postings, or individuals stationed at the entrance to the active disposal room when ventilation rates are below 35,000 scfm. Note: As provided in O-3c(2) entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed.

Shift: Those work shifts when there is normal access to the Waste Isolation Pilot Plant (**WIPP**) underground.

Worker: Anyone who has normal access to the WIPP underground.

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O-2 Objective

The objective of this plan is to describe how the ventilation requirements in the Permit will be met. This plan achieves this objective and documents the process by which the Permittees demonstrate compliance with the ventilation requirements by:

- Maintaining an annual running average of 260,000 scfm through the underground repository
- Maintaining a minimum of 35,000 scfm of air through the active rooms where waste disposal is taking place and when workers are present in the rooms

This plan contains the following elements: Objective; Design and Procedures; Equipment Calibration and Maintenance; Reporting and Record Keeping; Quality Assurance.

O-3 Design and Procedures

This section describes the four basic processes that make up the mine ventilation rate monitoring plan:

- Test and Balance, a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components
- Monitoring and calculation of the Running Annual Average of the Total Mine Airflow to verify achievement of the 260,000 scfm minimum requirement
- Monitoring of active room(s) to ensure a minimum flow of 35,000 scfm whenever waste disposal is taking place and workers are present in the room
- Quarterly verification of the total mine airflow

O-3a Test and Balance

O-3a(1) Test and Balance Process

The WIPP ventilation system and the underground ventilation modes of operation are described in Permit Application A2-2a(3). The Permittees shall verify underground ventilation system performance by conducting a periodic Test and Balance. The Test and Balance is a comprehensive series of measurements and adjustments designed to ensure that the system is operating within acceptable design parameters. The Test and Balance is an appropriate method of verifying system flow because it provides consistent results based on good engineering practices. The testing of underground ventilation systems is described in McPherson, 1993. Once completed, the Test and Balance data become the baseline for underground ventilation system operation until the next Test and Balance is performed.

The "Test" portion of the process shall involve measuring the pressure drop and air quantity of every underground entry excluding alcoves or other dead end drifts. In addition, the tests shall verify resistance curves for each of the main regulators, measure shaft resistance, and measure main fan pressure and quantity. This is done at the highest achievable airflow to facilitate

accurate measurements. From these measurements the frictional resistance of the system is determined.

Pressure shall be measured using the gage and tube method, which measures the pressure drop between two points using a calibrated pressure recording device and pitot tubes. Pressure drops across the shafts shall be measured by either calibrated barometers at the top and bottom of shafts or the gage and tube method. Airflow shall be measured using a calibrated vane anemometer to take a full entry traverse between system junctions. Fan pressure shall be measured using a calibrated pressure recording device and pitot tube to determine both static and velocity pressure components.

Multiple measurements shall be taken at each field location to ensure accurate results. Consecutive field values must fall within ±5% to be acceptable. These data shall be verified during the testing process by checking that:

- the sum of airflows entering and leaving a junction is equal to zero; and,
- the sum of pressure drops around any closed loop is equal to zero.

Once the measurements are taken, data shall be used to calculate the resistance of every underground drift, as well as shafts and regulators using Atkinson's Square Law

$$P=R \times Q^2$$

where the pressure drop of an entry (P) is equal to a resistance (R) times the square of the quantity of air flowing (Q) through the circuit.

The "Balance" portion of the process shall involve adjusting the settings of the system fans and regulators to achieve the desired airflow distribution in all parts of the facility for each mode of operation. Particular emphasis shall be given to the active disposal room(s) in the Waste Disposal Circuit to ensure that a minimum airflow of 35,000 scfm is achieved. The system baseline settings for the current Balance shall be established from the previous Test and Balance. Adjustments shall then be made to account for changes in system resistance due to excavation convergence due to salt creep, approved system modifications, or operational changes.

The Permittees shall use a commercially available ventilation simulator to process Test and Balance field data. The simulator uses the Hardy-Cross Iteration Method (McPherson, 1993) to reduce field data into a balanced ventilation network, including the appropriate regulator settings necessary to achieve proper airflow distribution for the various operating modes. Once balanced, the same simulator shall be used to evaluate changes such as future repository development and potential system modification before they are implemented.

The Test and Balance process culminates in a final report which is retained on site. Following receipt of the Test and Balance Report, the Permittees shall revise the WIPP surface and underground ventilation system procedures to incorporate any required changes to the ventilation system configuration. The Test and Balance data shall be used to adjust the operating range of fan controls, waste tower pressure, auxiliary air intake tunnel regulator settings, underground regulator settings, and door configurations. The model data and procedure changes shall be used to establish normal configuration settings to achieve the desired airflow in the underground. These settings shall then be modified by operations

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personnel throughout the year to compensate for system fluctuations caused by seasonal changes in psychrometric properties, and to meet specific operations needs. This ensures that the facility is operated at the design airflow rate for each ventilation mode.

O-3a(2) Test and Balance Schedule

The Test and Balance is generally conducted on a 12- to 18-month interval, but in no case shall the interval between consecutive Test and Balance performances exceed 18 months. This interval is sufficient to account for changes in the mine configuration since over this period the ventilated volume changes very little. The quality and maintenance of ventilation control structures (e.g., bulkheads) is excellent, so leakage is small and relatively constant. Historic test and balance results confirm that changes between test and balances fall within anticipated values.

O-3b Running Annual Average of the Total Mine Airflow

O-3b(1) Monitoring Total Mine Airflow

The Permittees shall use the Central Monitoring Room Operator's (**CMRO**) Log to monitor total mine airflow. Run-times for the various modes of operation shall be entered into the CMRO Log. For example, if the CMRO Log indicates that the ventilation system was configured for Alternate Mode (one main fan) at 8:00 am, and that this configuration was maintained until 11:30 am, a total of 3.5 hours of run-time in Alternate Mode would be recorded. Run times are recorded to the nearest quarter hour. The CMRO shall record each time when the ventilation system configuration is changed, including periods when there is no ventilation.

O-3b(2) Calculation of the Running Annual Average of Total Mine Airflow

The Permittees shall calculate the running average flow rate on a monthly basis. The Permittees shall use the logged runtime data for various modes of operation (as described in O-3b(1)) and the nominal design flow-rates for the various modes presented in Table O-1 to calculate the average monthly flow rate for the facility.

The average monthly mine flow rate is computed monthly using the following formula:

Monthly Average Flow Rate = {[Normal Mode Run-time (hrs.) x 425,000 scfm]
+ [Alternate Mode Run-time (hrs.) x 260,000 scfm]
+ [Maintenance Bypass Run-time (hrs.) x 260,000 scfm]
+ [Reduced Mode Run-time (hrs.) x 120,000 scfm]
+ [Minimum Mode Run Time (hrs.) x 60,000 scfm]
+ [Filtration Mode Run-time (hrs.) x 60,000 scfm]}
/ 730 Hours per month.

The running annual average of total mine airflow annual average flow rate shall be calculated using the monthly averages and the following formula:

$$\text{Annual Average Flow Rate} = \frac{\sum \text{Monthly Average for Previous 12 Months}}{12}$$

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The use of an average value of 730 hours per month in the monthly average calculation is reasonable, given that all the numbers involved are very large and that the final use of the monthly average flow is in an annual calculation.

O-3c Active Room Minimum Airflow

O-3c(1) Verification of Active Room Minimum Airflow

Whenever workers are present, the Permittees shall verify the minimum airflow through active room(s) where waste disposal is taking place of 35,000 scfm at the start of each shift, any time there is an operational mode change, or if there is a change in the ventilation system configuration.

O-3c(2) Measurement and Calculation of the Active Room Airflow

The Permittees shall measure the airflow rate and use the room cross-sectional area to calculate the volume of air flowing through a disposal room. The measurement of airflow shall use a calibrated anemometer and a moving traverse (McPherson, 1993). Airflow measurements shall be collected at an appropriate location, chosen by the operator to minimize airflow disturbances, near the entrance of each active room. The excavation dimensions at the measurement location are taken and the cross-sectional area is calculated. The flow rate is the product of the air velocity and the cross-section area. The value shall be entered on a log sheet (see Table O-3) and compared to the required minimum. The format and content of the log sheet may vary, but will always contain the data and information shown on Table O-3. Working values are in acfm and the conversion to scfm is described in section O-1 above. Measurements shall be collected, recorded, and verified by qualified operators.

The operator shall compare the recorded acfm value with the minimum acfm value provided at the top of the log sheet. The airflow shall be re-checked and recorded whenever there is an operational mode change or a change in ventilation system configuration. Once the ventilation rate has been recorded and verified to be at least the required minimum, personnel access to the room is unrestricted in accordance with normal underground operating procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room shall be restricted. Those periods when active disposal room access is restricted shall be documented on the log sheet for that active disposal room. Entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed. Such entry shall be documented on the log sheet including a reference to the SOP used for reentry,

O-3d Quarterly Verification of Total Mine Airflow

The Permittees shall perform a quarterly verification of the total mine airflow to ensure that rates established by the Test and Balance for various operational modes are reasonably maintained. These checks are identified in Permit Attachment E, Table E-1, and are performed as indicated in Table E-1.

O-4 Equipment Calibration and Maintenance

Equipment used for the periodic Test and Balance, quarterly flow verification checks, and daily verification of active disposal room flow rate shall be calibrated in accordance with appropriate WIPP calibration and data collection procedures. Work performed by subcontractors shall also

be calibrated to an equivalent standard. Equipment shall be inspected before each use to ensure that it is functioning properly and that the equipment calibration is current. Maintenance of equipment shall be completed by qualified individuals or by qualified off-site service vendors.

Equipment used to conduct the Test and Balance, Quarterly Verification of Total Mine Airflow, and to determine the airflow through the active disposal room(s) are provided in Table O-2.

O-5 Reporting and Recordkeeping

O-5a Reporting

The Permittees shall submit an annual report to NMED presenting the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In the years that the Test and Balance is performed, the Permittees will provide a summary of the results in the annual report.

The Permittees shall calculate the running annual average mine ventilation rate on a monthly basis and evaluate compliance with the minimum ventilation rate for an active room specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved..

O-5b Recordkeeping

The Permittees shall retain the following information in the Operating Record:

- The CMRO Log documenting the ventilation system operating mode.
- The underground facility running annual average mine ventilation rate on a monthly basis.
- Active disposal room ventilation flow rate readings as documented on the Active Disposal Room Ventilation Rate Log Sheet (Table O-3).
- The quarterly flow verification check and associated documentation.

These records will be maintained in the facility Operating Record until closure of the WIPP facility.

O-6 Quality Assurance

Quality assurance associated with the Mine Ventilation Rate Monitoring Plan shall comply with the requirements of the WIPP Quality Assurance Program Description (**QAPD**). The Permittees shall verify the qualification of personnel conducting ventilation flow measurements. The instrumentation used for monitoring both underground and active disposal shall be calibrated in accordance with the applicable provisions of the WIPP procedures. The software used to calculate the monthly and annual running averages and the ventilation simulation software programs shall be controlled in accordance with the WIPP QAPD and WIPP computer software quality assurance plans.

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Data generated by this plan, as well as records, and procedures to support this plan shall be maintained and managed in accordance with the WIPP QAPD. Nonconformance or conditions adverse to quality as identified in performance of this plan will be addressed and corrected as necessary in accordance with applicable WIPP Quality Assurance Procedures.

REFERENCES

McPherson, M. J., 1993. *Subsurface Ventilation and Environmental Engineering*, Chapman & Hall, London, First Edition.

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TABLES

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TABLE O-1
Ventilation Operating Modes and Associated Flow Rates

Mode of Operation	Flow Rate (scfm) Nominal Design Values
Normal (two main fans)	425,000
Alternate (one main fan)	260,000
Maintenance Bypass [parallel operation of main fan(s) and filtration Fan(s)]	260,000 to 425,000
Reduced (two filtration fans)	120,000
Minimum (one filtration fan)	60,000
Filtration (one filtration fan)	60,000

TABLE O-2
Mine Ventilation Rate Testing Equipment

Equipment Used to Conduct Test	Ventilation Test Performed		
	Test and Balance	Active Disposal Room(s)	Quarterly Flow Verification Check
Calibrated Anemometer	X	X	
Calibrated Differential Pressure Sensor	X		
Pitot Tubes	X		X
Tubing	X		X
Temperature Sensing Device	X		X
Relative Humidity Sensor	X		X
Calibrated Barometers	X		X
Electronic Manometer	X		X

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TABLE O-3
Active Disposal Room Ventilation Rate Log Sheet (Example)

ROOM NUMBER _____

NOTE: When airflow reading is below 42,000 acfm, access will be restricted.

DATE	TIME	AIRFLOW READING	WAS 42,000 ACFM ACHIEVED?		ROOM ACCESS WAS RESTRICTED?		SIGNATURE	VERIFIED BY
			YES	NO	YES	NO		

ENTERED

Allen, Pam, NMENV

From: Kliphuis, Trais, NMENV
Sent: Friday, February 03, 2012 12:11 PM
To: Allen, Pam, NMENV
Subject: FW: "errors" in yesterday's permit mod

Please add to Febraury WIPP Record.

-----Original Message-----
From: Kieling, John, NMENV
Sent: Thursday, February 02, 2012 8:57 AM
To: Kliphuis, Trais, NMENV
Subject: RE: "errors" in yesterday's permit mod

Trais,
As we discussed at the end of yesterday, make the changes as Charlie suggests. I will sign the letter.

Thanks, John

-----Original Message-----
From: Kliphuis, Trais, NMENV
Sent: Wednesday, February 01, 2012 5:02 PM
To: Kieling, John, NMENV
Subject: FW: "errors" in yesterday's permit mod

Charlie is suggesting that we write a cover letter stating we made some non-substantive changes to typographic errors and attach the corrected pages and a new CD. Then, post the letter on the web and update the files on the web but keep the issue dates associate with the files. I can do all that tomorrow.

Trais Kliphuis
WIPP Staff Manager
Hazardous Waste Bureau
New Mexico Environment Department
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-----Original Message-----
From: Don Hancock [mailto:sricdon@earthlink.net]
Sent: Wednesday, February 01, 2012 4:30 PM
To: Kliphuis, Trais, NMENV
Cc: Kieling, John, NMENV
Subject: "errors" in yesterday's permit mod

I've noticed some "errors" or "typos" in looking at the January 31, 2012 revisions on the WIPP download page.

I believe that they can and should be corrected by NMED.

120201

So far what I've found are:
1. Part 1 - odd numbered pages at bottom were not changed from "of 19" to "of 20."

2. Part 4 - Page 4-7 deleted a space " " after "room" in the fifth line of 4.5.3.2.

3. Part 4 - Page 4-12 - seventh line of 4.6.4.3 should be 4.6.4.2 (Mine ventilation), not 4.6.2.2 [On page O-7, line 17, the report is under 4.6.4.2.]

4. Part A2 - What's posted on the download page is still the April 15, 2011 version, not the January 31, 2012 revision.

5. Part O2 - Page O-6 - "Disposal" should be deleted on line 4.

I'd appreciate knowing how you're addressing these and any other similar matters with yesterday's revisions.

Thanks.

:01532

Allen, Pam, NMENV

ENTERED

From: Kliphuis, Trais, NMENV
t: Wednesday, February 08, 2012 3:49 PM
Allen, Pam, NMENV
Subject: FW: Shielded Containers

For the record

From: Kliphuis, Trais, NMENV
Sent: Thursday, February 02, 2012 1:32 PM
To: Kehrman, Bob
Cc: McCauslin, Susan - DOE; Chavez, Rick - RES; Basabilvazo, George - DOE
Subject: Shielded Containers

Greetings,

Below are portions of the internal initial analysis regarding the shielded containers and the technical adequacy of the PMR. Please note some of this may not be accurate or relevant at this time. Let me know if you have questions.

The following questions pertain to the shielded containers and container management practices:

a. Part 3: The PMR states that shielded containers will be managed in the same manner as CH containers when accepted at WIPP. Is modification of Table 3.1.1, WHB Unit, required to address management of the shielded RH containers?

b. Part 3, Section 3.1.1.9 and 3.1.1.10. Section 3.1.1.9 states that all RH waste will be stored in the RH Complex [Permit Attachment A1, Section A1-1(c)(1)]; please clarify whether the shielded RH containers will be stored with CH waste (Section 3.1.1.9). Also, the title of Section 3.1.1.10, RH TRU Mixed Waste Storage Time Limit, implies that the storage limitations apply to shielded containers; for clarity and if necessary, the section could probably be retitled to specify application of storage limitations to RH waste in canisters/casks (i.e. not shielded containers).

c. Part 3, Table 3.1.2. It is assumed that the limits associated with Contact Handled containers in Table 3.1.2, Parking Area Unit, would include the shielded containers; is this assumption is accurate? PMR should address this…?

d. Part 3, Section 3.3: The Shielded Containers will be managed at WIPP in accordance with CH requirements and presumably in surface areas designated for CH waste. Would there be any special issues or necessary considerations if the shielded RH containers were found to be in poor condition while in an area where CH waste is managed-- would this impact maintenance, clean up, and drum management in the CH area if an issue arose with a shielded container?

e. Part 4, Table 4.1.1. The Permittees propose modifications to Part 4 Table 4.1.1., removing the RH container equivalent calculations. For closed panels, removal of the information does not appear necessary since the container equivalency information is still pertinent.

f. Attachment A, Section A1-1b(2). The Permittees added shielded containers to the description of allowable RH TRU Mixed Waste Containers, stating the shielding will allow RH waste to be "managed as CH TRU mixed waste". This language infers the waste will be considered CH TRU mixed waste;

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however, it is clear that the waste will still be part of the RH inventory. For clarity, it may be better to indicate that the shielding will allow RH containers to be managed in the same manner as CH TRU mixed waste, rather than "managed as CH TRU mixed waste".

g. Attachment A, Section A1-1c. The Permittees propose no changes to Section A1-1c, but is it necessary to modify the HalfPACT discussion to included shielded containers and to clarify that not all RH waste will be managed in the RH complex?

h. Attachment A, Section A1-1d(3). The Permittees state that shielded containers will be "handled as CH TRU mixed waste", but Section A1-d(4) was also added that explicitly describes the management of shielded containers. For clarity, it would be better to state that shielded containers will be handled or managed consistent with CH practices, since the Permittees correctly recognize that some special consideration will be given to management of shielded containers (e.g. different dunnage, specified removal using a bridge crane, etc.).

i. Attachment A, Section A2-2a(1). This section is entitled CH TRU Mixed Waste Handling Equipment, but it also applies to RH shielded container management. To ensure that the section title reflects section contents, it could be retitled to indicate that the section also addresses RH containers to avoid the inference that the RH shielded containers contain CH waste. Please examine the rest of Attachment 2 for similar inferences.

j. Attachment A, Section A2-2b. PMRs for Section A2-2b imply that the shielded containers would be considered part of the CH inventory; it is understood that DOE does not intend to manage RH waste in RH shielded containers as part of the CH inventory, but elements of the PMR and in particular section titles infer the opposite. It is suggested that the title of this section could be revised to state: CH TRU Mixed Waste and RH Shielded Container Emplacement. Similarly, the following title could be modified: RH TRU Mixed Waste Emplacement should be changed to RH TRU Mixed Waste Emplacement in Canisters. This change would clarify the perception that the shielded containers are considered CH waste.

k. Attachment C1: For clarity, the term "shielded containers" could be revised to "shielded RH containers" here and throughout to ensure no confusion as to the contents of these containers. See Attachment A of this deliverable for additional information and commentary pertaining to the DAC determination for shielded RH containers.

l. Attachment C7: How does the presence of lead impact the ability of the Permittees to meet C7 permit requirements for the RH shielded containers? Will these containers undergo visual examination rather than RTR, and does it impact in any way the ability of the site to comply with the Permittees confirmation requirements since the drums will be managed as CH waste but will contain RH waste? How does the requirement to visually examine waste affect the speed at which the characterization may take place, since this the PMR states that the major justification for the use of shielded containers is to reduce "time and personnel" expenditures? Or is the time and personnel savings related to management at the WIPP site and not the generator site, as the RH waste would require repackaging to put waste in the shielded containers? Please clarify.

m. Attachment D, Section D-4d(1), All Emergencies. This section includes a paragraph specifically addressing RH TRU Mixed waste, but the paragraph wasn't updated to address shielded RH containers. At a minimum, this paragraph should identify the use of shielded RH containers and reference how releases from those containers will be managed.

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n. Attachment D, Section D-[illegible](6) Control of Spills or Leaking or Pun[illegible]red Containers of CH and RH TRU Mixed Waste, RH TRU Mixed Waste. The section addresses spills or leaks associated with canisters, but it does not address spill, leakage, or puncturing of shielded RH containers which also contains RH TRU Mixed Waste. The section should be revised to address how spills, leaks or punctures of shielded RH containers will be addressed. If the shielded RH containers will be addressed in the same manner as CH containers, the section should be revised to clarify this.

o. Attachment E, Section E-1b(1). As in previous sections, the container inspection criteria should state that shielded RH containers still contain RH waste, even if those containers are managed in the same manner as CH containers. The PMR language states that waste "will be managed as" CH waste or RH waste, when the intent is that both RH and CH waste will be managed using CH waste management practices. As written, it could be inferred that because shielded RH containers are managed as CH waste they would be considered CH waste, which is not the case.

p. Attachment G, Tables G3-2 and G3-3. Please identify the appropriate procedure(s) used for shielded RH containers.

2. Identify that the modification is a Class 2 modification [20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii))].

The Permittees indicate that the modification deals solely with the addition of a new container to manage existing accepted waste, so the modification is a Class 2 because "there is no need for specialized waste management equipment nor is there any increase in the proposed storage area in the Waste Handling Building for managing shielded containers. NMED processed and approved these containers and shipping packages as Class 2 PMRs. Therefore, this is a Class 2 as specified in 20.4.1.900 NMAC (incorporating 40 CFR, [illegible]0.42(b)), Appendix I, Item F.3.b which states: "*Storage of different wastes in containers, ... That do not require additional or different management practices from those authorized in the permit.*"...".

The waste to be managed in the new container is no different than waste currently managed in the facility. NMED has accepted other container modification requests as Class 2 changes. The Permittees correctly included modifications to the permit to describe the management and movement of these new containers in the subsurface, and the containers themselves require some special disposal configuration considerations due to the excessive weight of the containers. See Items 3 and C, below, for additional information.

3. Explain why the modification is needed [20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iii))].

The Permittees state that the modification is needed because "The use of the shielded containers will enable the DOE to reduce the time and personnel necessary for the packaging and management of specific RH TRU mixed waste that will meet the surface dose rate limitations for CH TRU mixed waste." However, PMR should elaborate on how the use of shielded containers will "reduce the time and personnel necessary for the packaging and management of specific RH TRU mixed waste...". For example, the PMR does not specify whether these cost and time savings will occur at the generator site and/or at WIPP. The time and personnel reductions should be more thoroughly presented, both at the WIPP and generator sites (assuming the savings applies to both), including personnel reduction, savings associated with the characterization process (e.g. visual examination during repackaging vs. other methods). Perhaps, clarify how the management of RH waste in shielded containers will reduce time and personnel since the waste may undergo packaging/repackaging similar to the processes currently used, and will undergo the same characterization methodologies prior to shipment (i.e. by [illegible]cing the management associated with RH casks).

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4. Provide the applicable information required by 40 CFR §270.13 through §270.21,§270.62 and §270.63[20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv))].

The PMR states: "The attached regulatory crosswalk describes those portions of the WIPP Permit that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised March 2009, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §270.16 through §270.22, §270.62, §270.63 and §270.66 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs." The cross matrix and proposed permit language modifications satisfy the intent of this requirement (see Item 1 above for additional comments).

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: 01536

ENTERED

Allen, Pam, NMENV

From: Kliphuis, Trais, NMENV
Sent: Monday, February 06, 2012 10:47 AM
To: Allen, Pam, NMENV
Subject: FW: Fixes

For the record

From: McCauslin, Susan - DOE [mailto:susan.mccauslin@wipp.ws]
Sent: Thursday, February 02, 2012 4:40 PM
To: Kliphuis, Trais, NMENV
Cc: Chavez, Rick - RES; Kehrman, Bob - RES; Most, Wille - RES
Subject: FW: Fixes

Hi Trais,

Below is a list of items we noted on the revision that should be corrected. Thanks, and please let me know if you have questions on these.

Susan McCauslin
(575) 234-7349

From: Kehrman, Bob - RES
Sent: Thursday, February 02, 2012 4:32 PM
To: Kehrman, Bob - RES; McCauslin, Susan - DOE
Cc: Most, Wille - RES; Chavez, Rick - RES; Pastorello, Linda - RES
Subject: Fixes

Susan

Here are the various discrepancies that we noted. Only the first two, (which we discussed on the phone) and the next two are important. The others can be fixed later.

Permit Part 5, Section 5.10.2.2. Groundwater Surface Elevation Results Not all of the changes were made, making this text inconsistent with the text that was changed in Attachment L

Permit Part 5, Section 5.10.2.3. Groundwater Flow and Radionuclide Sampling Results Not all of the changes were made, making this text inconsistent with the text that was changed in Attachment L

Attachment L, Section L-3b(1), Page L-9 on Line 11
Wording was left out:

"The wells were drilled through the Culebra ~~and~~ into the Los Medaños as shown in Table L-5."

Attachment L, Section L-4c(2)(ii), Page L-12, starting on Line 40 and going to Page L-13, Line 2
The word "than" is omitted and the "s" is left off of parameter:

"Each DMW will be purged to no more than three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed parameters are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump."

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Attachment L – Table of Contents
Jumps from L-7h to L-7j should be L-7i

Attachment L Section L-1a(1), paragraph that starts on the bottom of Page L-2, Line 39 and goes onto Page L-3, Line 2
Word "Application" was left in text. It should be deleted.

"These evaporite-bearing formations lie between two other formations significant to the geology 39 and hydrology of the WIPP facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) Application (DOE, 2009))."

Attachment L, Section L-1a(2)(iii) Page L-7, Lines 28-31
Add period at end of paragraph.

Attachment L, Section L-4c(2)(iii), Page L-14, starting on Line 18
The acronym SOPs does not need bolded in this instance:

"Final samples will be collected in the appropriate type of container for the specific analysis to be 18 performed. The samples will be collected in new and unused glass and plastic containers (refer 19 to Table L-6). For each parameter analyzed, a sufficient volume of sample will be collected to 20 satisfy the volume requirements of the analytical laboratory (as specified by laboratory **SOPs**)."

Attachment L, Section L-4c(2)(iii), Page L-14, Lines 27-28
The word Table needs capitalization and an "s" for plural.

"Final samples will be sent to the analytical laboratories and analyzed for parameters and 27 hazardous constituents specified in Part 5, t**T**able**s** 5.4a and 5.4b."

Attachment L, Section L-4c(2)(iv), Page L-15, Lines 5-8
The word "provide" should be singular.

"The sample tracking system at the WIPP facility uses uniquely numbered chain of custody/request for analysis (CofC/RFA) forms. The primary consideration for storage or transportation 6 is that samples shall be analyzed within the prescribed holding times for the analytes of interest. WIPP SOPs (see Table L-3) provide**s** instructions to ensure proper sample tracking protocol."

Attachment L, Section L-4c(3), Page L-16, Lines 27-30
Word "present" should be plural

"Analysis of samples will be performed using methods selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b present**s** the analytical parameters and hazardous constituents for the WIPP DMP."

Attachment L, Section L-7a(2)(i)(A), Page L-22, Lines 10-12
The word "check" was deleted in the PMR and should be deleted in the final:

"Field measurements will include pH, Specific Conductance (SC), temperature, specific gravity and static groundwater surface elevation. Field measurement accuracy will be determined using calibration ~~check~~ standards."

Attachment A2, Section A2-2a(4), Page A2-10, lines 33-35

To be consistent with our Class 1 request, the text should read "The Horizontal Emplacement and Retrieval Equipment (**HERE**) (Figure A2-15) **or functionally equivalent equipment (e.g., Figure A2-15a)** ..."

: 01538

Bob Kehrman
Washington TRU Solutions LLC - Regulatory Compliance Department
Contractor to the Department of Energy
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: 01539

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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGATE
Deputy Secretary

February 7, 2012

RE: FINAL PERMIT DECISION AND RESPONSE TO COMMENTS, CLASS 2 MODIFICATION REQUEST
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Interested Person:

On January 31, 2012, the New Mexico Environment Department (**NMED**) took final administrative action on a Class 2 permit modification request (**PMR**) to the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit. The Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC (**the Permittees**) submitted this PMR to the Hazardous Waste Bureau on October 3, 2011, seeking to update ventilation language, add a shielded container, and revise the Waste Isolation Pilot Plant (WIPP) Groundwater Detection Monitoring Program Plan.

NMED approved the groundwater revisions and the ventilation language updates with changes and denied the shielded container addition. This Class 2 PMR was evaluated and processed in accordance with the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)). It was subject to a 60-day public comment period.

Further information on this administrative action, including response to comments, may be found on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/>.

Sincerely,

John E. Kieling
Acting Chief
Hazardous Waste Bureau

cc: Trais Kliphuis, HWB

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

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JUL 2012
NMED Hazardous Waste Bureau

Mr. John Kieling, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Notification of Class 2 Permit Modification Request to the Hazardous Waste Facility Permit Number: NM4890139088-TSDF

Dear Mr. Kieling:

Enclosed is the following Class 2 Permit Modification Request:

- Addition of a Shielded Container

We certify under penalty of law that this document and the attachments were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact Mr. George T. Basabilvazo at (575) 234-7488.

Sincerely,

Jose R. Franco, Manager
Carlsbad Field Office

M. F. Sharif, General Manager
Washington TRU Solutions LLC

Enclosure

cc: w/enclosure
T. Kliphuis, NMED *ED
J. Davis, NMED ED
C. Walker, Trinity Engineering ED
*ED denotes electronic distribution

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CBFO:OESH:AS:ANC:12-0768:UFC 5486.00

Class 2 Permit Modification Request

Addition of a Shielded Container

Waste Isolation Pilot Plant
Carlsbad, New Mexico

WIPP Permit Number - NM4890139088-TSDF

July 2012

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Acronyms/Abbreviations/Units

AK	Acceptable Knowledge
CFR	Code of Federal Regulations
CH	Contact-Handled
DAC	Drum Age Criteria
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ft	feet
gal	gallon
HWDU	Hazardous Waste Disposal Unit
L	Liter
lbs	pounds
LWA	Land Withdrawal Act
m^3	cubic meters
mrem/h	millirem per hour
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
Permit	Hazardous Waste Facility Permit
PMR	Permit Modification Request
RCRA	Resource Conservation and Recovery Act
RH	Remote-Handled
TRU	transuranic
TSDF	Treatment, Storage and Disposal Facility
VHS	Vent Hood System
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WTS	Washington TRU Solutions LLC
WWIS	WIPP Waste Information System

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Overview of the Permit Modification Request

This document contains one Class 2 Permit Modification Request (**PMR**) for the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit (**Permit**) Number NM4890139088-TSDF.

This PMR is being submitted by the U.S. Department of Energy (**DOE**) Carlsbad Field Office and Washington TRU Solutions LLC (**WTS**), collectively referred to as the Permittees, in accordance with the Permit, Part 1, Section 1.3.1. (20.4.1.900 New Mexico Administrative Code (**NMAC**) incorporating Title 40 Code of Federal Regulations (**CFR**) §270.42(b)). The modification provides for the following changes:

- addition of a new shielded container for managing Remote-Handled (**RH**) transuranic (**TRU**) mixed waste as Contact-Handled (**CH**) TRU mixed waste since it meets the surface dose rate of CH TRU mixed waste,
- description of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked, and,
- related changes to waste handling descriptions.

The shielded container will be used to package RH TRU mixed waste that is approved for shipment to the WIPP facility for disposal and meets the surface dose requirements, once packaged, of CH TRU mixed waste.

These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment.

The requested modification to the Permit and related supporting documents are provided in this PMR. The proposed modification to the text of the Permit has been identified using red text and a double underline and a ~~strikeout~~ font for deleted information. All direct quotations are indicated by italicized text. The following information specifically addresses how compliance has been achieved with the Permit Part 1, Section 1.3.1. for submission of this Class 2 PMR.

1. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(i)) requires the applicant to describe the exact change to be made to the permit conditions and supporting documents referenced by the Permit.

The Permittees are proposing to add a new payload container to the Permit which is designated as a shielded container (shown in Figure 1). This container is similar in size to a standard 55-gallon drum. The shielded container body side wall is constructed of an approximately 3/16-in. inner steel shell, an approximately 1-in. middle layer of lead, and an approximately 1/8-in. outer steel shell. The shielded container lid and base are each constructed of approximately 3-in. steel plate. The lid is bolted on. A gasket of silicone rubber is utilized for lid closure. The empty weight of the shielded container is approximately 1,726 pounds. The shielded container accommodates a 30-gallon steel drum which will contain RH TRU mixed waste. Both the shielded container and its 30-gallon steel drum are vented in accordance with transportation requirements. The shielded container vent port includes a lead shield plug. Although the 30-gallon drum will be packaged with RH TRU mixed waste, the lead construction of the shielded

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container will reduce the surface dose rate at the outer surface to less than 200 millirem per hour (mrem/hr), allowing the container to be handled as CH TRU mixed waste.

The WIPP Land Withdrawal Act (**LWA**) also referred to as Public Law 102-579 defined CH TRU mixed waste in Section 2, item 3 as follows: "*The term "contact-handled transuranic waste" means transuranic waste with a surface dose rate not greater than 200 millirem per hour.*" This same definition of CH TRU mixed waste (mixed or non-mixed) was incorporated into the Permit Part 1, Section 1.5.1. When Congress included this definition in the Land Withdrawal Act, they codified a definition established by the DOE. The following plain language definitions for Contact-Handled and Remote-Handled transuranic waste are found in Section 7 of DOE N 435.1, *Contact-Handled and Remote-Handled Transuranic Waste Packaging*:

a. Contact-handled Transuranic (CH-TRU) Waste. Waste containing more than 100 nanocuries of alpha emitting transuranic isotopes per gram of waste with half-lives greater than 20 years and a payload surface dose rate not greater than 200 millirem per hour.

b. Remote-handled Transuranic (RH-TRU) Waste. Waste containing more than 100 nanocuries of alpha emitting transuranic isotopes per gram of waste with half-lives greater than 20 years and a payload surface dose rate of 200 millirem per hour or greater.

It is clear from these definitions that the designation of CH TRU or RH TRU is based solely on the dose rate at the surface of the payload container and not the dose rate of the waste before final packaging. Therefore, waste with high surface dose rates may be required to be managed as RH TRU mixed waste at a generator site. However, if that very same waste is packaged into a shielded container payload container such that the surface dose rate is below 200 mrem/hr, it can be managed and stored as CH TRU mixed waste after packaging.

Whenever transuranic waste is shipped in the shielded container payload container and the resulting surface dose rate is not greater than 200 mrem/hr then it is, by statute and DOE policy, CH TRU mixed waste.

The management and storage requirements for CH TRU mixed waste in the Permit will apply to the waste that arrives at the WIPP facility in shielded containers because the surface dose rate is less than 200 millirems/hr at the time of shipment. In this context, management of TRU mixed waste includes receipt, unloading, handling in the Waste Handling Building (**WHB**), hoisting, handling in the underground, emplacement, inspections, monitoring, and associated record keeping. Modification to the Permit is required to include shielded containers as approved containers. In developing this Class 2 PMR the Permittees addressed only those items which impact the addition of this new container at the WIPP facility.

The conditions for managing RH TRU mixed waste were established when the Permit was modified in 2006. These conditions assure the safety of the public and workers during management, storage and disposal at the WIPP facility. This PMR is not proposing a change to these conditions for managing RH TRU mixed waste. The Permittees are proposing a change to the way a portion of the RH TRU mixed waste inventory is managed if it is packaged in shielded containers and has a surface dose rate of less than 200 mrem/hr. In this case, the RH TRU mixed waste may be managed, stored, and disposed at the WIPP facility as CH TRU

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mixed waste. Management and storage of shielded containers as CH TRU mixed waste in accordance with the Permit is also protective of human health and the environment. This is because the management and storage of shielded containers can be accomplished within the existing operating framework (e.g., standard operating procedures, equipment, systems, and personnel) which has been demonstrated to be protective over more than a decade of operation.

Because the quantity of RH TRU mixed waste that can be successfully shielded to a surface dose rate of less than 200 mrem/hr is small, no increase in the volume of CH or RH TRU mixed waste which is permitted to be stored or emplaced at the WIPP facility is needed to accommodate this volume of waste. Therefore, changes in the maximum storage capacity or amount of storage area indicated in Permit Part 3, Section 3.1.1 and Section 3.1.2 or disposal volumes in Permit Part 4, Section 4.1.1, are **not** necessary since shielded containers will be managed, stored, and disposed within the existing operating envelope established for CH TRU mixed waste in the Permit. With one exception (i.e., the RH Hot Cell which does not apply to CH TRU mixed waste storage), the storage time limitations in Permit Part 3, Section 3.1.1 for TRU mixed waste is the same (i.e., 60 days) regardless of surface dose rate. Therefore, the limitations that currently apply to CH TRU mixed waste will also apply to waste contained in shielded containers, and no changes to these time limits are necessary. The management of shielded containers does not alter the potential exposure to hazardous waste and, therefore, does not increase the risk to human health and the environment. This is because the limits established for the facility and the operations specified in the Permit have been demonstrated to be protective and are unchanged to accommodate shielded containers.

The quantity of RH TRU mixed waste that can be shipped to the WIPP facility is limited to 4% of the total TRU mixed waste capacity. Only a portion of that waste has been identified as potentially eligible for shipment in Shielded Containers. Therefore, there is an insufficient quantity of RH TRU mixed waste to impact the overall capacity of the facility. This is illustrated in the following example calculation:

> According to Crawford, et.al., 2007[1], 1,922 m^3 of RH TRU mixed waste could potentially qualify for shipment in a shielded container. If the 30-gallon inner container is completely filled (0.11 m^3) then this will result in 17,473 shielded containers (1,922 m^3/ 0.11m^3 = 17,473 shielded containers). This represents about 6% of the floor space in Panels 7 – 10 (17,473 container / 3 containers per assembly / 2 assemblies per stack / 12,000 stacks per panel / 4 panels remaining = 0.06 or 6%). 12,000 stacks per panel is based on a footprint of a 7-pack assembly of TRU waste containers.

Some interested stakeholders asked for a more recent evaluation relative to the RH inventory. However, the Permittees have not performed an analysis relative to the most current RH TRU inventory in support of this modification simply because volume changes are not being proposed in this PMR and it is not within the scope of the PMR. The above referenced report is to illustrate that only a fraction of the 4% total capacity of RH TRU mixed waste is available for

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[1] http://www.epa.gov/radiation/docs/wipp/simpleanalysisreport.pdf

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use in shielded containers and therefore only a portion of that will take up floor space. The Permittees have clearly stated the need for the PMR is for the addition of the shielded container for use by the generator sites for managing certain RH TRU mixed wastes. In addition, benefits to the Permittees in terms of simplified waste management are discussed in the overview of the PMR. The Resource Conservation and Recovery Act (**RCRA**) does not require container-specific inventory projections as part of the regulatory process for including descriptions of containers used for managing hazardous waste. The topic of inventory, and its relationship to the capacity of the WIPP repository to dispose of up to 7,080 cubic meters of RH TRU waste, is best discussed in another forum because this PMR does not alter the volume to accommodate any more or less RH TRU mixed waste than what is currently allowed by the Permit.

This PMR is needed to add another container to the list of acceptable containers in Permit Part 3, Section 3.3.1. The Permittees believe that this container may further expedite the cleanup and disposal of TRU mixed waste from throughout the United States.

The Nuclear Regulatory Commission (**NRC**) has authorized the use of the HalfPACT transportation package for the shipment of shielded containers. The shielded containers comply with the U.S. Department of Transportation (**DOT**) Type 7A specifications.

The RH TRU mixed waste that is included in the current inventory for disposal at the WIPP facility was evaluated for packaging in shielded containers. Candidate RH TRU mixed waste streams for shipment and disposal in shielded containers will be selected based on the requirement to keep the radiation surface dose rate at the external surface of the shielded container below 200 mrem/hr in accordance with Permit Part 1, Section 1.5.1. The characterization being performed on waste being shipped in shielded containers will be no different than the waste characterization that is now required for RH TRU mixed waste in the Permittees' Waste Analysis Plan. Waste placed into shielded containers will have been characterized per the requirements of the Permit Attachments C-C6 and will have undergone confirmation per the Permit requirements specified in Permit Attachment C7.

Specifically, the requirements for characterizing RH TRU mixed waste apply to RH TRU mixed waste that will be placed into shielded containers. This assures that the radiography or visual examination record required by Permit Attachment C, Section C-3c for RH TRU mixed waste is available for confirmation. Characterization information will be available for confirmation for the 30-gallon drum. The Permit requirements specified in Permit Attachment C7 regarding confirmation apply equally to both CH TRU and RH TRU mixed waste regardless of the payload container used for shipment and management.

RH TRU mixed waste emplaced at the WIPP facility in shielded containers will remain designated as RH TRU mixed waste in the WIPP Waste Information System (**WWIS**). The emplaced volume will be counted against the RH TRU mixed waste volume limits specified in the Permit. The shielded container allows the Permittees to manage the shipment in a manner consistent with management of a CH TRU mixed waste shipment.

In the unlikely event that shielded containers have surface contamination or container integrity issues which may require decontamination/repair/patch/overpacking, the Permittees may overpack the shielded container into a standard waste box or ten drum overpack. Because the

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surface dose rate is less than 200 mrem/hr, this overpacking will occur in the CH Bay of the WHB and not in the RH Bay, consistent with overpacking other containers that are managed and stored as CH TRU mixed waste. Even if the damage to the shielded container resulted in a breach of the shielding, it would still be handled in the CH Bay in accordance with Permit Attachment D, Section D-4d(6). Facility radiological control programs will dictate how a container breach will be mitigated and may include the use of supplemental shielding, overpacks, or other methods to manage radiological hazards beyond the scope of this Permit.

The shielded containers will be assembled for shipment from the generator site in a three-pack configuration on a triangular pallet surrounded by radial and axial dunnage components. These components are designed to keep the load from shifting during transportation. They will be transported as a single three-pack configuration within the HalfPACT packaging. Currently, RH TRU mixed waste is transported in RH 72-B packaging. The shielded containers will be transported in HalfPACTs with no more than three HalfPACTs per shipment. Not all RH TRU mixed waste will be packaged in shielded containers. Therefore, both RH 72-B and HalfPACTs will be shipped to the WIPP facility. Using shielded containers has the potential to reduce the number of shipments so, therefore, there is no additional risk. Furthermore, regardless of the number of shipments, the Permittees are not requesting an increase in the storage capacity of the Parking Area Unit or WHB or disposal capacity for RH TRU mixed waste in the underground. The maximum amount of waste managed and stored at the WIPP facility will remain unchanged, thereby posing no additional risk.

Upon arrival at the WIPP facility, the shielded containers will be processed as CH TRU mixed waste using CH TRU mixed waste handling equipment and operating procedures. After receipt at the WIPP facility, the HalfPACT transportation container will be opened using existing lifting fixtures and equipment in the CH Bay portion of the Waste Handling Building. Once accessible after the HalfPACT lids have been removed, the top axial dunnage will be removed prior to removing the three-pack assembly from the HalfPACT (see Figure 2). Next, the three-pack assembly, the radial dunnage, the bottom slipsheet and the triangular pallet will be lifted from the HalfPACT using the installed guide tubes and placed on a facility pallet. A plastic reinforcing plate may be used for ease of handling and stacking purposes. When in storage in the Waste Handling Building, RH TRU mixed waste in shielded containers is subject to the more stringent visual inspection requirements for CH TRU mixed waste. The facility pallet will then be moved to the repository in the same manner as other CH TRU mixed waste. The three-pack assembly will be placed singly on the floor using the slipsheet. The triangular pallet will not be emplaced. The three-pack will be placed in the interstitial spaces among the CH TRU mixed waste (see Figure 3). In order to meet the stacking stability requirements of Permit Attachment A2, Section A2-2b, shielded containers will not be stacked more than two high, and no other waste assemblies or backfill MgO sacks will be placed on top of three-pack assemblies of shielded containers[2]. Emplacement of the three-pack assembly of shielded containers will be performed using existing waste handling equipment and fixtures.

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[2] http://www.epa.gov/radiation/docs/wipp/shielded_container/shieldedcontainers_090810.pdf;

http://www.epa.gov/radiation/docs/wipp/shielded_container/shieldedcontainers_090810_att1.pdf

The Permittees will track waste components, packaging, transportation and emplacement information using the same method as other waste that is transported and emplaced at the WIPP facility. The shielded container waste volume will be reported as the volume of RH TRU mixed waste in the inner waste container (i.e., 30 gallons). Quantities of RH TRU mixed waste that arrive in canisters are currently counted based on the canister internal volume (0.89 m^3) specified in the Permit. Therefore, shielded containers and canisters will have a common volume reporting basis in the WWIS.

The volume of the shielded container is specified as 0.11 m^3, which is the internal volume of the 30-gallon inner container. Accordingly, the volume of the shielded container is based on the maximum amount of waste that can be placed into the container. This is the same basis for the other containers in the Permit. This is the appropriate volume for this container because shielded containers are only being approved for use with 30-gallon inner containers (i.e., shielded containers will not be used without a 30-gallon inner container).

The Permittees are also proposing an administrative change by requesting the removal of the "Container Equivalency" column in Permit Part 4, Table 4.1.1 since this column is not used to meet any compliance requirements. The columns that do have compliance implications are only "Maximum Capacity" and "Final Waste Volume". Container Equivalency is not tracked in the WWIS nor is it used to calculate any final waste volumes. Converting shielded containers to RH canister equivalence will result in fractions of "equivalent containers" which is meaningless since fractions of containers are not disposed.

The Permittees have evaluated the Drum Age Criteria (**DAC**) for the shielded container packaging configuration using the same VDRUM model that was used for other container DAC calculations (Drum Age Criteria Values for the Shielded Container, September 2011). A conservative packaging configuration was used in the evaluation (Appendix C). The evaluation indicates that existing 55-gallon DAC values bound the values for the shielded container. This calculation takes into account the open-top coated and woven polypropylene bag used to hold the 30-gallon drum. In modeling, the Permittees considered this woven, open-topped bag as if it were a closed (via twist and tape) liner bag serving as another layer of confinement. The calculations indicate that the DAC is bounded by the current 55-gallon drum DAC.

The Permittees are proposing the following changes in this PMR:

1. Add a new container in Permit Part 3, Section 3.3.18.; Permit Part 4, Table 4.1.1; Permit Part 4, Section 4.3.1.8.; Permit Attachment A1, Section A1-1b(2); Section A1-1d(3); Section A1-1d(4); Table A1-2; Figure A1-37; Permit Attachment A2, Section A2-2a(1); Section A2-2b, Table A2-1; Permit Attachment A4, Section A4-3; Permit Attachment C1, Section C1-1a, Section C1-1a(1), Table C1-8 and footnote; Permit Attachment D, Section D-1d, Section D-1e(1); Permit Attachment E,

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Section E-1b(1); Permit Attachment G3, Section G3-4a; and Permit Attachment H1, Introduction.

2. Revise Permit Part 4, Table 4.1.1 to remove the container equivalent column since RH TRU mixed waste will be disposed of in both canisters and shielded containers. This is the same approach used for CH TRU mixed waste which can arrive in six different containers. Furthermore, this table is a volume based limitation and not a container limitation. Thus it is not necessary to have the number of equivalent containers since the volume is not being changed. The use of Container Equivalency is not a means by which neither the Permittees nor the NMED can show compliance with Panel volumes or repository volumes nor is it used to calculate any final volumes.

3. Add a figure of the shielded container (Permit Attachment A1, Figure A1-37).

4. Add "Shielded Containers" to Permit Attachment C1, Sections C1-1a and C1-1a (1) and revise Permit Attachment C1, Table C1-8 indicating that the 55-gallon drum DAC bounds the shielded container.

Appendix A, Table of Changes, provides a detailed list of changes by Permit section. Proposed text changes are included in Appendix B of this PMR.

2. 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(1)(ii)), requires the applicant to identify that the modification is a Class 2 modification.

This PMR proposes to add a new container to the Permit. The shielded container will contain hazardous waste already approved for disposal at the WIPP facility; however, that waste (RH TRU mixed waste) is approved for management in the RH Complex and not in the CH Bay, and therefore, as discussed below, it is a different waste in a particular unit. This type of modification is similar to what the Environmental Protection Agency (**EPA**) described when they added this item (F.3.b) to the RCRA regulations in 1988[3].

The Permit distinguishes between CH TRU mixed waste and RH TRU mixed waste even though both types of waste contain similar hazardous waste constituents. The reason for distinguishing between the two types is due to the presence of radioactivity as measured by the radioactive dose rate on the surface of the container. Excessive exposure to radioactivity (i.e., radioactivity at high levels) can be hazardous to workers. To mitigate the hazard, the Permittees use the categories CH TRU and RH TRU to dictate the management practices used for each container, thereby minimizing exposure to radioactivity for the purpose of protecting workers. For example, it is not possible to visually inspect the surface of a RH TRU mixed waste container or a RH TRU mixed waste container storage area except remotely using cameras. On the other

[3] 53 FR 37927, September 28, 1988.

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hand, CH TRU mixed waste containers and storage areas can be (and must be) inspected visually. Even though both RH TRU mixed waste and CH TRU mixed waste contain the same hazardous waste, they are considered to be different waste by the Permittees because they are managed and stored differently (remotely versus not remotely) and have different RCRA requirements applied to them (remote inspection versus visual inspection). Remote-Handled TRU mixed waste without sufficient shielding cannot be managed and stored in the CH TRU storage unit since the CH TRU mixed waste storage unit is not equipped to perform the needed remote management. Likewise, CH TRU mixed waste cannot be managed and stored in the RH TRU storage unit since visual inspection would be impractical. In this modification, the Permittees are proposing to manage hazardous waste that is defined as RH TRU mixed waste by the generator in the CH TRU mixed waste management areas by using the shielded container. Because RH TRU mixed waste has not been managed and stored in the CH TRU portion of the facility, the Permittees consider this Class 2 PMR as the appropriate modification request to authorize this activity. Since modification of the facility is not needed, and the imposition of different waste management practices is not needed, this modification is not classified as a Class 3 Permit Modification. This is because the management of RH TRU mixed waste in shielded containers can be done using existing CH TRU mixed waste practices in the CH TRU portion of the facility.

Unlike the SLB2 and TRUPACT III, there is no need for specialized waste management equipment nor is there any increase in the proposed storage area in the Waste Handling Building for managing shielded containers. NMED processed and approved these containers and shipping packages as Class 2 PMRs. Therefore, this is a Class 2 as specified in 20.4.1.900 NMAC (incorporating 40 CFR, §270.42(b)), Appendix I, Item F.3.b which states: "*Storage of different wastes in containers,…. That do not require additional or different management practices from those authorized in the permit.*"

Although RH TRU mixed waste has been shipped to the WIPP facility previously, this waste has not been managed and stored in the CH TRU mixed waste management portion of the facility. Therefore, this classification is appropriate and will allow for NMED evaluation of the proposal and public comment on this requested change.

The Permittees have added other containers and shipping packages. The basis for these changes was determined in accordance with 20.4.1.900 NMAC (incorporating 40 CFR 270.42 Appendix I) depending on the portions of the Permit that were affected by the change. Although the basis for classification was different in some cases, these have been approved by the New Mexico Environment Department (NMED) as Class 2 Permit Modifications. These include the following:

- Direct loaded ten drum overpack (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.
- Direct loaded 85-gallon drums (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.
- Addition of 100-gallon drums (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.

- Addition of a standard large box 2 (SLB2) (approved 4-15-2011) 40 CFR 270.42 Appendix I Item # F.a.2.
- Addition of a HalfPACT shipping package (approved 11-25-2002) Based upon an August 30, 2001, NMED letter that indicates that the addition of waste management containers is not a "non-substantive" change and, therefore, should be processed as a Class 2 Permit Modification.
- Addition of a TRUPACT III shipping package (approved 4-15-2011) 40 CFR 270.42 Appendix I Item # F.a.2.

This PMR also proposes some changes to the waste analysis plan relative to the drum age criteria to be used for the shielded container. Therefore, 40 CFR, §270.42(b), Appendix I, item B. General Facility Standards 1. Changes to waste sampling or analysis methods: d. Other changes...2, also applies"

It has been suggested by some stakeholders that this modification should be processed as a Class 3 modification. A regulatory analysis of why it is inappropriate for the Permittees to request a Class 3 process for a modification that is clearly defined in 20.4.1.900 NMAC (incorporating 40 CFR 270.42 Appendix I) as Class 2 is attached as Appendix D.

3. 20.4.1.900 NMAC (incorporating 40 CFR 270.42(b)(1)(iii)), requires the applicant to explain why the modification is needed.

This PMR is necessary to add a shielded container as an acceptable waste container at the WIPP facility.

Shielded containers have been developed as one method for generator sites to facilitate the packaging and shipment of RH TRU mixed waste. For example, a generator site using shielded containers may be able to avoid the need of some new RH waste handling and storage facilities once the waste is packaged. Consequently, in order to anticipate usage by TRU waste generators, the Permittees have identified the need to include these containers in the Permit. Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management, storage, and disposal of that waste at the WIPP facility. Only waste that meets the definitions of TRU mixed waste in Permit Part 1, Section 1.5.7 and that can be packaged to meet the surface dose rate limitations for CH TRU mixed waste will be managed, stored, and disposed at the WIPP facility in shielded containers. The shielded container will be transported to the WIPP facility in the HalfPACT transportation package and will be managed, stored, and subsequently emplaced in the rooms of the repository as CH TRU mixed waste as discussed in Section 1 of this Overview. The containers comply with DOT Type 7A specifications and they will have a surface dose rate of less than 200 mrem/h.

The Permittees believe the use of shielded containers will be beneficial because the shipment of RH TRU mixed waste in shielded containers in the HalfPACT may be more efficient than shipment in canisters using the RH 72-B Cask. This is because a single RH 72-B Cask shipment holds a single canister which typically will contain three 55-gallon drums or three 30-gallon drums. A shipment in HalfPACT may contain up to three HalfPACTs each containing

three shielded containers for a total of nine which is three times the amount in a single canister shipment. However, even if a single HalfPACT is used in a shipment with no other waste, the shipment is no less efficient than using a canister with the same payload. Furthermore, a pallet of shielded containers containing two three-packs can be managed from unloading to disposal in about two hours versus the eight to ten hours needed for RH TRU mixed waste in a canister. This is a significant saving in waste processing time. Handling as CH TRU mixed waste is inherently less complex than handling waste as RH TRU mixed waste as required by Permit Attachments A1 and A2.

The RH TRU mixed waste that will be packaged in shielded containers is waste that is or may be designated for disposal in the WIPP facility and will have undergone the required characterization as RH TRU mixed waste specified in the WIPP Waste Analysis Plan. No change in the permitted aboveground hazardous waste storage or underground disposal unit capacity is required. Candidate RH TRU mixed waste streams for shipment and disposal in shielded containers will be selected based on the requirement to keep the radiation surface dose rate at the external surface of the shielded containers below 200 mrem/hr. The volume of waste emplaced in shielded containers will remain designated as RH TRU mixed waste in the WWIS and will be counted against the RH TRU mixed waste underground hazardous waste disposal unit disposal limits in the Permit.

Additional explanations of why the changes are needed are provided in Item 1 above.

4. 20.4.1.900 NMAC (incorporating 40 CFR §270.42 (b)(1)(iv)) requires the applicant to provide the applicable information required by 40 CFR §270.13 through §270.21, §270.62 and §270.63.

The attached regulatory crosswalk describes those portions of the Permit that are affected by this PMR. Where applicable, regulatory citations in this modification reference Title 20, Chapter 4, Part 1, NMAC, revised March 2009, incorporating the CFR, Title 40 (40 CFR Parts 264 and 270). 40 CFR §270.16 through §270.22, §270.62, §270.63 and §270.66 are not applicable at WIPP. Consequently, they are not listed in the regulatory crosswalk table. 40 CFR §270.23 is applicable to the WIPP Hazardous Waste Disposal Units (**HWDUs**). This modification does not impact the conditions associated with the HWDUs.

5. 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1) and 40 CFR §270.30(k)) require that any person signing under paragraph a and b must certify the document in accordance with 20.4.1.900 NMAC.

The transmittal letter for this PMR contains the signed certification statement in accordance with Permit Part 1, Section 1.9. of the Permit.

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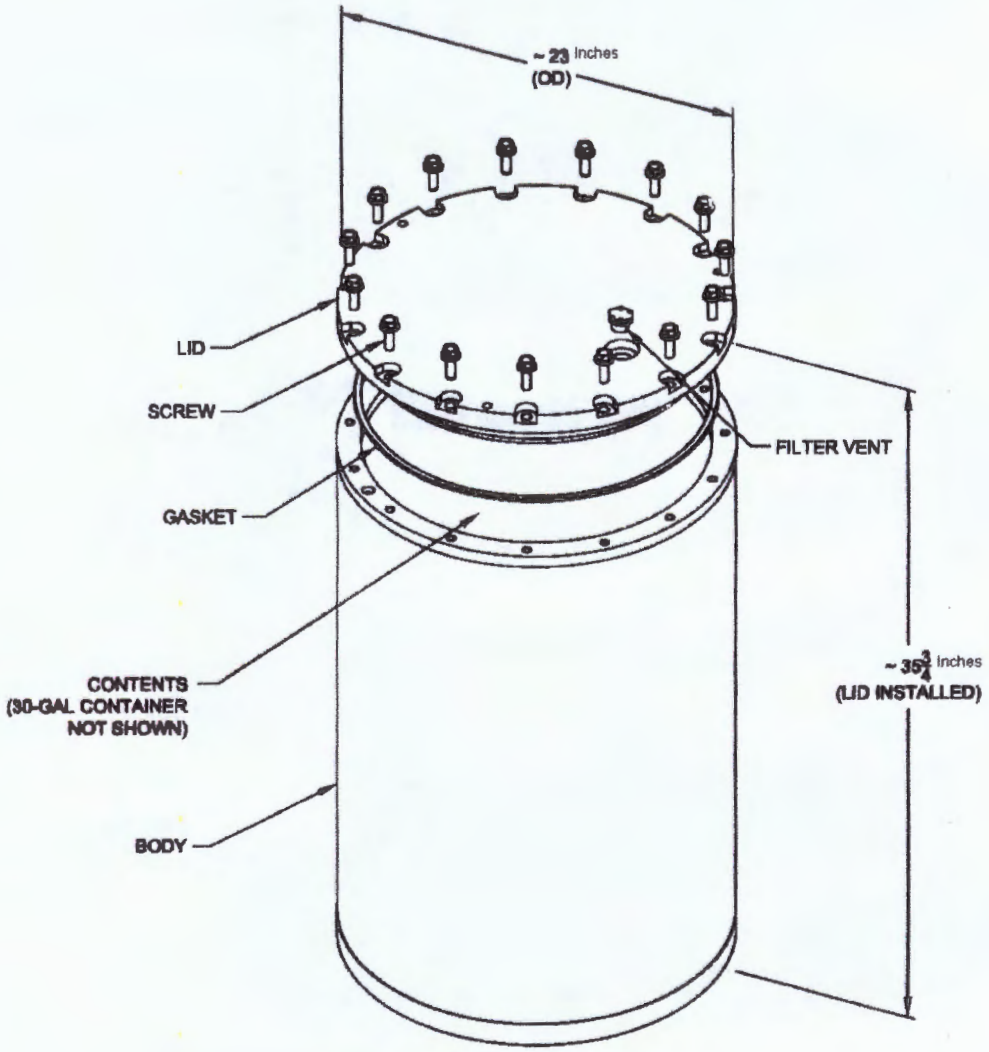

Figure 1
Shielded Container

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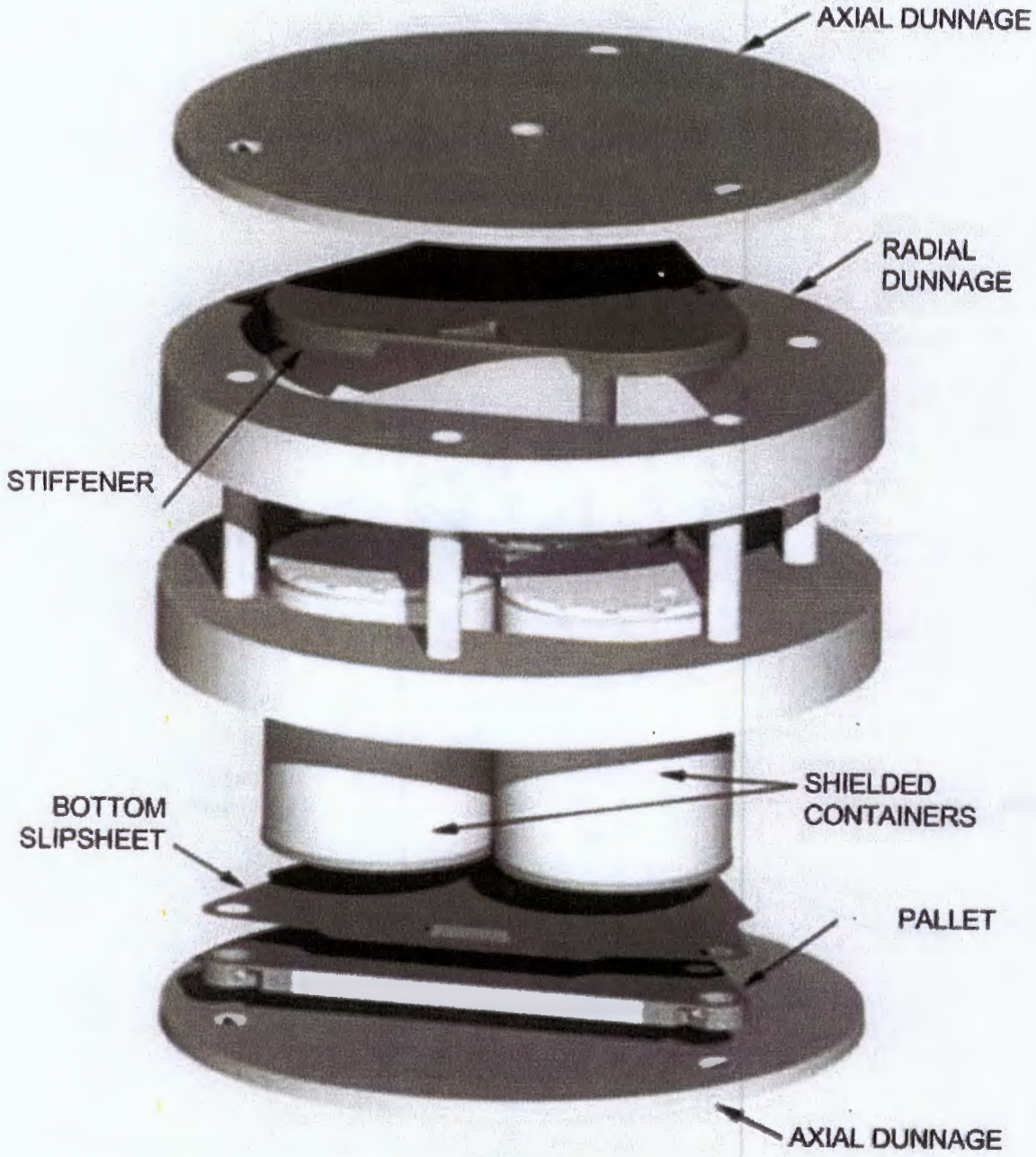

Figure 2
Three-Pack Assembly of Shielded Containers with Axial and Radial Dunnage

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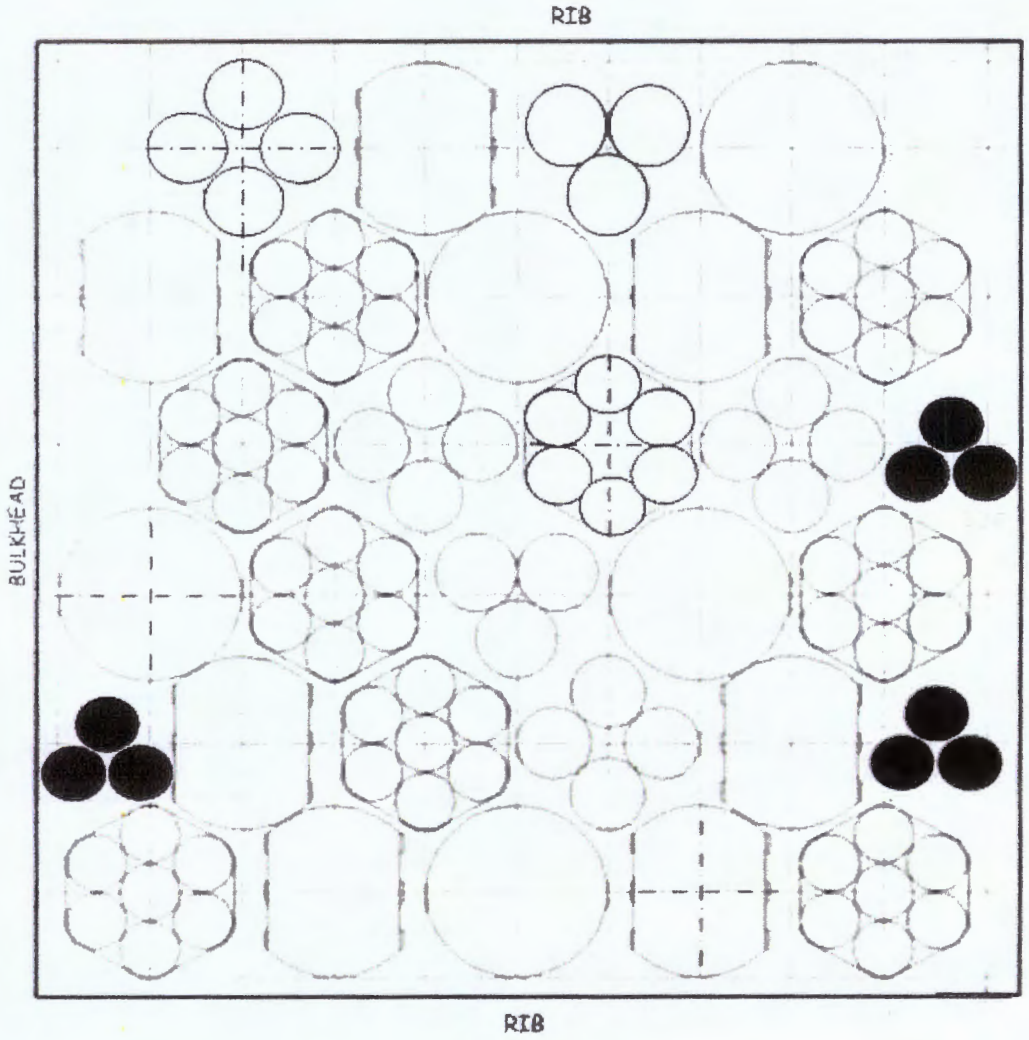

Figure 3
Shielded Containers – Randomly Placed in the Interstitial Spaces in Waste Rows

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Regulatory Crosswalk

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.13		Contents of Part A permit application	Attachment B, Part A		✓
§270.14(b)(1)		General facility description	Attachment A		✓
§270.14(b)(2)	§264.13(a)	Chemical and physical analyses	Attachment C		✓
§270.14(b)(3)	§264.13(b)	Development and implementation of waste analysis plan	Attachment C		✓
	§264.13(c)	Off-site waste analysis requirements	Attachment C		✓
§270.14(b)(4)	§264.14(a-c)	Security procedures and equipment	Part 2.6		✓
§270.14(b)(5)	§264.15(a-d)	General inspection requirements	Attachment E		✓
	§264.174	Container inspections	Attachment E	✓	
§270.23(a)(2)	§264.602	Miscellaneous units inspections	Attachment E		✓
§270.14(b)(6)		Request for waiver from preparedness and prevention requirements of Part 264 Subpart C	NA		
§270.14(b)(7)	264 Subpart D	Contingency plan requirements	Attachment D		✓
	§264.51	Contingency plan design and implementation	Attachment D		✓
	§264.52 (a) & (c-f)	Contingency plan content	Attachment D	✓	
	§264.53	Contingency plan copies	Attachment D		✓
	§264.54	Contingency plan amendment	Attachment D		✓
	§264.55	Emergency coordinator	Attachment D		✓
	§264.56	Emergency procedures	Attachment D		✓
§270.14(b)(8)		Description of procedures, structures or equipment for:	Part 2.10		✓
§270.14(b)(8)(i)		Prevention of hazards in unloading operations (e.g., ramps and special forklifts)	Part 2.10		✓
§270.14(b)(8)(ii)		Runoff or flood prevention (e.g., berms, trenches, and dikes)	Part 2.10		✓
§270.14(b)(8)(iii)		Prevention of contamination of water supplies	Part 2.10		✓
§270.14(b)(8)(iv)		Mitigation of effects of equipment failure and power outages	Part 2.10		✓
§270.14(b)(8)(v)		Prevention of undue exposure of personnel (e.g., personal protective equipment)	Part 2.10		✓
§270.14(b)(8)(vi) §270.23(a)(2)	§264.601	Prevention of releases to the atmosphere	Part Part 4 Attachment A2 Attachment N		✓
	264 Subpart C	Preparedness and Prevention	Part 2.10		✓
	§264.31	Design and operation of facility	Part 2.10		✓
	§264.32	Required equipment	Part 2.10 Attachment D		✓
	§264.33	Testing and maintenance of equipment	Attachment E		✓
	§264.34	Access to communication/alarm system	Part 2.10		✓
	§264.35	Required aisle space	Part 2.10		✓
	§264.37	Arrangements with local authorities	Attachment D		✓

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Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.14(b)(9)	§264.17(a-c)	Prevention of accidental ignition or reaction of ignitable, reactive, or incompatible wastes	Part 2.10		✓
§270.14(b)(10)		Traffic pattern, volume, and controls, for example: Identification of turn lanes Identification of traffic/stacking lanes, if appropriate Description of access road surface Description of access road load-bearing capacity Identification of traffic controls	Attachment A4	✓	
§270.14(b)(11)(i) and (ii)	§264.18(a)	Seismic standard applicability and requirements	Part B, Rev. 6 Chapter B		✓
§270.14(b)(11)(iii-v)	§264.18(b)	100-year floodplain standard	Part B, Rev. 6 Chapter B		✓
	§264.18(c)	Other location standards	Part B, Rev. 6 Chapter B		✓
§270.14(b)(12)	§264.16(a-e)	Personnel training program	Part 2 Attachment F		✓
§270.14(b)(13)	264 Subpart G	Closure and post-closure plans	Attachment G & H		✓
§270.14(b)(13)	§264.111	Closure performance standard	Attachment G		✓
§270.14(b)(13)	§264.112(a), (b)	Written content of closure plan	Attachment G		✓
§270.14(b)(13)	§264.112(c)	Amendment of closure plan	Attachment G		✓
§270.14(b)(13)	§264.112(d)	Notification of partial and final closure	Attachment G		✓
§270.14(b)(13)	§264.112(e)	Removal of wastes and decontamination/dismantling of equipment	Attachment G		✓
§270.14(b)(13)	§264.113	Time allowed for closure	Attachment G		✓
§270.14(b)(13)	§264.114	Disposal/decontamination	Attachment G		✓
§270.14(b)(13)	§264.115	Certification of closure	Attachment G		✓
§270.14(b)(13)	§264.116	Survey plat	Attachment G		✓
§270.14(b)(13)	§264.117	Post-closure care and use of property	Attachment H		✓
§270.14(b)(13)	§264.118	Post-closure plan; amendment of plan	Attachment H		✓
§270.14(b)(13)	§264.178	Closure/ containers	Attachment G		✓
§270.14(b)(13)	§264.601	Environmental performance standards-Miscellaneous units	Attachment G		✓
§270.14(b)(13)	§264.603	Post-closure care	Attachment G		✓
§270.14(b)(14)	§264.119	Post-closure notices	Attachment H		✓
§270.14(b)(15)	§264.142	Closure cost estimate	NA		✓
	§264.143	Financial assurance	NA		✓
§270.14(b)(16)	§264.144	Post-closure cost estimate	NA		✓
	§264.145	Post-closure care financial assurance	NA		✓
§270.14(b)(17)	§264.147	Liability insurance	NA		✓
§270.14(b)(18)	§264.149-150	Proof of financial coverage	NA		✓
§270.14(b)(19)(i), (vi), (vii), and (x)		Topographic map requirements Map scale and date Map orientation	Attachment B Part A		✓

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Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
		Legal boundaries Buildings Treatment, storage, and disposal operations Run-on/run-off control systems Fire control facilities			
§270.14(b)(19)(ii)	§264.18(b)	100-year floodplain	Attachment B Part A		✓
§270.14(b)(19)(iii)		Surface waters	Attachment B Part A		✓
§270.14(b)(19)(iv)		Surrounding Land use	Attachment B Part A		✓
§270.14(b)(19)(v)		Wind rose	Attachment B Part A		✓
§270.14(b)(19)(viii)	§264.14(b)	Access controls	Attachment B Part A		✓
§270.14(b)(19)(ix)		Injection and withdrawal wells	Attachment B Part A		✓
§270.14(b)(19)(xi)		Drainage on flood control barriers	Attachment B Part A		✓
§270.14(b)(19)(xii)		Location of operational units	Attachment B Part A		✓
§270.14(b)(20)		Other federal laws Wild and Scenic Rivers Act National Historic Preservation Act Endangered Species Act Coastal Zone Management Act Fish and Wildlife Coordination Act Executive Orders	Attachment B Part A		✓
§270.15	§264 Subpart I	Containers	Attachment A1 Part 3 Section 3.3.1.8.	✓	
	§264.171	Condition of containers	Attachment A1		✓
	§264.172	Compatibility of waste with containers	Attachment A1		✓
	§264.173	Management of containers	Attachment A1	✓	
	§264.174	Inspections	Attachment E Attachment A1		✓
§270.15(a)	§264.175	Containment systems	Attachment A1		✓
§270.15(c)	§264.176	Special requirements for ignitable or reactive waste	Part 2		✓
§270..15(d)	§264.177	Special requirements for incompatible wastes	Part 2		✓
	§264.178	Closure	Attachment G		✓
§270.15(e)	§264.179	Air emission standards	Part 4 Attachment N		✓
§270.23	264 Subpart X	Miscellaneous units	Attachment A2	✓	

Regulatory Citation(s) 20.4.1.900 NMAC (incorporating 40 CFR Part 270)	Regulatory Citation(s) 20.4.1.500 NMAC (incorporating 40 CFR Part 264)	Description of Requirement	Added or Clarified Information		
			Section of the Permit or Permit Application	Yes	No
§270.23(a)	§264.601	Detailed unit description	Permit Part 4, Section 4.3.1.8. Table 4.1.1 Attachment A2	✓	
§270.23(b)	§264.601	Hydrologic, geologic, and meteorologic assessments	Part 5 Attachment L		✓
§270.23(c)	§264.601	Potential exposure pathways	Part 4 Attachment A2 Attachment N		✓
§270.23(d)		Demonstration of treatment effectiveness	NA		✓
	§264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	Part 2 Part 4 Part 5 Attachment A2 Attachment N		✓
	§264.603	Post-closure care	Attachment H Attachment H1	✓	
	264 Subpart E	Manifest system, record keeping, and reporting	Part 2 Attachment C		✓

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Appendix A
Table of Changes

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Table of Changes

Affected Permit Section	Explanation of Change	Page Number
Permit Part 3, Section 3.3.1.8.	Add "3.3.1.8. Shielded Container Each shielded container contains a 30-gallon inner container with gross internal volume of 4.0 ft^3 (0.11 m^3). Shielded containers contain RH TRU mixed waste, but the shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste. Shielded containers may be overpacked into a standard waste box or ten drum overpack.	B-3
Permit Part 4, Table 4.1.1.	Remove "container equivalent" column since the RH TRU mixed waste may now be disposed at the WIPP facility in containers other than canisters.	B-4
Permit Part 4, Section 4.3.1.8	Add Section "4.3.1.8 Shielded Container" and "Shielded containers are configured as a three-pack."	B-5
Permit Attachment A1, Section A1-1b(2)	Add "shielded containers, which are received in HalfPACTs," Add "Shielded Container Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37). Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste."	B-6
Permit Attachment A1, Section A1-1d(3)	Add "that is not in a shielded container" Add "Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste."	B-6
Permit Attachment A1, Section A1-1d(4)	Add "A1-1d(4) Handling Waste in Shielded Containers Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with the handling of HalfPACT shipping packages in Section A1-1d(2), a	B-6,B-7

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Affected Permit Section	Explanation of Change	Page Number
	forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit. An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2). Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2)."	
Permit Attachment A1, Table A1-2	Revise Table A1-2 to add "Shielded container" and a "Three pack of shielded containers" to the table with those weights being "2,260 lbs." and "7,000 lbs." respectively.	B-8
Permit Attachment A1, Figure A1-37	Add "Figure A1-37 Typical Shielded Container"	B-9
Permit Attachment A2, Section A2-2a(1)	Add "two 3-packs of shielded containers" Delete "or"	B-10
Permit Attachment A2, Section A2-2b	Add "and shielded containers" Delete "(e.g., TRUPACT IIs or HalfPACTs)," Add "one 3-pack of shielded containers," Add "or shielded containers"	B-10
Permit Attachment A2,	Revise Table A2-1 to add "Shielded container" and a	B-11

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Affected Permit Section	Explanation of Change	Page Number
Table A2-1	"Three-pack of shielded containers" to the table with those weights being "2,260 lbs." and "7,000 lbs." respectively.	
Permit Attachment A4, Section A4-3	Add "one shielded container 3-pack," Add "two shielded container 3-packs,"	B-12
Permit Attachment C1, Section C1-1a	Add "and shielded containers"	B-13
Permit Attachment C1, Section C1-1a(1)	Add "and shielded containers" Delete "and" Add ", and shielded containers"	B-13,B-14
Permit Attachment C1, Table C1-8	Add "and shielded containers" Add "and shielded containers" to footnote [a]	B-15,B-16
Permit Attachment D, Section D-1d	Add "Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs."	B-17
Permit Attachment D, Section D-1e(1)	Add "3-pack of shielded containers," Delete "or"	B-17
Permit Attachment D, Section D-4d(1)	Add "that is not managed in shielded containers"	B-17
Permit Attachment D, Section D-4d(6)	Add "that are managed as" and delete "of"	B-17 B-18
Permit Attachment E, Section E-1b(1)	Delete "CH TRU mixed" Add "that will be managed and stored as CH TRU mixed waste" Add "," and delete "or" Add "or shielded containers as (3)-packs" Add "off-site waste that will be managed and stored as" Add "Off-site waste that will be managed and stored as" Delete "handled" Add "managed"	B-19
Permit Attachment G3, Section G3-4a	Add "TRU mixed waste, including RH TRU mixed waste in shielded containers"	B-20
Permit Attachment H1, Introduction	Add "Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1."	B-21

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Appendix B
Proposed Revised Permit Text

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Proposed Revised Permit Text:

3.3.1. Acceptable Storage Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for storage of TRU mixed waste at WIPP. The Permittees are prohibited from storing TRU mixed waste in any container not specified in Permit Attachment A1, Section A1-1b, as set forth below:

3.3.1.8. Shielded Container

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). Shielded containers contain RH TRU mixed waste, but the shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste. Shielded containers may be overpacked into a standard waste box or ten drum overpack.

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Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	~~Container Equivalent~~	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	~~400 RH TRU Canisters~~	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	15,720 ft^3 (445 m^3)	~~500 RH TRU Canisters~~	
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	~~600 RH TRU Canisters~~	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	**~~2960 RH TRU Canisters~~**	

[1] The area of each panel is approximately 124,150 ft^2 (11,533 m^2).

[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended).

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4.3. DISPOSAL CONTAINERS

4.3.1 Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.8. Shielded Container

Shielded containers are configured as a three-pack.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers, which are received in HalfPACTs, and 55-gallon drums, which are received in a CNS 10-160B cask.

Shielded Container

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

A1-1d(4) Handling Waste in Shielded Containers

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

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An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

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Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

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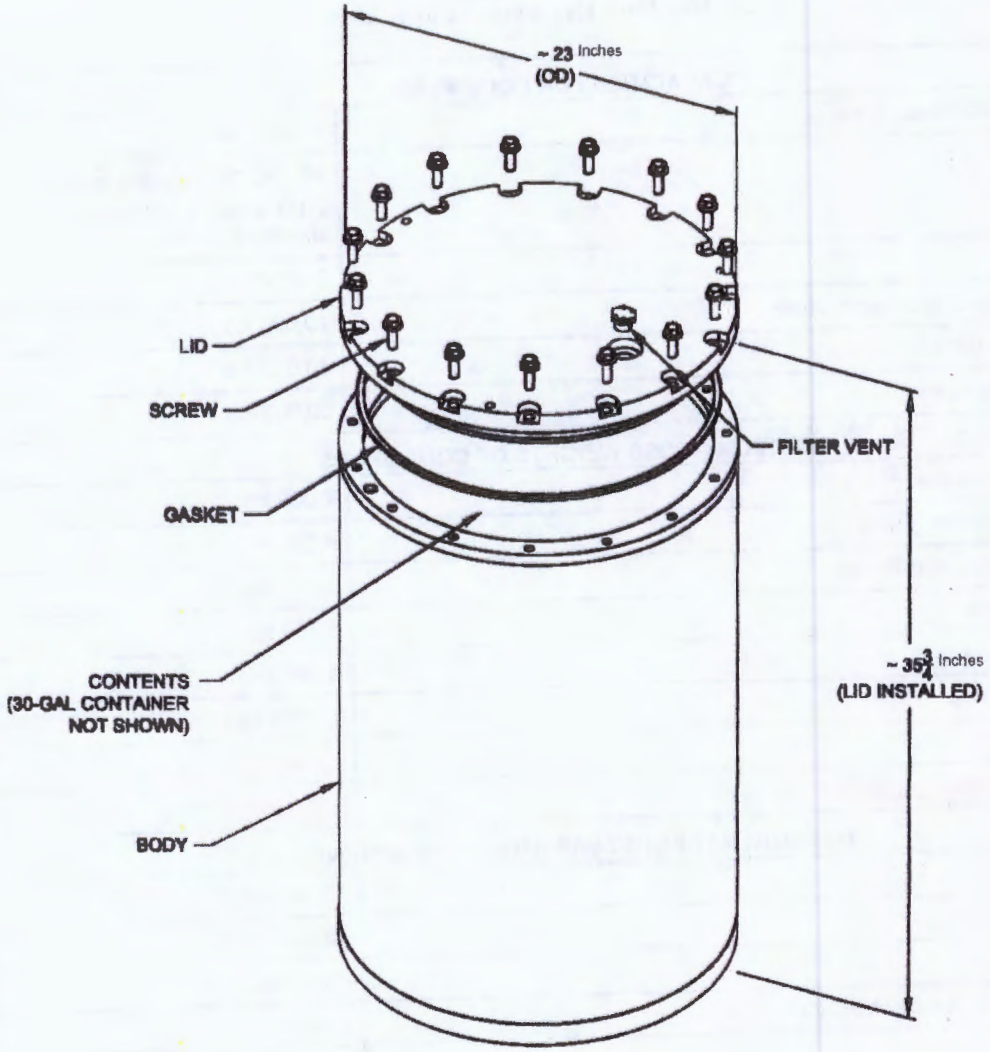

Figure A1-37
Typical Shielded Container

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A2-2a(1) CH TRU Mixed Waste Handling Equipment

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2 (**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, ~~or~~ four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

A2-2b Geologic Repository Process Description

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers ~~(e.g., TRUPACT-IIs or HalfPACTs),~~ at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one 3-pack of shielded containers, or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

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A4-3 Waste Handling Building Traffic

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one shielded container 3-pack, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two shielded container 3-packs, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

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C1-1a Method Requirements

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and

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100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, ~~and~~ SLB2s, and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

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Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)

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Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

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D-1d Description of Containers

Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs.

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (3-pack of shielded containers, 7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

D-4d(1) All Emergencies

For RH TRU mixed waste that is not managed in shielded containers, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers that are managed as ~~of~~ CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and

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or any approved fixatives such as polyvinyl alcohol (**PVA**) or paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and counted. This information is used by cognizant managers, RC personnel, and As Low As Reasonably Achievable (**ALARA**) Committee representatives to determine an appropriate course of action to recover the area. A plan to decontaminate and recover affected areas and equipment will be approved with a separate RWP written to establish the radiological controls required for the recovery.

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E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site ~~CH TRU mixed~~ waste that will be managed and stored as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), ~~or~~ in standard large box 2s (**SLB2s**) or shielded containers as (3)-packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

As described in Permit Attachment A1, Section A1-1d(3), off-site waste that will be managed and stored as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Off-site waste that will be managed and stored as RH TRU mixed waste is ~~handled~~ managed and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

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G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

Introduction

Upon receipt of the necessary certifications and permits from the EPA and the New Mexico Environment Department, the Permittees will begin disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU and TRU mixed waste in the WIPP. This waste emplacement and disposal phase will continue until the regulated capacity of the repository of 6,200,000 cubic feet (175,588 cubic meters) of TRU and TRU mixed waste has been reached, and as long as the Permittees comply with the requirements of the Permit. For the purposes of this Permit Attachment, this time period is assumed to be 25 years. The waste will be shipped from DOE facilities across the country in specially designed transportation containers certified by the Nuclear Regulatory Commission. The transportation routes from these facilities to the WIPP have been predetermined. The CH TRU mixed waste will be packaged in 55-gallon (208-liter), 85-gallon (322-liter), 100-gallon (379-liter) steel drums, standard waste boxes (**SWBs**), ten drum overpacks (**TDOPs**), and/or standard large box 2s (**SLB2s**). An SWB is a steel container having a free volume of 66.3 cubic feet (1.88 cubic meters). Figure H1-2 shows the general arrangement of a seven-pack of drums and an SWB as received in a Contact-Handled Package. RH TRU mixed waste inside a Remote-Handled Package is contained in one or more of the allowable containers described in Permit Attachment A1. Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1.

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Appendix C

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EVALUATION OF DRUM AGE CRITERIA FOR THE SHIELDED CONTAINER

April 2012
Revision 3

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Acronyms and Abbreviations

atm	atmosphere
CH-TRU	contact-handled transuranic
DAC	drum age criterion
K	Kelvin
mol/s/mol fraction	mole/second/mole fraction
TRU	transuranic
VOC	volatile organic compound

1.0 Background and Purpose

Containers of transuranic (TRU) waste must meet a minimum age criterion before a volatile organic compound (VOC) gas sample collected from the waste container headspace is considered representative of the VOCs within the container. The drum age criterion (DAC) is the time required after container closure, or after container closure and container venting, before a headspace gas sample can be collected. The methodology described in "Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations" (BWXT, 2000) is the basis for the packaging-specific DAC values for debris waste (summary category S5000) currently approved in the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant ("Permit") (NMED, current version).

The shielded container is a new waste container that has been proposed for disposal at the WIPP. The shielded container is a vented carbon steel and lead cylindrical assembly with a removable lid. It is approved for the shipment of transuranic (TRU) waste in the HalfPACT package. Up to three (3) shielded containers can be shipped within a HalfPACT package.

The shielded container is designed to carry one 30-gallon payload drum. A partially exploded view of the shielded container, including its 30-gallon payload drum, is provided in Figure 1. In addition to the 30-gallon payload drum, the shielded container may contain an optional 30-gallon drum handling bag, which is cylindrical in shape with an open top. The bag is made of a coated and woven polypropylene fabric with an internal diameter of approximately 20.25 inches and a height of 25 inches. The surface area associated with a bag holding the 30-gallon drum is approximately 1,590 square inches (10,261 square centimeters). The drum handling bag has a thickness of approximately 24 mil. The bottom portion of the bag is lined with 8-ounce geo-textile material. An alternative to the 30-gallon drum handling bag is a sling that is open at both the top and bottom and is approximately 8-mil thick. Two continuous loops of nylon webbing intersect each other at the bottom center of the sling to support the bottom of the 30-gallon drum.

The shielded container and 30-gallon drum must each be installed with a filter vent. Contact-handled TRU (CH-TRU) waste is placed into a vented 30-gallon drum, which is then loaded into the shielded container.

Packaging-specific DAC values were previously determined for a number of packaging configurations (BWXT, 2000, Shaw 2003). The DAC for each packaging configuration was determined using the computer program VDRUM that solved a series of differential equations describing the VOC transport phenomena within the waste container (BWXT, 2000 and Connolly et al, 1998). Model input parameters include the physical properties of VOCs, the initial concentration profile in the waste container, physical dimensions of each confinement

layer (thickness, surface area, void volume), and the hydrogen diffusion characteristics of filter vents installed on the waste containers (BWXT, 2000 and Connolly et al, 1998). Model parameters and assumptions used in determining the DAC values have also been documented (Shaw 2003, BWXT, 2000 and Connolly et al, 1998).

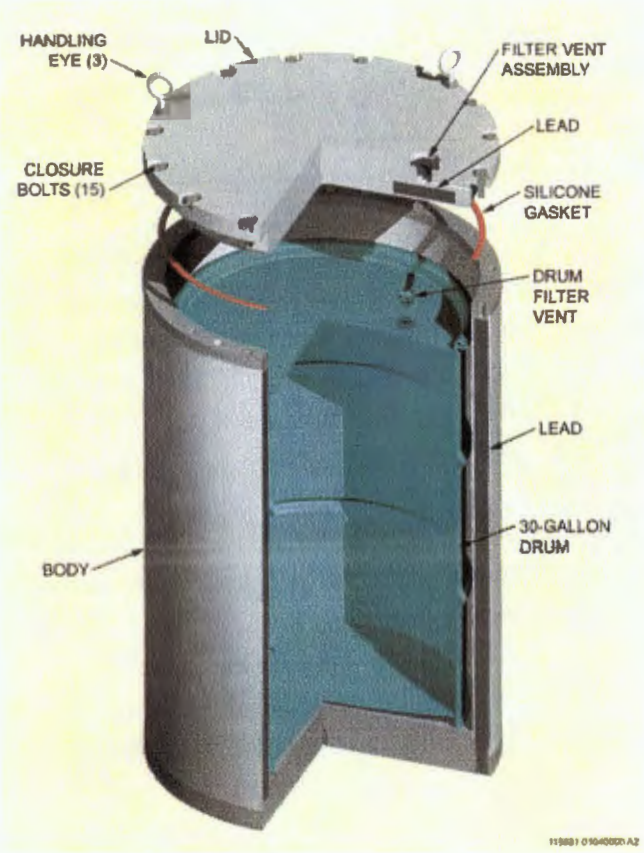


Figure 1
Shielded Container

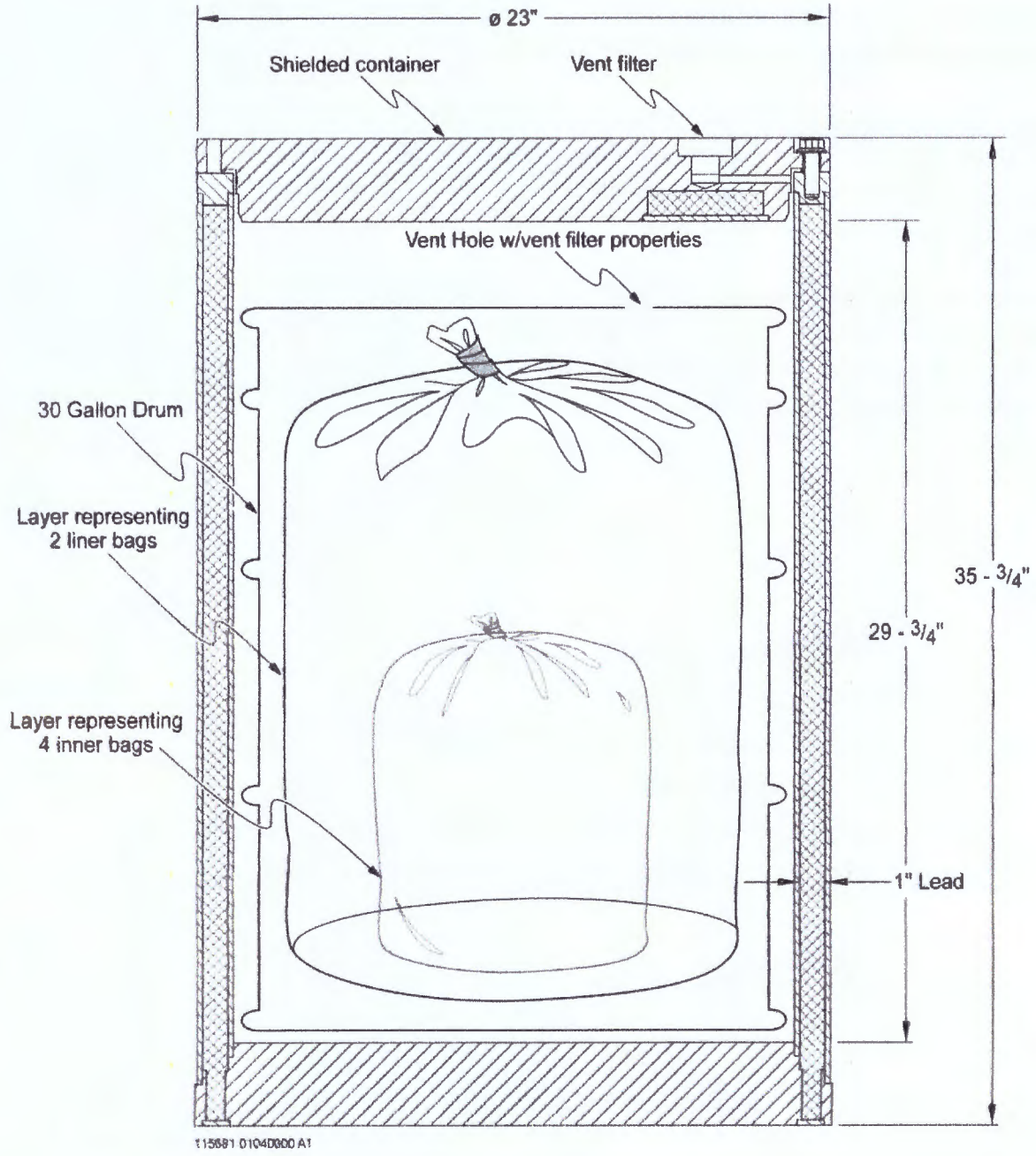
The purpose of this report is to demonstrate that separate DAC values are not required for the shielded container or the 30-gallon drum (to allow for headspace sampling of stand-alone 30-gallon drum before being placed in the shielded container) because the existing 55-gallon drum default DAC values under Scenario 3, Packaging Configuration Group 3 (debris waste, summary category S5000) serve as reference upper bounds for the shielded container and 30-gallon drum packaging configurations, and therefore can be conservatively applied to the shielded container or 30-gallon drum. The inside volume of an empty shielded container is approximately 159 liters (Day, 2008) compared to 208 liters for an empty 55-gallon drum. As

the waste will be loaded in a 30-gallon drum, a shielded container packaging configuration (and, by definition, the 30-gallon drum configuration) will hold less waste and has less available void volume than a typical 55-gallon drum loaded with debris waste. In addition, the shielded container packaging configurations will not use a rigid drum liner. Based on sensitivity studies (BWXT, 2000) these differences should result in lower DACs for the shielded container, and therefore the default 55-gallon drum DACs under Scenario 3, Packaging Configuration Group 3, should serve as conservative upper bounds. The next sections demonstrate that the DAC value for the shielded container (and the stand-alone 30-gallon drum) is indeed bounded by the existing 55-gallon drum packaging configuration DAC.

2.0 Methodology

All assumptions and parameters used in previous DAC calculations have been documented (Shaw 2003, BWXT, 2000). The VDRUM code was used to determine the DAC for a shielded container packaging configuration and 30-gallon drum configuration comparable to that of the 55-gallon drum. Parameter values specific to the shielded container DAC evaluation are discussed below and are listed in the input file included in Appendix A. Additional assumptions used in determining the DAC value for the shielded container are presented in this section.

A conservative inner packaging configuration was selected for the shielded container for this analysis. The packaging configuration consists of debris waste packaged in six plastic bags (i.e., four inner bags packaged in two liner bags). The optional 30-gallon drum handling bag (if used) is completely open at the top and made of a permeable mesh fabric and the sling (if used) is open at both the top and bottom. As a conservative measure in the DAC calculation for the shielded container packaging configuration, the 30-gallon drum handling bag is modeled by the VDRUM code as an additional drum liner bag with a twist-and-tape (closed) closure, which is conservative with regard to VOC equilibrium. Selection of this configuration is conservative as it will result in a longer DAC than the likely shielded container configuration with fewer bags. The bags are placed in a vented 30-gallon drum that is then placed inside a vented shielded container. There is no rigid drum liner in this packaging configuration. Both the 30-gallon drum and the shielded container are each assumed to be fitted with a filter vent with a hydrogen diffusivity characteristic of 1.85E-5 mole/second/mole fraction (mol/s/mol fraction). This filter is commonly used for new packaging configurations. The modeling of the shielded container packaging configuration is depicted in Figure 2. The calculated DAC for the shielded container configuration, as well as the DAC for the stand-alone 30-gallon drum, will be compared to the default Scenario 3, Packaging Configuration Group 3 DAC in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum with 4 inner bags, 2 liner bags, no rigid drum liner and a filter hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction. The size and thickness of the bags



Note: Optional 30-gallon drum handling bag not shown.

Figure 2
VDRUM Model of Shielded Container Packaging Configuration

is assumed to be the same as for the 55-gallon drum. Other parameter values are documented in Appendix A.

VOCs permeate across the inner and liner bags, diffuse out of the 30-gallon drum vent, into the shielded container headspace, and finally diffuse out through the shielded container filter vent.

In this and all previous DAC calculations (Shaw 2003, BWXT, 2000 and Connolly et al, 1998), it is conservatively assumed that the VOC concentration within the innermost confinement layer is constant due to thermodynamic equilibrium of the gas phase surrounding the VOC-contaminated waste matrix.

To model this configuration using VDRUM, the hydrogen diffusion value of the 30-gallon drum filter vent is expressed as an equivalent surface area of the opening in the lid. If the transport rate of a VOC across a filter vent and an opening are set equal to each other (BWXT, 2000), then an equivalent opening surface area can be defined in terms of the VOC diffusivity across the filter vent:

$$D^*_{VOC} \cdot \Delta y = \frac{D_{VOC} \cdot A_d c}{x_d} \Delta y \qquad (1)$$

where

D^*_{VOC} = VOC diffusivity across filter vent, mole s^{-1}

D_{VOC} = VOC diffusivity in air, $cm^2\ s^{-1}$

A_d = surface area of opening in confinement layer, cm^2

c = gas concentration, mole cm^{-3}

x_d = thickness of confinement layer at opening, cm

Δy = VOC mole fraction difference across confinement layer

Rearranging Equation (1) yields

$$A_d = \frac{D^*_{VOC} \cdot x_d}{D_{VOC} \cdot c} \qquad (2)$$

From Shaw, 2003 the ratio of VOC diffusivity across a filter vent to that across air is assumed equivalent to the ratio of hydrogen across a filter vent to that of hydrogen in air:

$$\frac{D^{*}_{VOC}}{D_{VOC}} = \frac{D^{*}_{H_2}}{D_{H_2}} \tag{3}$$

where

D^{*}_{H2} = Hydrogen diffusivity across filter vent, mole s^{-1}

D_{H2} = Hydrogen diffusivity in air, cm^2 s^{-1}

Therefore, the equivalent surface area of an opening in a confinement layer can be expressed in terms of hydrogen diffusivity across the filter vent in the confinement layer

$$A_d = \frac{D^{*}_{H_2} x_d}{D_{H_2} c} \tag{4}$$

The ideal gas law estimates the gas concentration:

$$c = \frac{P_{atm}}{RT} \tag{5}$$

where

P_{atm} = pressure, atmosphere (atm)

T = temperature, Kelvin (K)

R = gas constant = 82.06 cm^3 atm/(g-mole) K

Hydrogen diffusivity is estimated using the Fuller, Schettler, and Giddings equation (Shaw, 2003):

$$D_{H_2} = \frac{0.00143T^{1.75}}{PM^{0.5}_{H_2,air}\left[(\Sigma_v)^{1/3}_{H_2} + (\Sigma_v)^{1/3}_{air}\right]^2} \tag{6}$$

where

T = gas temperature, K

P = pressure, bar

$M_{H2,air} = 2\,[1/M_{H2} + 1/M_{air}]^{-1}$

M_i = molecular weight of component i, gram (gram-mole)$^{-1}$

$(\Sigma_v)_i$ = atomic diffusion volume of component i

where

$M_{H2} = 2.016$ $\quad (\Sigma_v)_i = 6.12$

$M_{air} = 28.97$ $\quad (\Sigma_v)_i = 19.7$ (BWXT, 2000)

In the case of hydrogen-air system at T = 298.2 K and P = 1 atmosphere = 1.01325 bar, the diffusivity is:

$$D_{H2} = 0.758\ cm^2\ s^{-1}$$

Assuming an area thickness of 1.0 cm, the equivalent surface area for the 30-gallon drum filter vent of 1.85 x 10^{-5} mol/s/mol fraction diffusivity is the following:

$$A_d = \frac{1.85x10^{-5}(82.06)(298.2)}{0.758} = 0.597\ cm^2$$

3.0 Results

The DAC calculated using an established methodology (BWXT, 2000) for a representative shielded container packaging configuration is documented in the output file included in Appendix A. The longest DAC is 16 days based on the VOC methyl isobutyl ketone. This DAC is equivalent to the Scenario 3, Packaging Configuration Group 3 DAC of 16 days in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum with 4 inner bags, 2 liner bags (bounding case), no rigid drum liner, and a filter hydrogen diffusivity value of 3.7E-6 mol/s/mol fraction. Thus, the analysis has demonstrated that separate DAC values are not required for the representative shielded container packaging configuration because the existing default 55-gallon drum DACs under Packaging Configuration Group 3 serve as upper bounds and should be used.

The DAC for directly sampling the headspace of the 30-gallon drum, prior to placing in a shielded container, was also evaluated. This DAC, calculated as 10 days, is also bounded by the Packaging Configuration Group 3 DAC of 16 days in Table C1-9 of the Permit (NMED, current version) for a 55-gallon drum. The input and output files for the 30-gallon drum configuration are also presented in Appendix A.

4.0 References

BWXT, see Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly.

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Shaw Environmental and Infrastructure, Inc. (Shaw), 2003, Determination of Drum Age Criteria Values for Ten-Drum Overpacks, 85-Gallon Drums, and 100-Gallon Drums, Revision 1, Shaw Environmental and Infrastructure, Inc, Albuquerque, New Mexico.

Appendix A
Input and Output Files Associated with the Shielded Container and 30-Gallon Drum DAC Value Determination

This appendix includes the input and output files for the shielded container and the 30-gallon drum that document the calculation of DAC values using the methodology described in BWXT (2000).

The computer program VDRUM used for deriving DAC values in BWXT (2000) employs input files of required data and reports the time for volatile organic compounds (VOCs) to reach at least 90 percent of their steady state concentrations. The input file for each packaging configuration includes the same data structure beginning with the input and output file names and the number of VOCs evaluated. Each VOC included in the analysis has two lines of input data, the initial concentrations in the layers of confinement and the physical and chemical properties. The physical characteristics, such as thickness and surface area, of each type of confinement layer are entered.

To determine the drum age criteria, the greatest time in days is selected from the VOCs (shown in bold in the output data listing). The data structures for the input and output files are shown in the following sections.

Input File Format

Line 1: Input file name, output file name, number of VOCs evaluated

Line 2: Name of VOC #1, $[IB]_0$, $[LB]_0$, $[LHS]_0$, $[DHS]_0$

Where:

$[IB]_0$ – Initial VOC concentration (ppmv) in inner bags
$[LB]_0$ – Initial VOC concentration (ppmv) in liner bags
$[LHS]_0$ – Initial VOC concentration (ppmv) in drum liner headspace
$[DHS]_0$ – Initial VOC concentration (ppmv) in drum headspace

Line 3: MW, ρ, D, T_c, P_c, D*, H, k, G (see Reference 1 for VOC-specific values)

Where:

MW – VOC molecular weight (g/gmol)
ρ – VOC permeability in polyethylene @ 25°C, $cm^3(STP)\ cm^{-1}\ sec^{-1}\ (cmHg)^{-1}$
D – VOC diffusivity in air @ 25°C, $cm^2\ s^{-1}$
T_c – VOC critical temperature, K
P_c – VOC critical pressure, atm
D* – VOC diffusivity across filter vent, mol/s/mol fraction
H – VOC Henrys constant for polyethylene drum liner, (cm^3 polymer) atm/(cm^3 (STP) gas)
k – VOC mass transfer coefficient at drum liner surface, s^{-1}
G – VOC generate rate (always set to 0 (zero)).

Lines (2n, 2n+1): Information for n^{th} (last) VOC

Line (2n+2): $A_p(1)$, $A_d(1)$, $V(1)$, $x_p(1)$, $x_d(1)$

Line (2n+3): $A_p(2)$, $A_d(2)$, $V(2)$, $x_p(2)$, $x_d(2)$

Line (2n+4): $A_p(3)$, $A_d(3)$, $V(3)$, $x_p(3)$, $x_d(3)$

Line (2n+5): $A_p(4)$, $A_d(4)$, $V(4)$, $x_p(4)$, $x_d(4)$

Where:

A_p – permeable surface area, cm^2
A_d – diffusional cross-sectional area, cm^2
V – void volume inside layer of confinement, cm^3
x_p – layer thickness, cm
x_d – length of diffusional path length, cm
1 – inner bag
2 – drum liner bag
3 – drum liner headspace
4 – drum headspace

Line (2n+6): T, P, D_v*

Where:

T – gas temperature = 25°C
P – gas pressure = 76 cm Hg
D_v* – hydrogen diffusion characteristic across drum filter vent, mol/s/mol fraction

Output File Format

Line 1: Input file name

Lines 2, n+1: VOC, DAC, [DAC], [SS]

Where:

VOC – name of VOC
DAC – drum age criterion, days
[DAC] – VOC concentration at the time of the DAC value, ppmv
[SS] – VOC concentration at steady-state conditions, ppmv

Specific information about data input includes the following:

- The hydrogen release rate across the 30-gallon drum is defined by the hydrogen diffusivity of the filter vent. The DAC value was calculated for a diffusivity value of 1.85E-5 mol/s/mol fraction for the 30-gallon drum filter vent.

- T_c, P_c are required if D = 0 (i.e., when VOC diffusivity in air is not specified).
- T_c, P_c, D_v* are required if D* = 0 (i.e., when VOC diffusivity across filter vent is not specified) and the drum is vented.
- If D > 0 and D* > 0 (i.e., when diffusivities are specified), T_c and P_c can equal zero.
- No VOC gas generation is assumed; therefore, g equals zero.
- Only gas permeation across bags is considered, so $A_d = x_d = 0$ (for bags only).
- Although a rigid drum liner is not included in the packaging configuration, the VDRUM model includes a rigid drum liner layer in the input file and specification of A_p and x_p is required to estimate the volume of liner material. In order to nullify the effects of resistance to permeation of the non-existent rigid drum liner, x_p is set to a very small, non-zero value as shown in the input file, making the resistance to permeation of VOCs through this layer negligible.
- The shielded container packaging configuration parameter values are assumed to be the same as those for the corresponding 55-gallon drum (BWXT, 2000) values of bag thickness and surface area.
- The 30-gallon drum handling bag, though open at the top, is conservatively modeled as a liner bag with twist and tape closure. The bag adds a thickness of 0.028 cm for 0.084 cm total. These values are shown in the corresponding input file.
- Assumptions for void volumes between the inner and liner bags and within the 30-gallon drum headspace are scaled by a factor of 30/55 from the corresponding 55-gallon drum void volumes previously used (BWXT, 2000). Thus, the void volume between inner and liner bags is 10,900 cm^3 (scaled from the 55-gallon drum value of 20,000 cm^3). The void volume in the 30-gallon drum headspace is 15,300 cm^3 (scaled from the 55-gallon drum value of 28,000 cm^3)
- The void volume between the 30-gallon drum and the shielded container is 37,284 cm^3 (Day, 2008).
- The release rate from the shielded container filter vent was set to a diffusivity of 1.85E-5 mol/s/mol fraction. Because VDRUM only allows entry of one filtered layer of confinement, the filter on the 30-gallon drum was accounted for by adjusting the parameter values for diffusion through the rigid drum liner layer hole to match the characteristics of the 30-gallon drum filter diffusion (the rigid drum liner layer is required in the VDRUM model). The modeled dimensions of the rigid drum liner hole are adjusted so the effective release rate equals the diffusivity value of 1.85E-5 mol/s/mol fraction 30-gallon drum filter vent. The 1.85E-5 mol/sec/mol fraction filter vent is modeled as a hole with an area of 0.597 cm^2 through a 1.0 cm thick layer.

Input File for Shielded Container DAC Evaluation

```
'shieldcontvdrum','shieldcontvdrum.out',12
'carbon tetrachloride',1000.,0.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',1000.,0.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',1000.,0.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',1000.,0.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',1000.,0.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',1000.,0.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',1000.,0.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',1000.,0.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',1000.,0.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',1000.,0.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',1000.,0.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',1000.,0.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
14000.,0.,0.,0.050,0.
14000.,0.,10900.,0.084,0.
12800.,0.597,15300.,0.00005,1.0
0.,0.,37284.,0.,0.
25.,76.,1.85e-5

c       shielded container, w/30-gal drum, each w/ filter vent, 4 inner bags, 2 liner bags
c         30-gallon drum handling bag modeled as a twist and tape liner bag even though
c         bag is open at top. The bag adds a thickness of 0.028 cm for 0.084 cm total.
c       Value for volume within innermost bags not required.
c       Void volume between bags: 10,900 cm3 (scaled from 55-gal drum value of 20,000 cm3)
c       Bag thickness same as Scenario 3
c       Void volume in 30-gal drum headspace = 15,300 cm3 (scaled from 55-gal drum value of 28,000 cm3)
c       Void volume between 30-gal and shielded container: 37,284 cm3
c       No liner so no solubility for VOCs (thus, 30-gal drum as  "liner thickness" xp = 0.00005 cm)
c       Effective surface area across 30-gal drum filter (assuming xd = 1.0 cm): Ad = 0.597 cm2
c       so effective H2 release rate equals 30-gal drum filter vent, D*(H2) = 1.85e-5 mol/s/mol fraction
c       D*H2 = total H2 diff. char. across shielded container filter vent = 1.85e-5 mol/s/mol fr
c       VOC diff. char. estimated knowing D*H2, VOC Tc, VOC Pc
```

Output File for Shielded Container DAC Evaluation

shieldcontvdrum			
carbon tetrachloride	14	399.5111	438.5642
methanol	11	346.9043	379.4464
dichloromethane	11	403.0082	443.6181
toluene	12	436.2250	480.7493
trichloroethylene	12	436.7753	477.0292
butanol	12	412.6895	456.2111
chloroform	12	406.4105	448.6669
1,1-dichloroethene	15	359.0007	392.9815
methyl ethyl ketone	14	389.6570	425.0542
methyl isobutyl ketone	**16**	**380.5107**	**419.6800**
1,1,2,2-tetrachloroethane	11	444.8763	493.8665
chlorobenzene	12	431.7012	479.1213

Input File for 30-Gallon Drum DAC Evaluation

'30galdrum','30galdrum.out',12
'carbon tetrachloride',1000.,0.,0.,0.
153.82,193.e-10,0.0,556.4,45.0,0.,0.0217,6.e-5,0.
'methanol',1000.,0.,0.,0.
32.0,135.e-10,0.,513.2,78.5,0.,0.0272,2.4e-7,0.
'dichloromethane',1000.,0.,0.,0.
84.9,263.e-10,0.,510.,62.2,0.,0.0431,2.e-6,0.
'toluene',1000.,0.,0.,0.
92.1,669.e-10,0.0,591.8,40.5,0.,0.002857,7.e-6,0.
'trichloroethylene',1000.,0.,0.,0.
131.4,583.e-10,0.0,572.0,49.8,0.,0.00640,6.e-5,0.
'butanol',1000.,0.,0.,0.
74.1,300.e-10,0.,563.1,43.6,0.,0.02273,8.e-6,0.
'chloroform',1000.,0.,0.,0.
119.4,260.e-10,0.,536.4,53.0,0.,0.04545,8.e-6,0.
'1,1-dichloroethene',1000.,0.,0.,0.
96.9,110.e-10,0.,513.0,47.5,0.,0.09091,8.e-6,0.
'methyl ethyl ketone',1000.,0.,0.,0.
72.1,165.e-10,0.,536.8,41.5,0.,0.03704,8.e-6,0.
'methyl isobutyl ketone',1000.,0.,0.,0.
100.2,130.e-10,0.,571.0,32.3,0.,0.01724,8.e-6,0.
'1,1,2,2-tetrachloroethane',1000.,0.,0.,0.
167.9,2300.e-10,0.,661.2,57.6,0.,0.003846,8.e-6,0.
'chlorobenzene',1000.,0.,0.,0.
112.6,600.e-10,0.,632.4,44.6,0.,0.007692,8.e-6,0.
14000.,0.,0.,0.050,0.
14000.,0.,10900.,0.056,0.
12800.,150.,40000.,0.00005,1.4
0.,0.,15300.,0.,0.
25.,76.,185.e-7
c 30-gal drum w/ filter vent, 4 inner bags, 2 liner bags
c Value for volume within innermost bags not required.
c Void volume between bags: 10,900 cm3 (scaled from 55-gal drum value of 20,000 cm3)
c Bag thickness same as Scenario 3
c Void volume in 30-gal drum headspace = 15,300 cm3 (scaled from 55-gal drum value of 28,000 cm3)
c No liner (estimated by Ad=150 cm2, xd=1.4 cm, xp=0.00005)
c 30-gal drum filter vent = 1.85e-5 mol/s/mol fr
c VOC diff. char. estimated knowing D*H2, VOC Tc, VOC Pc

Output File for 30-Gallon Drum DAC Evaluation

30galdrum			
carbon tetrachloride	7	756.5144	814.9987
methanol	8	612.8073	663.1251
dichloromethane	5	762.1498	828.8836
toluene	3	904.2119	935.8895
trichloroethylene	3	878.6143	924.7414
butanol	5	809.4791	864.1644
chloroform	5	769.9742	842.9145
1,1-dichloroethene	**10**	**639.2377**	**696.2681**
methyl ethyl ketone	7	704.3638	778.6090
methyl isobutyl ketone	9	696.7892	764.4190
1,1,2,2-tetrachloroethane	1	950.9211	976.5667
chlorobenzene	3	887.4651	930.9960

Appendix D

WHY THE SHIELDED CONTAINER MODIFICATION IS NOT A CLASS 3 MODIFICATION

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WHY THE SHIELDED CONTAINER MODIFICATION IS NOT A CLASS 3 MODIFICATION

PART 1 REGULATORY ANALYSIS

In 1988 the Environmental Protection Agency (EPA) codified the process for modifying Resource Conservation and Recovery Act (RCRA) permits. The EPA established a tiered system that assured that modifications received a proper level of public involvement. The system consists of two fundamental parts: the process for modifying Permits based on the Classification of a modification; and the Classification process. This paper focuses on the classification of a modification.

In the Rulemaking, the EPA stated the following fundamental premise for the classification system"

> *As defined in revised § 270.42, Class 1 and 2 permittee-requested modifications do not substantially alter existing permit conditions or significantly affect the overall operation of the facility. Class 1 covers routine changes, such as changing typographical errors, upgrading plans and records maintained by the facility, or replacing equipment with functionally equivalent equipment. Class 2 modifications address common or frequently occurring changes needed to maintain a facility's capability to manage wastes safely or to conform with new regulatory requirements. Class 3 modifications cover major changes that substantially alter the facility or its operations.* (53 FR 37912-01, p. 37913).

There are no facility alterations being proposed by this modification and the changes are descriptive in nature mostly duplicating information relevant to containers already in the Permit.

The EPA's determination of how the various changes in Appendix I of 40 CFR 270.42 are to be classified clearly reflects this philosophy. The shielded container modification does not substantially alter the facility or its operations as is evident from the descriptions in the Overview and the limited number of changes in the Permit.

Also in the Rulemaking, the EPA allows the Permittee to elect to follow the procedures of a Class 2 modification for a Class 1 modification if the regulatory agency is notified.

> *Several commenters asked for a specified timeframe for Agency decisions for the Class 1 modifications that require prior approval. Therefore, in today's rule a new provision has been added at § 270.42(a)(3) that allows the permittee to elect to follow the Class 2 process instead of the Class 1 procedures. As discussed in the following section, the Class 2 process will assure that an Agency decision will be made on the modification request within established timeframes (generally 90 to 120 days). This approach will also result in additional public participation regarding the permittee's request. Furthermore, the deadlines in the Class 2 process balance the concerns of the Agency, the public, and the permittee, and are readily adaptable to the types of facility changes encompassed in Class 1.* (53 FR 37912-01, p. 37915)

The EPA realized that there would be times when a Permittee would seek a modification that is not included in Appendix I. They addressed this in the Rulemaking:

:01612

Although EPA has sought to provide a complete list of possible permit modifications and their classifications in Appendix I, there will undoubtedly be permit modification requests that are not included in Appendix I. Therefore, EPA today is establishing procedures that permittees can use under § 270.42(d) where a permittee wishing to make a permit modification not included in Appendix I can submit a Class 3 modification request, or alternatively ask the Agency for a determination that Class 1 or 2 modification procedures should apply. In making this determination, the Agency will consider the similarity of the requested modification to modifications listed in Appendix I, and will also apply the general definitions of Class 1, 2, and 3 modifications. It should be noted that EPA intends to monitor decisions by permitting authorities (both EPA Regional offices and authorized States) on modification request classifications and will periodically amend Appendix I of this regulation to include new classifications. (53 FR 37912-01, p. 37919)

The plain meaning of this is that because the Shielded Container modification is covered by at least one entry in Appendix I of 40 CFR 270.42, then the classification is appropriate and correct. This is reinforced by the NMED's own ruling on August 30, 2001 when they stated:

5. If the Permittees decide to submit another modification request addressing additional containers, new uses for existing containers, and the impacts on facility storage capacity, they should provide sufficient information to determine whether the modification would be considered a Class 2 or a Class 3 modification. This determination would be based upon calculations demonstrating the percent increase in the facility's container storage capacity, considering the impact on both the Parking Area Unit and the WHB Unit." (Letter from Gregory J Lewis to Dr. Ines Triay and Mr. John Lee, August 30, 2001)

The NMED supported this policy with a response to classify a modification to add a new container to the Permit in the following letter:

2. Class 2 modification: Add Waste Containers

This modification is related to several earlier permit modification requests (November 15, 1999, Item 4; July 20, 2000, Item2.d; April 27, 2001, Item 1) regarding additional waste containers that NMED previously rejected or denied (August 4, 2000; August 30, 2001). The current modification request seeks to allow the direct loading of ten drum overpacks (TDOPs), direct loaded 85-gallon drums, and 100-gallon drums in addition to the currently permitted containers for waste management at WIPP. In requesting a class determination, the Permittees cite 40 CFR §270.42 Appendix I, Item F.2.a (modification of a container unit without increasing the capacity of the unit) as the most analogous modification, which is considered a Class 2 modification according to the regulations.

NMED agrees, and has determined that this item [new containers] *is a Class 2 modification, subject to the permit modification requirements of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42(b)).* (Letter from James Bearzi to Dr. Ines Triay and Mr. John Lee, July 22, 2002)

In conclusion, the Permittees have the following factors that indicate this is a Class 2 modification:

REGULATIONS: 40 CFR 270.42, Appendix I, Item F.3.b . covers the precise situation that the Permittees are proposing. In addition, the Permittees are making an "other change" to the Waste Analysis Plan (Item B.1.d.), also a Class 2.

GUIDANCE: The letters from the NMED of August 30, 2001 and July 22, 2002 clearly put this modification in Class 2 space.

PRECEDENT: New Mexico Environment Department (NMED) has approved the following modifications as Class 2 Permit Modifications:

- Direct loaded ten drum overpack (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.
- Direct loaded 85-gallon drums (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.
- Addition of 100-gallon drums (approved 11-25-2002) 40 CFR 270.42 Appendix I Item # F.a.2.
- Addition of a standard large box 2 (SLB2) (approved 4-15-2011) 40 CFR 270.42 Appendix I Item # F.a.2.
- Addition of a HalfPACT shipping package (approved 11-25-2002) based upon an August 30, 2001, NMED letter that indicates that the addition of waste management containers is not a "non-substantive" change and, therefore, should be processed as a Class 2 Permit Modification.
- Addition of a TRUPACT III shipping package (approved 4-15-2011) 40 CFR 270.42 Appendix I Item # F.a.2

PART 2 DISCUSSION OF STAKEHOLDER'S REQUESTS FOR CLASS 3

Some stakeholders have indicated that the modification should follow the procedures of a Class 3 due to substantial public interest because this PMR is related to RH TRU mixed waste and this makes it a complex modification. The EPA built in the option that the regulatory agency can elevate the modification to a Class 3 under certain specific conditions as follows:

> *At the same time, the safeguards built into today's rule will ensure that Class 2 modifications receive sufficient review and that risks are limited under automatic authorizations. These safeguards include: (1) Limitations on the types of modifications that can be made under Class 2 procedures, (2) the Agency's authority to reject Class 2 modification requests because the applications are incomplete, or to require that they undergo Class 3 procedures (a new requirement in this final rule), (3) the fact that the Agency has up to 300 days to revoke an automatic authorization, if human health or environmental concerns are identified, and (4) the requirement that activities under automatic authorizations comply with Part 265 requirements.*
>
> *As noted above, these safeguards include one significant new requirement, which EPA has included in response to commenters' concerns about the default provision. Section 270.42(b)(6) has been amended to allow the Director to determine that a Class 2 modification request should instead follow the Class 3 modification procedures. The Director may make this determination by the 90-day deadline (or 120-day deadline, if extended) required for Class 2 modifications, provided that there is significant public concern about the proposed modification or if he believes that the nature of the change warrants the more extensive procedures of Class 3. Therefore, if members of the public feel strongly that a Class 2 modification request should be subject to the Part 124*

approval procedures contained in Class 3, they can raise this issue with the Agency during the comment period and express the reasons why the Class 2 process is not appropriate in the particular case. (53 FR 37912-01, p. 37917)

Substantial public interest simply because this is related to RH TRU mixed waste does not justify making this modification request a Class 3. The permitting process allowed significant public participation in the process of approving the WIPP Permit and modifying it to include RH TRU waste, consistent with the intent of the EPA and the New Mexico Hazardous Waste Act. However, the rules do not automatically parlay that substantial public interest into each modification that is requested. In fact, as seen above, the tiered modification system is established to promote acceptable levels of public participation in changes to the facility prior to making those changes. Furthermore, this change does not impact RH TRU mixed waste management since shielded containers will be managed as CH TRU mixed waste. The changes being proposed are few and simple. The proposed changes are fewer and much less complex than the TRUPACT-III changes that were recently adjudicated as a class 2 PMR. In fact, managing RH TRU waste as CH TRU waste greatly simplifies the handling process and allows it to be handled in a quarter of the time.

: 01615

Draft Permit Modification Request

Addition of a Shielded Container

Albuquerque, New Mexico
June 7, 2012

091619

Proposed Permit Changes

- The modification proposes the following changes to the Permit
  - Addition of new shielded container for managing remote-handled transuranic mixed waste as contact-handled transuranic mixed waste since the surface dose rate is less than 200 millirem/hour
  - Description of how the volume of remote-handled transuranic mixed waste which is disposed in shielded containers will be tracked
  - Description of how shielded containers are managed, stored, and disposed using the existing contact-handled transuranic mixed waste handling processes
  - Includes shielded container under the 55-gallon drum age criterion

01617

Basis of Classification

- Class 2 PMR as stated in 20.4.1.900 NMAC (incorporating 40 CFR, §270.42(b)), Appendix I, Item F.3.b : "*Storage of different wastes in containers,…. **That do not** require additional or different management practices from those authorized in the permit.*"

  - The shielded container will contain hazardous waste already approved for disposal at the WIPP facility, however, that waste (remote-handled transuranic mixed waste) is approved for management in the RH Complex and not in the CH Bay.

  - This type of modification is similar to what EPA describes as a **"different waste in** a particular unit." **EPA added this item (F.3.b) to the RCRA regulations in 1988** (53 FR 37927, September 28, 1988).

- Consistent with NMED instruction regarding classification of container modifications (letter dated August 30, 2001, Attachment 1, Item 5)

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Description of Shielded Container

- Dimensions
  - Outside: height ~35 ¾ inches, diameter ~23 inches
  - Inside: height ~29 ¾ inches, diameter ~20 3/8 inches
- Construction
  - External side wall: ~1/8 inch steel
  - Internal side wall: ~3/16 inch steel
  - Shielding between walls: ~ 1 inch lead
  - Lid: ~ 3 inch steel
  - Bottom: ~ 3 inch steel
- Weight
  - Empty: ~1,726 lbs
  - Maximum gross: 2,260 lbs
- Waste Loading and Venting
  - RH TRU waste must be loaded into a vented 30-gallon drum
  - Shielded container and 30 gallon drum must be vented

9161

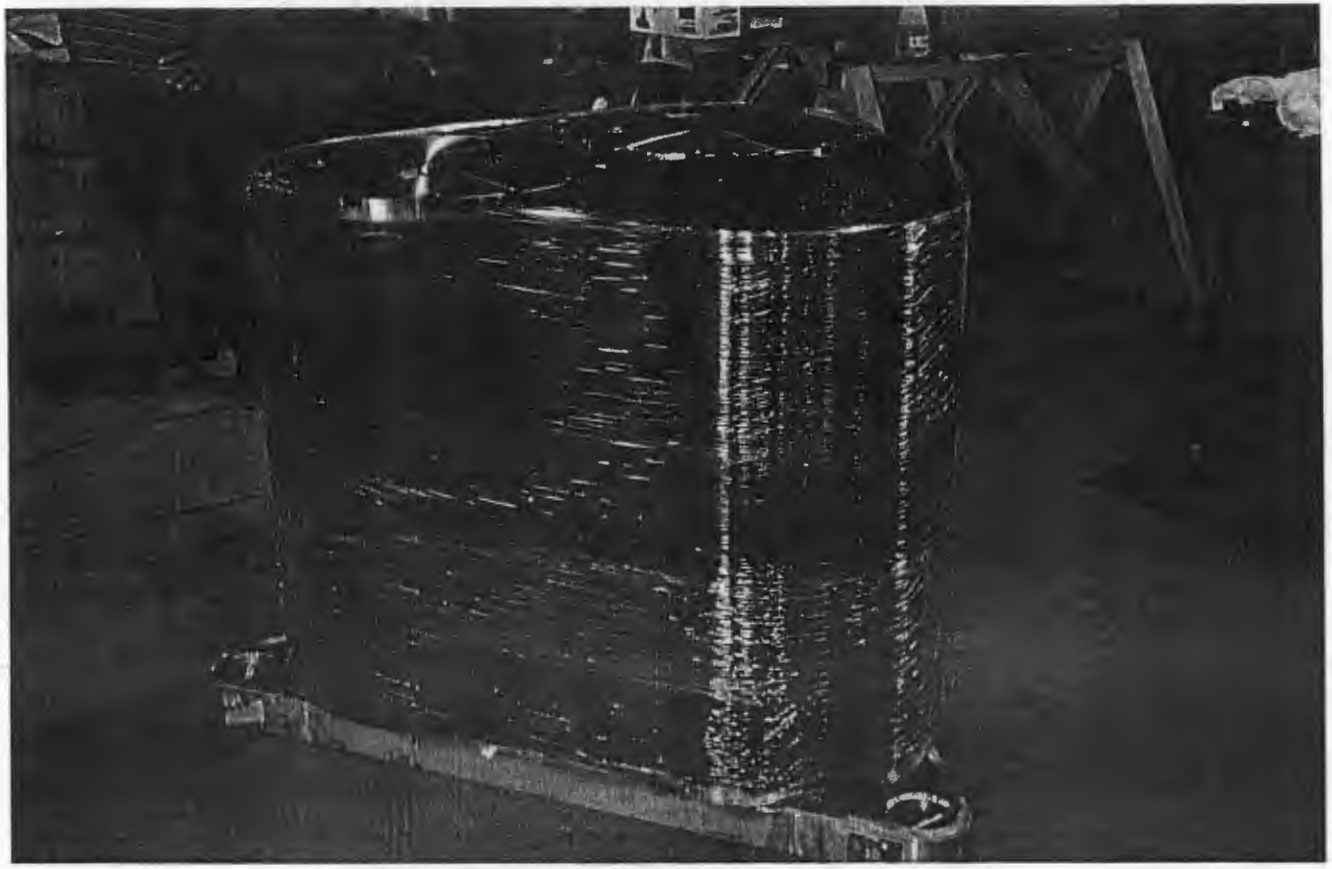
30-gallon Drum inside a Shielded Container

494 lb empty

560 lb
Total Gross

: 01620

3 Shielded Containers on a Pallet



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Radial Shock Absorber

01622

Shielded Container Approvals

- DOT Type 7A
  - Per Permit Part 3, Section 3.3.1.
- Package approved by NRC for shipment in HalfPACT
  - Drop Tested
  - Certification of Compliance on NRC webpage
- Approved by EPA
  - No detrimental effects on repository performance
  - Approval on EPA/WIPP docket
- Within WIPP safety envelope per 10 CFR 830

01923

At the Generator/Storage Site

- RH TRU waste placed into Shielded Containers will be characterized per Permit Attachments C-C6

At the WIPP Facility

- Why is it ok to manage as CH TRU waste?
  - Shielded containers are designed to be compatible with the CH TRU waste process and equipment
  - Because surface does rate is < 200 millirems/hour
  - Meets CH TRU waste definition
    - Permit Part 1, Section 1.5.1.

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At the WIPP Facility

- The Permittees are not asking for change in
  - process changes
  - Storage capacities
  - Storage time limits in Parking Area Unit or Waste Handling Building Unit
  - Disposal capacities
- These limits are not impacted by this Permit Modification Request

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Primary Changes to the Overview

- Specifies overpack containers to be used for shield containers
- Discusses drum handling bag impact on DAC
- Clarifies that 30 gallon drum is waste container subject to characterization
- Adds definitions of RH and CH TRU mixed wastes to clarify why the waste will be managed as CH TRU mixed waste
- References stability requirements for underground stacking of waste containers
- Provides more justification for basis of classification

J. Kelly

July 12, 2012

Waste Isolation Pilot Plant

Fact Sheet

ENTERED
RECEIVED
JUL 2012
NMED Hazardous Waste Bureau

DOE Proposes Modification To Hazardous Waste Facility Permit

Changes to the WIPP Hazardous Waste Facility Permit

Background

The U.S. Department of Energy Carlsbad Field Office (DOE) and Washington TRU Solutions LLC (WTS) submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED) to change the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit). The NMED issued the Permit (Permit Number: NM4890139088-TSDF) in November 2010.

What is Proposed?

The proposed modification submitted to NMED on July 5, 2012 is:

Addition of a Shielded Container

The generator/storage sites are proposing to package a portion of the remote-handled (RH) transuranic (TRU) mixed waste inventory in shielded containers for disposal at the WIPP facility. The use of the shielded containers will enable the WIPP facility to have an approved container to manage, store, and dispose RH TRU mixed waste as CH TRU mixed waste. Shielded containers will be transported to the WIPP in 3-pack assemblies in the HalfPACT transportation package and comply with the U.S. Department of Transportation requirements for a Type 7A container. The RH TRU mixed waste that will be packaged in these containers is the same type of waste that is currently being disposed at the WIPP. This waste will continue to count against the total RH TRU waste volume allowed for disposal at the WIPP facility, as specified in the Permit.

The shielded containers are similar to a 55-gallon drum, however, they consist of approximately one-inch of lead shielding that is located between a three-inch inner and outer steel wall. A shipment will consist of a three-shielded container assembly. Once they arrive at the WIPP facility, employees will unload and process the shipment in the using existing CH-TRU mixed waste shipment equipment and procedures.

Comments

Comments for the record must be sent to Ms. Trais Kliphaus, New Mexico Environment Department, 2905 Rodeo Park Drive, Building 1, Santa Fe, NM 87505. They also may be e-mailed: trais.kliphuis@state.nm.us or faxed to 505-476-6060. Only written comments will be accepted and must be received no later than 5 p.m. (MDT) on

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September 10, 2012. A copy of the permit modification may be viewed or copied at the NMED offices of Ms. Kliphuis. To be placed on the WIPP mailing list, contact Ms. Kliphuis at the address above.

For more Information

For more information about transuranic waste shipments and procedures, call the WIPP Information Center at 1-800-336-WIPP (9477). This permit modification request is available for review in the Information Repository located on the WIPP home page at www.wipp.energy.gov. Comments to the Permittees regarding this permit modification may be sent to Mr. Bobby St. John, Washington TRU Solutions LLC, P.O. Box 2078, Carlsbad, NM 88221.

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RECEIVED
JUL 2012
NMED Hazardous Waste Bureau

Waste Isolation Pilot Plant

CORRECTED

Fact Sheet

July 16, 2012

DOE Proposes Modification To Hazardous Waste Facility Permit

Changes to the WIPP Hazardous Waste Facility Permit

Background

The U.S. Department of Energy Carlsbad Field Office (DOE) and Washington TRU Solutions LLC (WTS) submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED) to change the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit) on July 5, 2012. The NMED issued the Permit (Permit Number: NM4890139088-TSDF) in November 2010.

What is Proposed?

Addition of a Shielded Container

The generator/storage sites are proposing to package a portion of the remote-handled (RH) transuranic (TRU) mixed waste inventory in shielded containers for disposal at the WIPP facility. The approval of the shielded containers will enable the WIPP facility manage, store, and dispose of RH TRU mixed waste as CH TRU mixed waste. Shielded containers have already been approved by the Nuclear Regulatory Commission for transport to the WIPP facility in 3-pack assemblies in the HalfPACT transportation package. Shielded containers also comply with the U.S. Department of Transportation requirements for a Type 7A container. The RH TRU mixed waste that will be packaged in these containers is the same type of waste that is currently being disposed at the WIPP facility. This waste will continue to count against the total RH TRU waste volume allowed for disposal at the WIPP facility as specified in the Permit.

The shielded containers are similar to a 55-gallon drum, however, they consist of approximately one-inch of lead shielding that is located between an inner and outer steel wall and approximately 3" of steel on the top and bottom. Once shielded containers arrive at the WIPP facility, employees will unload and process the shipment in the Waste Handling Building using existing CH-TRU mixed waste shipment equipment and procedures.

Comments

Comments for the record must be sent to Ms. Trais Kliphuis, New Mexico Environment Department, 2905 Rodeo Park Drive, Building 1, Santa Fe, NM 87505. They also may be e-mailed: trais.kliphuis@state.nm.us or faxed to 505-476-6060. Only written comments

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will be accepted and must be received no later than 5 p.m. (MDT) on September 4, 2012. A copy of the permit modification may be viewed or copied at the NMED offices of Ms. Kliphuis. To be placed on the WIPP mailing list, contact Ms. Kliphuis at the address above.

For more Information

For more information about transuranic waste shipments and procedures, call the WIPP Information Center at 1-800-336-WIPP (9477). This permit modification request is available for review in the Information Repository located on the WIPP home page at www.wipp.energy.gov. Comments to the Permittees regarding this permit modification may be sent to Mr. Bobby St. John, Washington TRU Solutions LLC, P.O. Box 2078, Carlsbad, NM 88221.

PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO: U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)

WHAT: DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.

WHEN:

Tuesday, August 14, 2012
5 – 6 p.m.

Thursday, August 16, 2012
2 – 4 p.m. & 6 – 8 p.m.

WHERE:

Skeen-Whitlock Building
4021 National Parks Highway
Carlsbad, New Mexico

Courtyard by Marriott
3347 Cerrillos Road
Santa Fe, New Mexico

WHY: On July 5, 2012, DOE submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED). The permit modification request proposes to:

Add a shielded container for use at WIPP

This request is to add an additional container to the list of approved containers for disposal at WIPP. The container will allow the Permittees to handle waste that is packaged in a shielded container.

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COMMENTS: Written comments for the record must be sent to the NMED contact person at the address below and received no later than 5 p.m. on September 10, 2012:

Ms. Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, N.M. 87505
Phone: 505-476-6051
Fax: 505-476-6060
E-mail: trais.kliphuis@state.nm.us

The Permittees' compliance history during the life of the permit being modified is available from Ms. Kliphuis at the New Mexico Environment Department.

QUESTIONS: Any questions or comments to the Permitees regarding this permit modification may be sent to Mr. Bobby St. John, P.O. Box 2078, Carlsbad, N.M. 88221, no later than August 27, 2012.

WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov / toll-free: 1-866-271-9640 / e-mail: communityrelations@wipp.ws

PUBLIC INFORMATION MEETINGS

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Waste Isolation Pilot Plant

CORRECTED

July 23, 2012

Fact Sheet

DOE Proposes Modification To Hazardous Waste Facility Permit

Changes to the WIPP Hazardous Waste Facility Permit

Background

The U.S. Department of Energy Carlsbad Field Office (DOE) and Washington TRU Solutions LLC (WTS) submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED) to change the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit) on July 5, 2012. The NMED issued the Permit (Permit Number: NM4890139088-TSDF) in November 2010.

What is Proposed?

Addition of a Shielded Container

The generator/storage sites are proposing to package a portion of the remote-handled (RH) transuranic (TRU) mixed waste inventory in shielded containers for disposal at the WIPP facility. The approval of the shielded containers will enable the WIPP facility to manage, store, and dispose RH TRU mixed waste as CH TRU mixed waste. Shielded containers have already been approved by the Nuclear Regulatory Commission for transport to the WIPP facility in 3-pack assemblies in the HalfPACT transportation package. Shielded containers also comply with the U.S. Department of Transportation requirements for a Type 7A container. The RH TRU mixed waste that will be packaged in these containers is the same type of waste that is currently being disposed at the WIPP facility. This waste will continue to count against the total RH TRU waste volume allowed for disposal at the WIPP facility as specified in the Permit.

The shielded containers are similar to a 55-gallon drum, however, they consist of approximately one-inch of lead shielding that is located between an inner and outer steel wall and approximately 3" of steel on the top and bottom. Once shielded containers arrive at the WIPP facility, employees will unload and process the shipment in the Waste Handling Building using existing CH-TRU mixed waste shipment equipment and procedures.

Comments

Comments for the record must be sent to Ms. Trais Kliphuis, New Mexico Environment Department, 2905 Rodeo Park Drive, Building 1, Santa Fe, NM 87505. They also may be e-mailed: trais.kliphuis@state.nm.us or faxed to 505-476-6060. Only written comments

01634

will be accepted and must be received no later than 5 p.m. (MDT) on September 10, 2012. A copy of the permit modification may be viewed or copied at the NMED offices of Ms. Kliphuis. To be placed on the WIPP mailing list, contact Ms. Kliphuis at the address above.

For more Information

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: 01635

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

SEP 1 0 2012

RECEIVED
SEP 2012
NMED Hazardous Waste Bureau

Mr. John E. Kieling, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Notification of Public Notice and Fact Sheet to the Waste Isolation Pilot Plant Mailing List Permit Number NM4890139088-TSDF

Dear Mr. Kieling:

The purpose of this letter is to provide the New Mexico Environment Department with the information identified in 20.4.1.900 New Mexico Administrative Code (NMAC) incorporating 40 CFR 270.42(b)(2) regarding the Class 2 permit modification request entitled *Addition of a Shielded Container*. The information the Permittees mailed and published is included in Enclosures 1 and 2 and is summarized below:

Enclosure 1

- Public Notice for a Class 2 PMR entitled, *Add a Shielded Container for use at WIPP.*
- Fact Sheet for a Class 2 PMR entitled, *Changes to the WIPP Hazardous Waste Facility Permit*

Enclosure 2 (Evidence of the mailing and publication including)

- Copy of the receipt from Mail Service Center, indicating a mail out to the WIPP Facility Mailing List
- Copy of the Public Notice from the Albuquerque Journal
- Copy of the Public Notice from the Carlsbad Current-Argus
- Copy of the Public Notice from the Santa Fe New Mexican

We certify under penalty of law that this document and all attachments were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

120920

CBFO:OESH:GTB:ANC:12-0784:UFC 5487.00

636

If you have questions regarding this submittal, please contact Mr. George T. Basabilvazo at (575) 234-7488.

Sincerely

Jose R. Franco, Manager
Carlsbad Field Office

M.F. Sharif, General Manager
Washington TRU Solutions LLC

Enclosures (2)

cc: w/enclosures
J. Davis, NMED *ED
T. Kliphuis, NMED ED
C. Walker, Trinity Engineering ED
CBFO M&RC
*ED denotes electronic distribution

Enclosure 1

3 Pages

1a) Public Notice for a Class 2 PMR entitled, *Add a shielded container for use at WIPP*

1b) Fact Sheet for a Class 2 PMR entitled, Changes to the WIPP Hazardous Waste Facility Permit

PUBLIC INFORMATION MEETINGS

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WHERE:
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WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov / toll-free: 1-866-271-9640 / e-mail: communityrelations@wipp.ws

: 01639

Enclosure 2 (Evidence of the mailing and publication including)

4 Pages

2a) Copy of the receipt from Mail Service Center, indicating a mail out to the WIPP Facility Mailing List

2b) Copy of the Public Notice from the Albuquerque Journal

2c) Copy of the Public Notice from the Carlsbad Current-Argus

2d) Copy of the Public Notice from the Santa Fe New Mexican

MAIL SERVICE CENTER
522 W. MERMOD
CARLSBAD, NM 88220

Statement

Date
8/1/2012

To:

WASHINGTON TRU SOLUTIONS LLC
BOBBY ST. JOHN-COMMUNICATIONS
PO BOX 3090
CARLSBAD, NM 88221-3090

Amount Due	Amount Enc.
$671.50	

Date	Transaction	Amount	Balance
07/14/2012	Balance forward		1,025.88
07/18/2012	INV #1030539.	304.75	1,330.63
07/19/2012	PMT #28541.	-659.13	671.50

Current	1-30 Days Past Due	31-60 Days Past Due	61-90 Days Past Due	Over 90 Days Past Due	Amount Due
0.00	671.50	0.00	0.00	0.00	$671.50

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GOP Offers Working Folks a 'You're On Your Own'

By David Pritchett
Santa Fe resident

Mitt Romney pledged that he would repeal Obamacare on his first day as president if he wins. The ultra-conservative billionaire Koch brothers have allocated $9 million from their super-PAC Americans for Prosperity to run ads in swing states calling for repeal of the law and thus for the defeat of President Obama in the November elections.

How quickly the Republicans forget!

The foundation of Obamacare, the individual mandate, upheld as constitutional by the Supreme Court, was the subject of a report and recommendation in 1989 by the Heritage Foundation, a conservative think tank.

The idea was incorporated in Republican-sponsored legislation as a viable alternative to the health care reforms sought by President Bill Clinton. Bob Dole, a Republican presidential candidate, was a co-sponsor of the bill.

Mitt Romney endorsed the bipartisan Wyden-Bennett bill, whose centerpiece was the individual mandate, in a 2009 interview with "Meet the Press." He has now come 180 degrees. Why?

The reason for Romney's switch is that his money sponsors — people like the Koch brothers — believe that the United States should be a "you're on your own" kind of place where the smart and wealthy and well-placed take care of themselves and the others. "Oh well, tough luck, you're on your own."

Sorry that you can't afford the health insurance premiums because you are unemployed or because, as most Americans, your income has not risen in real terms for about 40 years while health insurance costs have skyrocketed. Sorry that you have a pre-existing condition that won't be insured because the financial risk to a corporate interest is deemed too high to take. There is always the choice of suffering with your condition or incurring enormous debt — so large, in fact, that you are likely to have to file for personal bankruptcy.

The opposition to "Obamacare" is only a part of the picture.

The deck is badly stacked against ordinary Americans already as a result of the continued rising economic inequities in our society. This information is not new.

Financial inequality — the gap between the rich and the rest of us — has been growing over the past 40 years. Now, 1 percent of our citizens own 36 percent of the nation's wealth. The top 20 percent own 85 percent of United States' wealth, leaving the other 15 percent shared by 80 percent of our people.

The economy essentially doubled in the last 40 years. Half got little benefit, as the median wage grew only 7 per cent during that period.

According to recent statistics, 76 million Americans earn less than the median income of $34,000 per year and 25 percent of all jobs pay less than $22,000 per year, the Federal poverty level for a family of four.

These statistics should enrage every working man and woman in America, creating purpose for social unrest.

This disturbing growing wealth gap benefits few to the detriment of many and contributes significantly to long term national economic decline, ultimately depriving everyone irrespective of their current economic or social status.

In my view it would be a shame for us to continue this trend by electing a president who promises to begin his term by overturning a signature safety net law that finally bucks the trend.

I don't want to live in a nation that tells its sick and disadvantaged "you're on your own."

General Calls for Return of the Draft

By John Rogin
Foreign Policy

WASHINGTON — Gen. Stanley McChrystal, the former top commander of international forces in Afghanistan, said recently that the United States should bring back the draft if it ever goes to war again.

"I think we ought to have a draft. I think if a nation goes to war, it shouldn't be solely be represented by a professional force, because it gets to be unrepresentative of the population," McChrystal said at a late-night event June 29 at the 2012 Aspen Ideas Festival. "I think if a nation goes to war, every town, every city needs to be at risk. You make that decision, and everybody has skin in the game."

He argued that the burdens of the wars in Iraq and Afghanistan haven't been properly shared across the U.S. population, and emphasized that the U.S. military could train draftees so that there wouldn't be a loss of effectiveness in the war effort.

"I've enjoyed the benefits of a professional service, but I think we'd be better if we actually went to a draft these days," he said. "There would some loss of professionalism, but for the nation it would be a better course."

The wars in Afghanistan and Iraq placed unfair and extreme burdens on the professional military, especially reservists, and their families, McChrystal said.

"We've never done that in the United State before; we've never fought an extended war with an all-volunteer military. So what it means is you've got a very small population that you're going to, and you're going to it over and over again," he said. "Because it's less than 1 percent of the population ... people are very supportive, but they don't have the same connection to it."

Reservists following multiple deployments have trouble maintaining careers and families and have a "frighteningly high" rate of suicide, he said.

"The reserve structure is designed for major war, you fight and then you stop, but what we've done instead is gone back over and over to the same people," he said. "We're going to have to relook the whole model because I don't think we can do this again."

McChrystal was speaking at a panel focused on how to manage marriage in the military. He was joined by Annie, his wife of 35 years, and the discussion was moderated by CNN's Suzanne Malveaux.

Multiple deployments often result in divorces and split families, he said.

"The marriages I see most strained are the senior NCOs (non-commissioned officers) and officers who have four or five tours ... you're apart so much that it's hard to have a marriage if you're not together at least a critical mass of time, and that's tough," McChrystal said.

Malveaux asked McChrystal how he has managed to get through 36 years of marriage.

"One day at a time," he responded.

Catholics Follow Consciences, Too

By George Gibbs
Albuquerque resident

This is in response to the comments of Joan Lamunyon Sanford, the executive director of the New Mexico Religious Coalition for Reproductive Choice, which were published in the Monday edition of the Albuquerque Journal under the heading: "Birth Control a Matter of Conscience."

Sanford has taken aim at an old but ongoing dispute, the forcing of taxpayers to fund birth control. However, this time the guns are armed with new ammunition — the stand that has been taken by the Catholic bishops of the country.

Either Sanford hasn't read the literature put forth by the bishops or she hasn't paid much attention to media reports on the matter. In both cases the point has been made that what is at stake is the religious freedom of caring people, of people who serve the needs of others, to not be forced to violate the laws of God.

It seems as though Sanford would like to use the argument, "If you can't stand the heat, get out of the kitchen," against those people whose consciences are diametrically opposite to the consciences of the members of her group. In other words, if you can't, in good conscience, provide people with birth control or the clinic or hospital where you work, maybe it's time you look for a different job.

And let's extend that thought a little farther: If the Catholic or other religiously based hospital or clinic cannot, in good conscience, acquiesce to the government's demands that it provide birth control as a condition of receiving Medicare or other federal funding, maybe it is time for it to close its doors to all the people who depend on it and turn itself into an office building.

Sanford writes, "The freedom and conscience that must be protected is that of individuals." I couldn't agree more, in fact, that is what I have been saying.

She concludes her sentence by indicating that such freedoms do not belong in the hands of "... a corporation such as the U.S. Conference of Catholic Bishops."

But again the point is totally missed. The bishops are not pressing the matter as a means of gaining more authority or power. They are speaking on behalf of people who will be forced to do something against their will, against their religious beliefs.

Yes, traditional belief of the Catholic Church says that artificial birth control is wrong, and the bishops continue to support that doctrine.

But that is part of an old battle: let's not blackmail people of deep religious faith into doing something they know to be morally wrong.

Letter policy

Letters expressing opinions on news and commentary published in the Albuquerque Journal are welcome. They may appear in electronic media, including the Journal's Web site and searchable archives as well as in print. All letters and opinion articles are edited.

Letters to the Journal, P.O. Drawer J, Albuquerque, N.M. 87103

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PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO:	U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)
WHAT:	DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.
WHEN:	Tuesday, August 14, 2012, 5 – 6 p.m. and Thursday, August 16, 2012, 2 – 4 p.m. & 5 – 8 p.m.
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COMMENTS:	Written comments for the record must be sent to the NMED contact person at the address below and received no later than 5 p.m. on September 10, 2012: Ms. Trais Kliphuis New Mexico Environment Department 2905 Rodeo Park Drive East, Building 1 Santa Fe, N.M. 87505 Phone: 505-476-6051 Fax: 505-476-6060 E-mail: trais.kliphuis@state.nm.us The Permittees' compliance history during the life of the permit being modified is available from Ms. Kliphuis at the New Mexico Environment Department.
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WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov / toll-free: 1-866-271-9840 / e-mail: communityrelations@wipp.ws

OUTDOORS

The fishing report is provided by [illegible] and the Department of Game and Fish. It has been generated from the best information available from area offices and anglers. Conditions encountered after the report is compiled may differ, as stream, lake and weather conditions alter fish and angler activities.

JULY 11, 2012

Southeast

▶ **Bataan Lake:** We had no reports from anglers this week.

▶ **Bonito Lake.** The lake and surrounding area remain closed to fishing due to the recent fire in the area. Check for updates in later reports.

▶ **Bosque Redondo:** Fishing was fair using nightcrawlers, shrimp and chicken liver for catfish. We had no reports on other species.

▶ **Bottomless Lakes:** Fishing was slow for all species.

▶ **Brantley Lake.** Anglers are to practice catch-and-release for all fish here as high levels of DDT were found in several fish.

▶ **Carlsbad Municipal Lake:** We had no reports from anglers this week.

▶ **Grindstone Reservoir:** Trout fishing was slow to fair using salmon peach Power Bait, Pistol Petes and salmon eggs.

▶ **Jal Lake:** Fishing was fair using liver and hot dogs for catfish.

▶ **Lake Van:** Fishing was fair using liver and shrimp for catfish. We had no reports on other species.

▶ **Oasis Park Lake:** Fishing was slow for all species.

▶ **Pecos River:** Water flow on Monday below Sumner Lake was 95 cfs. Fishing was slow for all species.

▶ **Perch Lake:** Fishing was slow.

▶ **Ruidoso River:** Water flow at Hollywood on Monday was 6.6 cfs. We had no reports from anglers this week.

▶ **Santa Rosa Lake:** Fishing was good using minnows, crank baits, grubs and sassy shad for walleye. Fishing was good using crank baits, tubes and top water lures for smallmouth bass and largemouth bass. Fishing for crappie was fair to good using minnows and jigs. Fishing was good using liver, shrimp and homemade dough bait for catfish. The boat ramp remains open. The surface water temp was in the high 60s.

▶ **Sumner Lake:** Fishing was generally slow but there were a few walleye taken by anglers using minnows, nightcrawlers and crank baits. The only boat ramp accessible at this time is the east-side ramp.

Northeast

▶ **Cabresto Lake:** The lake and campground closed May 14 and will stay closed for about six months while the dam is being rebuilt.

▶ **Charette Lakes:** Fishing was fair using salmon eggs, Power Bait, jigs and worms for trout and perch.

▶ **Cimarron River:** Hot spot for trout: Trout fishing continued to be very good this past week. Anglers did well using tricos, yellow sallies, elk hair caddis, spinners and worms. Water flow [illegible] Nest Lake on Monday was 13 cfs. Fishing at the Gravel Pit lakes was fair using Pistol Petes and Power Bait.

▶ **Clayton Lake:** Fishing was fair to good using Power Bait and homemade dough bait for trout. We had no reports on other species. Due to low water conditions, only small boats, kayaks and canoes can be launched.

▶ **Conchas Lake:** Fishing was fair to good using crank baits, grubs, bottom-bouncer nightcrawler combinations and sassy shad for walleye. Fishing was fair to good using crank baits, sassy shad, topwater lures and grubs for white bass. Fishing was fair to good using buzz baits, tubes, creature baits, jerk baits and crank baits for smallmouth bass and largemouth bass. Fishing was good using liver, shrimp, homemade dough baits and nightcrawlers for catfish. We had no reports on other species. The surface water temp was in the low 70s. The steep north side boat ramp is open.

▶ **Coyote Creek:** Trout fishing was fair using salmon eggs, Power Bait, worms and elk hair caddis.

▶ **Eagle Nest Lake:** Fishing was good using worms from the bank and from anchored boats for perch. Fishing was slow to fair using Kastmasters, Krocodile spoons and large spinners for northern pike. Fishing was fair trolling Panther Martins, Z Rays, double whammies and Pistol Petes for trout and kokanee.

▶ **El Rito Creek:** Trout fishing was good using PMDs, parachute adams, elk hair caddis and BWOs for 7 to 10 inch fish.

▶ **Hopewell Lake:** We had no reports from anglers this week.

▶ **Lake Maloya:** Fishing was good using Power Bait, Pistol Petes and an assortment of dry flies for trout.

▶ **Los Pinos:** Trout fishing was good using hoppers, elk hair caddis, copper John flies, spinners and salmon eggs.

▶ **Maxwell Lake 13:** We had no reports from anglers this week.

▶ **Monastery Lake:** Trout fishing was fair to good using garlic cheese, salmon peach Power Bait and Pistol Petes. Anglers fishing in the evening hours did well using a variety of dry flies.

▶ **Morphy Lake:** Fishing was fair using Power Bait, salmon eggs, garlic cheese and Pistol Petes.

▶ **Pecos River:** Water flow near the town of Pecos on Monday was 49 cfs. Trout fishing was good using tan and olive elk hair caddis, orange stimulators, royal Wulffs, prince nymphs and salmon eggs.

▶ **Red River:** Water flow below the hatchery was 45 cfs. Trout fishing was good using elk hair caddis, orange and yellow stimulators, small spinners and salmon eggs.

▶ **Rio Costilla:** Trout fishing was good using parachute adams, brown and olive elk hair caddis, yellow humpys, yellow sallies and orange stimulators. Through the Valle Vidal, Costilla and Comanche creeks were both fishing very well.

▶ **Rio Grande:** The water flow Monday at the Taos Junction Bridge was 343 cfs. Trout fishing was good using spinners, salmon eggs, hoppers, Chernobyl ants, copper John flies and orange and yellow stimulators. We had no reports on other species.

▶ **Rio Hondo:** Water flow near Valdez on Monday was 21 cfs. Trout fishing was very good using parachute adams, royal wulffs, hoppers and stimulators.

▶ **Santa Barbara:** Trout fishing was fair using elk hair caddis, yellow stimulators and yellow humpys.

▶ **Springer Lakes:** Fishing was slow for all species.

▶ **Storrie Lake:** Fishing was fair using Power Bait, cheese, corn and salmon eggs for trout. Fishing was slow to fair using liver and stink bait for catfish. We had no reports on other species.

▶ **Ute Lake:** Fishing was good using topwater lures, tubes, creature baits, senkos, grubs and soft plastics in shallow water for smallmouth bass and largemouth bass. Fishing was good using stink baits on the flats for catfish. Night fishing was good using minnows under a light for white bass. During the daytime hours anglers did well using topwater lures, crank baits and grubs. Fishing was fair using minnows and nightcrawlers in or next to submerged trees for walleye. Fishing was fair using worms for bluegill. The surface water temp was in the upper 60s.

▶ **Vallecitos Creek:** Fishing was fair using renegades, PMDs and royal coachmen for brown trout. Fletcher Dexon reported having a great time here and on El Rito Creek last week. He reported catching more fish on El Rito but more browns here including one that popped a coachman.

Northwest

▶ **Abiquiu Lake:** Fishing was good using curly tail grubs, crank baits, spinner-minnow combinations and nightcrawlers for walleye and smallmouth bass. Fishing was fair using nightcrawlers for bluegill. Fishing was fair to good using chicken liver and nightcrawlers for catfish. The best catfish reports came from anglers fishing at night. We had no reports on other species. The surface water temp was in the upper 60s.

▶ **Bluewater Lake:** Hot spot for tiger muskie: Fishing continued to be very good using swim baits, jerk baits, crank baits and large spoons for tiger musky. Most of the musky were in the 25 to 36 inch range. We had reports of 3 fish over 40 inches caught this past week but were unable to verify before press time. Recommend releasing short fish as soon as possible to keep them healthy and a big catch for the future. We had no reports on other species. The surface water temp was in the mid to high 60s.

Southwest

▶ **Bear Canyon:** We had no reports from anglers this week.

▶ **Bill Evans Lake:** We had no reports from anglers this week.

▶ **Caballo Lake:** Fishing was fair to good using crank baits, curly tail grubs and spinner minnow combinations for [illegible] Fishing was fair [illegible] using [illegible] combinations for walleye. Fishing was fair using shrimp and liver for catfish.

▶ **Elephant Butte:** Hot spot for white bass: Fishing was very good using [illegible] baits, spinners, Rat-L-Traps, Pop-Rs, Tucker Shad and [illegible] for white bass. We received several great reports from anglers fishing the Lone Pom and Kettle Top areas. Watch for the white bass busting on shad and have a great time. Fishing was fair to good using crank baits and spinner nightcrawler combinations for walleye. Fishing was fair using Pop-Rs, buzz baits, jerk baits, crank baits, tubes and creature baits for largemouth bass and smallmouth bass. Fishing was good using stink baits, chicken liver and shrimp for catfish. We had no reports on other species. Surface temps on the main lake were in the mid to upper 70s and the water level is dropping. The Monticello and Dam Site boat ramps remain closed.

▶ **Escondida Lake:** Fishing was fair using stink bait, worms and chicken liver for catfish. We had no reports on other species.

▶ **Gila River:** Water flow on the Gila as of this past Monday was 86 cfs. We had no reports from anglers this week. For updated information regarding closures in the area call 575-533-6231.

▶ **Glenwood Pond:** Trout fishing was good using Power Bait.

▶ **Lake Roberts:** Fishing was fair to good using salmon peach Power Bait, cheese and spinners for trout up to 20 inches. We had no reports on other species.

▶ **Percha Dam:** Fishing was good using grubs and minnows for walleye. Fishing was good using cut bait and liver for catfish.

▶ **Quemado Lake:** Fishing was slow for all species.

▶ **Rio Grande:** Water flow below Elephant Butte on Monday was 2,160 cfs. Fishing below Elephant Butte was fair to good using spinners, spoons, grubs and sassy shad for white bass and walleye. Fishing below Caballo was good using minnows, curly tail grubs and spoons for walleye and white bass.

▶ **Snow Lake:** The Snow Lake/Dipping Vat Campground has been closed until further notice due to the Whitewater/Baldy Complex fire. For more information call 575-533-6231.

Catches of the week

If you have a catch of the week story or just want to tell us about your latest New Mexico fishing experience, send it to us at fishforfun2@hotmail.com. We may include your story in our next report.

▶ **Cochiti Lake:** July 4, Lee Scott of Albuquerque caught and released a 36-inch, 10-pound northern pike. He was fishing from the bank and working the rocky shoreline with a Rooster Tail.

▶ **Elephant Butte Lake:** July 6, Randy Campbell of Sandia Park caught and released a 5.19-pound largemouth bass. He was using a crank bait. Randy also reported catching several 2- to 4-pound walleye on crank baits.

▶ **Bluewater Lake:** July 7, Nathan Pratt of Bernalillo and Valerie Tsosie of Albuquerque caught and released several tiger musky ranging from 24 to 36 inches. They were trolling a Strike King deep diver in a shad color.

The following came in too late for last week's report but we thought it was definitely worth mentioning.

▶ **Conchas Lake:** July 1, Eric McElroy of [illegible], Texas, caught and released a 6.3-pound largemouth bass. He was using a Texas-rigged 7-inch worm.

NOTICE

[illegible]

AVISO

DE SOLICITUD DE PERMISO RELATIVO A LA CALIDAD DEL AIRE

[illegible]

PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO: U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)

WHAT: DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.

WHEN: Tuesday, August [illegible] 5 – 8 p.m. | Thursday, August [illegible], 2012 2 – 4 p.m. and [illegible] p.m.

WHERE: [illegible] 4021 National Parks Highway, Carlsbad, New Mexico | [illegible] Santa Fe, New Mexico

WHY: On July 5, 2012, DOE submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED). [illegible]

[illegible]

Poll finds Obama has strong lead in N.M.

Heinrich has 9-point lead over Wilson in U.S. Senate race

By Steve Terrell
The New Mexican

An Illinois-based company on Wednesday released results of a new automated poll that show President Barack Obama with a double-digit lead over Republican Mitt Romney in the race for New Mexico's five electoral votes. The poll also shows Democratic U.S. Senate candidate Martin Heinrich is doing nearly as well in his race with Republican Heather Wilson.

Obama leads Romney 51 percent to 40 percent according to polling by the company, called We Ask America. Nine percent are undecided.

The same survey shows Heinrich with a nine-point lead over Wilson — 51 percent to 42 percent. Seven percent are undecided in this race, according to the poll.

The numbers in the presidential contest are generally in line with those from other recent polls in New Mexico. A late April poll by Democratic-leaning company Public Policy Polling showed Obama with a 14-point lead over Romney.

Obama in 2008 won the state by 15 percentage points over Republican John McCain.

However, the new Senate poll by We Ask America has Heinrich with a significantly stronger lead over Wilson than he has had in other polls. The April Public Policy Polling survey showed Heinrich with just a five-point lead over Wilson.

Apparently, the presidential poll did not include former New Mexico Gov. Gary Johnson, who is the Libertarian Party's candidate for president. The Public Policy Polling poll in April showed Johnson getting 15 percent of the vote when his name was included.

We Asked America conducted its poll Monday and Tuesday. A total of 1,227 "likely voters" were surveyed. The statistical margin of error is 2.8 percent.

The company apparently determined who was a "likely" voter by asking respondents about their intention to vote. The questions asked were, "If the election for president were held today, for whom would you vote?" and, "If the election for U.S. Senator were held today, for whom would you vote?"

We Ask America is a subsidiary of the Illinois Manufacturers' Association.

Contact Steve Terrell at sterrell@sfnewmexican.com. Read his political blog at roundhouseroundup.com.

ON THE WEB

http://weaskamerica.com/2012/07/11/pa-nm

Duran joins effort asking feds to help stop voter fraud

Secretary of state supports Colorado governor's request

By Steve Terrell
The New Mexican

New Mexico Secretary of State Dianna Duran this week joined with Republican elections officials from several other states in asking the U.S. Department of Homeland Security to help ensure that noncitizens aren't on voting rolls.

The request comes just months after Duran's office reported that a lengthy investigation here found evidence that a handful of noncitizens had cast ballots in New Mexico.

Colorado Secretary of State Scott Gessler on Monday wrote to Homeland Security Secretary Janet Napolitano on Monday, asking the agency to help verify the citizenship status of about 5,000 Colorado voters.

Gessler's letter said that nine secretaries of state — including Duran — and two lieutenant governors from states where that post oversees elections "share this approach and expect to request" similar agreements with the agency.

Duran's office on Wednesday verified that she supports Gessler's effort and provided a reporter with the July 6 letter she sent on to Gessler.

In that letter Duran wrote, "The New Mexico Secretary of State's office [illegible] undertaken similar efforts to ensure the accuracy of New Mexico's voter rolls. However, without a reliable means to determine citizenship we have been unable to determine if registered voters in New Mexico were in fact citizens and eligible to vote."

Both Gessler and Duran want to access Homeland Security's Systematic Alien Verification and Entitlement database, to match against state voter rolls.

Duran's letter concludes, "I support this initiative and stand ready to participate with any efforts in coordinating access to federal databases that contain accurate and reliable information that will assist us in our statutorily mandated duties."

The issue of alleged voter fraud has been a hot one for years in New Mexico and other states.

Republicans have accused Democrats of benefiting from fraud while Democrats have accused Republicans of using "voter fraud" as a cover for voter suppression.

Democrat Daniel Ivey-Soto, a former New Mexico elections director and lobbyist for the state county clerks association, said, "Certainly we want to make sure that only those eligible vote. But we need to be very careful that we don't remove [illegible] the voter rolls."

[illegible] says the only [illegible] to that [illegible] occur.

Viki Harrison, executive director of New Mexico Common Cause, said, "The [illegible] real crisis in voting is that 50 percent of New Mexicans who are eligible to vote are not registered. And we're worried about things like this." She added that voter fraud already is a felony and those who commit it should be prosecuted.

Duran first put her [illegible] the spotlight [illegible] during the 2011 session of the state Legislature.

During a committee debate on a bill that would have required voters to show photo identification at the polls, [illegible] Motor Vehicle [illegible] and state voter rolls [illegible] 117 noncitizens [illegible] to vote [illegible] ballots.

Her last November, Duran released a report saying that there was evidence that only [illegible] noncitizens had actually voted. And some of those people, the report said, might have obtained citizenship by the time they registered to vote.

Duran's report said a possible reason for some noncitizens registering to vote is the fact that court settlement [illegible] voter registration forms be offered to all applicants for driver's licenses at the [illegible] Motor Vehicle Division, and for public assistance from the state Human Services Department.

[illegible] has resulted in noncitizens being [illegible] into believing that they are eligible to register and vote," the report said.

Contact Steve Terrell at sterrell@sfnewmexican.com. Read his political blog at roundhouseroundup.com.

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PUBLIC INFORMATION MEETINGS

On a Requested Modification to the Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant

WHO: U.S. Department of Energy (DOE) Carlsbad Field Office and Washington TRU Solutions LLC (WTS)

WHAT: DOE and WTS will conduct public meetings to provide information on the following permit modification request to the WIPP Hazardous Waste Facility Permit.

WHEN:	Tuesday, August 14, 2012 5 - 8 p.m.	Thursday, August 16, 2012 2 - 4 p.m. & 6 - 8 p.m.
WHERE:	Skeen-Whitlock Building 4021 National Parks Highway Carlsbad, New Mexico	Courtyard by Marriott 3347 Cerrillos Road Santa Fe, New Mexico

WHY: On July 5, 2012, DOE submitted a Class 2 permit modification request to the New Mexico Environment Department (NMED). The permit modification request proposes to:

Add a shielded container for use at WIPP

This request is to add an additional container to the list of approved containers for disposal at WIPP. The container will allow the Permittees to handle waste that is packaged in a shielded container.

HOW: To obtain additional information about this permit modification request, contact Mr. Bobby St. John, WTS, at 1-800-336-9477. The permit modification is also available on the WIPP web site at http://www.wipp.energy.gov and at the WIPP Information Center, Skeen-Whitlock Building, 4021 National Parks Highway, Carlsbad, N.M. A copy of the requested permit modification also may be obtained from NMED at the address listed below.

COMMENTS: Written comments for the record must be sent to the NMED contact person at the address below and received no later than 5 p.m. on September 10, 2012.

Ms. Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, N.M. 87505
Phone: 505-476-6051
Fax: 505-476-6060
E-mail: trais.kliphuis@state.nm.us

The Permittees' compliance history during the life of the permit being modified is available from Ms. Kliphuis at the New Mexico Environment Department.

QUESTIONS: Any questions or comments to the Permittees regarding this permit modification may be sent to Mr. Bobby St. John, P.O. Box 2078, Carlsbad, N.M. 88221, no later than August 27, 2012.

WIPP Permit Community Relations Plan

On-line: http://www.wipp.energy.gov/ toll-free: 1-866-271-9640 E-mail: communityrelations@wipp.ws

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September 10, 2012

Trais Kliphuis
New Mexico Environment Department
2095 Rodeo Park Drive, Building 1
Santa Fe, NM 87505

RE: WIPP Class 2 Permit Modification Request – Addition of a Shielded Container

Dear Trais,

Southwest Research and Information Center (SRIC) provides the following comments on the Addition of a Shielded Container Class 2 permit modification request that was submitted by the permittees on July 5, 2012, according to their public notice.

SRIC appreciates that the permittees provided a draft of the proposed request and that representatives of the permittees as well as NMED met with SRIC and other citizen group representatives on June 7, 2012. SRIC continues to believe that such pre-submittal meetings are useful and supports continuing that "standard" practice in the future. SRIC also notes that there were some changes made in the modification request after the pre-submittal meeting, although several major changes suggested by SRIC at that meeting were not incorporated into the modification request.

1. NMED must deny the modification request

Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(7)), NMED may deny the class 2 modification request for any of three reasons. SRIC believes that denial is required because the request is deficient under each of the three criteria -- the request is not complete, the request does not meet the requirements of the Resource Conservation and Recovery Act (RCRA) and the Hazardous Waste Act (HWA), and the request does not demonstrate that the changes requested will protect human health and the environment.

A. The request is not complete. 40 CFR §270.42(b)(7)(i)

Despite the December 5, 2011 SRIC written comments, other comments on the 2011 Permit Modification Request for Shielded Containers, and the discussion at the pre-submittal meeting, the request is incomplete and does not include important information necessary for the public to adequately comment and for NMED to determine that the modification would protect public health and the environment and comply with other provisions of RCRA and the HWA.

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Following are examples of important information that is missing or incomplete or inadequate and some of the questions that need to be answered.

Page 2 of the request states:

> The management and storage requirements of CH TRU mixed waste in the Permit will apply to the waste that arrives at the WIPP facility in shielded containers because the surface dose rate is less than 200 millirems/hr at the time of shipment.

That statement is incorrect. Permit Section 1.5.2. states:

> "Remote-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate of 200 millirem per hour or greater. For WIPP, the surface dose rate shall not exceed 1,000 rems per hour. [Pub. L. 102-579 (1992)]

Thus, regardless of the surface dose rate "at the time of shipment," any container at the WIPP site with a surface dose rate of 200 millirem per hour or greater is remote-handled (RH) waste and must he managed according to the RH waste requirements of the Permit. The request does not appear to recognize that requirement. Because the 30-gallon inner container has a surface dose rate of 200 millirem per hour or greater in each shielded container, there could be one, tens, hundreds, or thousands of such RH waste containers at WIPP. The request provides no technical analysis about the potential for one or more shielded containers with a surface dose rate of less than 200 millirem per hour at the time of shipment to have a surface dose rate of 200 millirem per hour at the time of arrival at WIPP or to have such a surface dose rate at any time at WIPP. Questions that should have been addressed include whether vibration or movement from rough roads could cause shifting or settling of the RH waste such that the surface dose rate changes at the time of shipment to arrival at WIPP; whether there is variation among the generator sites as to how surface dose rates are measured, as compared with how they are measured at WIPP, that give differing results; and whether handling practices at WIPP could result in shifting or settling such that the surface dose rate changes. What circumstances, including accidents and manufacturing errors or quality assurance deficiencies, could result in a shielded container having a surface dose rate of 200 millirem per hour or greater? Not only are there not answers to those questions included in the request, but the request includes no Documented Safety Analysis (DSA) for shielded containers. Thus, the request is incomplete, and is in contrast to the class 3 permit modification that approved RH waste and included a DSA for RH waste.

The modification request includes no limits on the amount of remote-handled (RH) waste in shielded containers that can be stored in the Parking Area Unit (PAU) or in the contact-handled (CH) Bay of the Waste Handling Building (WHB), even though such containers will likely have external dose rates that are more than an order-of-magnitude greater than the CH waste that is normally handled. That much higher surface dose rate is never mentioned in the request. The Permit now allows no RH waste in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. Permit Part 3.1.1.2 and Table 3.1.1.

The request is to allow RH waste to be managed in precisely those CH areas in which RH waste is currently, and has always been, prohibited. Yet the request includes no changes regarding

Table 3.1.1 and no limits on the number of shielded containers in those areas. Thus, the entire CH Bay Storage Area could be filled with RH waste in shielded containers for up to 60 calendar days. Similarly, the request also includes no changes regarding Table 3.1.2, so the entire PAU could be filled with RH waste in shielded containers and in canisters for up to 59 days, in some cases. Such storage would be in sharp contrast to the storage time limits for the other RH waste not in canisters. Permit Section 3.1.1.10.ii. The request asserts safety, but provides no analysis to show that the 60-day storage time would be protective of public health and the environment, as compared with shorter time limits. The request omits a DSA or other technical basis to demonstrate that such additional storage time beyond 25 calendar days for uncanistered RH waste is protective of public health and the environment. Thus, the request is incomplete.

The request does not include the amounts of RH waste that would be managed at WIPP in shielded containers, nor the amount of RH waste that would be managed at WIPP in canisters, nor whether the amount of waste in shielded containers would reduce the number of RH canisters or would allow additional RH waste to be managed. Thus, the public and NMED cannot determine, among other things, the types and amounts of RH waste that would be managed in the CH Bay Storage Area, in the CH Bay Surge Storage Area, and in the Derived Waste Storage Area. The public and NMED cannot determine how much RH waste in shielded containers would be emplaced in the Underground Hazardous Waste Disposal Units (HWDUs) and how much RH waste in canisters would be in Panels 6, 7, and 8. The request omits a DSA or other technical basis to demonstrate that the requested storage and disposal is protective of public health and the environment. Therefore, the request is incomplete.

The public and NMED cannot determine how much remaining capacity would be available for CH waste in the Underground HWDUs if shielded containers were emplaced. The request Figure 3 (which is not proposed for inclusion in the permit) shows some shielded containers being "randomly placed." However, the request does not describe how "random emplacement" would be accomplished and why shielded containers would be not emplaced if they are received in three three-packs at a time in a shipment with three HalfPACTs. That "normal" operation would result in three-packs being emplaced in locations other than "interstitial" spaces. The request omits a DSA or other technical basis to demonstrate that such "random emplacement" is protective of workers, public health, and the environment. The request includes no information about shielded containers emplaced randomly (or in any other configuration) would make the most efficient use of Underground HWDU capacity. Some CH waste emplacement space will be displaced for RH waste in shielded containers, but there is no analysis of how much that might be. The number (17,473 shielded containers) stated on page 3 of the request cannot be considered reliable, as it was done 5 years ago and the RH inventory has changed since that time. Moreover, that estimated amount does not account for dunnage containers, which could up to triple the amount of space taken by shielded containers, if each three-pack contains two dunnage containers. Using the estimated amount and adding dunnage containers, therefore, up to 18 percent of the floor space in panels 7-10 could be taken by shielded containers. There is no analysis provided about whether displacing up to that amount of the remaining CH waste in the WIPP Inventory could result in reduction of the permitted amounts of CH waste in panels 7 and 8. Therefore, the request is incomplete.

: 01647

Despite extensive discussion in SRIC's December 5, 2011 comments and questions at the June 7, 2012 pre-submittal meeting by SRIC and others, the permittees continue to not discuss a major need for the modification request, despite the requirement that the request explains why the modification is needed. 40 CFR §270.42(b)(1)(iii). That need is to address the permittees' management of WIPP over the past 13+ years in such a way that there is not enough available capacity in the Underground HWDUs for a significant portion of the RH waste in the WIPP Inventory. In Panels 1-5, there are 462 RH canisters emplaced, with a volume of 411.18 cubic meters (462 x 0.89). Panels 6, 7, and 8 have a total capacity of 2,060 canisters (600+730+730), or 1,834 cubic meters, according to Table 4.1.1. Since the permittees have stated that they intend to request a permit modification for panels 9 and 10 to be the same size as panels 1-8, the presumed RH capacity of those two panels would be 1,460 canisters or 1,300 cubic meters. Thus, the total available capacity for RH waste is 3,545.18 cubic meters (411.18+1,834+1,300). That is approximately half of the RH waste legal capacity of 7,079 cubic meters and approximately 2,000 cubic meters less than the amount of RH waste described in the 2011 WIPP Inventory (DOE/TRU-11-3425). (Attachment 1). The actual RH capacity is being further limited by the fact that canister emplacement in Panel 6 will be less than half of the 600 cubic meter limit.

The fact that there is no enough space for the RH waste in the current WIPP inventory using the current configuration and permit requirements has not been contested by the permittees.[1] How shielded containers relate to meeting the need for capacity for RH waste in the Underground HWDUs must be addressed in an adequate permit modification request. That this major need and the above data are not even mentioned clearly show that the request is grossly incomplete.

Page 4 of the request states:

> RH TRU mixed waste emplaced at the WIPP facility in shielded containers will remain designated as RH TRU mixed waste in the WIPP Waste Information System (**WWIS**). The emplaced volume will be counted against the RH TRU mixed waste volume limits specified in the Permit.

Proposed revised Permit Section A1-1b(2) states that "Each 30-gallon inner container has a gross internal volume of 4.0 ft3 (0.11 m3)." Since each shipment could contain a single 3-pack of shielded containers, each shipment could have 0.33 cubic meters. Each RH canister holds 0.89 cubic meters. Thus, 100 cubic meters of RH waste in canisters can be handled in 113 shipments, whereas 100 cubic meters of RH waste in shielded containers is handled in a minimum of 304 3-packs, and could require that number of shipments. Therefore, use of shielded containers would substantially increase the number of packages containing RH waste being handled at WIPP, and substantially increase the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. However, those matters are not discussed in the request, and the request is inadequate and incomplete.

---

[1] The SRIC analysis, attachment 1, was provided to the permittees on January 26, 2012 (Attachment 2). They have never contested its accuracy, and have agreed with the factual statement that the current configuration does not provide enough actual capacity on more than one occasion.

: 01648

Since the permit request provides for no prohibition on dunnage drums, one or two of the 30-gallon inner containers in the shielded container three-pack, the number of containers to be transported to and managed at WIPP could be two or three times the amounts provided in the preceeding paragraph. The impact of dunnage drums on the number of shielded containers that could be emplaced, and the amount of space shielded containers could occupy in the PAU, WHB, and Underground SWDU is not discussed in the request. Thus, the amounts described in the request are not accurate and complete, and the request is incomplete.

Instead, the request asserts, but provides no technical analysis, (page 9) for the proposition:

> Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management, storage, and disposal of that waste at the WIPP facility.

Absent any analysis to support the assertion, NMED cannot accept the assertion as stating a need for the modification. Such a proposition could only be true if shielded containers eliminate some RH canisters, for if the same number of canisters are packaged at the generator sites and shipped to WIPP, there are no such reductions.

The second "need" discussed in the request (page 9) is:

> The Permittees believe the use of shielded containers will be beneficial because the shipment of RH TRU mixed waste in shielded containers in the HalfPACT may be more efficient than shipment in canisters using the RH 72-B Cask.

What the permittees "believe" is not adequate documentation, and it is not an adequate statement of need for the modification. Indeed, shielded containers appear not to be beneficial, especially since shielded containers will compete with use of the storage facilities for CH waste, thereby potentially slowing handling of CH waste. Shielded containers also will displace some actual CH waste capacity in the Underground HWDUs. Of course, use of shielded containers would be extremely detrimental if those containers result in accidents, releases or contamination of the PAU, CH Bay, or Underground HWDUs that disrupt other operations at WIPP. Moreover, there could only be more efficiency if the use of shielded containers reduces the number of RH canisters. But the request does not mention that possibility. Instead, what the Permittees apparently desire is to bring as many RH canisters as possible and additional RH waste in shielded containers. As already discussed, the reality is that shielded containers would increase the amount of RH waste being stored and disposed at WIPP.

The request includes a new section in Attachment A1, A1-1d(4) Handling Waste in Shielded Containers, which states, among other things:

> If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

The request also includes a new section in Part 3, 3.3.1.8. Shielded Container, which states, among other things:

> Shielded containers may be overpacked into a standard waste box or [sic] ten drum overpack.

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Those provisions are not valid and cannot be incorporated into the permit. First, a three-pack of shielded containers could not be overpacked into either a standard waste box (SWB) or a ten-drum overpack (TDOP). According to Table A1-2 of the request, a three-pack of shielded containers weighs 7,000 pounds. However, that same table shows that weight exceeds the maximum gross weights of a SWB or a TDOP. Thus, it would be a violation of the permit (and endanger public health and the environment) to allow a three-pack of shielded containers to be overpacked in the proposed containers. Second, a shielded container that is damaged such that in any location its surface dose exceeds 200 millirem per hour should not be overpacked in either a SWB or TDOP because those containers are solely for CH waste. Therefore, overpacking may not be possible for shielded containers. Repair and patching may not be possible for shielded containers. Returning a shielded container not in good condition to the generator site may not be possible, if the damage precludes the HalfPACT from being returned to the generator site. Thus, shielded containers that are not in good condition could be "stranded" at WIPP. The request is incomplete in not fully analyzing those possibilities and describing how the situations could be addressed.

If the permittees intend to overpack a single 30-gallon inner container, the request must then discuss how such a situation would comply with the limitations on SWBs and TDOPs and another new proposed provision:

4.3.1.8. Shielded Container
Shielded containers are configured as a three-pack.

A single overpacked shielded container is not consistent with that proposed provision. Nor would the remaining two containers that were not overpacked be consistent with the proposed provision without a dunnage drum.

Moreover, the Permit provides that SWBs and TDOPs are for CH waste. To allow shielded containers to be overpacked in those containers requires changes in various other provisions of the Permit, which have not been requested. For example, Permit Section 3.3.1.3, provides that TDOPs may be used to overpack "CH TRU mixed waste." But a damaged shielded container could have a surface dose rate of 200 millirem per hour and could not then be considered to be CH TRU waste. Permit Section A1-1b(1) includes SWBs and TDOPs as CH TRU mixed waste, so those provisions would have to be changed to allow overpacking of shielded containers, which are not CH TRU waste. But such a change would be inconsistent with Section A1-1b(2), which relates to RH TRU mixed waste containers, including shielded containers.

Co-permittee U.S. Department of Energy (DOE) has stated another need for shielded containers. Its *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class-C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE/EIS-0375-D), February 2011, states:

> Consistent with this planned change request, this EIS assumes that all activated metal waste and Other Waste - RH would be packaged in shielded containers that would be emplaced on the floor of the mined panel rooms in a manner similar to that used for the emplacement of CH waste. at 2-4.

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That need is not discussed in the request, nor is there any discussion of whether, if the request were approved, any further modification in the shielded container provisions would be required. Therefore, the request is incomplete.

SRIC would also note that its comments on the *GTCC DEIS* strongly criticized the document for many legal and technical deficiencies.

Thus, regarding several different essential matters, the request is incomplete and denial of the request is required.

B. The request does not meet the requirements of the HWA and RCRA. 40 CFR §270.42(b)(7)(ii)

The request includes numerous changes to the Permit in how RH waste is packaged (using the shielded container), stored in the PAU, opened in the CH Bay of the WHB, examined for contamination and damaged containers, placed on the facility pallet, and emplaced underground. As already noted above, aspects of handling of shielded containers are not completely and adequately described in the request, as required by the HWA and RCRA.

20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(1)(iii)) requires that the request explain why the modification is needed. The request fails to discuss, let alone adequately explain, that a major need is to expand the available disposal capacity for RH waste in the Underground HWDUs (see discussion on pages 3-4 above). It is clearly a violation of the HWA and RCRA to not fully explain the need, and the request should be denied. Moreover, the discussion of need in the request is clearly inadequate or erroneous, and does not adequately explain the need.

As will be further discussed in #2 below, the request also does not meet the requirements for a class 2 modification request. Consequently, the request does not meet the requirements of RCRA and the HWA.

Thus, the request does not meet the requirements of RCRA and the HWA and denial of the request is appropriate.

C. The request does not demonstrate that use of shielded containers will protect public health and the environment. 40 CFR §270.42(b)(7)(iii); §74-4-4 NMSA.

The modification request does not discuss the characteristics of RH waste, including that it can have a surface dose rate of up to 1,000 Rem per hour and is highly dangerous to workers and the public. Because of the difficulties of safely permitting RH waste at WIPP, RH waste was not allowed until a Class 3 modification was approved on October 16, 2006, effective November 16, 2006.

As discussed on pages 4-5 above, the use of shielded containers substantially increases the number of packages containing RH waste being handled at WIPP, substantially increases the number of containers arriving at the site and being stored in the PAU, WHB, and Underground HWDUs. In addition to significantly increasing the operations at the site, those increases pose dangers and increased risk to public health and the environment that are not discussed in the request. The request does not demonstrate that such an increase in the number of packages with

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RH waste would not endanger public health and the environment. On the contrary, increasing the actual number of RH waste packages could endanger public health and the environment by requiring additional handling of RH waste, thereby increasing exposures and the likelihood of accidents and releases.

The request (p. 5) states:

> Upon arrival at the WIPP facility, the shielded containers will be processed as CH TRU mixed waste using CH TRU mixed waste handling equipment and operating procedures.

SRIC objects to shielded containers being handled identically to CH waste because RH waste and CH waste are significantly different. Shielded containers will have much higher surface dose rates (an order of magnitude or more) than most CH waste containers. The higher radiation dose in a container could generate gases at a higher rate. The higher radiation dose and different waste characteristics could also generate different gases than CH containers. The higher radiation doses can pose an increased risk of releases to the environment and threat of worker exposures. The permittees should have performed a time motion study for each waste handling step for shielded containers and calculated expected radiation doses and included such study in the request. Such a study could demonstrate that certain procedures should be adopted for shielded containers to minimize personnel exposures, both for workers directly handling shielded containers and for other workers in the PAU, CH Bay, and Underground HWDU. For example, additional worker protective equipment, such as a respirator, may be indicated for personnel doing radiological surveys required by Permit Attachment G3. Specifying additional minimum distances in aisle spaces and limiting the number of shielded containers in the PAU and CH Bay could minimize personnel exposures. Specifying emplacement locations and distances and limiting the number of shielded containers in the Underground HWDU could minimize personnel exposures. Thus, if shielded containers are to be used, revised procedures should be discussed and analyzed to determine the need for changed permit requirements. The permittees reluctance to discuss such requirements may be because they do not want to be subject to class 3 procesees. Regardless, technical analysis of these matters should be required to protect public health and the environment.

It is not exceeding NMED's authority to recognize the radioactivity in the mixed waste, and addressing radioactivity does not regulate radionuclides. NMED, the permittees, and the public have recognized during the past 20 years since the original draft WIPP permit was submitted that radiation monitoring was an essential part of WIPP's operations and is appropriate and necesssary under the HWA. Such monitoring and radiological survey is necessary, and has always been part of the Permit, under the principle of co-detection, to determine whether a potential release of hazardous constituents has occurred. The permittees also have recognized that NMED has authority to include, or not include, RH waste in the WIPP permit. Indeed, the original Permit issued on October 27, 1999 included a prohibition on RH waste. Permit Condition II.C.3.h. The class 3 permit modification, approved on October 16, 2006, removed the RH waste prohibition, but included other provisions that limited RH waste, which were supported by the permittees. Thus, there is both state and federal legal and regulatory authority and historic practice that provide that NMED may not approve, or may put various limitations on, RH waste in shielded containers.

Because the request does not demonstrate that use of shielded containers will protect public health and the environment, denial of the request is appropriate.

2. If NMED does not deny the request, it must process the request as a class 3 permit modification under 40 CFR §270.42(c).

Pursuant to 20.NMAC 4.1.900 (incorporating 40 CFR §270.42(b)(6)(i)(C)), NMED may determine that the modification request must follow the procedures for a class 3 modification because there is substantial public concern about the proposed modification or the complex nature requires the more extensive procedures of class 3. Both requirements are met regarding shielded containers. There is substantial public concern about shielded containers, and there is very substantial public interest in WIPP and RH waste, as has been demonstrated repeatedly over the past 15 years with the WIPP permitting process in which hundreds of people have participated in addition to several organizations, including SRIC, that represent hundreds of other people.

The complex nature of using shielded containers also has been demonstrated by the above comments regarding matters that are not adequately discussed in the request. Handling RH waste at WIPP is demonstrably complex and was subject to class 3 modification procedures in 2005 and 2006. Shielded containers would continue the complexity of the existing RH operations and add new procedures. Thus, shielded containers would multiply the complexity of managing RH waste at WIPP.

Also, as noted above on page 3, the permittees previously requested that some RH waste not in canisters be handled at WIPP. As a result of the class 3 permit modification – HWB 06-01 (M) - Permit Section 3.1.1.10.ii was approved to allow RH waste not in canisters to be handled in 55-gallon drums in the Hot Cell. But shorter time limits were established on such RH waste, as compared with CH waste or RH waste in canisters. As part of the class 3 process, more detailed information would be provided as to what time limits should apply if shielded containers are included in the Permit. This complexity requires class 3 processes.

That class 3 modification for RH waste also imposed volume limits on the amounts of RH waste not in canisters that could be in the Hot Cell. Permit Section 3.1.1.11. As part of the class 3 process, more detailed information would be provided as to what volume limits should apply if shielded containers are included in the Permit. This complex situation also requires class 3 processes.

To incorporate shielded containers also requires additional changes to the permit that the permittees have not included in the request. The need for such additional changes also shows the complexity of the request.

Moreover, on October 24, 2011, NMED Secretary David Martin made a determination that the Los Alamos National Laboratory (LANL) class 2 permit modification request for TA-63 Transuranic Waste Facility would be processed as a class 3 modification (which is ongoing) because of a "long history of substantial public concern regarding the management of hazardous waste at LANL." (Page 2). The NMED Secretary also determined that the modification "would require complex changes to the facility and its operations." (Page 2). There is an even longer

history of substantial public concern regarding the management of hazardous waste at WIPP, dating back at least 20 years. That public concern has been manifested repeatedly in the original permitting process, including the public hearing that lasted 19 days in 1999; and in public involvement in numerous permit modification requests over the past 13 years, including the request that allowed RH waste to be managed at WIPP. As already discussed, the use of shielded containers would require complex changes to many aspects of RH management at WIPP.

Additionally, other regulations require shielded containers to be a class 3 modification. 40 CFR §270.42, Appendix I.F.1.a requires that a modification "resulting in greater than 25% increase in the facility's container storage capacity..." is a class 3 modification. Also noted above, there are no limits on the amount of RH waste that could be stored in shielded containers in the PAU and CH Waste Bay, so the amount of RH waste allowed in those areas is certainly more than a 25% increase and the amount of RH waste in the WHB can increase by more than 25%.

Regarding the Underground HWDUs, the request (p. 3) states:

> According to Crawford, et.al., 2007[1], 1,922 m3 of RH TRU mixed waste could potentially qualify for shipment in a shielded container.

The existing permitted Underground HWDU capacity for RH waste is 2,635 m3. Table 4.1.1. The amount of RH waste that could potentially be in shielded containers is much more than a 25 percent increase in that storage capacity. Moreover, as described on page 4 and in Attachment 1, even assuming that panels 9 and 10 would be permitted for the maximum number of RH canisters, the capacity would be about 3,545 m3. The amount of RH waste that could potentially be in shielded containers is much greater than a 25 percent increase of that RH container storage capacity.

40 CFR 270.42, Appendix I F.3.a requires that modifications "[t]hat require additional or different management practices than those authorized in the permit" are class 3. The purpose of shielded containers is to require additional and different management practices for RH waste than those in the Permit. As also discussed on page 8, there should be some different management practices for shielded containers as compared with CH containers. Here again, shielded containers require a class 3 modification.

Thus, based on the HWA and RCRA regulations and because of current NMED practices, shielded containers must be processed as a class 3 modification, if the modification request is not denied.

3. <u>The request includes other inadequacies</u>.

A. The request on page 5 states:

> In order to meet the stacking stability requirements of Permit Attachment A2, Section A2-2b, shielded containers will not be stacked more than two high, and no other waste assemblies or backfill MgO sacks will be placed on top of three-pack assemblies of shielded containers.

However, those stacking requirements are not proposed for inclusion as permit language.

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Permit Section A2-1 provides:

> The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Since the request includes no change in that provision and states that shielded containers would be handled as CH waste, other CH waste containers could be placed on top of a 3-pack assembly or a 3-pack assembly could be placed on top of CH TRU mixed waste containers. The request does not demonstrate that such stacking would protect workers or public health and the environment, and indeed the request states that such stacking is not appropriate. SRIC objects to allowing 3-packs of shielded containers to be stacked on top of CH TRU waste containers or to CH TRU waste containers being stacked on top of shielded containers. The Permit should include specific provisions related to handling and stacking of shielded containers. Again, the request does not include a DSA or other technical analysis that stacking of shielded containers in like manner as CH waste is protective of public health and the environment.

B. The request proposes to revise Permit Part 4, Table 4.1.1 to remove the container equivalent column. SRIC strongly objects to such a revision. The limit on the number of RH TRU canisters, which is indicated in the column, was supported by public comment and technical testimony in the class 3 modification process that added RH waste to the Permit. The information proposed to be stricken is accurate and would remain so if shielded containers were approved. In the request, the permittees have provided no adequate technical basis to remove the column and the limits. The request states that "this column is not used to meet any compliance requirement." (Page 6). There are many parts of the Permit that do not state a "compliance requirement," so that is not a basis to remove the column.

Further, Permit Part 4, Table 4.1.1 as included in the request is not consistent with the current Permit regarding Panel 5 Final Waste Volume, so it could not be included in the Permit.

C. The permittees included in the request Appendix D "Why the Shielded Container Modification is not a Class 3 Modification." At best, the permittees discussion is incomplete. For example, in Part 1 there is no mention that Permit Section 3.3.1 includes seven acceptable storage containers, not solely the four containers included on page D-5 (and pages 8-9 of the request). Thus, three of the permitted storage containers were not included as class 2 modifications. 55-gallon drums and SWBs were part of the original permit application and approved in the 1999 Permit. The RH TRU canister was approved as part of the class 3 modification to permit RH waste.

In the Part 1 discussion, there is no mention of the requirement that increasing facility container storage capacity by more than 25 percent is a class 3 modification. There also is no mention that 40 CFR 270.42(d)(1) specifically allows the permittee to submit a class 3 request even if not sure of the proper classification.

There also is no mention of the HWA requirement for a public hearing "on a minor permit modification if the secretary determines that there is significant public interest in the minor modification." Section 74-4-4.2.I NMSA 1978. The permittees should have saved themselves,

NMED, and the public the time, resources, and inconvenience of twice debating the classification by submitting the request as a class 3 modification.

As regards the Part 2 discussion of stakeholders concerns, it does not fully reflect SRIC's comments of December 5, 2011 or those at the June 7, 2012 pre-submittal meeting. Moreover, the discussion does not reflect the WIPP permit record, which clearly shows substantial public concern regarding the dangers of RH waste and impacts on public health and the environment and that permit requirements regarding RH waste have always included public hearings. There was substantial public concern about RH waste, and support for the RH waste prohibition, during the several year process for issuance of the Permit. There was very substantial public concern about the RH waste permit modification, which was submitted as a class 3 modification request. There was significant public interest in the 2011 shielded containers request, and there is even more significant public concern, and more people commenting, on the current request.

D. As described in the request, shielded container three-pack assemblies include items not in CH waste containers. Figure 2 of the request includes a "stiffener," upper and lower "axial dunnage," "radial dunnage," and "pallet," which is also described as a "triangular pallet" (page 5). Figure 2 also shows a "bottom slipsheet." Page 5 of the request also mentions a "plastic reinforcing plate." None of those items are described or incorporated into the Permit, and they may need to be. At a minimum, the request should describe why they should not be incorporated into the Permit.

Slipsheets are typically used with CH waste and are discussed in Permit Section A2-2a(1). The request should clarify whether the shielded container "bottom slipsheet" serves the same purpose as it does for CH waste and whether the "bottom slipsheet" can be used with the forklifts with a push-pull attachment. Page 5 of the request states: "The three-pack assembly will be placed singly on the floor using the slipsheet." However, the request in other places states that shielded containers may also be stacked, so that narrative description is not complete and accurate as regards where the assembly will be emplaced or as to how the slipsheet is used for stacking.

E. The proposed changes to Permit Section E-1b(1) are not appropriate. RH waste in shielded containers is to be counted toward the RH waste volume limits. The inspection requirements for shielded containers should be separatedly described in this section, rather than changing the container inspection requirements for CH and RH waste. Changes proposed for "off-site waste" should not be approved. "Off-site" is the term used in the Permit to distinguish it from "on-site" derived waste. There should be no derived RH waste at WIPP.

4. SRIC requests a public hearing on any shielded containers modification request.
RH waste and shielded containers are a matter of significant interest and concern to SRIC and the public. As demonstrated by these comments, the use of shielded containers would be complex, and stringent measures are required to protect public health and the environment. The complexity of the matters and the incompleteness of the request require a public hearing so that the matters may be adequately examined and questions answered, and the required determinations regarding protecting public health and the environment can be adequately made. Therefore, any permit modification to allow use of shielded containers is a major modification,

and SRIC requests a public hearing on the current, or any other, shielded containers permit modification request.

Thank you very much for your careful consideration of, and your response to, these and all other comments.

Sincerely,

Don Hancock

cc: John Kieling

01657

WIPP DISPOSAL VOLUMES (cubic meters) (as of January 14, 2012)											
	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Panel 7	Panel 8	Panel 9	Panel 10	Totals
55-gal. Drums	38,139	23,865	8,394	12,858	21,255	6,339					110,850
Volume	8,009.19	5,011.65	1,762.74	2,700.18	4,463.55	1,331.19					23,278.50
SWB	1,239	3,176	1,730	1,405	2,200	741					10,491
Volume	2,329.32	5,970.88	3,252.40	2,641.40	4,136.00	1,393.08					19,723.08
TDOPS	35	1,451	2,227	1,048	788	131					5,680
Volume	157.50	6,529.50	10,021.50	4,716.00	3,546.00	589.50					25,560.00
85-gal drums	2	0	0	3	0	0					5
Volume	0.64	0.00	0.00	0.96	0.00	0.00					1.60
100-gal. Drums	0	1,278	5,409	11,050	9,951	1,218					28,906
Volume	0.00	485.64	2,055.42	4,199.00	3,781.38	462.84					10,984.28
SLB2s	0	0	0	0	0	5					5
Volume	0.00	0.00	0.00	0.00	0.00	36.95					36.95
R-Lid 72-Bs	0	0	0	198	246	74					518
Volume	0.00	0.00	0.00	176.22	218.94	65.86					461.02
F-Lid 72 Bs	0	0	0	0	18	0					18
Volume	0.00	0.00	0.00	0.00	16.02	0.00					16.02
CH volume	10,496.65	17,997.67	17,092.06	14,257.54	15,926.93	3,813.56					79,584.41
RH volume	0.00	0.00	0.00	176.22	234.96	65.86					477.04
Sources: Container numbers: http://www.wipp.energy.gov/general/GenerateWippStatusReport.pdf											
Container volumes: http://www.nmenv.state.nm.us/wipp/documents/Part3.pdf											
RH legal limit											***7,079***
RH canister capacity				176.22	234.96	534	650	650	650	650	3,545.18
CH legal limit											***168,485***
CH capacity	10,496.65	17,997.67	17,092.06	14,257.54	15,926.93	18,750.00	18,750.00	18,750.00	18,750.00	18,750.00	169,520.85
Cumulative	10,496.65	28,494.32	45,586.38	59,843.92	75,770.85						
2011 Inventory remaining (DOE/TRU-11-3425, pages 426-427)											
CH						76,561					
RH (undercounted)						*3,459*					
RH (per Patterson - 1/26/2012)						*5,336*					
Note: Numbers in red are based on WIPP permit volumes and differ from the volumes in the source document, which undercounts the volumes..											
Compiled by: Don Hancock, Southwest Research and Information Center; 505/262-1862; sricdon@earthlink.net											

Attachment 1

01558

Attachment 2

Subject: Re: RH Inventory
From: Don Hancock <sricdon@earthlink.net>
Date: Thu, 26 Jan 2012 18:42:32 -0700
To: "Patterson, Russ - DOE" <Russ.Patterson@wipp.ws>
CC: "McInroy, Bill" <wmcinroy@lanl.gov>, "McCauslin, Susan - DOE" <susan.mccauslin@wipp.ws>, "Basabilvazo, George - DOE" <George.Basabilvazo@wipp.ws>, "Nelson, Roger - DOE" <Roger.Nelson@wipp.ws>

Russ:

Thanks very much for the helpful response.

Hopefully, we can now agree about two things:
1. The two ways of counting RH volumes result in significant differences. Using the WDS volumes in the ATWIR, the inventory of WIPP-bound and emplaced RH waste is 3,459 cubic meters. Using the outer container volumes you provided, the WIPP-bound and emplaced RH waste is 5,336 cubic meters or about a 35 percent larger amount. Both volumes are under the legal limit for RH waste at WIPP.

2. The actual underground available space using one RH canister per borehole is substantially less than the 5,336 cubic meters. A conservative calculation (attached) is with that configuration, the available capacity is 3,545 cubic meters. That number is conservative because it assumes that 534 cubic meters of RH waste allowed by the permit will be emplaced in panel 6, which we already know will not occur, since a substantial number of boreholes have not been filled in rooms 6 and 7. Of course, I'm aware that the actual configuration of panels 9 and 10 is proposed to change, but I'm not aware that the new configuration would have more boreholes than are provided in panels 7 and 8.

However, we do not seem to agree on some other matters.
1. While I have no objection to WDS tracking the RH volumes using both methods, I don't understand why the outer container volumes should not be the ones used in all "public" forums - which include the permit and its table 4.1.1, the public WDS and ATWIR, and Budget and NEPA documents. That would result in consistent numbers being used, which track with the permit and other legal requirements, and can be clearly understood. If you are not going to use that approach, it seems to me that in each case you need to provide an explanation of why the alternative number is being used and how it differs from the calculation for the permit. I think the latter approach is more cumbersome for DOE and more confusing to the public. As Susan knows, there was some discussion about this matter at the Quarterly Meeting today.

2. While I think there should be public acknowledgment and discussion of the RH volume "shortage," and how to address it, DOE seems to want to avoid either acknowledging or discussing it. I don't believe that there's been any generally available DOE document that discusses the matter. Please point such document(s) out, if I've missed them. And the matter wasn't discussed in the EPA planned change request for shielded containers or in the class 2 permit modification request for shielded containers. I'd like to understand why such acknowledgment hasn't not happened and how and when DOE intends to have a public discussion about it.

I'd appreciate your further response on these matters. Of course, I'm also glad to

have further discussions about these matters and any others of mutual interest.

Thanks.

Don Hancock
Southwest Research and Information Center
505/262-1862

On 1/26/2012 2:49 PM, Patterson, Russ - DOE wrote:

> Don:
>
> In response to your telephone message earlier this week,IdirectedLANL-CO last year,to start reporting RH inner container volume in the annual report to be in line with the WDS RH reporting. The WDS is the"official"volume of record used to show compliance with theHazardousWaste Facility Permit requirements. To keep from undue confusion for the reported volumeof RH waste emplaced I thought, and still do think,it was best if the WDS andATWIRmatched.Of course the outsideRHcontainer volume and materialparameters arestill tracked andused for performance assessment calculations.
>
> Ialsoasked LANL-CO if the outside container volume was used for RH wouldwe exceed the 7,080 m3 volume limit for RH waste or ifWIPP physicallywould nothave enough space to emplace all the RH waste being reportedin the 2011 ATWIR. LANL-COcalculated RH volumes using the outer container volume of .89 to addressthisquestion. Below are the recalculated volumes using the .89 m3.
>
> As of 12/31/2010
>
> RH volume remaining at site (WIPP-bound) = 4,939 m3
>
> RH volume emplaced at WIPP = 397 m3
>
> Total = 5,336 m3
>
> RH volume remaining at site (Potential) = 1,853m3
>
> Total = 7,189m3
>
> As you can see using the RH outer container volume of .89 we are 1,744 m3 under the RH 7,080 m3 volume limit; for WIPP bound and emplaced. If you include the waste designated as Potential you exceed the 7,080 m3 by 109 m3. As you know not all RH waste designated as Potential will end up being shipped to WIPP. Ifyou have any additional questionsplease let me know.
>
> Thank you,
>
> Russ

Container numbers-volumes011412.xls	**Content-Type:** application/vnd.ms-excel **Content-Encoding:** base64

ENTERED

From:	Scott Kovac
To:	Kliphuis, Trais, NMENV
Cc:	Jay Coghlan
Subject:	Nuclear Watch New Mexico Comments on Shielded Containers PMR
Date:	Monday, September 10, 2012 4:59:16 PM
Attachments:	NWNM Shielded Containers Comments 9-10-12.pdf

Trais Kliphuis:

Nuclear Watch New Mexico respectfully submits these comments for the Permit Modification Request (PMR) for Addition of a Shielded Container at the Waste Isolation Pilot Plant (WIPP). The PMR is dated July 2012.

Thank you,
Scott

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Scott Kovac
Operations and Research Director
Nuclear Watch New Mexico
1000 Cordova Place #808
Santa Fe, NM, 87505
505.989.7342 office & fax
www.nukewatch.org

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nuclear watch new mexico

September 10, 2012

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Via e-mail: trais.kliphuis@state.nm.us

Dear Ms. Kliphuis:

Nuclear Watch New Mexico respectfully submits these comments for the Permit Modification Request (PMR) for Addition of a Shielded Container at the Waste Isolation Pilot Plant (WIPP). The PMR is dated July 2012. **We request a public hearing and that the shielded containers PMR be treated as a Class 3 modification.**

We are concerned that we have not been given the true reason for the Department of Energy's (DOE's) need for this PMR. It is stated that, "These changes do not reduce the ability of the Permittees to provide continued protection to human health and the environment." (Pg. 1) It is unclear if these changes will increase the ability of the Permittees to provide continued protection. Please request that the Permittees explain how the use of shielded containers will increase safety.

Page 9 states, "The Permittees believe the use of shielded containers will be beneficial because the shipment of RH TRU mixed waste in shielded containers in the HalfPACT may be more efficient than shipment in canisters using the RH 72-B Cask." Believe? May be? What, if any, are the exact benefits?

Page 9 states, "Shielded containers are expected to reduce the time and personnel necessary for the packaging of RH TRU mixed waste at generator sites and the management, storage, and disposal of that waste at the WIPP facility." Are expected? What are the exact management, storage, and disposal time and personnel reductions?

If this PMR is a money-saving measure, please have the Permittees state how much will be returned to the taxpayers annually with the use of shielded containers. We have all already spent much time and effort on this issue.

551 Cordova Place #808, Santa Fe, NM, 87505 • 505.989.7342
info@nukewatch.org • www.nukewatch.org • http://www.nukewatch.org/watchblog/

The September 2011 PMR stated, "*The use of the shielded containers will enable DOE to significantly increase the efficiency of transportation and disposal operations for RH TRU waste at the Waste Isolation Pilot Plant (WIPP).*" This statement is missing from the current July 2012 revision. Has it been decided that shielded containers will not increase the efficiency was operations?

In the September 2011 PMR, DOE claimed "negligible effect on long-term performance" of the shielded containers. This claim is no longer made. What are the effects of shielded containers on long-term performance?

No mention is given of any thermal effects of remote-handled waste stored in shielded containers. The thermal effects of remote-handled waste stored in shielded containers on the waste matrix at WIPP must be studied.

It seems that we have been getting less information on shielded containers, not more. What we do know is that much of the planned RH space in the walls of underground rooms is not available because DOE brought contact handled waste to WIPP while RH waste was prohibited. Available RH space for emplacement in some of the panels was lost. And, from the time RH waste was permitted, DOE still has not shipped RH waste at a rate sufficient to use the available capacity. Is this PMR an effort to catch up on lost opportunities to emplace RH in WIPP? In this Permit Modification Request, ***DOE must state a valid reason to use shielded containers.***

This shielded containers request is NOT a proper Class 2 permit modification. ***We request a public hearing and that the proposal for shielded containers be treated as a Class 3 modification*** so that there would be the opportunity for more extensive public comment and a hearing.

Given the inherent increased dangers of RH waste, the need for much more information, the complexity of the changes proposed, and the public concern about RH waste, shielded containers require a Class 3 modification request. This proposal is of more than sufficient significance that NMED should now designate DOE's request as a Class 3 modification and treat it as such.

Contrary to what DOE says, shielded containers cannot be managed in a manner consistent with management of CH waste. This language must be changed in the PMR. There is the simple matter of the radically increased weight involved with shielded containers, which logically would call for using different handling procedures than CH wastes.

The amount of RH waste allowed in the Waste Handling Building would greatly increase. The modification request includes no limits on the number of RH shielded containers that could be in the CH Bay, in effect substantially increasing the amount of RH waste allowed. The exact limits must be stated in the PMR.

These comments respectfully submitted,

Jay Coghlan
Scott Kovac
Nuclear Watch New Mexico
551 Cordova Road #808
Santa Fe, NM, 87501
505.989.7342 office & fax
www.nukewatch.org

: 01664

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

SEP 10 2012

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SEP 2012
NMED Hazardous Waste Bureau

Mr. John E. Kieling, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Subject: Comments on the July 5, 2012, Class II Permit Modification Request, "Addition of a Shielded Container"

Dear Mr. Kieling:

The purpose of this letter is to provide the New Mexico Environment Department (NMED) with comments on the Class II Permit Modification Request, "Addition of a Shielded Container" submitted to the NMED on July 5, 2012.

If you have questions regarding this submittal, please contact Mr. George T. Basabilvazo at (575) 234-7488.

Sincerely

Jose R. Franco, Manager
Carlsbad Field Office

M.F. Sharif, General Manager
Washington TRU Solutions, LLC

Enclosure

cc: w/enclosure
J. Davis, NMED *ED
T. Kliphuis, NMED ED
C. Walker, Trinity Engineering ED
CBFO M&RC
*ED denotes electronic distribution

120922

CBFO:OESH:GTB:ANC:12-0783:UFC 5487.00

01665

Permittees' Comments on the Class 2 Permit Modification Request for the *Addition of a Shielded Container*

On July 5, 2012, the Permittees submitted a Class 2 permit modification request (**PMR**) for the addition of shielded containers as an authorized disposal container to the New Mexico Environment Department (**NMED**). Public meetings were held in Carlsbad and Santa Fe, New Mexico, on August 14th and 16th, respectively. The end of the 60-day public comment period ends at 5:00 PM on September 10, 2012.

The Permittees are submitting one comment with regards to the Class 2 PMR for the *Addition of a Shielded Container*. During meetings with the public and regulator discussing the Permittees proposal, the Permittees discerned some amount of confusion between shielded containers in general and the shielded container the Permittees are proposing to add as an authorized disposal container. By this comment, the Permittees' are clarifying that the shielded container subject to this PMR is the shielded container that has been approved for shipment in a HalfPACT by the Nuclear Regulatory Commission (NRC). To specifically identify the shielded container being requested as an authorized disposal container at the WIPP facility, the Permittees are providing proposed revised text for consideration for inclusion in proposed Permit Part 3, Section 3.3.1.8. *Shielded Container*. This proposed text references previously proposed figure A1-37. Figure A1-37 is based on the specific drawing of the shielded container that was approved by the NRC. A copy of the referenced drawing is attached for the administrative record. Only the shielded container depicted in Figure A1-37 is being proposed as an authorized disposal container.

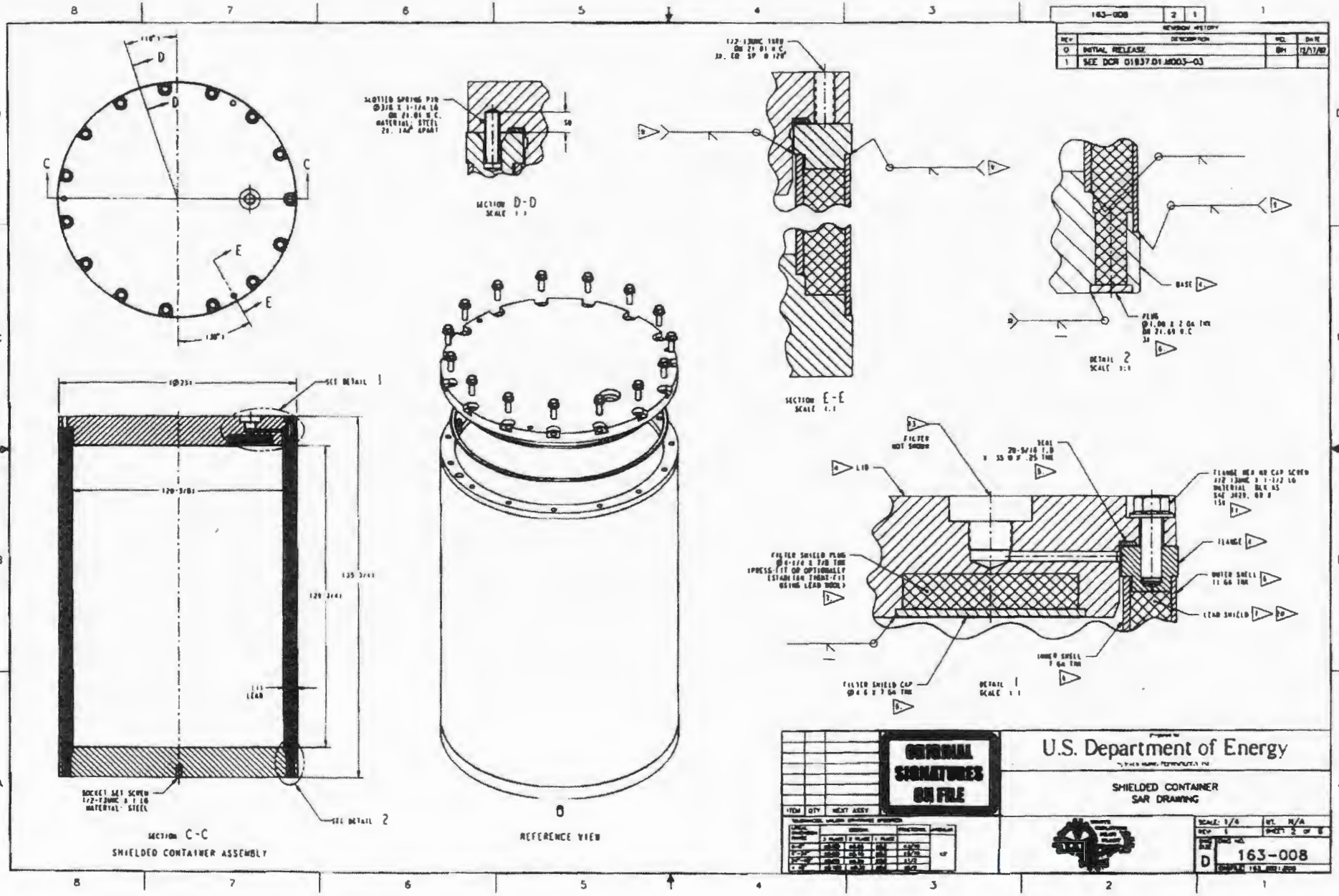
The Permittees' comment appears here as blue text in the redlined proposed revised text provided in the July 5, 2012 PMR:

3.3.1.8. Shielded Container *

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). Shielded containers contain RH TRU mixed waste, but the shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste.

Shielded containers may be overpacked into a standard waste box or ten drum overpack.

* "Shielded Container" refers to the container depicted in Figure A1-37.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REVISION HISTORY
REV DESCRIPTION ECO DATE
0 INITIAL RELEASE BH 12/17/02
1 SEE DCR 01837.01.M003-03
SECTION D-D
SCALE 1:1
SECTION E-E
SCALE 1:1
DETAIL 2
SCALE 1:1
DETAIL 1
SCALE 1:1
SECTION C-C
SHIELDED CONTAINER ASSEMBLY
REFERENCE VIEW
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SEE DETAIL 2
SOCKET SET SCREW
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LEAD SHIELD
INNER SHELL
7 GA THK
FILTER SHIELD CAP
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SHIELDED CONTAINER
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SCALE: 1/6
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01667

Trais Kliphuis, NMED,
2905 Rodeo Park Drive East, Building 1,
Santa Fe, NM 87505

Dear Trais Kliphuis:

I am very concerned about the plan to use shielded containers at WIPP. They would expand the space available at WIPP for remote-handled waste, which is extremely dangerous to transport, store, and dispose.

Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a series of public hearings. I also request that shielded containers be designated as a class 3 modification, so that there would be more extensive public comment and opportunity for hearings.

This plan represents a betrayal of all the assurances given the public, when WIPP was first proposed, about what the site would be used for. Time and again we were told there would be no remote-handled waste from commercial or other sources. Your first duty is to the health of New Mexicans, who are your employers and constituents. Please do not go forth with this betrayal, and please do not insult the public by refusing to listen to our feedback via public hearings.

Sincerely,

Marilyn Hoff

Marilyn Hoff
PO Box 295
El Prado, NM 87529

120928

PO Box 295
El Prado, NM 87529

Trais Klipl
NMED
2905 Rodeo
Bldg #
Santa Fe

87505631399 II.

9198

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

- The amount of RH waste shipped to WIPP, stored aboveground, and disposed underground would substantially increase.
- Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.
- Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Teddy Nez Teddy Nez

address PO Box 4346, Gallup NM 87305

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Speak Out Against More "Hot" Waste at WIPP

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Thank you!

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Rose Marie Cecchini HM
Office of Life, Peace, Justice + Creation Stewardship
Catholic Charities
address 506 W. Highway 66, Gallup, NM 87301

21672

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

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Use the sample comments below, or write whatever you want.

Thank you!

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Robert Tohe

address 408 E. Route 66, Flagstaff AZ 86001

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

91675

Speak Out Against More "Hot" Waste at WIPP

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What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Don Hyde

address 113 E. Logan Ave. Gallup NM 87301

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

91677

Speak Out Against More "Hot" Waste at WIPP

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Use the sample comments below, or write whatever you want.

Thank you!

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Michael Poe

address PO Box 1614, Winslow, AZ 86025

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Speak Out Against More "Hot" Waste at WIPP

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name Mary Rose Kordsmeier

address PO Box 2933 Fort Defiance AZ 86504

1686

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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name Tomasita Gonzalez

address 1743 Valley Rd SW
ABQ NM 87105

01682

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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name Monica Cheyenne Beardsley

address 924 Edith NE
Albuquerque, NM 87102

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Marco C. Martinez

address 2105 Osuna Rd NE, Albuquerque, NM

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

9-10-12

Trais Kliphui

NMED 2905 Rodeo Park Dr. East,Bldg 1

Santa Fe, NM 87505

Dear Sir,

I am from Eunice NM and live next to a nuclear waste dump that opened and TCEQ did not allow local citizens a public hearing that was requested by several people in Eunice. Now three years later and I am sure quite a lot of money spent later by WCS, a judge in Texas had ruled we will have a contested case hearing if there is pertinent data to present. Since water has been seeping into several monitoring wells at the WCS dump, some people are backing up and looking at this situation including Lon Burnham of Texas. Texas has let this dump just write their own waste disposal rules since inception. Since money runs the Texas train of government they do what they want even though there are two state department that oversee the various industries in Texas. My concern is that since I have a water well on my property, what if a leaking radioactive dump contaminates my water and land. That has been my concern all along. No one in NM seems to care about New Mexicans and water and health in this Eunice area. Water is so precious, Jal just had water main breaks and it shut the town down. My water is valuable to me. Water is valuable and will be the source of outbreaks of war over domain of water, yes even in Lea County. Jal is having its precious resource pumped over to Midland County because they have very little. Jal is concerned and in a bad situation.

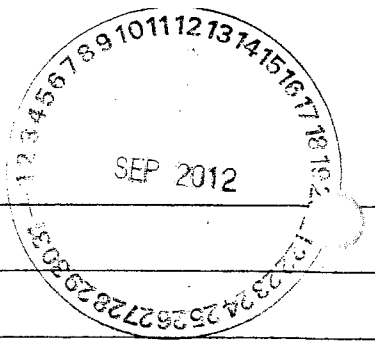
The situation as WIPP is different but not very much so. The issue about shielded containers is so very important since we cannot control the forces of nature. People must be allowed the freedom to speak about the important issues including the transport, storage and final disposition of nuclear waste of all kinds. Now that mercury storage is being considered at WIPP as well as WCS my concern over transport and storage of all hazardous and nuclear waste in this country.

I request a public hearing and that those shielded containers be a Class 3 Modification so that there will be more extensive public comment and an opportunity for a hearing.

Sincerely, Rose Gardner

Rose Gardner, Box 514, Eunice NM 882321

01688



To Trais Kliphuis
NMED.
2905 Rodeo Park Drive, E
Building 1
Santa Fe, NM 87505

Sept. 6, 2012

Dear mr. Trais Kliphuis:

I am very concerned ABout "shield Containers" OF TRU waste.

They would expand The Space AVAILABLE AT WIPP for Remote-handled that is dangerous to Transport, Store and Dispose: Despite what the Dept of Energy SAYS, these "shielded Containers" could Not Be Handled like Contact-handled waste Because damaged or Leaking Containers Could Be too Radio active to over-pack!

The shielded Containers Request, once again, Is not a proper CLASS II permit modification I Request that a public hearing be held to make the "shielded containers" a CLASS III modification, so That there would Be more extensive public input and have opportunity for A hearing.

Thank you

Sincerely

Barbara O'Connor
P.O. Box 2226, S.F., NM 87502

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

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Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

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Thank you!

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I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name L Watchempino

address P.O. Box 407, Acoma, NM 87034

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

DEAR TRAIS KLIPHUIS

AS A RESIDENT OF SANTAFE I A CATHOLIC PRIEST, I AM CONCERNED ABOUT SHIELDED CONTAINERS - EXPANDING THE SPACE AVAILABLE AT WIPP FOR REMOTE-HANDLED WASTE THAT IS DANGEROUS TO TRANSPORT, STORE & DISPOSE.

IN MY OPINION SHIELDED CONTAINERS COULD NOT BE HANDLED LIKE CONTACT-HANDLED WASTE BECAUSE DAMAGED OR LEAKING CONTAINERS COULD BE TOO RADIOACTIVE TO OVER-PACK.

THE SHIELDED CONTAINERS REQUEST ONCE AGAIN IS NOT A PROPER CLASS 2 PERMIT MODIFICATION. I REQUEST A PUBLIC HEARING & THAT SHIELDED CONTAINER BE A CLASS 3 MODIFICATION SO THAT THERE WOULD BE MORE EXTENSIVE PUBLIC COMMENT & AN OPPORTUNITY FOR A HEARING.

SINCERELY
FR. ERIK RAHLAN
2540 CALLE DE PUEBLO
SANTA FE, NM 87505

01692

Speak Out Against More "Hot" Waste at WIPP

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name MICHAEL J MONTOYA

address 3431 ANDERSON AVE SE
ABQ, NM 87106

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

: 21691

Speak Out Against More "Hot" Waste at WIPP

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name Emma Sandoval

address 1128 18th St NW 87104

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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name Josh Yustaga

address P.O. Box 315 New Laguna, NM 87038

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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name _____

address _____

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

01790

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name Tomás Garduño

address 805 Riverside Dr SW, ABQ NM 87105

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

01782

Speak Out Against More "Hot" Waste at WIPP

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name Rachel Arachuleta - Lindsay Marisol Arachuleta

address 3615 Big Cottonwood Dr SW; Albuquerque, NM 87105

21703

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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name Roberto Roiba

address 2233 Don Felipe Rd SW
Alb NM 87105

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

01795

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name Tony Watkins

address 1219 Orchard Pl NW
Albuquerque NM 87102

71707

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

91708

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name Lilia Diaz

address 11 Montoya Circle, Santa Fe, NM 87501

1739

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

91719

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name Mary Jessica Antonia Bunker

address 540 Camino de Higinio · Los Lunas, NM 87031

31711

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

91712

Fr. Earl R. Rohleder
2540 Calle Rincon Bonita
Santa Fe, NM 87505

TRAIS KLIPPE
2905 ROD
SANTA FE NM
87505

87505631399

97176

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name Leona Morgan

120927

address 725 Tijeras Ave NW, Albuquerque, NM 87102

01714

PRIORITY MAIL

UNITED STATES POSTAL SERVICE

Label 228, February 2006 www.usps.com

From Leona Morgan
725 Tijeras Ave NW
Albuquerque NM 87102

TO Trais Kliphuis
NM Environment Dept.
2905 Rodeo Park Dr. East,
Bldg. 1
Santa Fe, NM 87505

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name Kynnette Abbate

address Health Promotion and Education, W.M.U.
Kalamazoo MI 49008-5445

01716

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name Michael barcelona

address Dept of Chemistry, Western Michigan University
Kalamazoo, MI 49008-5413

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name Scott Kovac

address Santa Fe, NM 903 W. Alameda #740 87501

91716

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name DAVE McCoy CITIZEN ACTION

address PO BOX 4276

ABQ, NM 87196

11719

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name David Bacon

address 54 San Marcos Road West
SF 87508

01727

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SEP 2012

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name Rev. Holly Beaumont

address 27 Old Galisteo Way

Santa Fe NM 87508

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name Beata Tsosie

address #93 S. Santa Clara

Espanola, NM. 87532

: C1722

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name Lura Brookins Lura Brookins

address P. O. Box 1362

Santa Fe 87504

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name Lisa Puttkey

address 167 State Rd 399

Española, NM 87532

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address 662 Alta Vista #D19

Sf Fe NM 87505

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name Joanne Kennedy

address 903 W. Alameda #763
Santa Fe 87501

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name Virginia J. Miller

address 125 Calle Don Jose

Santa Fe NM 87501

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Thank you!

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name Jeffrey Bircbaum PhD

address 94 Sibley Rd
Sf NM 87508

01728

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name Betsy Millard

address 2012 Valle Rio

Santa Fe, NM 87505

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name MARion Seymour

address 2300 W. Alameda St

SF 87507

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name Ethan Genauer

address 209 S Coronado Ave

Espanola, NM 87532

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name Halima M. Christy Halima M. Christy

address 1025 Chelwood Park NE #123
Abq 87112

01732

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name Merida Wexler Merida Wexler

address 610 Ridge PL. NE

Albuquerque NM

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name Tom Snyder

address 1940 Poplar Ln SW

ABQ NM 87105

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name Judy Kaul
JUDY KAUL

address 524 Sycamore SE

Albq. NM 87106

01735

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name Lesley Weinstock

address 1712 Richmond Dr. NE

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name Mary I. Steele

address 329 Person St SE
Albuquerque, NM 87123

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name Susan Rodriguez

address 7224 Cerrillos Trl NW

Abq NM 87120

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name Scott Moore

address PO Box 1671

Ranchos de Taos, NM 87557

Speak Out Against More Plutonium at LANL & WIPP

The Department of Energy (DOE) plans to ship 13.1 metric tons of plutonium from nuclear weapons to Los Alamos National Lab (LANL) and to the Waste Isolation Pilot Plant (WIPP).

What are DOE's Plans?

DOE has released the *Draft Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD DSEIS).* The preferred alternative is for the Savannah River Site (SRS) to process 6 metric tons of plutonium and ship it to WIPP for disposal with other contact-handled transuranic (TRU) waste. For 7.1 metric tons of plutonium in "pits" - the triggers for nuclear bombs - some or all would be shipped from the Pantex Plant in Texas to LANL to be disassembled. The resulting plutonium oxide powder would be shipped to SRS to be fabricated into plutonium-uranium mixed oxide (MOX) fuel to be used in the Sequoyah (Tennessee) and/or Browns Ferry (Alabama) Nuclear Plants operated by the Tennessee Valley Authority.

What are concerns about DOE's plan?

- LANL is not meeting its waste cleanup schedule, and its facilities do not meet seismic standards in case of a severe earthquake. Bringing thousands of plutonium pits to LANL would further endanger public health and safety and divert resources away from cleanup.
- Doubling the amount of TRU waste coming from SRS will likely exceed WIPP's capacity. As a result, TRU waste from LANL and other sites might not fit into WIPP.
- Plutonium should be immobilized so that it can be safety stored until new disposition options are available. Immobilization would also be less expensive than MOX.
- MOX is not viable as there are no utilities that want to use MOX fuel in existing power plants because of its costs, dangers, and the need to make changes to the reactors.

What Can I Do?

Submit written comments to: Sachiko McAlhany, NEPA Document Manager, SPD Supplemental EIS, U.S. Department of Energy, P.O. Box 2324, Germantown, MD 20874-2324, by **September 25, 2012.**

Use the sample comments below, or write whatever you want. ***August 3, 2012***

Thank you!

Dear Sachicko McAlhany:

I am very concerned about Department of Energy plans for surplus plutonium. No additional plutonium should be brought to Los Alamos National Lab (LANL), which has a cleanup mission and cannot meet seismic standards in the case of a severe earthquake. WIPP has a limited mission and does not have the capacity for all surplus plutonium. Stop MOX and immobilize and safely store plutonium until technically sound, suitable disposition facilities are available.

Name Karen Whitley

Address 2435 Oro Vista Rd NW

Albuquerque, NM 87107

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SEP 2012

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name Judith Krald

address 5170 Delia Rd NE
ABQ 87102

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name Robert Prest

address 901 adams SE

Abq. N.M. 87108

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name Paula Gotthelf

address 3466 Camino Rd C-2
Santa Fe, NM 87507

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name Marion Seymour Dz

address 2300 W. Alameda St

Santa Fe 87507

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name Haylee Becker

address 424 Arroyo Seco, NM 87

01747

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name Crystal Bix

address 424 Arroyo Seco, NM USA

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name Erin Dennison

address P.O. Box 444 Ft. Wingate, NM 87316

01745

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name James Dennison

address P.O. Box 444 Gallup, NM 87316

21750

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name Ryan Benson

address PO Box 444 FT WINGATE, NM 87316

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name Rose Marie Cecchini MM
Office of Life, Peace, Justice + Creation Stewardship
Gallup Diocese
address 305 W. Highway 66, Gallup, NM 87301

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name Stephen Mills
STEPHEN MILLS

address 212 RICHMOND DR SE
ALBUQUERQUE, NM 87106

01753

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name Michael Swick

address 6002 Redondo CT NW
Los Ranchos NM 87107

11754

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SEP 2012

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name David J. Barbour
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address 1312 C Narcissus Dr NE
Albuquerque, NM 87112

91755

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name Annette Martinez

address Rt. 4 Box 224 # 19413

Espanola NM 87532

01756

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name Melissa W. Williams

address PO Box 1114

Santa Fe NM 87504

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name Michael Mandell

address 3031 Calle Caballero
Santa Fe, NM 87507

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name Jan Boyer Janice Boyer

address 815 Rio Vista St.

Sfe NM 87501

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name Griselda Lopez

address 3031 Calle Caballero
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name Kay Giles Kay Giles

address 1321 Jeanette SW

Albuquerque, NM 87105

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name HANH NGUYEN

address 1027 SHIRLEY NE ALB, NM 87112

0762

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name Lonni Ann Fredman

address 514 Valley High St SW

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address 3829 camino Capistrano NE

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name Kim Heaney

address 3124 Carolina St NE

ABQ, NM 87110

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name CAROLINA YAHNE

address 441 SOLANO NE
ABQ 87108

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name W. William J ZIMMER

address 441 Solano NE

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name Georgia Naranjo

address Box 0001

Espanola, NM 87532

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name Robert Chavez

address PO Box 916

Ohkay Owingeh, NM 87566

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name JOE HEMERLING

address 1824 Kiva Rd 87505-3313

Santa Fe, NM

0779

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name David Cooper

address 3707 Comanche Rd.
Albuquerque, NM 87110

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name (DIANA BAKER) diana J Baker

address Santa Fe, NM 87501

LA772

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name Angela Boone

address 1421 Richmond SE.
Alb. 87106

91773

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name REV. JOHN W. FISHBURN

address 1443 MORA ROAD SW ALB NM87105

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name Richard L. Harrison

address 5404 Montgomery, N.E. #409A
ALBUQUERQUE, N.M. 87109

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name Benjamin Abbott

address 1809 Las Lomas Rd NE Apt D

Albuquerque, NM 87106

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name Catherine Ewer

address PO Box 707

Tesuque, NM

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name Anna Molktor

address 2100 Paseo Ponderosa

Santa Fe, NM 87501

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name Christian Peaty

address PO Box 23682

Santa Fe, NM 87502

91779

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name CYNTHIA JURS

address 6 CAMINO CHUPADERO

SANTA FE NM 87506.

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name Andres Vargas

address P O Box 2066

El Prado, NM 87529

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name JON PYLE

address 4388 FAIRWAY DR

LOS ALAMOS, NM 87544

01782

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name Ruby Fuentes

address P.O. Box 155, Polvica Az. 86042

091783

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name Gerald R. Brown Gerald R. Brown July 14, 2012

address Box 451 Church Rock, N.M. 87311

01784

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name [signature] Juana Colon

address 315 Rosario Blvd. Santa Fe, 87501

01765

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name Maggie Billman

address 1650 Dani Dr Apt D-23 Gallup NM 87301

01786

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name John Boomer

address P.O. Box 3207, Milan, N.M. 87021

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name Kelsey B Gregory

address 650 Dani Dr Apt D-23

Gallup, NM 87301

71788

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name Albert Shirley

address PO Box 2[illegible], Ft. Wingate, NM 87316

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name Robert Tohe/ [illegible]

address 408 E. Route 66, Flagstaff AZ 86001

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name Jonathan Perry

address P.O. Box 1212 Cowgirl, NM 87313

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name Larry S King

address POB 2197 Gallup NM 87305

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name PROF. DANIEL SCHWARTZ

address Sociology, UNIV OF NEW MEXICO

Albuquerque, NM 87131

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name Virginia L. Obenshain Obenshain

address 3024 Barcelona SW

Albuquerque NM 87105

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name Claire Holmes

address 1329 Vassar Dr NE

Albuquerque NM 87106

01795

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name David R. Lopez

address 2416-B Rice Ave. NW

Albuquerque, NM 87104

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name Mark Doppke

address 1209 Forrester Ave NE

Albuquerque, NM, 87104

31797

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name Arturo Uribe

address PO Box 95 Mesquite, NM 88048

114 Emerson St. Mesquite NM 88048

21798

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name Cindy Sassenrath Cindy Sassenrath

address 1003 Silver SW

ABQ NM 87102

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name Bridget Mullins

address 3513 Camino Alameda SW

Albuquerque, NM 87105

21866

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name George Lujan

address 353 Camino Alameda

Española, NM 87505

71871

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12

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name E. Joaquin Griego Emiliano

address 427 Placido Martinez Ct NE

Albuquerque, NM 87102-2524

1892

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name DAVID R. LINDSEY

address 424 AMHERST DR SE

ALBUQUERQUE NM 87102

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address 140 Terracotta Pl SW

Alb. N.M. 87121-9507

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name Julie McIntyre

address 3917 La Hacienda, NE

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name Rodrigo Rodriguez

address 829 Alvarado dr SE

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name Karli Schwartz Karli Schwartz

address 209 Columbia Dr SE
Apt #20
ABQ, NM 87106

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name Alex Innis

address 404 Richmond Dr. NE

Albuquerque, NM, 87106

01978

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Use the sample comments below, or write whatever you want.

Thank you!

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name Emily Ennis Emily Ennis

address 404 Richmond SE

Albuquerque, NM 87106

Speak Out Against More "Hot" Waste at WIPP

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name Corinne Lykins Corinne Lykins

address 1581 Chihuahua Rd,

Rio Rancho NM 87144

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name Casey Holland

address 805 Riverside Dr SW

ABQ, NM 87105

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name Lars Fabricius-Olsen

Lars Fabricius Olsen

address 805 Riverside SW

Albuquerque, NM 87105

71812

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name CHRIS EVANS CHRISTIAN

address 223 High ST NE

87106, ABQ, NM

01813

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name Ellyse Gentry Ellyse Gentry

address 802 Coal

802 Coal, SW

Albuquerque, NM 87102

C1814

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name Lesley Bennett Moore

address 850 Riverside Dr SW

Albuquerque, NM 87105

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name Lauren McAuley

address 2120 Gold St

Albuquerque, NM 87106

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name Dominic Perea

address 4002 Camino Del Valle SW
87105

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name [illegible]

address 308 12th St SW 87102

01316

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SEP 2012

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name Robert Aly

address 215 Hartline Av. SW
Albuquerque, NM 87105

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name [illegible]

address 34 CAMINO TOH, UNIT D

SANTA FE, NM 87506

ENTERED

Allen, Pam, NMENV

From: Maestas, Ricardo, NMENV
Sent: Thursday, October 11, 2012 2:48 PM
To: Allen, Pam, NMENV
Subject: FW: Public comment on Shielded containers
Attachments: PermitMod_RH_letters_091012.pdf; NMED_post_office_090612.pdf

WIPP file

-----Original Message-----
From: Kliphuis, Trais, NMENV
Sent: Monday, September 10, 2012 3:21 PM
To: Maestas, Ricardo, NMENV; Holmes, Steve, NMENV
Cc: Kieling, John, NMENV
Subject: FW: Public comment on Shielded containers

-----Original Message-----
From: Don Hancock [mailto:sricdon@earthlink.net]
Sent: Monday, September 10, 2012 3:08 PM
To: Kliphuis, Trais, NMENV
Subject: Public comment on Shielded containers

Trais,

Attached are 55 more people commenting on shielded containers. The originals are being mailed today, but we wanted to ensure that you received them today.

On a related matter, we priority mailed you last Thursday, 106 comment letters. They were supposed to have been delivered on Friday. See attached confirmation.

Unfortunately, rather than delivering on Friday, the post office tried to deliver on Saturday and left a notice! See the following tracking.
Priority Mail®
Notice Left (Business Closed)
September 08, 2012, 1:13 pm
SANTA FE, NM 87505

Expected Delivery By:
September 7, 2012
Delivery Confirmation™

Acceptance
September 06, 2012, 3:38 pm
ALBUQUERQUE, NM 87106

So I'm wondering how you plan to handle the situation, given that the receipt date could be today (I hope!) or not?

SRIC's detailed comments will be submitted in a little while.

Thanks.

120926

U.S. Postal Service™ Delivery Confirmation™ Receipt

Postage and Delivery Confirmation fees must be paid before mailing.

Article Sent To: (to be completed by mailer)

(Please Print Clearly)

POSTAL CUSTOMER:
Keep this receipt. For inquiries:
Access internet web site at
www.usps.com®
Or call 1-800-222-1811

CHECK ONE (POSTAL USE ONLY)
☒ Priority Mail™ Service
☐ First-Class Mail® parcel
☐ Package Services parcel
(See Reverse)

Postmark Here

SEP - 6 2012

PS Form 152, May 2002

DELIVERY CONFIRMATION NUMBER:

0312 0860 0000 2811 4837

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UNIVERSITY POSTAL STORE
ALBUQUERQUE, New Mexico
871069998
3401500106-0098
09/06/2012 (800)275-8777 03:40:00 PM

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Sales Receipt

Product Description	Sale Unit Qty	Price	Final Price
SANTA FE NM 87505			$5.30
Zone-1 Priority Mail			
1 lb. 2.10 oz.			
Expected Delivery: Fri 09/07/12			
Delivery Confirmation			$0.75
Label #:	03120860000228114837		
Issue PVI:			$6.05
Total:			$6.05

Paid by:
Personal Check $6.05

Order stamps at usps.com/shop or call 1-800-Stamp24. Go to usps.com/clicknship to print shipping labels with postage. For other information call 1-800-ASK-USPS.

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Get your mail when and where you want it with a secure Post Office Box. Sign up for a box online at usps.com/poboxes.

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Bill#:1000201465829
Clerk:14

All sales final on stamps and postage
Refunds for guaranteed services only
Thank you for your business

****
****

HELP US SERVE YOU BETTER

Go to:
https://postalexperience.com/Pos

TELL US ABOUT YOUR RECENT
POSTAL EXPERIENCE

YOUR OPINION COUNTS

****
****

Customer Copy

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Dear Trais Kliphuis:

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name Susan Schuurman

address 2112 Charlevoix NW

Albuquerque NM 87104

Speak Out Against More "Hot" Waste at WIPP

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name [illegible] (Otwaya)

address 213 13 St. NW

Albuq 87102

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name Rick Mercer

address 1011 Forester Ave

Cedar Hills

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name JENNIFER WYLIE

SEP 2012

address 300 CARLISLE BLVD., S.E.

ALBUQUERQUE N.M. 87106

71826

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name David Noel

address 523 1/2 Central NE

NM

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name Barbara Grothus

address 905 Silver SW

Albuq NM 87102

1138

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name Barbara Welcer

address 624 Douglas MacArthur Rd NW

Abq 87107

21829

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name Dorothy Dodd

address 909 8th St NW

Albuquerque 87102

31337

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name Monica Mirabal

address 926 San Lorenzo NW

Alb NM 87107

SEP 2012

01831

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name _____

address _____

: 31832

Speak Out Against More Plutonium at LANL & WIPP

The Department of Energy (DOE) plans to ship 13.1 metric tons of plutonium from nuclear weapons to Los Alamos National Lab (LANL) and to the Waste Isolation Pilot Plant (WIPP).

What are DOE's Plans?

DOE has released the *Draft Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD DSEIS).* The preferred alternative is for the Savannah River Site (SRS) to process 6 metric tons of plutonium and ship it to WIPP for disposal with other contact-handled transuranic (TRU) waste. For 7.1 metric tons of plutonium in "pits" - the triggers for nuclear bombs - some or all would be shipped from the Pantex Plant in Texas to LANL to be disassembled. The resulting plutonium oxide powder would be shipped to SRS to be fabricated into plutonium-uranium mixed oxide (MOX) fuel to be used in the Sequoyah (Tennessee) and/or Browns Ferry (Alabama) Nuclear Plants operated by the Tennessee Valley Authority.

What are concerns about DOE's plan?

- LANL is not meeting its waste cleanup schedule, and its facilities do not meet seismic standards in case of a severe earthquake. Bringing thousands of plutonium pits to LANL would further endanger public health and safety and divert resources away from cleanup.
- Doubling the amount of TRU waste coming from SRS will likely exceed WIPP's capacity. As a result, TRU waste from LANL and other sites might not fit into WIPP.
- Plutonium should be immobilized so that it can be safety stored until new disposition options are available. Immobilization would also be less expensive than MOX.
- MOX is not viable as there are no utilities that want to use MOX fuel in existing power plants because of its costs, dangers, and the need to make changes to the reactors.

What Can I Do?

Submit written comments to: Sachiko McAlhany, NEPA Document Manager, SPD Supplemental EIS, U.S. Department of Energy, P.O. Box 2324, Germantown, MD 20874-2324, by **September 25, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Sachicko McAlhany:

I am very concerned about Department of Energy plans for surplus plutonium. No additional plutonium should be brought to Los Alamos National Lab (LANL), which has a cleanup mission and cannot meet seismic standards in the case of a severe earthquake. WIPP has a limited mission and does not have the capacity for all surplus plutonium. Stop MOX and immobilize and safely store plutonium until technically sound, suitable disposition facilities are available.

Name [redacted]

Address 313 Hale circle SW.

Alb NM 87105

Speak Out Against More "Hot" Waste at WIPP

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name Grace Dena

address 313 Hale Circle SW

Albuq. NM 87105

01834

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name Crystal Sanchez

address 710 Rancher 87105

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name Max Jaramillo

address 340 Reynolds 87105

Albuq, NM

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name PETER GALLO

address 828 RIVERSIDE DR. SW

ALBQ. NM, 87105

01837

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name Joyeon Gallo

address 928 Riverside Dr. SW

Albuquerque, NM 87105

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name Corina Hernandez

address 816 Arroyo Pl SW

Albq NM 87105

21839

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name Mary Haywood

address 660 20 Bluewater NW

Albuq N.M. 87121

SEP 2012

71846

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name James Marshall

address 309 Mesilla St. NE

Albuquerque, NM 87108

2012 41

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name [signature] Jerry Ortiz y Pino

address 400 12th NW

Albuquerque, N.M. 87102

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name Albert Hiat

address 4607 Grand Ave NE 87108-1214

SEP

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name Jinnelli C R. Godulin

address 6324 Zimmerman Avenue NE

87110 - Albuquerque - NM

: 91844

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name Heather Huston

address 1407 15th St NW

Abq, NM 87104

014845

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name Robert Messenger

address 810 13th St. NW

Albuquerque, NM 87102

SEP 2012

7184E

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name Ari Biernoff

address 220 Girard Blvd SE

Albuquerque NM 87106

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name DAN COLLETT

address 706 FRUIT AVE NW APT C

Albuquerque, NM 87102

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name [illegible] S Bleau

address 2004 Del Norte Rd SW

Albuquerque NM 87105

91649

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I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name [illegible]

address [illegible]

Albuquerque, NM 87102

SEP 2012

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

- The amount of RH waste shipped to WIPP, stored aboveground, and disposed underground would substantially increase.
- Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.
- Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Matthew Scott

address 309 Placitas NW

ABQ, NM 87107

SEP 2012

01851

Speak Out Against More "Hot" Waste at WIPP

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Billy Pepper

address 1313 Girard SE.

Abq. N.M. 87106

Speak Out Against More "Hot" Waste at WIPP

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Thank you!

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Cindy Hong

address 313 Princeton Dr SE

Albuquerque, NM 87106

SEP 2012

1853

Speak Out Against More "Hot" Waste at WIPP

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Amander Rich

address 2303 Meadow Rd

Albuquerque, NM 87105

91254

Speak Out Against More "Hot" Waste at WIPP

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Ellen C Robinson

address 1501 Tijeras NE #312W

Albuquerque NM 87102

: 31855

Speak Out Against More "Hot" Waste at WIPP

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Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Virginia Quinn

address 123 A 9th St. SW

Albuquerque, NM 87102

01855

Speak Out Against More "Hot" Waste at WIPP

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Thank you!

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Shelece Easterday

address 312 Monroe St. NE

Albuquerque, NM 87108

1857

Speak Out Against More "Hot" Waste at WIPP

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Donald Wells

address 600 Alvarado Pl SW #6D

ABQ NM 87104

091858

2523 Carson Rd NW
Albuquerque, NM 87104-1903
August 22, 2012

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Dr E, Bldg 1
Santa Fe, NM 87505

Dear Trais Kliphuis:

I understand the New Mexico Department of Energy wants to bring more remote-handled transuranic waste to the Waste Isolation Pilot Plant.

Is it true that DOE's plans to use shielded containers for this hot commercial waste will expand WIPP beyond its legal limit?

I believe it is essential to oversee this proposal with vigor and to hold a public hearing in regard to DOE's request.

Sincerely,

Sally E. Schwartz

01859

9-7-12

Dear Trais Kurphuis,

"I am very concerned about the use of "shielded" containers going into our WIPP site which is designed for contact-handled waste & NOT remote handled waste.

As I understand shielded containers are not proper Class 2 permit modification - I am requesting a public hearing that shielded containers be a Class 3 modification - We need more opportunity to discuss these plans.

Thank you,

Maureen Wright
2816 Kentucky St NE
Albuquerque NM 87110
mgwright@comcast.net

71971

Dear Trais Kliphuis:

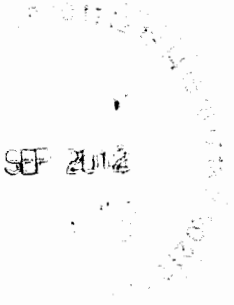
I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Claudia Fluegge

address 6020 Northland Ave. NE

Albuquerque NM, 87109



Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Trais Kliphuis:

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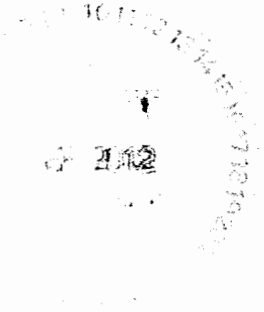
The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Luis A. Ortega (Luis A. Ortega)

address 7509 Guadalupe Tr NW

ABQ, NM 87107



639144

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

616 La Mesuza Dr.,
Santa Fe, NM 87501

To. Travis Klipheis, NMED
2905 Rodeo Park Drive East, Bldg 1
Santa Fe, NM 87505

September 6th 2012.

Dear Travis Klipheis,

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store & dispose. Despite what the Department of Energy says, shielded containers could NOT be handled like contact-handled waste because damaged or leaking containers could be too radio-active to over-pack.

The shielded containers request once agreen is NOT a proper class 2 permit modification. I request a public hearing & that shielded containers be a class 3 modification so that there would be more extensive public comment & an opportunity for a hearing.

Yours faithfully,

Nadia A. Anhalt
NADIA. A. ANHALT

01865

Mary Jacklyn Dulle
211c Calle Tecolote
Santa Fe, New Mexico 87505

Sept. 6, 2012

Mr. Trais Klyphius
New Mexico Environment Dept.
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe NM 87505

Dear Mr. Klyphius:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the DOE says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to overpack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely, Jacklyn Dulle

01856

Trais Kliphuis
NMED
2905 Rodeo Park Drive East Bldg I
Santa Fe, NM 87505

Dear Mr Kliphuis:

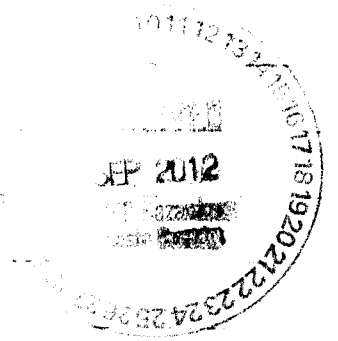
Regarding the RH waste shipment to WIPP, I have great concern about the use of shielded containers. Since these containers cannot be handled like contact-handled waste, due to the possibility of damage or leakage, the overpacking of the containers adds an additional level of danger & concern.

I would like to ask that another hearing be conducted to classify the containers as a class 3 modification, provide additional opportunity for public response.

Sincerely,
Joan E Alessi
13 Descanso Rd
Santa Fe, NM 87508

Sept 6, 2012

Trais Klephais
NMED
2905 Rodeo Park Drive
East, Building 1.
Santa Fe, N.M. 87505



Dear Trais Klephais

It is my understanding that NMED denied in Jan. 01, 2012 the use of shielded containers at WIPP the shielded containers is not a proper class 2 permit modification I request a public hearing and that the shielded containers be a class 3 modification & that be more extensive public comment and an opportunity for a hearing.

Eleanor Vitsolas
4345 Dandy Ground
Santa Fe, N. M. 87507

September 6, 2012

Trais Kliphuis
NMED
2905 Rodeo Park Dr E., Bldg. 1
Santa Fe, NM. 87505

Dear Trais Kliphuis:

I am very concerned about shielded containers. They could expand the space available at WIPP for remote-handled waste that is dangerous to transport store & dispose despite what the DOE says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to upgrade.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing, and that shielded containers be a class 3 modification so that there would be more extensive public comment & an opportunity for a hearing.

Thank you,

Flor de María Oliva
2140 Candelaria St
Santa Fe, NM 87505

01869

From:	Me
To:	Kliphuis, Trais, NMENV
Cc:	Jeffrey Dillon
Subject:	Nuclear Waste, WIPP, Area 55, Citizen Concerns, Hazards, DOE Reports of Adversity ot Environment and Minority People, ETC.
Date:	Sunday, September 09, 2012 1:46:34 AM

Dear Trais Kliphuis:

I live in Taos County, and though it is not in the fifty mile radius of a foreseeable disaster, the winds do blow this way. I remember the s,ell of the fires at Los Alamos a few summers ago, and how the smoke filled the skies. I don't believe there is anything safe about storing the waste, about the safety of shielded containers, or about the transportation of the plutonium rods or bits that would be part of all this. Though our nation needs a solution to nuclear waste, placing it in this pristine environment at the expense of poor and minority communities is wrong.

We must all share the burden equally. Those who use the power should be expected to handle their share of the waste, so please don't let more waste come to New Mexico. Perhaps the first peoples walked on these lands in New Mexico some 12,000 years ago. A nuclear accident is not impossible with terrorism threats, poor management at LANL, and a lack of dedicated resources. Our world's history could be obliterated as well as the current occupants of the beautiful southwest. I pay my taxes, and support our constitution. Where does it say, the few should pay for the many?

I urge you and this committee to act in accordance with the ordinary people who live here, who have made this area home. I will continue to educate myself and my family and my friends here in Taos Ounty, and around the world about the plans and activities at Area 55 and in New Mexico, generally. The world is with us.

Additionally, I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,

Jeffrey C. Bullard

Post Office Box 222

Carson, New Mexico, 87517

120918

This device was developed by an American corporation with components from several countries, and assembled by non-union labor in China. Any patent infringements should be addressed to the company of manufacture. This user supports creative copyrights, sharing of technological achievements, and global trade. 2012:09:04 JCB

From:	Mary Kay Blackmon
To:	Kliphuis, Trais, NMENV
Subject:	Msg to NMED re: my concern and request related to WIPP
Date:	Saturday, September 08, 2012 9:34:56 PM
Importance:	High

To whom it may concern:

I grew up in Carlsbad and continue to visit friends there. I love and care about the health and welfare of the people and environment of New Mexico. I am especially concerned about the hazards involved in transporting nuclear waste through the state for storage at WIPP just outside my hometown.

I am writing to express my concern that shielded containers at WIPP allow more remote-handled waste that is dangerous to transport, store, and dispose of.

I request a public hearing on shielded containers, which should be a class 3 modification to allow additional public comment and hearing.

Respectfully yours,

Mary K. Blackmon
1202 Loma Drive #19
Ojai CA 93023

120917
372

JOAN ROBINS
3565 RIO GRANDE BLVD. NW
ALBUQUERQUE, NEW MEXICO 87107
505-341-2306 PH.; 505-342-1810 FAX
September 3, 2012

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Dr. East, Bldg. 1
Santa Fe, New Mexico 87505

Dear Trais Kliphuis,

I am opposed to the Department of Energy bringing more "hot" Remote Handled transuranic waste to the Waste Isolation Pilot Plant. When WIPP opened in 1999, you no doubt are aware Remote Handled waste was not permitted. Since 2007 when Remote Handled Waste had begun to be shipped to WIPP, it was not done in a manner to leave enough room for further waste that is being proposed now.

The transfer of waste in shielded containers being proposed now has many problems. The containers would expand the space available at WIPP for Remote Handled waste that is dangerous to transport, store and dispose of. Contrary to what the Department of Energy says, shielded containers cannot be handled the same as contact-handled waste. Shielded containers that are damaged or leaking could be too radioactive to be placed in over-pack containers without exposing workers and the public. As DOE plans to use shielded containers for hotter commercial nuclear waste, this requires changing federal law to expand WIPP beyond its legal limit of 175,564 cubic meters of defense plutonium contaminated transuranic waste. Shielded containers have not been used before.

The Environment Department denied a similar request on January 31, 2012 and should deny it again. Minimally I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing. We do not need more hot wastes coming to WIPP.

Sincerely,

Joan Robins

Joan Robins

120913
3-873

Ms [illegible]an Robins
35[illegible]o Grande Blvd NW
Albuquerque NM 87107

Ms. Tras Kliphu
N.M Environme
2905 Rodeo Par
Santa Fe, N.M.

87505631301 ||

9/2/2012

Dear Tim:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could not be over-packed.

The shielded containers request is not a proper class 2 permit modification. **I request a public hearing** and **that shielded containers be a class 3 modification** so that there would be more extensive public comment and an opportunity for a hearing.

Barbara Kieffer
4100 Ravenwood Court NW
Albuquerque, NM 87107

Barbara Kieffer
4100 Ravenwood Ct. NW
Albuquerque, NM 87107-3128

Tom Hall
P.O. Box
2905 Rodeo
Santa Fe, NM

87505691301 IL

54876

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Thank you for listening to the public and our concern for our safety of our families and the land that supports us.

Sincerely,

Alyson Steinman
527 Ponderosa NW
Albuquerque, NM 87107

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

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ais Klipluis
ю Mex Environmental Dept
;05 Rodeo Park Drive East, Bldg 1
nta Fe, NM
8 7 5 0]

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name S. Jatkar Shrayas Jatkar

address 225 Jefferson St, SE, Apt. 14

Albuquerque, NM 87108

C-915

Dear Trais Klipnuis:

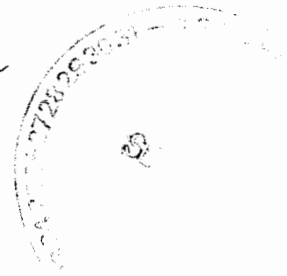
I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Joseph & Merida Wefler

address 610 Ridge PL. NE

Albuquerque, NM 87106



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Mr. & Mrs. Joseph Wexler
610 Ridge Pl NE
Albuquerque, NM 87106-4538

.01991

MR. Trask
NMED
2905 Rod
Building 1
Santa Fe,
87505631301

From:	Mark Holland
To:	Kliphuis, Trais, NMENV
Subject:	RH waste
Date:	Tuesday, September 04, 2012 10:17:37 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. As you know, my hometown would be vulnerable to any transport incidents. Plus, they would expand the spaceavailable at WIPP for remote-handled waste that is dangerous to store and dispose. Despite what the Department of Energy says, shieldedcontainers could not be handled like contact-handled waste because damaged orleaking containers could be too radioactive to over-pack.

Theshielded containers request once again is not a proper class 2 permitmodification. I request the DOE's permitbe denied. If this is not so, then I request a public hearing and that shieldedcontainers be a class 3 modification so that there would be more extensivepublic comment and an opportunity for a hearing.

Sincerely,

Mark Holland
237 Casados St.
Santa Fe, NM 87501

Reply

Reply to all

Forward

120904

Ella Joan Fenoglio
Lawyer

4427 Avenida del Sol NE
Albuquerque, NM 87110-6178
(505) 266-1955, FAX (505) 266-7815
email: EllaJoan@HighFiber.com

August 31, 2012

Trais Kliphuis, NMED
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear M. Kliphuis:

I write to comment on the use by DOE of shielded containers at WIPP. The waste stored there is dangerous to transport, store and dispose. Please do not allow the shielded containers. It is not a permissible class 2 permit modification.

I request a public hearing. Shielded containers should be a class 3 modification to allow more extensive public comment.

Thank you for your time and attention to my request.

Sincerely,

Ella Joan Fenoglio

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

- The amount of RH waste shipped to WIPP, stored aboveground, and disposed underground would substantially increase.
- Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.
- Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you! Thanks for your letter!!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

(Mrs) name Lilly K. Rendt

address 11005 Morris Court NE

Albuquerque, N.M. 87112

(00495

I have always been opposed to transport of radioactive waste in N.M.!! First of all, as a teacher who was traveling in the summer months and was held up in Gallup, NM. for hours (which was when a truck carrying only inflammable materials overturned near a school) I helped the teachers, who were frantic to get the children away from the accident and safely home to their parents. I helped to interview frantic parents + teachers, looking for children who had gone to homes of friends or attempted to WALK home. It was chaos — and THAT wasn't even nuclear. Your conceptions of safety are NOT adequate and will never be with nuclear items. I've gone to the meetings + protested, I have written letters to all sorts of significant people and I've sat in a "SIT-IN" about the WIPP site. You ignore us + do as you please, thinking your latest small concessions are adequate for safety — but your have never been in a real emergency. I was on Mtn. Rescue in Albuquerque for years, I helped relocate people to Albuquerque from New Orleans, etc. Adding nuclear danger to the equation is IMPOSSIBLE! WAKE UP and Live!! Lilly K. Rendt

SEP 2012

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

01887

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

- The amount of RH waste shipped to WIPP, stored aboveground, and disposed underground would substantially increase.
- Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.
- Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Madeline Aron

address 1006 Richmond NE

Albq NM 87106

Thank you for your attention I hope you take this seriously into consideration.

Madeline Aron

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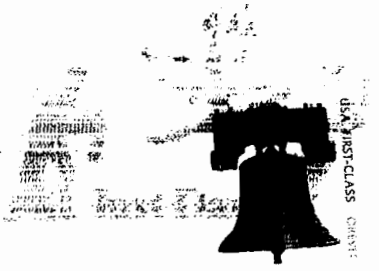
Madeline Cron
1006 Richmond NE
Albq NM 87106



Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

87505631301 01889

From:	Patti Blair
To:	Kliphuis, Trais, NMENV
Subject:	radioactive waste
Date:	Monday, September 03, 2012 8:21:21 AM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request the DOE's permit be denied. If this is not so, then I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,

P. Blair
Santa Fe, NM

120903

From:	Linda Garcia
To:	Kliphuis, Trais, NMENV
Subject:	deny DOE permit for shielded containers
Date:	Monday, September 03, 2012 8:23:06 AM

Please deny DOE permit due to concerns about shielded containers.

Linda Garcia
83 Old Agua Fria Rd W
Santa Fe, NM 87508

From:	Patty Conway
To:	Kliphuis, Trais, NMENV
Subject:	plutonium waste
Date:	Monday, September 03, 2012 8:23:45 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request the DOE's permit be denied. If this is not so, then I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,

Patty Conway

1205 San Jose Ave

Santa Fe, NM 87505

From:	Andrew Gold
To:	Kliphuis, Trais, NMENV
Subject:	Concerns about more RH waste at WIPP
Date:	Sunday, September 02, 2012 2:18:41 PM

Dr. Mr. Kliphuis,
I am very concerned about the DOE"S request to ship more RH waste to the WIPP site including the substantial increase in the amount of RH waste that would be shipped to WIPP, stored aboveground, and disposed underground. The amount of RH waste in the WIPP inventory is more than 2,000 canisters more than will fit in the remaining designated space.

Further, contrary to what DOE says, shielded containers cannot be handled the same as contact-handled waste. Shielded containers that are damaged or leaking could be too radioactive to be placed in over-pack containers without exposing workers and the public. DOE also plans to use shielded containers for hotter commercial nuclear waste, which requires changing federal law to expand WIPP beyond its legal limit of 175,564 cubic meters of defense plutonium-contaminated transuranic waste. And, shielded containers have never been used.

The Environment Department denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

Please take these concerns into consideration and refuse the DOE'S current request as it has been filed.
Thank you.
Andrew Gold; Santa Fe, NM

120902 1893

From:	Mona Ruark
To:	Kliphuis, Trais, NMENV
Cc:	ccns@nuclearactive.org
Subject:	Request to deny DOE"s per
Date:	Sunday, September 02, 2012 4:22:34 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request the DOE's permit be denied. If this is not so, then I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,

Mona Ruark
2210 Miguel Chavez #426

Santa Fe, NM 87505

From: Caitlin Dean
To: Kliphuis, Trais, NMENV
Subject: Public comment: shiping shielded containers to WIPP
Date: Sunday, September 02, 2012 6:32:07 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request the DOE's permit be denied. If this is not so, then I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely,

Caitlin Dean

1707 Medio St

Santa Fe, NM 87501

--

Forget safety. Live where you fear to live.
Destroy your reputation. Be notorious.
I have tried prudent planning long enough.
From now on, I'll be mad.

- Rumi

From:	Lesley Weinstock
To:	Kliphuis, Trais, NMENV
Cc:	Don Hancock; Janet Greenwald
Subject:	More "Hot" Waste Planned for WIPP
Date:	Saturday, September 01, 2012 6:24:41 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available
at WIPP for remote-handled waste that is dangerous to transport, store, and dispose.
Despite what the Department of Energy says, shielded containers could not be handled
like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification.
I request a public hearing and that shielded containers be a class 3 modification so that
there would be more extensive public comment and an opportunity for a hearing.

Sincerely,
Lesley Weinstock, Coordinator
Agua es Vida Action Team (AVAT)
representing 300 members
202 Harvard SE
Abq, NM 87106

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ENTERED

From: Piper
To: Kliphuis, Trais, NMENV
Subject: Comments on Proposed WIPP Permit Modification
Date: Sunday, July 29, 2012 2:47:43 PM

I have the following comments on the proposed WIPP hazardous Waste Permit Modification for the Addition of a Shielded Container.

1. I fully support the proposed modification. Using small shielded containers with simplified emplacement underground will reduce worker industrial safety exposure to the handling of remote-handled TRU waste compared to the currently approved wall emplacement methods in the permit. Using small shielded containers that are never opened and minimally handled will also reduce worker radiological exposure. These industrial and radiological safety enhancements are sufficient to approve the proposed modification.
2. I fully support the proposed permit modification proceeding as a Class 2 Modification. The proposed changes are simple and do not affect the total RH TRU waste volumes limited in the permit. Prudently expediting this modification will hasten the safety benefits derived from its approval.

Thank you for the opportunity to comment.

Regards,

Lloyd Piper
PO Box 6353
Bryan, Texas 77805
piper@ieee.org

120724.5

From:	Kyle Marksteiner
To:	Kliphuis, Trais, NMENV
Subject:	shielded container letter
Date:	Monday, August 20, 2012 12:48:05 PM
Attachments:	shieldedcontainerheaton.pdf

The following letter is submitted at the request of John Heaton.

August 16, 2012

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, N.M. 87505

Dear Ms. Kliphuis:

As an involved resident of Carlsbad who currently serves as the chair of the Carlsbad Mayor's Nuclear Task Force, I would like to comment on the proposed Class 2 permit modification to allow the use of shielded containers at the Waste Isolation Pilot Plant for some remote handled waste.

It is my understanding that this simply an increased efficiency which will make it easier for generator sites to bring remote handled waste to WIPP. Furthermore, DOE and its contractors have provided ample evidence that this issue should be handled as a Class 2 permit modification request, not a Class 3 request. Previous technical questions have been answered, and I encourage the New Mexico Environment Department to approve this permit modification request.

Sometimes it helps me understand an issue by taking a look at the arguments made in opposition. The web site www.nuclearwatch.org, under a subhead "Speak Out Against More Hot Waste at WIPP!" encourages its visitors to send you a form letter opposing shielded containers. I'd like to address these alleged reasons for opposition.

- Nuclear Watch New Mexico states: *The amount of RH waste shipped to WIPP, stored above ground, and disposed underground would substantially increase.*

  This is simply not true. The permitees are not asking for a change in storage capacity or volume limit. In fact, a prior argument made by some of Nuclear Watch's affiliates is that WIPP is falling behind in its RH disposal, which shielded containers could help remedy.

- Nuclear Watch New Mexico states: *Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.*

  "Might not be able" is interestingly speculative language, and the DOE and its contractors explained how overpack containers would be used during the recent hearings. I believe DOE has adequately explained and demonstrated its ability to handle shielded containers.

- Nuclear Watch New Mexico states: *DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.*

  I don't know what other potential uses of shielded containers the DOE might be considering for the future, but that's an entirely different issue not related to this permit modification. Shielded containers are a tool designed to increase efficiency. Because the waste in the shielded containers will meet all

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the criteria in the permit, then this argument is like saying we should not allow this waste stream at WIPP because WIPP might want to dispose of more of this waste stream in the future.

- Nuclear Watch New Mexico states: *Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.*

Shielded containers have never been used because the permit modification has yet to be approved. That's the entire point to the permit modification request, and it is a logical fallacy for justifying any opposition. This argument is basically saying we should oppose their use because we oppose their use.

The arguments currently presented by Nuclear Watch New Mexico in opposition to shielded containers have a feel to them of being obligatory placeholders, made only because the group feels compelled to make some sort of argument in opposition to anything at WIPP. I'd like to also note that the use shielded containers would actually decrease the number of RH trucks transporting waste to WIPP, a point that seems lost on its detractors. In fact, due to the increased transportation and waste handling efficiency, shielded containers will actually lessen the already very small risks to the citizens of New Mexico from WIPP operations, thereby making the Nuclear Watch New Mexico opposition actually opposite to the organization's stated goals.

I believe the Department of Energy and its contractors have done an excellent job addressing the technical questions asked by the NMED earlier this year and encourage your organization to approve this permit modification request.

John Heaton
575-302-6358
jaheaton1@gmail.com
102 S. Canyon
Carlsbad, NM 88220

ENTERT

August 20, 2012

Trais Kliphuis
NMED 2905 Rodeo Park Drive, East
Building 1
Santa Fe, NM 87505

Dear Trais Kliphuis

I have a grave concern re proposed use of "shielded containers." They would expand the space available at WIPP for remote-handled wasted that is very dangerous to transport, store, and of which to dispose. I am totally against that idea. Despite what the Department of Energy says, I don't believe it could possibly be safe. I don't believe that because I think that shielded containers cannot be handled like contact-handled waste. They would be vulnerable to damage and resulting leakage of radioactive substance. It could be catastrophic!

Shielded Containers, as requested, do not meet proper class 2 permit modification standards. I request a public hearing. I also request that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

Sincerely and with hope for your serious consideration of my request,

Tiska Blankenship
1523 Solano Dr. NE
ABQ NM 87110

Tiska Blankenship

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01901

Ms. Tiska Blankenship
1523 Solano Dr. NE
Albuquerque, NM 87110

Trais Kliphuis
NMED 2905 Rodeo Park Dr. E
Building 1
Santa Fe, NM 87505

87501 1301

01502

ENTERED

From: charlie davidson
To: Kliphuis, Trais, NMENV
Date: Tuesday, August 21, 2012 3:25:21 PM

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name _____

address_____

mail to: Trais Kliphuis

New Mexico Environment Department

2905 Rodeo Park Drive East, Building 1

Santa Fe, NM 87505

E-mail: trais.kliphu

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

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The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name __Carlos Villodas_____

address po-215 RDT

,nm 87557_____

mail to: Trais Kliphuis

New Mexico Environment Department

2905 Rodeo Park Drive East, Building 1

Santa Fe, NM 87505

E-mail: trais.kliphuis@state.nm.us

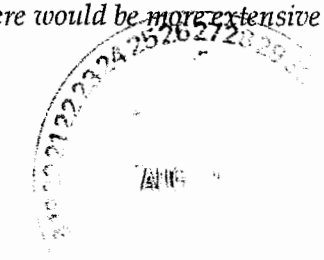
is@state.nm.us

61904

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.



name Sterling Sherwood

address 1224 Nakomis NE #1

Albuquerque

ALBUQUERQUE NM 870

23 AUG 2013 PM 1 L

Roman Park
Fe, NM 87505

91968

ENTERED

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Trais Kliphius,

I am very concerned that shielded containers at WIPP allow more remote-handled waste that is dangerous to transport, store, and dispose. I request a public hearing on shielded containers, which should be a class 3 modification to allow additional public comment and hearing.

The Department of Energy (DOE) opened the Waste Isolation Pilot Plant (WIPP) in 1999 when "Remote-Handled" (RH) transuranic (TRU-plutonium-contaminated) waste was prohibited. Since RH waste has been permitted, DOE still has not shipped RH waste at a rate to use the available capacity. Consequently, about one-half of the planned RH space in the walls of the underground rooms cannot be used because contact-handled (CH) waste has been emplaced. If NMED approves the modification request, RH waste in shielded containers could be trucked to WIPP and emplaced in the underground rooms along with CH waste.

At the surface of containers, RH TRU waste dose rate is more than 200 millirem per hour and can be up to 1,000 rem per hour. If a shielded container is damaged or leaking, DOE says it will be overpacked in the CH Bay, but in case of a severe leak that might not be possible without substantial radiation doses to workers. The modification request states that shielded containers could be overpacked, but neither the Standard Waste Box nor the Ten Drum Overpack is big enough for a three-pack.

The entire Waste Handling Building, both CH and RH Bays, is permitted for 194.1 cubic meters of TRU waste, of which 11 cubic meters can be RH waste. The modification request includes no limits on the number of RH shielded containers that could be in the CH Bay, effectively substantially increasing the amount of RH waste allowed.

DOE also has stated that it would use shielded containers to bring commercial waste, much of which is more radioactive than RH waste, to WIPP in its Greater-Than-Class C waste environmental impact statement. Thus, DOE's plans are to use shielded containers as a way to expand WIPP beyond its legal mission of disposal of up to 175,564 cubic meters of defense TRU waste, the limit set by the WIPP Land Withdrawal Act of 1992. WIPP should not be the dumping ground for profit-making commercial nuclear power waste. New Mexico has sacrificed enough of our environment. Don't let the nuclear power industry pawn off on us their dangerous, life-killing waste as well.

Given the dangers of RH waste, the need for much more information, the complexity of the changes proposed, and the public concern about RH waste, shielded containers require a class 3 modification request, which provides for more extensive public comment and an opportunity for public hearing. In response to the 2011 request, DOE was told by dozens of people that it was a class 3 request. Please take heed of the public's needs, not just for-profit industry. We are the people. We don't want it.

Sincerely, Jeanne Green, El Prado, NM 87529

Jeanne Green

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is Klipfuis (Public Comment)
ED
95 Rodeo Park Dr. E., Bldg 1
nta Fe, NM 87505

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Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

What are DOE's Plans?

DOE has submitted a *Permit Modification Request - Addition of a Shielded Container* to the New Mexico Environment Department (NMED) so that DOE can transport and dispose of RH waste in lead shielded containers. RH waste would continue to be shipped and disposed in large canisters in the walls of the underground rooms, as has been done since January 2007. If the NMED approves the request, RH waste in shielded containers could be trucked to WIPP and emplaced on the floor in the underground rooms along with Contact-Handled (CH) TRU waste.

What are concerns about shielded containers?

- The amount of RH waste shipped to WIPP, stored aboveground, and disposed underground would substantially increase.
- Contrary to what DOE says, shielded containers cannot be handled the same as CH waste. Shielded containers that are damaged or leaking might not be able to be placed in over-pack containers without exposing workers and the public.
- DOE also plans to use shielded containers for hotter commercial waste, expanding WIPP beyond its legal limit of 175,564 cubic meters of TRU waste.
- Shielded containers have never been used. NMED denied a similar request on January 31, 2012 because of public opposition and the inadequacies of the request.

What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Rose S Law

address 2203 Twisted Juniper Rd

Rio Rancho, NM 87124

120835

R SHAW
2203 TWISTED JUNIPER RD SE
RIO RANCHO, NM 87124-6310

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

87505631301

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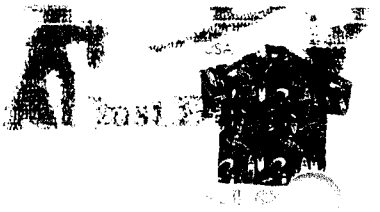
DO NOT allow shielded containers at WIPP! They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store and dispose. Despite what DOE says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request is NOT a proper class 2 permit modification. Hold a public hearing. Make shielded containers a class 3 modification with more extensive public comment. - Don Schrad

AMNESTY INTERNATIONAL
Mr. Don Schrader
1806 Walter St SE
Albuquerque, NM 87102-4763



Trais Klipkuis
NMED
2905 Rodeo Park
Drive East
Building 1
Santa Fe, N.M. 87505

AUG 2012

313 Washington N.E.
Albuquerque, N.M. 87108
August 1, 2012

Trais Kliphuis
NMED
2905 Rodeo Park Dr. East, Bldg. 1
Santa Fe, N.M. 87505

Dear Trais Kliphuis,

I am very concerned about shielded containers. The shielded containers request once again is not a proper Class 2 permit modification. I request a public hearing and that shielded containers be a Class 3 modification. Then there would be more extensive public comment and an opportunity for a hearing.

Despite what the Department of Energy says, shielded containers could not be handled like contact handled waste. There would be a danger that damaged or leaking containers could be too radioactive to over-pack.

I implore you to hold a public hearing and give the public an opportunity to present their concerns.

It's important that the workers be protected from contamination and that the environment and the air and water also be protected from contamination.

Very Sincerely, Floy Barrett

120801
01343

Mrs. Floy Barrett
316 Washington St NE
Albuquerque, NM 87108-1153

Trais Kliphuis, NMED
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, N.M. 87505

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

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What Can I Do?

Submit written comments to: Trais Kliphuis, NMED, 2905 Rodeo Park Drive East, Building 1, Santa Fe, NM 87505 by **September 10, 2012.**

Use the sample comments below, or write whatever you want.

Thank you!

Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name Juan Reynosa

address 312 Arno NE, ABQ, NM 87102

31915

Juan Reynoso
312 Arno NE
ABQ, NM 87102

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Speak Out Against More "Hot" Waste at WIPP

The Department of Energy (DOE) wants to bring more "hot" Remote-Handled (RH) transuranic (plutonium-contaminated or TRU) waste to the Waste Isolation Pilot Plant (WIPP) without providing adequate justification and without an opportunity for a public hearing.

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Use the sample comments below, or write whatever you want.

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Dear Trais Kliphuis:

I am very concerned about shielded containers. They would expand the space available at WIPP for remote-handled waste that is dangerous to transport, store, and dispose. Despite what the Department of Energy says, shielded containers could not be handled like contact-handled waste because damaged or leaking containers could be too radioactive to over-pack.

The shielded containers request once again is not a proper class 2 permit modification. I request a public hearing and that shielded containers be a class 3 modification so that there would be more extensive public comment and an opportunity for a hearing.

name LOUIS A. HEAD

address 802 HEADINGLY AV NW
ABQ NM 87107

917

Trais Kliphuis
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

NEW MEXICO
ENVIRONMENT DEPARTMENT

Resource Protection Division

Harold Runnels Building
1190 Saint Francis Drive (87505)
P.O. Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-0419 Fax (505) 827-0310
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SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary
JAMES H. DAVIS, Ph.D.
Division Director

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

September 28, 2012

Jose Franco, Manager
Carlsbad Field Office
Department of Energy
P.O. Box 3090
Carlsbad, New Mexico 88221-3090

M. Farok Sharif
Washington TRU Solutions LLC
P.O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: NOTICE OF EXTENSION FOR CLASS 2 PERMIT MODIFICATION DECISION
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Messrs. Franco and Sharif:

On July 6, 2012, the New Mexico Environment Department (**NMED**) received a Request for Class 2 Permit Modification to the Waste Isolation Pilot Plant Hazardous Waste Facility Permit from the Department of Energy's Carlsbad Field Office and Washington TRU Solutions LLC (**Permittees**) dated January 10, 2011. This Class 2 modification included the following items:

- Add the shielded container as a shipping package
- Description of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked
- Related changes to waste handling descriptions

According to 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)(6)), NMED must take specific action on the modification request no later than ninety (90) days after receipt of the request. In this instance, the date for a decision would be October 4, 2012. By this letter, I am notifying you as the Permittees that NMED will decide on this modification request within the next thirty (30) days, as allowed by 20.4.1.900 NMAC (incorporating §270.42(b)(6)(i)(E)).

120950

If you have any questions regarding this matter, please contact Trais Kliphuis of my staff at (505) 476-6051.

Sincerely,

James H. Davis, Ph.D.
Director
Resource Protection Division

cc: John E. Kieling, NMED HWB
Trais Kliphuis, NMED HWB
Thomas Kesterson, NMED DOE-OB/WIPP
Laurie King, EPA Region 6
Tom Peake, EPA ORIA
Connie Walker, Trinity Engineering
File: Red WIPP '12

NEW MEXICO
ENVIRONMENT DEPARTMENT

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SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary
JAMES H. DAVIS, Ph.D.
Division Director

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

November 1, 2012

Jose Franco, Manager
Carlsbad Field Office
Department of Energy
P.O. Box 3090
Carlsbad, New Mexico 88221-3090

Farok Sharif, Project Manager
Nuclear Waste Partnership LLC
P.O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: FINAL DETERMINATION, CLASS 2 MODIFICATION REQUEST
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Messrs. Franco and Sharif:

The New Mexico Environment Department (**NMED**) hereby approves with changes the permit modification request (**PMR**) to the WIPP Hazardous Waste Facility Permit as submitted to the Hazardous Waste Bureau in the following document:

- Request for Class 2 Permit Modification (TRUPACT-III, SLB2, CH Bay), Letter Dated 7/5/2012, Rec'd 7/6/12

The following items were included in this submittal:

- Add the shielded container as a shipping package
- Add a description of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked
- Related changes to waste handling descriptions

This Class 2 PMR was evaluated and processed in accordance with the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)). It was subject to a 60-day public comment period running from July 12, 2012 through September 10, 2012.

NMED hereby approves this modification with changes as noted in Attachment 1. Attachment 2 contains redline/strikeout pages of the modified permit to help the reader rapidly identify each modification. Language deleted from the permit is ~~stricken out~~. Language added to the permit is highlighted in redline. Specific language changes imposed by NMED are distinguished from language changes proposed in the modification request by yellow highlighting. Also enclosed is a CD-ROM containing the modified files in MS Word redline/strikeout format as well as files with markings and comments removed. An electronic version of the modified permit with markings removed will be publicly posted on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/download.html>.

For purposes of version control, please note that NMED has established the date of these modified module and attachment pages as November 1, 2012. The effective date of the permit modification approval is your date of receipt of this letter.

NMED is providing response to all public comments under separate cover.

If you have any questions regarding this matter, please contact Trais Kliphuis of my staff at (505) 476-6051.

Sincerely,

James H. Davis, Ph.D.
Director
Resource Protection Division

Attachment 1 – CD with Microsoft Word copies of both redline strikeout version and changes incorporated version

cc: John Kieling, NMED HWB
Trais Kliphuis, NMED HWB
Thomas Kesterson, NMED DOE-OB/WIPP
Laurie King, EPA Region 6
Tom Peake, EPA ORIA

File: Red WIPP '12

3.3.1.3. Ten-drum Overpack (**TDOP**)

Each TDOP has a gross internal volume of 160 ft^3 (4.5 m^3). TDOPs may be used to contain up to ten standard 55-gallon drums or one SWB. TDOPs may be direct loaded or used to overpack drums or SWBs containing CH TRU mixed waste.

3.3.1.4. 85-gallon (322-liter) Drum

Each 85-gallon drum has a gross internal volume of up to 11.4 ft^3 (0.32 m^3). 85-gallon drums may be direct loaded or used for overpacking 55-gallons drums containing CH TRU mixed waste and for collecting and storing derived waste.

3.3.1.5. 100-gallon (379-liter) Drum

Each 100-gallon drum has a gross internal volume of 13.4 ft^3 (0.38m^3). 100-gallon drums may be direct loaded with CH TRU mixed waste.

3.3.1.6. RH TRU Canister

Each RH TRU canister has a gross internal volume of 31.4 ft^3 (0.89 m^3). RH TRU canisters contain RH TRU mixed waste packaged in small containers (e.g., 55-gallon drums) or waste loaded directly into the canister.

3.3.1.7. Standard Large Box 2 (**SLB2**)

Each SLB2 has a gross internal volume of 261 ft^3 (7.39 m^3). SLB2s may be direct loaded with CH TRU mixed waste.

3.3.1.8. Shielded Container*

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11m^3). Shielded containers contain RH TRU mixed waste, but shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste. Shielded containers may be overpacked into standard waste box or ten drum overpack.

* "Shielded Container" refers to the container depicted in Figure A1-37.

3.3.2. Derived Waste Containers

The Permittees shall use standard 55-gallon drums, SWBs, or 85-gallon drums to collect, store, and dispose of derived waste.

ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	~~Container Equivalent~~	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	~~400 RH TRU Canisters~~	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)	~~500 RH TRU Canisters~~	8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	~~600 RH TRU Canisters~~	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	~~2960 RH TRU Canisters~~	

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

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4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.1.8. Shielded Container

Shielded containers are configured as a three-pack.

(as described in Section A1-1d(1)) will be installed in the 85-gal drum to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

85-gal (322-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

The 85-gal (322-L) drum, which is shown in Figure A1-6, will be used for overpacking contaminated 55-gal (208 L) drums at the WIPP facility. The 85-gal drum may also be direct loaded with CH TRU mixed waste.

85-gal (322-L) drums may be used to collect derived waste.

100-Gallon Drum

100-gal (379-L) drums meet the requirements for DOT specification 7A regulations.

A 100-gal (379-L) drum has a gross internal volume of 13.4 ft^3 (0.38 m^3). One or more filtered vents (as described in Section A1-1d(1) will be installed in the drum lid or body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

100-gal (379-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

100-gal (379-L) drums may be direct loaded.

Standard Large Box 2

The SLB2 meets the requirements of DOT specification 7A requirements. The SLB2 is a welded steel container with a gross internal volume of 261 ft^3 (7.39 m^3).

One or more filtered vents will be installed in the SLB2 body and located near the top of the SLB2 to prevent the escape of radioactive particulates and to prevent internal pressurization. Figure A1-34 shows an SLB2.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers, which are received in HalfPACTs, and 55-gallon drums, which are received in a CNS 10-160B cask.

RH TRU Canister

The RH TRU Canister is a steel single shell container which is constructed to be of high integrity. An example canister is depicted in Figure A1-16a. The RH TRU Canister is vented and

will have a nominal internal volume of 31.4 ft^3 (0.89 m^3) and shall contain waste packaged in small containers (e.g., drums) or waste loaded directly into the canister.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (DOT) specification 7A regulations. A detailed description of a standard 55-gallon drum is provided above. Up to ten 55-gallon drums containing RH TRU mixed waste are arranged on two drum carriage units in the CNS 10-160B cask (up to five drums per drum carriage unit). The drums are transferred to an RH TRU mixed waste Facility Canister that will contain three drums.

Shielded Container

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste.

A1-1b(3) Container Compatibility

All containers will be made of steel, and some will contain rigid, molded polyethylene liners. The compatibility study, documented in Appendix C1 of the WIPP RCRA Part B Permit Application (DOE, 1997a), included container materials to assure containers are compatible with the waste. Therefore, these containers meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

A1-1c Description of the Container Storage Units

A1-1c(1) Waste Handling Building Container Storage Unit (WHB Unit)

The Waste Handling Building (**WHB**) is the surface facility where TRU mixed waste handling activities will take place (Figure A1-1a). The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters (m^2)) of which 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for handling and storage of RH TRU mixed waste, as shown in Figures A1-1, A1-14a, and A1-17a, b, c, and d. These areas are being permitted as the WHB Unit. The concrete floors are sealed with a coating that is sufficiently impervious to the chemicals in TRU mixed waste to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(1)).

For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved with the generator before TRU mixed waste is emplaced. Discrepancies that are not resolved within 15 days will be reported to the NMED in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Each facility pallet has two recessed pockets to accommodate two sets of 7-packs (see Figure A1-10), two sets of 4-packs, two sets of 3-packs, or two SWBs stacked two-high, two TDOPs, or any combination thereof. Each facility pallet will accommodate one SLB2. Each stack of waste containers will be secured prior to transport underground. A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room located adjacent to the Waste Shaft. The conveyance loading room serves as an air lock between the CH Bay and the Waste Shaft, preventing excessive air flow between the two areas. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379-L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the Underground HWDUs. Figure A1-13 is a flow diagram of the CH TRU mixed waste handling process.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

Following cask inspections, the shipping cask and trailer are moved into the RH Bay or held in the Parking Area Unit. The waste handling process begins in the RH Bay where the impact limiter(s) are removed from the shipping cask while it is on the trailer. Additional radiological surveys are conducted on the end of the cask previously protected by the impact limiter(s) to verify the absence of contamination. The cask is unloaded from the trailer using the RH Bay Overhead Bridge Crane and placed on a Cask Transfer Car.

Differential air pressure between the RH TRU mixed waste handling locations in the RH Complex protects workers and prevents potential spread of contamination during handling of RH TRU mixed waste. Airflow between key rooms in the WHB is controlled by maintaining differential pressures between the rooms. The CH Receiving Bay is maintained with a negative pressure relative to outside atmosphere. The RH Receiving Bay is maintained with a requirement to be positive pressure relative to the CH Receiving Bay. The RH Hot Cell is

Transfer of Disposal Canister into the Facility Cask

The transfer of a canister into the Facility Cask from the Transfer Cell is monitored by closed-circuit television cameras. The Transfer Cell Shuttle Car positions the RH-TRU 72-B cask or Shielded Insert under the Facility Cask Loading Room port and the shield valve is opened. Then the remotely operated 6.25 Ton Grapple Hoist attaches to the canister, and the canister is lifted through the open shield valve into the vertically-oriented Facility Cask located on the Cask Transfer Car in the Facility Cask Loading Room. During this cask-to-cask transfer, the telescoping port shield is in contact with the underside of the Facility Cask to assure shielding continuity, as does the shield bell located above the Facility Cask.

For canisters received at the WIPP from the generator site in a RH-TRU 72-B cask, the identification number is verified using cameras, which also provide images of the canister surfaces during the lifting operation. Identification numbers are verified against the WWIS. If there are any discrepancies, the canister is returned to the RH-TRU 72-B cask, returned to the Parking Area Unit, and the generator is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72). As the canister is being lifted from the RH-TRU 72-B cask into the Facility Cask, additional swipe samples may be taken.

Transfer of the Canister to the Underground

When the canister is fully within the Facility Cask, the lower shield valve is closed. The 6.25 Ton Grapple Hoist detaches from the canister and is raised until the 6.25 Ton Grapple Hoist clears the Facility Cask, at which time the upper shield valve is closed. The 6.25 Ton Grapple Hoist and shield bell are then raised clear of the Facility Cask, and the telescoping port shield is retracted. The Facility Cask Rotating Device rotates the Facility Cask until it is in the horizontal position on the Facility Cask Transfer Car. The shield doors on the Facility Cask Loading Room are opened, and the facility Cask Transfer Car moves onto the waste shaft conveyance and is lowered to the waste Shaft Station underground. At the waste Shaft Station underground, the Facility Cask Transfer Car moves the Facility Cask from the waste shaft conveyance. A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU.

Returning the Empty Cask

The empty RH-TRU 72-B cask or Shielded Insert is returned to the RH Bay by reversing the process. In the RH Bay, swipe samples are collected from inside the empty cask. If necessary, the inside of the cask is decontaminated. The RH-TRU 72-B cask lids are replaced, and the cask is replaced on the trailer using the RH Bay Bridge Crane. The impact limiters are replaced, and the trailer and the RH-TRU 72-B cask are then moved out of the RH Bay. The Shielded Insert is stored in the RH Bay until needed.

A1-1d(4) Handling Waste in Shielded Containers

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will

undergo security and radiological checks and shipping documentation reviews. Consistent with the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

A1-1e Inspections

Inspection of containers and container storage area are required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174). These inspections are described in this section.

A1-1e(1) WHB Unit

The waste containers in storage will be inspected visually or by closed-circuit television camera prior to each movement and, at a minimum, weekly, to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. Waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. This visual inspection of CH TRU mixed waste containers shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If waste handling operations should stop for any reason with containers located at the TRUDOCK while still in the Contact-Handled Package, primary waste container inspections will not be accomplished until the containers of waste are removed from the Contact-Handled Package. If the lid to the Contact-Handled Package inner container vessel is removed, radiological checks (swipes of Contact-Handled Package inner surfaces) will be used to determine if there is contamination within the Contact-Handled Package. Such

Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

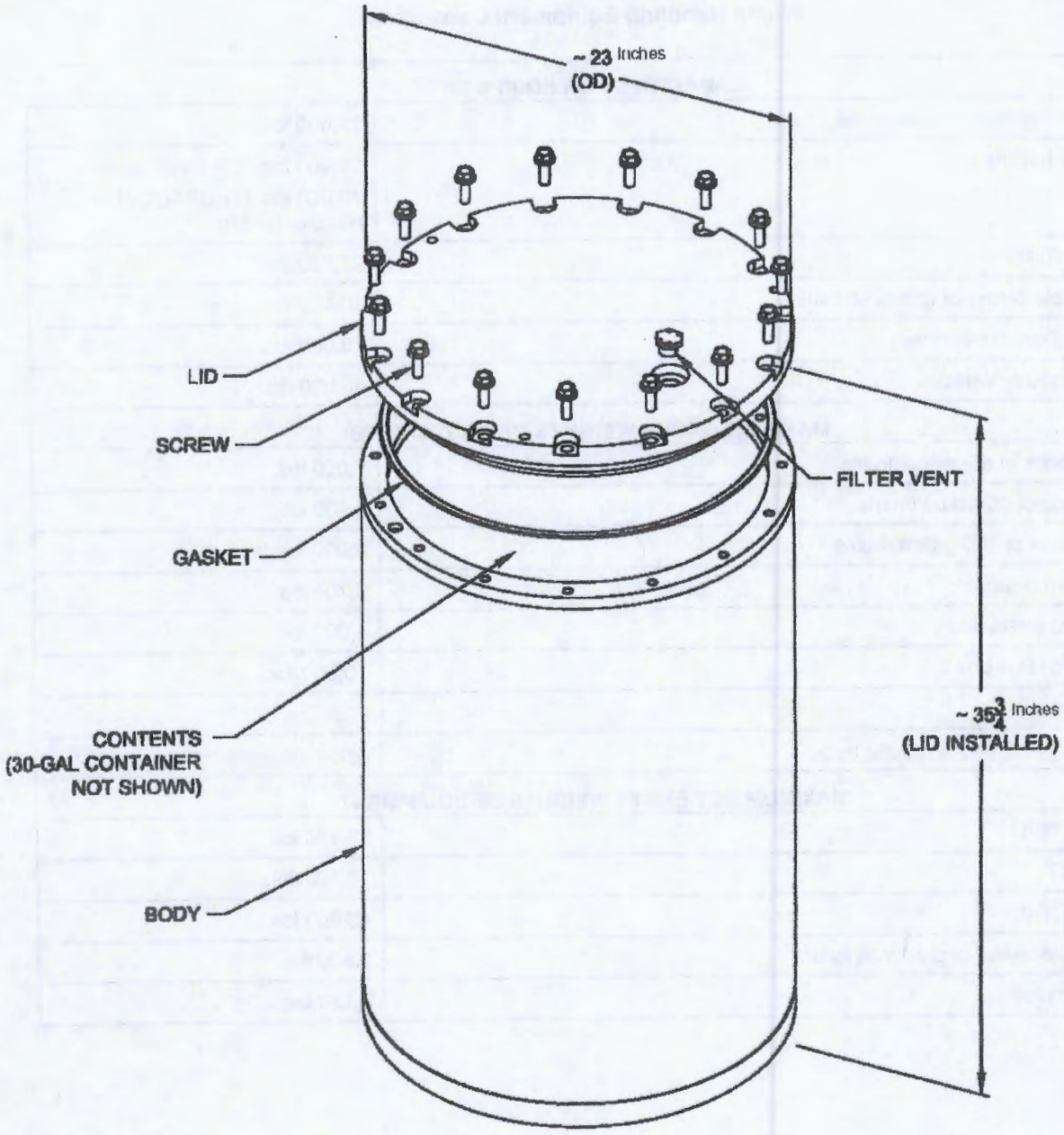

Figure A1-37
Typical Shielded Container

(**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, ~~or~~ four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Backfill

Magnesium oxide (**MgO**) will be used as a backfill in order to provide chemical control over the solubility of radionuclides in order to comply with the requirements of 40 CFR §191.13. The MgO backfill will be purchased prepackaged in the proper containers for emplacement in the underground. Purchasing prepackaged backfill eliminates handling and placement problems associated with bulk materials, such as dust creation. In addition, prepackaged materials will be easier to emplace, thus reducing potential worker exposure to radiation. Should a backfill container be breached, MgO is benign and cleanup is simple. No hazardous waste would result from a spill of backfill.

The MgO backfill will be managed in accordance with Specification D-0101 (MgO Backfill Specification) and WP05-WH1025 (CH Waste Downloading and Emplacement). These documents are kept on file at the WIPP facility by the Permittees.

Backfill will be handled in accordance with standard operating procedures. Typical emplacement configurations are shown in Figures A2-5 and A2-5a. Some emplacement configurations may include the use of MgO emplacement racks, as shown in Figure A2-5a.

Quality control will be provided within standard operating procedures to record that the correct number of sacks are placed and that the condition of the sacks is acceptable.

Backfill placed in this manner is protected until exposed when sacks are broken during creep closure of the room and compaction of the backfill and waste. Backfill in sacks utilizes existing techniques and equipment and eliminates operational problems such as dust creation and introducing additional equipment and operations into waste handling areas. There are no mine operational considerations (e.g. ventilation flow and control) when backfill is placed in this manner.

The Waste Shaft Conveyance

The hoist systems in the shafts and all shaft furnishings are designed to resist the dynamic forces of the hoisting system and to withstand a design-basis earthquake of 0.1 g. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided engineering design-basis earthquake report which provides the basis for seismic design of WIPP facility structures. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system (such as overtravel, overspeed, power loss, circuitry failure, or starting in a wrong direction) and will trigger an alarm that automatically shuts down the hoist.

A2-2b Geologic Repository Process Description

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste shaft conveyance and is lowered to the waste shaft station underground. At the waste shaft station underground, the Facility Cask is moved from the waste shaft conveyance by the Facility Cask Transfer Car (Figure A2-16). A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU. There, the Facility Cask is placed on the HERE (Figure A2-17). The HERE is used to emplace the RH TRU mixed waste canister into the borehole. The borehole will be visually inspected for obstructions prior to aligning the HERE and emplacement of the RH TRU mixed waste canister. The Facility Cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear Facility Cask shield valve. The shield valves on the Facility Cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the Facility Cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the Facility Cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure A2-18). The transfer mechanism is retracted, the shield valves close on the Facility Cask, and the Facility Cask is removed from the HERE.

A shield plug is a concrete filled cylindrical steel shell (Figure A2-21) approximately 61 in. long and 29 in. in diameter, made of concrete shielding material inside a 0.24 in. thick steel shell with a removable pintle at one end. Each shield plug has integral forklift pockets and weighs approximately 3,750 lbs. The shield plug is inserted with the pintle end closest to the HERE to provide the necessary shielding , limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr . Additional shielding is provided at the direction of the Radiological Control Technician based on dose rate surveys following shield plug emplacement. This additional shielding is provided by the manual emplacement of one or more shield plug supplemental shielding plates and a retainer (Figures A2-19 and A2-20).

The amount of RH TRU mixed waste disposal in each panel is limited based on thermal and geomechanical considerations and shall not exceed 10 kilowatts per acre as described in Permit Attachment A2-1. RH TRU mixed waste emplacement boreholes shall be drilled in the ribs of the panels at a nominal spacing of 8 ft (2.4 m) center-to-center, horizontally.

Figures A1-26 and A1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and CNS 10-160B casks, respectively.

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers ~~(e.g., TRUPACT-IIs or HalfPACTs)~~, at which time they will undergo security and radiological checks and shipping documentation reviews. The

trailers carrying the shipping containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one three-pack of shielded containers or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste shaft conveyance, and the facility pallet will be transferred from the waste shaft conveyance onto the transporter (see Figure A2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement. The underground waste transporter is equipped with a fire suppression system, rupture-resistant diesel fuel tanks, and reinforced fuel lines to minimize the potential for a fire involving the fuel system.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment or, in the case of an SLB2, the SLB2 will be lifted from the facility pallet and placed directly on the floor of the emplacement room. The waste will be emplaced room by room in Panels 1 through 8. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade and, if necessary, bulkheads will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

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GECSB = 1.2 - (0.21× 2.07) - (0.33 × 1.2) ⇒ 0.37'
TCBS = 0.37/1.0 = 0.37' ~ 4½"

Based on the results of the above calculation, the site paved roads designated for waste transportation are safe to be used by the heavier truckloads carrying shipping casks used in RH TRU mixed waste transportation to the WIPP.

A4-3 Waste Handling Building Traffic

CH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed Contact Handled Packages. Upon receipt, security checks, radiological surveys, and shipping documentation reviews will be performed. A forklift or Yard Transfer Vehicle will remove the Contact Handled Packages and transport them a short distance through an air lock that is designed to maintain differential pressure in the WHB. The forklift or Yard Transfer Vehicle will place the shipping containers at one of the two TRUPACT-II unloading docks (**TRUDOCK**) inside the WHB or, in the case of the TRUPACT-III, at the payload transfer station in Room 108.

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one shielded container 3-pack, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two shielded container 3-packs, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

RH TRU mixed waste will arrive at the WIPP facility in a payload container contained in a shielded cask loaded on a tractor-trailer. Upon arrival, radiological surveys, security checks, and shipping documentation reviews will be performed, and the trailer carrying the cask will be moved into the Parking Area or directly into the RH Bay of the Waste Handling Building Unit.

The cask is unloaded from the trailer in the RH Bay and is placed on the Cask Transfer Car. The Cask Transfer Car is used to move the cask to the Cask Unloading Room. At this point, a crane moves the waste to the Hot Cell or the Transfer Cell. Some RH TRU mixed waste may be moved to the Hot Cell for overpacking before being moved to the Transfer Cell. Once in the Transfer Cell, the Transfer Cell Shuttle Car moves the waste beneath the facility cask. A crane is used to move the waste from the Transfer Cell Shuttle Car into the facility cask. The Facility Cask Transfer Car then moves the facility cask to the underground. A more detailed description of waste handling in the WHB is included in Attachment M1. Figures A4-5, A4-6 and A4-7 show RH TRU mixed waste transport routes.

ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

Introduction

The Permittees will require generator/storage sites (**sites**) to use the following methods, as applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at WIPP. These methods include requirements for headspace-gas sampling, sampling of homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this Attachment provides quality control, sample custody, and sample packing and shipping requirements.

C1-1 Sampling of Debris Waste (Summary Category S5000)

Headspace gas sampling and analysis shall be used to resolve the assignment of Environmental Protection Agency (**EPA**) hazardous waste numbers to debris waste streams.

C1-1a Method Requirements

The Permittees shall require all headspace-gas sampling be performed in an appropriate radiation containment area on waste containers that are in compliance with the container equilibrium requirements (i.e., 72 hours at 18° C or higher).

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using

the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

The determination of packaging configuration consists of identifying the number of confinement layers and the identification of rigid poly liners when present. Generator/storage sites shall use either the default conditions specified in Tables C1-7 through C1-9 for retrievably stored waste or the data documented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) for determining the appropriate DAC for each container from which a headspace gas sample is collected. These drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling documents for each container from which a headspace gas sample is collected:

- sampling scenario from Table C1-5 and associated information from Tables C1-6 and/or Table C1-7;
- the packaging configuration from Table C1-8 and associated information from Table C1-9, including the diameter of the rigid liner vent hole, the number of inner bags, the number of liner bags, the presence/absence of drum liner, and the filter hydrogen diffusivity,
- the permit-required equilibrium time,
- the drum age,
- for supercompacted waste, both
  - the absence of rigid liners in the compacted 55-gallon drums which have not been headspace gas sampled in accordance with this permit prior to compaction, and
  - the absence of layers of confinement must be documented in the WWIS if Packaging Configuration Group 7 is used.

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and

100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly liners) shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a representative sample is collected (using a sampling needle connected to the sampling head to pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies this requirement). The configuration of the containment area and remote-handling equipment at each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the analytes listed in Table C3-2 of Permit Attachment C3. If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000). Consistent with footnote "a" in Table C1-8, any waste container selected for headspace gas sampling that cannot be assigned a packaging configuration specified in Table C1-8 shall be assigned a conservative default packaging configuration..

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, ~~and~~ SLB2s, and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

The Permittees shall require site personnel to collect samples in SUMMA® or equivalent canisters using standard headspace-gas sampling methods that meet the general guidelines established by the EPA in the Compendium Method TO-14A or TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by using on-line integrated sampling/analysis systems. Samples will be directed to an analytical instrument instead of being collected in SUMMA® or equivalent canisters if a single-sample on-line integrated sampling/analysis system is used. If a multi-sample on-line integrated sampling/analysis system is used, samples will be directed to an integrated holding area that meets the cleaning requirements of Section C1-1c(1). The leak proof and inert nature of the integrated holding area interior surface must be demonstrated and documented. Samples are not transported to another location when using on-line integrated sampling/analysis systems; therefore, the sample custody requirements of Section C1-4 and C1-5 do not apply. The same sampling manifold and sampling heads are used with on-line integrated sampling/analysis systems and all of the requirements associated with sampling manifolds and sampling heads must be met. However, when using an on-line integrated sampling/analysis system, the sampling batch and analytical batch quality control (**QC**) samples are combined as on-line batch QC samples as outlined in Section C1-1b.

C1-1a(2) Manifold Headspace Gas Sampling

This headspace-gas sampling protocol employs a multiport manifold capable of collecting multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be used to collect samples in SUMMA® or equivalent canisters or as part of an on-line integrated sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to first use and as needed thereafter. The manifold and sample canisters will be evacuated to 0.0039 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet valve is opened. The manifold inlet valve will be attached to a changeable filter connected to either a side port needle sampling head capable of forming an airtight seal (for penetrating a

Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)

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Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

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Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such generated waste may occur in either the WHB Unit or the Underground. For example, when TRU mixed wastes are received at the WHB Unit, the CH or RH Package shipping containers and the TRU mixed waste containers are checked for surface contamination. Under some circumstances,[1] if contamination is detected, the shipping container and/or the TRU mixed waste containers will be decontaminated. In the underground, waste may be generated as a result of radiation control procedures used during monitoring activities. The waste generated from radiation control procedures will be assumed to be TRU and/or TRU mixed waste. Throughout the remainder of this plan, this waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

D-1c Containers

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

TRU mixed waste containers, containing off-site waste, will not be opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Waste, including "derived waste," containing liquid in excess of TSDF-WAC limits shall not be emplaced in the WIPP (See Permit Attachment C, Section C-1c).

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 177). The RCRA Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) precludes ignitable, reactive, or incompatible TRU mixed waste from being placed into storage or disposed of at WIPP.

D-1d Description of Containers

CH TRU mixed waste containers will be either 55-gallon (gal) (208-liter (L)) drums singly or arranged into seven (7)-packs, 85-gal (322-L) drums (used as singly or arranged into four (4)-packs, 100-gal (379 L) drums singly or arranged into three (3)-packs, ten-drum overpacks (**TDOP**), 66.3 ft^3 (1.88 m^3) SWBs, or standard large box 2s (**SLB2**).

RH TRU mixed waste containers are either canisters or drums. Canisters will be loaded singly in an RH-TRU 72-B cask and drums will be loaded in a CNS 10-160B cask. Drums in the CNS 10-160B cask will be arranged singly or in drum carriage units containing up to five drums each. Canisters and drums are described in Permit Attachment M1.

Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs.

[1] Typically contamination that is less than six square feet in area and less than 2000 disintegrations per minute (dpm) alpha or 20,000 dpm beta/gamma, may be decontaminated. Containers that exceed these thresholds will be returned to the point of origin for decontamination.

D-1e Description of Surface Hazardous Waste Management Units

The WHB is the surface facility where waste handling activities will take place. The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters [m^2]) of which 49,710 ft^2 (4,618 m^2) are designated as the WHB Unit for TRU mixed waste management. Within the WHB Unit, 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for the handling and storage of RH TRU mixed waste. These areas are being permitted as container storage units. The concrete floors within the WHB Unit are sealed with an impermeable coating that has excellent resistance to the chemicals in TRU mixed waste and, consequently, provide secondary containment for TRU mixed waste. In addition, a Parking Area Unit south of the WHB will be used for storage of waste in sealed shipping containers awaiting unloading. This area is also being permitted as a container storage unit. The sealed shipping containers provide secondary containment in this hazardous waste management unit (**HWMU**).

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (3-pack of shielded containers, 7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

In addition, four Contact-Handled Packages, containing up to 640 ft^3 of CH TRU waste in containers, may occupy positions at the TRUPACT-II Unloading Docks (**TRUDOCK**).

Aisle space shall be maintained in all CH Bay waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire response personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space between facility and containment pallets will be maintained in all CH TRU mixed waste storage areas.

D-1e(2) RH Complex Operations

Loaded RH TRU casks are received in the RH Bay of the WHB. The RH Bay is served by an overhead bridge crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. A maximum of two loaded casks may be stored in the RH Bay and a maximum of one cask in the Cask Unloading Room may be stored at one time. A minimum of 44 inches (1.1 m) will be maintained between loaded casks in the RH Bay. The cask serves as secondary containment in the RH Bay for the RH TRU mixed waste payload container. In addition, the RH Bay has a concrete floor.

Single RH TRU mixed waste canisters are unloaded from the RH-TRU 72-B casks in the Transfer Cell of the RH Complex where they are transferred to facility casks. Drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, into the Hot Cell, and loaded into a canister. Storage in the Hot Cell occurs in either drums or canisters. A maximum

equipment to control and plug leaks may be utilized for response to all levels of incidents.

F. Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually or by pump, from a leaking or damaged container. Scoops, shovels, jugs, and pails as well as drum transfer pumps for chemical and petroleum transfer are utilized as needed in response to all levels of incidents.

G. Vapor Suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents such as an aqueous foam blanket.

2. Chemical Methods of Mitigation

A. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. This would include using the neutralizing adsorbents.

B. Solidification is the process whereby a hazardous liquid is added to material such as an absorbent so that a solid material results.

The established procedures are based upon the incident level and a graded approach for nonradioactive or CH TRU waste emergencies and initiated to:

1. Minimize contamination or contact (through PPE, etc.)
2. Limit migration of contaminants
3. Properly dispose of contaminated materials

For RH TRU mixed waste that is not managed in shielded containers, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(2) Fire

The incident level emergency response identified in Section D-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using

8. No TRU mixed waste that may be incompatible with the released material will be managed in the affected area until cleanup procedures are complete.

9. The RCRA Emergency Coordinator will direct spill control, decontamination, and termination procedures described below.

D-4d(5) Decontamination of Personnel

Decontamination of personnel with radioactive contamination is the responsibility of the Radiological Control (**RC**) section. If a person is contaminated with radioactivity during a site evacuation to the staging areas, the contaminated area will be covered before the person can be moved (under escort by RC personnel) to the staging area. The RC personnel will ensure the contaminated person remains segregated from other site personnel while under RC supervision.

In the event of an emergency that requires immediate evacuation of the area, the contamination can be covered by any method warranted, given the circumstance (e.g., clean clothing wrapped around the area). If the size of the radioactive contamination on the body is small and localized, it can be covered with clothing (e.g., glove, shoe cover, coveralls). If the size of the radioactive contamination on the body is large, it may be covered by dressing the individual in a full set of Anti-Contamination clothing (coveralls, hood, gloves, shoe covers, etc.).

If time and location permit and the contamination is on the face, it will be decontaminated immediately using a cloth moistened with tepid water (and a mild detergent, if necessary). If the size of the radioactive contamination on the individual's body is small and localized, it will be decontaminated using the same method as for the face, but after the individual has been transferred to an area appropriate for conducting decontamination.

If the individual is transferred to the staging area prior to decontamination, he/she will be decontaminated at the staging area using site procedures for personnel decontamination and using decontamination supplies and equipment as appropriate for the extent and magnitude of the contamination.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

In the event of spills or leaking or punctured containers of CH and RH TRU mixed waste, the WIPP responds to three distinct phases: 1) the event, 2) the re-entry, and 3) the recovery.

During the event, the following immediate actions are completed: 1) stop work, 2) warn others (notify CMR), 3) isolate the area, 4) minimize exposure, and 5) close off unfiltered ventilation. These actions can take place simultaneously, as long as they are completed before proceeding to the re-entry phase.

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers that are managed as ~~of~~ CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and or any approved fixatives such as polyvinyl alcohol (**PVA**) or paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and

E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site ~~CH TRU mixed~~ waste that will be managed and stored as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), ~~or in~~ standard large box 2s (**SLB2s**) or shielded containers as (3)-packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

As described in Permit Attachment A1, Section A1-1d(3), off-site waste that will be managed and stored as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Off-site waste that will be managed and stored as RH TRU mixed waste is ~~handled~~ managed and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity

decontamination activities that follow a release or spill and retrieval. Radiation monitoring and sampling are mandated by DOE Orders and provide an immediate indication of a release or spill, even when they are not visibly detectable. A release or spill involving hazardous constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components, as described in Table G3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

G3-4b TRU Mixed Waste Releases

The RCRA Contingency Plan (Permit Attachment D) specifies actions required by the Permittees in the event of spills or leaking or punctured containers of CH and RH TRU mixed waste. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm the removal of hazardous waste constituents.

G3-4c Decontamination Activities at Closure

The Closure Plan (Permit Attachment G, Section G-1e(2)) specifies decontamination activities required by the Permittees at closure. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm removal of hazardous waste constituents.

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demonstration, and siting studies relevant to the permanent disposal of TRU wastes. Most of these wastes will be contaminated with hazardous constituents, making them mixed wastes.

The LWA addresses the disposal phase of the WIPP project, the period following closure of the site, and the removal of the surface facilities. The LWA set aside 10,240 acres (4,144 hectares) located in Eddy County, 26 miles (42 kilometers) east of Carlsbad, New Mexico, as the WIPP site. A 277-acre (112-hectare) portion within the 10,240 acres (4,144 hectares) is bounded by a barbed wire fence. This fenced area contains the surface facilities and the mined salt piles for the WIPP site. Figure H1-1 is a cutaway illustrating the spatial relationship of the surface facilities and the underground repository.

Upon receipt of the necessary certifications and permits from the EPA and the New Mexico Environment Department, the Permittees will begin disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU and TRU mixed waste in the WIPP. This waste emplacement and disposal phase will continue until the regulated capacity of the repository of 6,200,000 cubic feet (175,588 cubic meters) of TRU and TRU mixed waste has been reached, and as long as the Permittees comply with the requirements of the Permit. For the purposes of this Permit Attachment, this time period is assumed to be 25 years. The waste will be shipped from DOE facilities across the country in specially designed transportation containers certified by the Nuclear Regulatory Commission. The transportation routes from these facilities to the WIPP have been predetermined. The CH TRU mixed waste will be packaged in 55-gallon (208-liter), 85-gallon (322-liter), 100-gallon (379-liter) steel drums, standard waste boxes (**SWBs**), ten drum overpacks (**TDOPs**), and/or standard large box 2s (**SLB2s**). An SWB is a steel container having a free volume of 66.3 cubic feet (1.88 cubic meters). Figure H1-2 shows the general arrangement of a seven-pack of drums and an SWB as received in a Contact-Handled Package. RH TRU mixed waste inside a Remote-Handled Package is contained in one or more of the allowable containers described in Permit Attachment A1. Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1.

Upon receipt and inspection of the waste containers in the waste handling building, the containers will be moved into the repository 2,150 feet (655 meters) below the surface. The containers will then be transported to a disposal room. (See Figure H1-1 for room and panel arrangement.) The initial seven disposal rooms are in Panel 1. Panel 1 is the first of eight panels planned to be excavated. Special supports and ground control corrective actions have been implemented in Panel 1 to ensure its stability. Upon filling an entire panel, that panel will be closed to isolate it from the rest of the repository and the ventilation system. During the period of time it takes to fill a given panel, an additional panel will be excavated. Sequential excavation of Panels 2 through 8 will ensure that these individual panels remain stable during the entire time a panel is being filled with waste. Ground control maintenance and evaluation with appropriate corrective action will be required to ensure that Panels 9 and 10 (ventilation and access drifts in the repository) remain stable.

Decontamination of the WIPP facility will commence with a detailed radiation survey of the entire site. Contaminated areas and equipment will be evaluated and decontaminated in accordance with applicable requirements. Where decontamination efforts identify areas that meet clean closure standards for permitted container storage units and are below radiological release criteria, routine dismantling and salvaging practices will determine the disposition of the material or equipment involved. Material and equipment that do not meet these standards and criteria will be emplaced in the access entries (Panels 9 and/or 10). Upon completion of emplacement of the contaminated facility material, the entries will be closed and the repository

PART 3 - CONTAINER STORAGE

3.1. DESIGNATED CONTAINER STORAGE UNITS

This Part authorizes the storage and management of transuranic (**TRU**) mixed waste containers in the Waste Handling Building and Parking Area Container Storage Units described below. Specific facility and process information for the storage and management of TRU mixed waste in these Container Storage Units is incorporated in Permit Attachment A1 (Container Storage).

3.1.1. Waste Handling Building Container Storage Unit

The Waste Handling Building Container Storage Unit (**WHB Unit**) is located in the Waste Handling Building (**WHB**) at the WIPP facility. The WHB Unit consists of the WHB contact-handled (**CH**) Bay and the remote-handled (**RH**) Complex. The areas and storage capacities for the WHB unit are defined in Table 3.1.1.

The Permittees may store and manage TRU mixed waste in the WHB Unit, provided the Permittees comply with the following conditions:

3.1.1.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1.

3.1.1.2. Storage Locations and Quantities

The Permittees may store TRU mixed waste containers in the locations in the WHB Unit, as specified in Table 3.1.1 below and depicted in Permit Attachment A1, Figures A1-1 and A1-17a, b, and c. The Permittees may store quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 3.1.1 below.

3.1.1.3. Use of CH Bay Surge Storage

The Permittees may use the CH Bay Surge Storage Area in Table 3.1.1 below only as specified in Permit Attachment A1, Section A1-1c(1).

3.1.1.4. Notification of CH Bay Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the CH Bay Surge Storage Area and provide justification for its use. The Permittees shall post a link to the notice of CH Bay Surge Storage Area use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing CH Bay Surge Storage Area usage.

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Table 3.1.1 - WHB Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
CH Bay Storage Area	32,307ft^2 (3,001 m^2)	4,800 ft^3 (135.9 m^3)	13 loaded facility pallets and 4 CH Packages at the TRUDOCKS
CH Bay Surge Storage Area	included in CH Bay Storage Area	1,600 ft^3 (45.3 m^3)	5 loaded facility pallets
Derived Waste Storage Area	included in CH Bay Storage Area	66.3 ft^3 (1.88 m^3)	1 Standard Waste Box
Total for CH Waste	32,307 ft^2 (3,001 m^2)	**6,466.3 ft^3 183.1 m^3**	
RH Bay	12,552 ft^2 (1,166 m^2)	156 ft^3 (4.4 m^3)	2 loaded casks and 1 drum of derived waste
Cask Unloading Room	382 ft^2 (36 m^2)	74 ft^3 (2.1 m^3)	1 loaded cask
Hot Cell	1,841 ft^2 (171 m^2)	94.9 ft^3 (2.7 m^3)	12 drums and 1 drum of derived waste
Transfer Cell	1,003 ft^2 (93 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Facility Cask Loading Room	1,625 ft^2 (151 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Total for RH Waste	**17,403 ft^2 (1,617 m^2)**	**387.7 ft^3 (11.0 m^3)**	
Facility Total	**49,710 ft^2 (4,618 m^2)**	**6,854 ft^3 (194.1 m^3)**	

3.1.1.5. Storage on Pallets

The Permittees shall store TRU mixed waste containers unloaded from the Contact-Handled Packages (**TRUPACT-II, HalfPACT, or TRUPACT III** shipping containers) on pallets in the WHB Unit, as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.6. Storage of Derived Waste

The Permittees shall store containers of TRU mixed derived waste only in the Derived Waste Storage Area, the RH Bay, and the RH Hot Cell. The

Permittees shall store the derived waste containers on a pallet that provides secondary containment and elevates the containers at least 6 inches above the floor to protect them from contact with accumulated liquid.

3.1.1.7. CH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a CH TRU mixed waste container in the WHB Unit for more than 60 calendar days, with the exception of the Derived Waste Storage Area, where derived waste may be accumulated and stored until the container is full.

3.1.1.8. Minimum Aisle Space

The Permittees shall maintain a minimum aisle space of 44 inches (1.1 m) between facility pallets in the CH Bay of the WHB Unit. The Permittees shall maintain adequate aisle space of 44 inches (1.1 m) between loaded casks in the RH Bay of the WHB Unit. For other locations within the RH Complex, sufficient aisle space will be maintained to assure that emergency equipment can be accessed or moved to the necessary locations.

3.1.1.9. Storage of RH TRU Mixed Waste Containers

The Permittees shall store RH TRU mixed waste in casks, canisters, or drums in the RH Complex as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.10. RH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a RH TRU mixed waste container in the RH Complex for more than 60 calendar days, with the following exceptions:

i. Derived Waste Storage Areas, where derived waste may be accumulated and stored until the container is full; and

ii. Hot Cell, where 55-gallon drums may be stored for no more than 25 of the 60 calendar days.

3.1.1.11. Hot Cell RH TRU Mixed Waste Processing Capacity

The processing capacity of the Hot Cell is limited to 13,773 ft^3 (390 m^3) of RH TRU mixed waste.

3.1.2. Parking Area Container Storage Unit

The Parking Area Container Storage Unit (**Parking Area Unit**) is an asphalt and concrete surface extending from north of the rail sidings to the WHB, within the Controlled Area. The Parking Area Unit shall be enclosed by chain link fence. The Parking Area Unit shall comprise a surface area of no more than 137,050 ft^2 (12,730 m^2), as depicted in Permit Attachment A1, Figure A1-2.

The Permittees may store and manage TRU mixed waste in the Parking Area Unit, provided the Permittees comply with the following conditions:

3.1.2.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1. These TRU mixed waste containers shall be stored within the sealed Contact-Handled or Remote-Handled Packages described in Permit Attachment A1.

3.1.2.2. Storage Locations and Quantities

The Permittees shall store TRU mixed waste containers in any location within the Parking Area Unit, as specified in Table 3.1.2 below. The Permittees may store quantities of TRU mixed waste containers within sealed Contact-Handled or Remote-Handled Packages in these locations not to exceed the maximum capacities specified in Table 3.1.2 below.

3.1.2.3. Use of Parking Area Surge Storage

The Permittees may use the Parking Area Surge Storage in Table 3.1.2 below only when the maximum capacity in the Parking Area is reached and as specified in Permit Attachment A1, Section A1-1c(2).

3.1.2.4. Notification of Parking Area Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the Parking Area Surge Storage and provide justification for its use. The Permittees shall post a link to the notice of Parking Area Surge Storage use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing Parking Area Surge Storage usage.

Table 3.1.2 - Parking Area Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
Parking Area	137,050 ft^2 (12,730 m^2)	6,734 ft^3 (191 m^3)	40 Contact-Handled Packages containing waste and 8 Remote-Handled Packages containing waste. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.
Parking Area Surge Storage	Included in Parking Area	2,129 ft^3 (60 m^3)	12 Contact-Handled Packages and 4 Remote-Handled Packages. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.

3.1.2.5. Prohibition on Opening Shipping Containers

The Permittees shall keep the Contact-Handled or Remote-Handled Packages sealed at all times while in the Parking Area Unit.

3.1.2.6. Storage Time Limit

The Permittees shall not store sealed Contact-Handled or Remote-Handled Packages in the Parking Area Unit for more than 59 days after the date the Inner Containment Vessel (**ICV**) of the Package was sealed at the generator site. Prior to storing a sealed Package, the Permittees shall verify that the ICV Closure Date for each Package is recorded in the WIPP Waste Information System (**WWIS**) database described in Permit Attachment C (Waste Analysis Plan).

3.1.2.7. Minimum Aisle Space

The Permittees shall maintain a minimum spacing of 4 ft (1.2 m) between loaded Contact-Handled or Remote-Handled Packages.

3.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

3.2.1. Permitted Waste

The Permittees may store and manage TRU mixed waste in the WHB Unit and Parking Area Unit, provided the Permittees comply with the following conditions:

3.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

3.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

3.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

3.2.2. Prohibited Waste

The Permittees shall not store or manage any TRU mixed waste that fails to comply with Permit Section 3.2.1.

3.3. CONDITION OF CONTAINERS

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 3.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

3.3.1. Acceptable Storage Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for storage of TRU mixed waste at WIPP. The Permittees are prohibited from storing TRU mixed waste in any container not specified in Permit Attachment A1, Section A1-1b, as set forth below:

3.3.1.1. Standard 55-gallon (208-liter) Drum

Each standard 55-gallon drum has a gross internal volume of 7.4 ft^3 (0.21 m^3).

3.3.1.2. Standard Waste Box (**SWB**)

Each SWB has a gross internal volume of 66.3 ft^3 (1.88 m^3).

3.3.1.3. Ten-drum Overpack (**TDOP**)

Each TDOP has a gross internal volume of 160 ft^3 (4.5 m^3). TDOPs may be used to contain up to ten standard 55-gallon drums or one SWB. TDOPs may be direct loaded or used to overpack drums or SWBs containing CH TRU mixed waste.

3.3.1.4. 85-gallon (322-liter) Drum

Each 85-gallon drum has a gross internal volume of up to 11.4 ft^3 (0.32 m^3). 85-gallon drums may be direct loaded or used for overpacking 55-gallons drums containing CH TRU mixed waste and for collecting and storing derived waste.

3.3.1.5. 100-gallon (379-liter) Drum

Each 100-gallon drum has a gross internal volume of 13.4 ft^3 (0.38m^3). 100-gallon drums may be direct loaded with CH TRU mixed waste.

3.3.1.6. RH TRU Canister

Each RH TRU canister has a gross internal volume of 31.4 ft^3 (0.89 m^3). RH TRU canisters contain RH TRU mixed waste packaged in small containers (e.g., 55-gallon drums) or waste loaded directly into the canister.

3.3.1.7. Standard Large Box 2 (**SLB2**)

Each SLB2 has a gross internal volume of 261 ft^3 (7.39 m^3). SLB2s may be direct loaded with CH TRU mixed waste.

3.3.1.8. Shielded Container*

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11m^3). Shielded containers contain RH TRU mixed waste, but shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste. Shielded containers may be overpacked into standard waste box or ten drum overpack.

* "Shielded Container" refers to the container depicted in Figure A1-37.

3.3.2. Derived Waste Containers

The Permittees shall use standard 55-gallon drums, SWBs, or 85-gallon drums to collect, store, and dispose of derived waste.

3.4. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittees shall use containers made of or lined with materials which will not react with, and are otherwise compatible with, the TRU mixed waste to be stored, so that the ability of the container to contain the waste is not impaired, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

3.5. MANAGEMENT OF CONTAINERS

The Permittees shall manage all containers as specified in Permit Attachment A1 and shall keep all containers closed during storage, except when it is necessary to add waste to derived waste containers. The Permittees shall not open, handle, or store containers in a manner which may rupture the container or cause it to leak, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.173).

3.6. CONTAINMENT SYSTEMS

The Permittees shall maintain the secondary containment systems for all containers managed in the WHB Unit and Parking Area Unit as specified in Permit Attachment A1, Section A1-1f, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.175).

3.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the WHB Unit and Parking Area Unit TRU mixed waste container storage and management areas at least weekly, in accordance with Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and Permit Attachment A1, Section A1-1e, to detect leaking containers and deterioration of containers and the containment system caused by corrosion and other factors, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174).

3.7.1. Inspection of 55-Gallon Drum Seven-Packs

The Permittees shall not be required to inspect the center drum of a 55-gallon seven-pack assembly, as depicted in Permit Attachment A2 (Geologic Repository), Figure A2-6.

3.7.2. Inspection of Sealed Contact-Handled or Remote-Handled Packages

The Permittees shall not be required to inspect the contents of sealed Contact-Handled or Remote-Handled Packages stored in compliance with Permit Section 3.1.2 and Permit Attachment A1, Section A1-1e(2). The Permittees shall attach a clearly legible sign to each Contact-Handled and Remote-Handled Package indicating whether the Contact-Handled or Remote-Handled Package contains TRU mixed waste.

3.8. RECORDKEEPING

The Permittees shall place the results of waste analyses in the operating record as specified in Permit Section 2.14 and Permit Attachment C.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter C).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

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PERMIT PART 3

PART 3 - CONTAINER STORAGE

3.1. DESIGNATED CONTAINER STORAGE UNITS

This Part authorizes the storage and management of transuranic (**TRU**) mixed waste containers in the Waste Handling Building and Parking Area Container Storage Units described below. Specific facility and process information for the storage and management of TRU mixed waste in these Container Storage Units is incorporated in Permit Attachment A1 (Container Storage).

3.1.1. Waste Handling Building Container Storage Unit

The Waste Handling Building Container Storage Unit (**WHB Unit**) is located in the Waste Handling Building (**WHB**) at the WIPP facility. The WHB Unit consists of the WHB contact-handled (**CH**) Bay and the remote-handled (**RH**) Complex. The areas and storage capacities for the WHB unit are defined in Table 3.1.1.

The Permittees may store and manage TRU mixed waste in the WHB Unit, provided the Permittees comply with the following conditions:

3.1.1.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1.

3.1.1.2. Storage Locations and Quantities

The Permittees may store TRU mixed waste containers in the locations in the WHB Unit, as specified in Table 3.1.1 below and depicted in Permit Attachment A1, Figures A1-1 and A1-17a, b, and c. The Permittees may store quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 3.1.1 below.

3.1.1.3. Use of CH Bay Surge Storage

The Permittees may use the CH Bay Surge Storage Area in Table 3.1.1 below only as specified in Permit Attachment A1, Section A1-1c(1).

3.1.1.4. Notification of CH Bay Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the CH Bay Surge Storage Area and provide justification for its use. The Permittees shall post a link to the notice of CH Bay Surge Storage Area use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing CH Bay Surge Storage Area usage.

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Table 3.1.1 - WHB Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
CH Bay Storage Area	32,307ft^2 (3,001 m^2)	4,800 ft^3 (135.9 m^3)	13 loaded facility pallets and 4 CH Packages at the TRUDOCKS
CH Bay Surge Storage Area	included in CH Bay Storage Area	1,600 ft^3 (45.3 m^3)	5 loaded facility pallets
Derived Waste Storage Area	included in CH Bay Storage Area	66.3 ft^3 (1.88 m^3)	1 Standard Waste Box
Total for CH Waste	32,307 ft^2 (3,001 m^2)	**6,466.3 ft^3 183.1 m^3**	
RH Bay	12,552 ft^2 (1,166 m^2)	156 ft^3 (4.4 m^3)	2 loaded casks and 1 drum of derived waste
Cask Unloading Room	382 ft^2 (36 m^2)	74 ft^3 (2.1 m^3)	1 loaded cask
Hot Cell	1,841 ft^2 (171 m^2)	94.9 ft^3 (2.7 m^3)	12 drums and 1 drum of derived waste
Transfer Cell	1,003 ft^2 (93 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Facility Cask Loading Room	1,625 ft^2 (151 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Total for RH Waste	**17,403 ft^2 (1,617 m^2)**	**387.7 ft^3 (11.0 m^3)**	
Facility Total	**49,710 ft^2 (4,618 m^2)**	**6,854 ft^3 (194.1 m^3)**	

3.1.1.5. Storage on Pallets

The Permittees shall store TRU mixed waste containers unloaded from the Contact-Handled Packages (**TRUPACT-II, HalfPACT, or TRUPACT III** shipping containers) on pallets in the WHB Unit, as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.6. Storage of Derived Waste

The Permittees shall store containers of TRU mixed derived waste only in the Derived Waste Storage Area, the RH Bay, and the RH Hot Cell. The

Permittees shall store the derived waste containers on a pallet that provides secondary containment and elevates the containers at least 6 inches above the floor to protect them from contact with accumulated liquid.

3.1.1.7. CH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a CH TRU mixed waste container in the WHB Unit for more than 60 calendar days, with the exception of the Derived Waste Storage Area, where derived waste may be accumulated and stored until the container is full.

3.1.1.8. Minimum Aisle Space

The Permittees shall maintain a minimum aisle space of 44 inches (1.1 m) between facility pallets in the CH Bay of the WHB Unit. The Permittees shall maintain adequate aisle space of 44 inches (1.1 m) between loaded casks in the RH Bay of the WHB Unit. For other locations within the RH Complex, sufficient aisle space will be maintained to assure that emergency equipment can be accessed or moved to the necessary locations.

3.1.1.9. Storage of RH TRU Mixed Waste Containers

The Permittees shall store RH TRU mixed waste in casks, canisters, or drums in the RH Complex as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.10. RH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a RH TRU mixed waste container in the RH Complex for more than 60 calendar days, with the following exceptions:

i. Derived Waste Storage Areas, where derived waste may be accumulated and stored until the container is full; and

ii. Hot Cell, where 55-gallon drums may be stored for no more than 25 of the 60 calendar days.

3.1.1.11. Hot Cell RH TRU Mixed Waste Processing Capacity

The processing capacity of the Hot Cell is limited to 13,773 ft^3 (390 m^3) of RH TRU mixed waste.

3.1.2. Parking Area Container Storage Unit

The Parking Area Container Storage Unit (**Parking Area Unit**) is an asphalt and concrete surface extending from north of the rail sidings to the WHB, within the Controlled Area. The Parking Area Unit shall be enclosed by chain link fence. The Parking Area Unit shall comprise a surface area of no more than 137,050 ft^2 (12,730 m^2), as depicted in Permit Attachment A1, Figure A1-2.

The Permittees may store and manage TRU mixed waste in the Parking Area Unit, provided the Permittees comply with the following conditions:

3.1.2.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1. These TRU mixed waste containers shall be stored within the sealed Contact-Handled or Remote-Handled Packages described in Permit Attachment A1.

3.1.2.2. Storage Locations and Quantities

The Permittees shall store TRU mixed waste containers in any location within the Parking Area Unit, as specified in Table 3.1.2 below. The Permittees may store quantities of TRU mixed waste containers within sealed Contact-Handled or Remote-Handled Packages in these locations not to exceed the maximum capacities specified in Table 3.1.2 below.

3.1.2.3. Use of Parking Area Surge Storage

The Permittees may use the Parking Area Surge Storage in Table 3.1.2 below only when the maximum capacity in the Parking Area is reached and as specified in Permit Attachment A1, Section A1-1c(2).

3.1.2.4. Notification of Parking Area Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the Parking Area Surge Storage and provide justification for its use. The Permittees shall post a link to the notice of Parking Area Surge Storage use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing Parking Area Surge Storage usage.

Table 3.1.2 - Parking Area Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
Parking Area	137,050 ft^2 (12,730 m^2)	6,734 ft^3 (191 m^3)	40 Contact-Handled Packages containing waste and 8 Remote-Handled Packages containing waste. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.
Parking Area Surge Storage	Included in Parking Area	2,129 ft^3 (60 m^3)	12 Contact-Handled Packages and 4 Remote-Handled Packages. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.

3.1.2.5. Prohibition on Opening Shipping Containers

The Permittees shall keep the Contact-Handled or Remote-Handled Packages sealed at all times while in the Parking Area Unit.

3.1.2.6. Storage Time Limit

The Permittees shall not store sealed Contact-Handled or Remote-Handled Packages in the Parking Area Unit for more than 59 days after the date the Inner Containment Vessel (**ICV**) of the Package was sealed at the generator site. Prior to storing a sealed Package, the Permittees shall verify that the ICV Closure Date for each Package is recorded in the WIPP Waste Information System (**WWIS**) database described in Permit Attachment C (Waste Analysis Plan).

3.1.2.7. Minimum Aisle Space

The Permittees shall maintain a minimum spacing of 4 ft (1.2 m) between loaded Contact-Handled or Remote-Handled Packages.

3.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

3.2.1. Permitted Waste

The Permittees may store and manage TRU mixed waste in the WHB Unit and Parking Area Unit, provided the Permittees comply with the following conditions:

3.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

3.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

3.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

3.2.2. Prohibited Waste

The Permittees shall not store or manage any TRU mixed waste that fails to comply with Permit Section 3.2.1.

3.3. CONDITION OF CONTAINERS

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 3.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

3.3.1. Acceptable Storage Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for storage of TRU mixed waste at WIPP. The Permittees are prohibited from storing TRU mixed waste in any container not specified in Permit Attachment A1, Section A1-1b, as set forth below:

3.3.1.1. Standard 55-gallon (208-liter) Drum

Each standard 55-gallon drum has a gross internal volume of 7.4 ft^3 (0.21 m^3).

3.3.1.2. Standard Waste Box (**SWB**)

Each SWB has a gross internal volume of 66.3 ft^3 (1.88 m^3).

3.3.1.3. Ten-drum Overpack (**TDOP**)

Each TDOP has a gross internal volume of 160 ft^3 (4.5 m^3). TDOPs may be used to contain up to ten standard 55-gallon drums or one SWB. TDOPs may be direct loaded or used to overpack drums or SWBs containing CH TRU mixed waste.

3.3.1.4. 85-gallon (322-liter) Drum

Each 85-gallon drum has a gross internal volume of up to 11.4 ft^3 (0.32 m^3). 85-gallon drums may be direct loaded or used for overpacking 55-gallons drums containing CH TRU mixed waste and for collecting and storing derived waste.

3.3.1.5. 100-gallon (379-liter) Drum

Each 100-gallon drum has a gross internal volume of 13.4 ft^3 (0.38m^3). 100-gallon drums may be direct loaded with CH TRU mixed waste.

3.3.1.6. RH TRU Canister

Each RH TRU canister has a gross internal volume of 31.4 ft^3 (0.89 m^3). RH TRU canisters contain RH TRU mixed waste packaged in small containers (e.g., 55-gallon drums) or waste loaded directly into the canister.

3.3.1.7. Standard Large Box 2 (**SLB2**)

Each SLB2 has a gross internal volume of 261 ft^3 (7.39 m^3). SLB2s may be direct loaded with CH TRU mixed waste.

3.3.1.8. Shielded Container*

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11m^3). Shielded containers contain RH TRU mixed waste, but shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste. Shielded containers may be overpacked into standard waste box or ten drum overpack.

* "Shielded Container" refers to the container depicted in Figure A1-37.

3.3.2. Derived Waste Containers

The Permittees shall use standard 55-gallon drums, SWBs, or 85-gallon drums to collect, store, and dispose of derived waste.

3.4. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittees shall use containers made of or lined with materials which will not react with, and are otherwise compatible with, the TRU mixed waste to be stored, so that the ability of the container to contain the waste is not impaired, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

3.5. MANAGEMENT OF CONTAINERS

The Permittees shall manage all containers as specified in Permit Attachment A1 and shall keep all containers closed during storage, except when it is necessary to add waste to derived waste containers. The Permittees shall not open, handle, or store containers in a manner which may rupture the container or cause it to leak, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.173).

3.6. CONTAINMENT SYSTEMS

The Permittees shall maintain the secondary containment systems for all containers managed in the WHB Unit and Parking Area Unit as specified in Permit Attachment A1, Section A1-1f, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.175).

3.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the WHB Unit and Parking Area Unit TRU mixed waste container storage and management areas at least weekly, in accordance with Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and Permit Attachment A1, Section A1-1e, to detect leaking containers and deterioration of containers and the containment system caused by corrosion and other factors, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174).

3.7.1. Inspection of 55-Gallon Drum Seven-Packs

The Permittees shall not be required to inspect the center drum of a 55-gallon seven-pack assembly, as depicted in Permit Attachment A2 (Geologic Repository), Figure A2-6.

3.7.2. Inspection of Sealed Contact-Handled or Remote-Handled Packages

The Permittees shall not be required to inspect the contents of sealed Contact-Handled or Remote-Handled Packages stored in compliance with Permit Section 3.1.2 and Permit Attachment A1, Section A1-1e(2). The Permittees shall attach a clearly legible sign to each Contact-Handled and Remote-Handled Package indicating whether the Contact-Handled or Remote-Handled Package contains TRU mixed waste.

3.8. RECORDKEEPING

The Permittees shall place the results of waste analyses in the operating record as specified in Permit Section 2.14 and Permit Attachment C.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter C).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

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PERMIT PART 3

PART 4 - GEOLOGIC REPOSITORY DISPOSAL

4.1. DESIGNATED DISPOSAL UNITS

This Part authorizes the management and disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste containers in the Underground Hazardous Waste Disposal Units (**Underground HWDUs**) identified herein. Specific facility and process information for the management and disposal of CH and RH TRU mixed waste in the Underground HWDUs is incorporated in Permit Attachment A2 (Geologic Repository).

4.1.1. Underground Hazardous Waste Disposal Units

The Underground HWDUs are located at the WIPP facility approximately 2150 feet (665 meters) below the ground surface within the Salado formation. An Underground HWDU is a single excavated panel, consisting of seven rooms and two access drifts, designated for disposal of TRU mixed waste containers.

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.1.1.1. Disposal Containers

The Permittees shall dispose TRU mixed waste in containers specified in Permit Section 4.3.1.

4.1.1.2. Disposal Locations and Quantities

The Permittees shall dispose TRU mixed waste containers in eight Underground HWDUs, as specified in Table 4.1.1 below and depicted in Permit Attachment A2, Figure A2-1. The Permittees may dispose quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 4.1.1 below. The Permittees may increase these capacities subject to the following conditions:

i. The Permittees may submit a Class 1 permit modification requiring prior approval of the Secretary in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(a)) to increase the CH TRU mixed waste capacity by 35,300 ft^3 (1,000 m^3) or less, and the RH TRU mixed waste capacities in Panels 5 and 6 to a maximum of 22,950 ft^3 (650 m^3).

At least 15 calendar days before submittal to NMED, the Permittees shall post a link to the Class 1 permit modification on the WIPP Home Page and inform those on the e-mail notification list.

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ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]		Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)		6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)		8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)		
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**		

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

4.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

4.2.1. Permitted Waste

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

4.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

4.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

Derived waste may be disposed in the Underground HWDUs as specified in Permit Section 2.3.5.

4.2.2. Prohibited Waste

4.2.2.1. General Prohibition

The Permittees shall not dispose any TRU mixed waste that fails to comply with Permit Section 4.2.1.

4.2.2.2. Specific Prohibition

After this Permit becomes effective, the Permittees shall not dispose non-mixed TRU waste in any Underground HWDU unless such waste is characterized in accordance with the requirements of the WAP specified in Permit Section 2.3.1. The Permittees shall not dispose TRU mixed waste in any Underground HWDU if the Underground HWDU contains non-mixed TRU waste which was disposed of after this Permit became effective and was not characterized in accordance with the requirements of the WAP.

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4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.1.8. Shielded Container

Shielded containers are configured as a three-pack.

4.3.2. Condition of Containers

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak prior to disposal in an Underground HWDU, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 4.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

4.4. VOLATILE ORGANIC COMPOUND LIMITS

The Permittees shall limit releases to the air of volatile organic compound waste constituents (**VOCs**) as specified by the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)):

4.4.1. Room-Based Limits

The measured concentration of VOCs in any open (active) room and in each closed room in active panels within an Underground HWDU shall not exceed the limits specified in Table 4.4.1 below:

Table 4.4.1 - VOC Room-Based Limits

Compound	VOC Room-Based Concentration Limit (PPMV)
Carbon Tetrachloride	9625
Chlorobenzene	13000
Chloroform	9930
1,1-Dichloroethylene	5490
1,2-Dichloroethane	2400
Methylene Chloride	100000
1,1,2,2-Tetrachloroethane	2960
Toluene	11000
1,1,1-Trichloroethane	33700

There are no maximum concentration limits for other VOCs.

4.4.2. Determination of VOC Room-Based Limits

The Permittees shall confirm the VOC concentration and emission rate limits identified in Permit Section 4.4.1 using the VOC Monitoring Plan specified in Permit Attachment N

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(Volatile Organic Compound Monitoring Plan). The Permittees shall conduct monitoring of VOCs as specified in Permit Sections 4.6.2 and 4.6.3.

4.4.3. Ongoing Disposal Room VOC Monitoring in Panels 3 Through 8

The Permittees shall continue disposal room VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless the explosion-isolation wall specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System) is installed in the panel.

4.5. DESIGN, CONSTRUCTION, AND OPERATION REQUIREMENTS

The Permittees shall design, construct, and operate the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601):

4.5.1. Repository Design

The Permittees shall construct each Underground HWDU in conformance with the requirements specified in Permit Attachment A2 and Permit Attachment A3 (Drawing Number 51-W-214-W, "Underground Facilities Typical Disposal Panel").

4.5.2. Repository Construction

4.5.2.1. Construction Requirements

Subject to Permit Section 4.5.1, the Permittees may excavate the following Underground HWDUs, as depicted in Permit Attachment A2, Figure A2-1, "Repository Horizon", and specified in Section A2-2a(3), "Subsurface Structures (Underground Hazardous Waste Disposal Units (HWDUs))":

- Panel 10 (Disposal area access drift)
- Panel 2
- Panel 9 (Disposal area access drift)
- Panel 3
- Panel 4
- Panel 5
- Panel 6
- Panel 7
- Panel 8

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.7.11.2.

4.5.2.2. Notification Requirements

At least 30 calendar days prior to the projected start date of excavation of each Underground HWDU, the Permittees shall provide written notification to the Secretary stating the projected start date of excavation, along with supporting rationale (e.g., projected waste receipt rate, etc.). The Permittees shall post a link to the notification transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room when waste disposal is taking place and workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

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4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a

link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

4.6.2.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the VOC Monitoring Plan.

4.6.2.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall post a link to any exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.2.3 - VOC Concentrations of Concern

Compound	Drift E-300 Concentration	
	ug/m3	ppbv
Carbon Tetrachloride	6040	960
Chlorobenzene	1015	220
Chloroform	890	180
1,1-Dichloroethylene	410	100

1,2-Dichloroethane	175	45
Methylene Chloride	6700	1930
1,1,2,2-Tetrachloroethane	350	50
Toluene	715	190
1,1,1-Trichloroethane	3200	590

4.6.2.4. Remedial Action

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3, the Permittees shall cease disposal in the active CH disposal room and install ventilation barriers as specified in Permit Section 4.5.3.3.

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 for six consecutive months, the Permittees shall close the affected Underground HWDU as specified in Permit Section 4.9.1.

For any remedial action taken under this Permit Section, the Permittees shall submit to the Secretary written quarterly status reports, beginning 30 calendar days after the Permittees submit the initial notification in Permit Section 4.6.2.3 which resulted in the remedial action. The quarterly status report shall analyze the cause of exceedance, describe the implementation and results of the remedial action, and describe measures taken to prevent future exceedances. The Permittees shall submit such reports until the Secretary determines the remedial action has been completed in accordance with all applicable requirements of this Permit.

4.6.3. Disposal Room Volatile Organic Compound Monitoring

4.6.3.1. Implementation of Disposal Room VOC Monitoring

The Permittees shall implement disposal room VOC monitoring as specified in Permit Attachment N and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.3.2. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 in any closed room in an active panel or in the immediately adjacent closed room exceeds the action levels specified in Table 4.6.3.2 below. The Permittees shall post a link to

the exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring		
Compound	**50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv**	**95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv**
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethylene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report to the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

The Permittees shall post a link to the notification letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.5.3 - Action Levels for Hydrogen and Methane Monitoring		
Compound	**Action Level 1**	**Action Level 2**
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

4.6.5.4. Remedial Action

Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 1" in Table 4.6.5.3, the sampling frequency in that filled panel will increase to once per week. Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 2" in Table 4.6.5.3 in two consecutive weekly samples, the Permittees shall install in that panel the explosion-isolation wall specified in Permit Attachment G1.

4.6.5.5. Sampling Line Loss

The Permittees shall notify the Secretary in writing within seven calendar days of the discovery of loss of sampling line(s). The Permittees shall evaluate any loss of sampling lines as described in Permit Attachment N1, Section N1-5b, "Sample Tubing", and shall notify the Secretary in writing within seven calendar days the results of such evaluation. The Permittees shall also post a link to such notification letters on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11

4.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the Underground HWDUs at least weekly, as specified in Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15). The Permittees shall perform these inspections to detect malfunctions, signs of deterioration, operator errors, discharges, or any other factors which have caused or may cause a release of hazardous wastes or hazardous waste constituents to the environment or which may compromise the ability of any Underground HWDU to comply with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

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4.8. RECORDKEEPING

4.8.1. Underground HWDU Location Map

The Permittees shall maintain, in the operating record, a map containing the exact location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks.

4.8.2. Disposal Waste Type and Location

The Permittees shall maintain, in the operating record, a record identifying the types and quantities of TRU mixed waste in each Underground HWDU and the disposal location of each container or container assembly (e.g., a 7-pack of standard 55-gallons drums) within each Underground HWDU, using the following fields from the WWIS data dictionary:

1. Panel Number
2. Room Number or Drift Number
3. Row Number (for CH TRU mixed waste) or Borehole Number (for RH TRU mixed waste)
4. Column Number (for CH TRU mixed waste)
5. Column Height (for CH TRU mixed waste)
6. Container Type Code
7. Container Identification Number
8. Manifest Document Number
9. Disposal Date

The Permittees shall also maintain, in the operating record, a map or diagram depicting the location and quantity of each waste. The map or diagram shall include a cross reference to specific manifest document numbers, if the waste was accompanied by a manifest, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(2)).

4.8.3. Ventilation Rates

The Permittees shall maintain, in the operating record, a record identifying any non-conformance to the ventilation rates specified in Permit Section 4.5.3.2.

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PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment A3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Underground Facilities Typical Disposal Panel" – Drawing Number 51-W-214-W, Appendix M3).

Permit Attachment A4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Traffic Patterns" – Chapter G).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, " Volatile Organic Compound Monitoring Plan" - Chapter N).

Permit Attachment N1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Hydrogen and Methane Monitoring Plan" - Appendix N1)

Permit Attachment O (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Mine Ventilation Rate Monitoring Plan" - Chapter Q).

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PART 4 - GEOLOGIC REPOSITORY DISPOSAL

4.1. DESIGNATED DISPOSAL UNITS

This Part authorizes the management and disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste containers in the Underground Hazardous Waste Disposal Units (**Underground HWDUs**) identified herein. Specific facility and process information for the management and disposal of CH and RH TRU mixed waste in the Underground HWDUs is incorporated in Permit Attachment A2 (Geologic Repository).

4.1.1. Underground Hazardous Waste Disposal Units

The Underground HWDUs are located at the WIPP facility approximately 2150 feet (665 meters) below the ground surface within the Salado formation. An Underground HWDU is a single excavated panel, consisting of seven rooms and two access drifts, designated for disposal of TRU mixed waste containers.

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.1.1.1. Disposal Containers

The Permittees shall dispose TRU mixed waste in containers specified in Permit Section 4.3.1.

4.1.1.2. Disposal Locations and Quantities

The Permittees shall dispose TRU mixed waste containers in eight Underground HWDUs, as specified in Table 4.1.1 below and depicted in Permit Attachment A2, Figure A2-1. The Permittees may dispose quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 4.1.1 below. The Permittees may increase these capacities subject to the following conditions:

i. The Permittees may submit a Class 1 permit modification requiring prior approval of the Secretary in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(a)) to increase the CH TRU mixed waste capacity by 35,300 ft^3 (1,000 m^3) or less, and the RH TRU mixed waste capacities in Panels 5 and 6 to a maximum of 22,950 ft^3 (650 m^3).

At least 15 calendar days before submittal to NMED, the Permittees shall post a link to the Class 1 permit modification on the WIPP Home Page and inform those on the e-mail notification list.

ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]	~~Container Equivalent~~	Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	~~400 RH TRU Canisters~~	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)	~~500 RH TRU Canisters~~	8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)	~~600 RH TRU Canisters~~	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)	~~730 RH TRU Canisters~~	
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**	~~2960 RH TRU Canisters~~	

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

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capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

4.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

4.2.1. Permitted Waste

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

4.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

4.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

Derived waste may be disposed in the Underground HWDUs as specified in Permit Section 2.3.5.

4.2.2. Prohibited Waste

4.2.2.1. General Prohibition

The Permittees shall not dispose any TRU mixed waste that fails to comply with Permit Section 4.2.1.

4.2.2.2. Specific Prohibition

After this Permit becomes effective, the Permittees shall not dispose non-mixed TRU waste in any Underground HWDU unless such waste is characterized in accordance with the requirements of the WAP specified in Permit Section 2.3.1. The Permittees shall not dispose TRU mixed waste in any Underground HWDU if the Underground HWDU contains non-mixed TRU waste which was disposed of after this Permit became effective and was not characterized in accordance with the requirements of the WAP.

4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.1.8. Shielded Container

Shielded containers are configured as a three-pack.

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4.3.2. Condition of Containers

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak prior to disposal in an Underground HWDU, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 4.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

4.4. VOLATILE ORGANIC COMPOUND LIMITS

The Permittees shall limit releases to the air of volatile organic compound waste constituents (**VOCs**) as specified by the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)):

4.4.1. Room-Based Limits

The measured concentration of VOCs in any open (active) room and in each closed room in active panels within an Underground HWDU shall not exceed the limits specified in Table 4.4.1 below:

Table 4.4.1 - VOC Room-Based Limits

Compound	VOC Room-Based Concentration Limit (PPMV)
Carbon Tetrachloride	9625
Chlorobenzene	13000
Chloroform	9930
1,1-Dichloroethylene	5490
1,2-Dichloroethane	2400
Methylene Chloride	100000
1,1,2,2-Tetrachloroethane	2960
Toluene	11000
1,1,1-Trichloroethane	33700

There are no maximum concentration limits for other VOCs.

4.4.2. Determination of VOC Room-Based Limits

The Permittees shall confirm the VOC concentration and emission rate limits identified in Permit Section 4.4.1 using the VOC Monitoring Plan specified in Permit Attachment N

(Volatile Organic Compound Monitoring Plan). The Permittees shall conduct monitoring of VOCs as specified in Permit Sections 4.6.2 and 4.6.3.

4.4.3. Ongoing Disposal Room VOC Monitoring in Panels 3 Through 8

The Permittees shall continue disposal room VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless the explosion-isolation wall specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System) is installed in the panel.

4.5. DESIGN, CONSTRUCTION, AND OPERATION REQUIREMENTS

The Permittees shall design, construct, and operate the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601):

4.5.1. Repository Design

The Permittees shall construct each Underground HWDU in conformance with the requirements specified in Permit Attachment A2 and Permit Attachment A3 (Drawing Number 51-W-214-W, "Underground Facilities Typical Disposal Panel").

4.5.2. Repository Construction

4.5.2.1. Construction Requirements

Subject to Permit Section 4.5.1, the Permittees may excavate the following Underground HWDUs, as depicted in Permit Attachment A2, Figure A2-1, "Repository Horizon", and specified in Section A2-2a(3), "Subsurface Structures (Underground Hazardous Waste Disposal Units (HWDUs))":

- Panel 10 (Disposal area access drift)
- Panel 2
- Panel 9 (Disposal area access drift)
- Panel 3
- Panel 4
- Panel 5
- Panel 6
- Panel 7
- Panel 8

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.7.11.2.

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4.5.2.2. Notification Requirements

At least 30 calendar days prior to the projected start date of excavation of each Underground HWDU, the Permittees shall provide written notification to the Secretary stating the projected start date of excavation, along with supporting rationale (e.g., projected waste receipt rate, etc.). The Permittees shall post a link to the notification transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room when waste disposal is taking place and workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

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4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a

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link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

4.6.2.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the VOC Monitoring Plan.

4.6.2.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall post a link to any exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.2.3 - VOC Concentrations of Concern

Compound	Drift E-300 Concentration	
	ug/m3	ppbv
Carbon Tetrachloride	6040	960
Chlorobenzene	1015	220
Chloroform	890	180
1,1-Dichloroethylene	410	100

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1,2-Dichloroethane	175	45
Methylene Chloride	6700	1930
1,1,2,2-Tetrachloroethane	350	50
Toluene	715	190
1,1,1-Trichloroethane	3200	590

4.6.2.4. Remedial Action

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3, the Permittees shall cease disposal in the active CH disposal room and install ventilation barriers as specified in Permit Section 4.5.3.3.

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 for six consecutive months, the Permittees shall close the affected Underground HWDU as specified in Permit Section 4.9.1.

For any remedial action taken under this Permit Section, the Permittees shall submit to the Secretary written quarterly status reports, beginning 30 calendar days after the Permittees submit the initial notification in Permit Section 4.6.2.3 which resulted in the remedial action. The quarterly status report shall analyze the cause of exceedance, describe the implementation and results of the remedial action, and describe measures taken to prevent future exceedances. The Permittees shall submit such reports until the Secretary determines the remedial action has been completed in accordance with all applicable requirements of this Permit.

4.6.3. Disposal Room Volatile Organic Compound Monitoring

4.6.3.1. Implementation of Disposal Room VOC Monitoring

The Permittees shall implement disposal room VOC monitoring as specified in Permit Attachment N and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.3.2. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 in any closed room in an active panel or in the immediately adjacent closed room exceeds the action levels specified in Table 4.6.3.2 below. The Permittees shall post a link to

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the exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring

Compound	50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv	95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethylene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

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4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report to the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

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The Permittees shall post a link to the notification letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.5.3 - Action Levels for Hydrogen and Methane Monitoring		
Compound	**Action Level 1**	**Action Level 2**
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

4.6.5.4. Remedial Action

Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 1" in Table 4.6.5.3, the sampling frequency in that filled panel will increase to once per week. Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 2" in Table 4.6.5.3 in two consecutive weekly samples, the Permittees shall install in that panel the explosion-isolation wall specified in Permit Attachment G1.

4.6.5.5. Sampling Line Loss

The Permittees shall notify the Secretary in writing within seven calendar days of the discovery of loss of sampling line(s). The Permittees shall evaluate any loss of sampling lines as described in Permit Attachment N1, Section N1-5b, "Sample Tubing", and shall notify the Secretary in writing within seven calendar days the results of such evaluation. The Permittees shall also post a link to such notification letters on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11

4.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the Underground HWDUs at least weekly, as specified in Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15). The Permittees shall perform these inspections to detect malfunctions, signs of deterioration, operator errors, discharges, or any other factors which have caused or may cause a release of hazardous wastes or hazardous waste constituents to the environment or which may compromise the ability of any Underground HWDU to comply with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

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4.8. RECORDKEEPING

4.8.1. Underground HWDU Location Map

The Permittees shall maintain, in the operating record, a map containing the exact location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks.

4.8.2. Disposal Waste Type and Location

The Permittees shall maintain, in the operating record, a record identifying the types and quantities of TRU mixed waste in each Underground HWDU and the disposal location of each container or container assembly (e.g., a 7-pack of standard 55-gallons drums) within each Underground HWDU, using the following fields from the WWIS data dictionary:

1. Panel Number
2. Room Number or Drift Number
3. Row Number (for CH TRU mixed waste) or Borehole Number (for RH TRU mixed waste)
4. Column Number (for CH TRU mixed waste)
5. Column Height (for CH TRU mixed waste)
6. Container Type Code
7. Container Identification Number
8. Manifest Document Number
9. Disposal Date

The Permittees shall also maintain, in the operating record, a map or diagram depicting the location and quantity of each waste. The map or diagram shall include a cross reference to specific manifest document numbers, if the waste was accompanied by a manifest, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(2)).

4.8.3. Ventilation Rates

The Permittees shall maintain, in the operating record, a record identifying any non-conformance to the ventilation rates specified in Permit Section 4.5.3.2.

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PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment A3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Underground Facilities Typical Disposal Panel" – Drawing Number 51-W-214-W, Appendix M3).

Permit Attachment A4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Traffic Patterns" – Chapter G).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, " Volatile Organic Compound Monitoring Plan" - Chapter N).

Permit Attachment N1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Hydrogen and Methane Monitoring Plan" - Appendix N1)

Permit Attachment O (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Mine Ventilation Rate Monitoring Plan" - Chapter Q).

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ATTACHMENT A1

CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

Introduction

Management and storage of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under 20.4.1.500 NMAC. The technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.170 to 264.178 are applied to the operation of the Waste Handling Building Container Storage Unit (**WHB Unit**)(Figure A1-1), and the Parking Area Container Storage Unit (**Parking Area Unit**)(Figure A1-2). This Permit Attachment describes the container storage units, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1 NMAC. The configuration of the WIPP facility consists of completed structures, including all buildings and systems for the operation of the facility.

A1-1 Container Storage

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

A1-1a Containers with Liquid

The Permit Treatment, Storage, and Disposal Facility (**TSDF**) Waste Acceptance Criteria (**WAC**) and the Waste Analysis Plan (Permit Attachment C) prohibit the shipment of waste to the WIPP with liquid in excess of one percent of the volume of the waste container (e.g., drum, standard waste box [**SWB**], or canister). Since the maximum amount of liquid is one percent, calculations made to determine the secondary containment as required by 20.4.1.500 NMAC (incorporating §264.175) are based on ten percent of one percent of the volume of the containers, or one percent of the largest container, whichever is greater.

A1-1b Description of Containers

20.4.1.500 NMAC (incorporating 40 CFR §264.171) requires that containers holding waste be in good condition. Waste containers shall be in good condition prior to shipment from the generator sites, i.e., containers will be of high integrity, intact, and free of surface contamination above DOE limits. The Manager of the DOE Carlsbad Field Office has the authority to suspend a generator's certification to ship TRU mixed waste to the WIPP facility should the generator fail to meet this requirement. The containers will be certified free of surface contamination above DOE limits upon shipment. This condition shall be verified upon receipt of the waste at WIPP. The level of rigor applied in these areas to ensure container integrity and the absence of external contamination on both ends of the transportation process will ensure that waste containers entering the waste management process line at WIPP meet the applicable Resource Conservation and Recovery Act (**RCRA**) requirements for container condition.

A1-1b(1) CH TRU Mixed Waste Containers

Contact handled (**CH**) TRU mixed waste containers will be either 55-gal (208-L) drums singly or arranged into 7-packs, 85-gal (322-L) drums singly or arranged into 4-packs, 100-gal (379 L)

drums singly or arranged into 3-packs, ten-drum overpacks (**TDOP**), standard large box 2s (**SLB2**), or SWBs. A summary description of each CH TRU mixed waste container type is provided below.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (**DOT**) specification 7A regulations.

A standard 55-gal (208-L) drum has a gross internal volume of 7.4 cubic feet (ft^3) (0.21 cubic meters (m^3)). Figure A1-3 shows a standard TRU mixed waste drum. One or more filtered vents (as described in Section A1-1d(1)) will be installed in the drum lid to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

Standard 55-gal (208-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

Standard 55-gal (208-L) drums may be used to collect derived waste.

Standard Waste Boxes

The SWBs meet all the requirements of DOT specification 7A regulations.

One or more filtered vents (as described in Section A1-1d(1)) will be installed in the SWB body and located near the top of the SWB to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. They have an internal volume of 66.3 ft^3 (1.88 m^3). Figure A1-4 shows a SWB.

The SWB is the largest container that may be used to collect derived waste.

Ten-Drum Overpack

The TDOP is a metal container, similar to a SWB, that meets DOT specification 7A and is certified to be noncombustible and to meet all applicable requirements for Type A packaging. The TDOP is a welded-steel, right circular cylinder, approximately 74 inches (in.) (1.9 meters (m)) high and 71 in. (1.8 m) in diameter (Figure A1-5). The maximum loaded weight of a TDOP is 6,700 pounds (lbs) (3,040 kilograms (kg)). A bolted lid on one end is removable; sealing is accomplished by clamping a neoprene gasket between the lid and the body. One or more filter vents are located near the top of the TDOP on the body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. A TDOP may contain up to ten standard 55-gal (208-L) drums or one SWB. TDOPs may be used to overpack drums or SWBs containing CH TRU mixed waste. The TDOP may also be direct loaded with CH TRU mixed waste. Figure A1-5 shows a TDOP.

Eighty-Five Gallon Drum

The 85-gal (322-L) drums meet the requirements for DOT specification 7A regulations. An 85-gal (322-L) drum has a gross internal volume of 11.4 ft^3 (0.32 m^3). One or more filtered vents

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(as described in Section A1-1d(1)) will be installed in the 85-gal drum to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

85-gal (322-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

The 85-gal (322-L) drum, which is shown in Figure A1-6, will be used for overpacking contaminated 55-gal (208 L) drums at the WIPP facility. The 85-gal drum may also be direct loaded with CH TRU mixed waste.

85-gal (322-L) drums may be used to collect derived waste.

100-Gallon Drum

100-gal (379-L) drums meet the requirements for DOT specification 7A regulations.

A 100-gal (379-L) drum has a gross internal volume of 13.4 ft^3 (0.38 m^3). One or more filtered vents (as described in Section A1-1d(1) will be installed in the drum lid or body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

100-gal (379-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

100-gal (379-L) drums may be direct loaded.

Standard Large Box 2

The SLB2 meets the requirements of DOT specification 7A requirements. The SLB2 is a welded steel container with a gross internal volume of 261 ft^3 (7.39 m^3).

One or more filtered vents will be installed in the SLB2 body and located near the top of the SLB2 to prevent the escape of radioactive particulates and to prevent internal pressurization. Figure A1-34 shows an SLB2.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers, which are received in HalfPACTs, and 55-gallon drums, which are received in a CNS 10-160B cask.

RH TRU Canister

The RH TRU Canister is a steel single shell container which is constructed to be of high integrity. An example canister is depicted in Figure A1-16a. The RH TRU Canister is vented and

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will have a nominal internal volume of 31.4 ft^3 (0.89 m^3) and shall contain waste packaged in small containers (e.g., drums) or waste loaded directly into the canister.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (DOT) specification 7A regulations. A detailed description of a standard 55-gallon drum is provided above. Up to ten 55-gallon drums containing RH TRU mixed waste are arranged on two drum carriage units in the CNS 10-160B cask (up to five drums per drum carriage unit). The drums are transferred to an RH TRU mixed waste Facility Canister that will contain three drums.

Shielded Container

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste.

A1-1b(3) Container Compatibility

All containers will be made of steel, and some will contain rigid, molded polyethylene liners. The compatibility study, documented in Appendix C1 of the WIPP RCRA Part B Permit Application (DOE, 1997a), included container materials to assure containers are compatible with the waste. Therefore, these containers meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

A1-1c Description of the Container Storage Units

A1-1c(1) Waste Handling Building Container Storage Unit (WHB Unit)

The Waste Handling Building (**WHB**) is the surface facility where TRU mixed waste handling activities will take place (Figure A1-1a). The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters (m^2)) of which 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for handling and storage of RH TRU mixed waste, as shown in Figures A1-1, A1-14a, and A1-17a, b, c, and d. These areas are being permitted as the WHB Unit. The concrete floors are sealed with a coating that is sufficiently impervious to the chemicals in TRU mixed waste to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(1)).

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CH Bay Surge Storage Area

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the CH Bay Storage Area. The Permittees may use the CH Bay Surge Storage Area as specified in Part 3 (see Figure A1-1) only when the maximum capacities in the CH Bay Storage Area (except for the Shielded Storage Room) and the Parking Area Unit are reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because Parking Area Container Storage Unit Surge Storage is in use; or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.1.4) upon using the CH Bay Surge Storage and provide justification for its use.

CH TRU Mixed Waste

The Contact-Handled Packages used to transport TRU mixed waste containers will be received through one of three air-lock entries to the CH Bay of the WHB Unit. The WHB heating, ventilation and air conditioning (**HVAC**) system maintains the interior of the WHB at a pressure lower than the ambient atmosphere to ensure that air flows into the WHB, preventing the inadvertent release of any hazardous or radioactive constituents contamination as the result of a contamination event. The doors at each end of the air lock are interlocked to prevent both from opening simultaneously and equalizing CH Bay pressure with outside atmospheric pressure.

- TRUPACT-II and HalfPACT Management

  The CH Bay houses two TRUPACT-II Docks (**TRUDOCKs**), each equipped with overhead cranes for opening and unloading Contact-Handled Packages. The TRUDOCKs are within the TRUDOCK Storage Area of the WHB Unit. The cranes are rated to lift the Contact-Handled Packaging lids as well as their contents. The cranes are designed to remain on their tracks and hold their load even in the event of a design-basis earthquake.

  Upon receipt and removal of CH TRU mixed waste containers from the Contact-Handled Packaging, the waste containers are required to be in good condition as provided in Permit Part 3. The waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are good condition prior to storage. Waste containers will also

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be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the Contact-Handled Package to a third party contractor. Decontamination activities will not be conducted on containers which are not in good condition, or which are leaking. If local decontamination activities are opted for, the work will be conducted in the WHB Unit on the TRUDOCK. These processes are described in Section A1-1d.

Once unloaded from the Contact-Handled Packaging, CH TRU mixed waste containers (7-packs, 3-packs, 4-packs, SWBs, or TDOPs) are placed in one of two positions on the facility pallet or on a containment pallet. The waste containers are stacked, on the facility pallets (one- or two-high, depending on weight considerations). Waste on containment pallets will be stacked one-high. The use of facility or containment pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage.

In addition, four Contact-Handled Packages, containing up to eight 7-packs, 3-packs, 4-packs, SWBs, or four TDOPs, may occupy positions at the TRUDOCKs. If waste containers are left in this area, they will be in the Contact-Handled Package with or without the shipping container lids removed. The maximum volume of waste in containers in four Contact-Handled Packages is 640 ft^3 (18.1 m^3).

- TRUPACT-III Management

The TRUPACT-III containing one SLB2 will be transferred to a Yard Transfer Vehicle in the Parking Area Unit using a forklift. The Yard Transfer Vehicle then transports the TRUPACT-III into the CH Bay through one of the airlocks and into Room 108 for unloading (Figure A1-1b). The TRUPACT-III is first transported to the bolting station where the overpack cover and closure lid are removed using a bolting robot, or manually as required, and a monorail hoist The TRUPACT-III is then moved to the payload transfer station where the SLB2 is removed from the TRUPACT-III.

The SLB2 will be visually inspected for physical damage in a similar manner as containers removed from a TRUPACT-II or HalfPACT (i.e., severe rusting, apparent structural defects, or signs of pressurization) and for leakage to ensure it is in good condition. The SLB2 will also be checked for external surface contamination. If the SLB2 is not in good condition, the Permittees will repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the SLB2 to a third-party contractor. If local decontamination activities are opted for, the work will be conducted in the WHB Unit.

Once the SLB2 is unloaded from the TRUPACT-III in Room 108, it will be placed on a facility pallet and moved to a pallet stand or floor storage location in the CH Bay for storage or to the conveyance loading room for waste emplacement.

The CH Bay Storage Area, which is shown in Figure A1-1, will be clearly marked to indicate the lateral limits of the storage area. This CH Bay Storage Area will have a maximum capacity of 13 pallets (4,160 ft^3 [118 m^3]) of TRU mixed waste containers during normal operations.

The Derived Waste Storage Area of the WHB Unit is on the north wall of the CH Bay. This area will contain containers up to the volume of a SWB for collecting derived waste from all TRU mixed waste handling processes in the WHB Unit. The Derived Waste Storage Area is being permitted to allow containers in size up to a SWB to be used to accumulate derived waste. The volume of TRU mixed waste stored in this area will be up to 66.3 ft^3 (1.88 m^3). The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which are polyethylene trays with a grated deck, which will elevate the derived waste containers approximately 6 in. (15 cm) from the floor surface, and provide approximately 50 gal (190 L) of secondary containment capacity.

Aisle space shall be maintained in all WHB Unit TRU mixed waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire-fighting personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space of 44 in. (1.1 m) between facility pallets will be maintained in all WHB Unit TRU mixed waste storage areas. An aisle space of 60 in. (1.5 m) will be maintained between the west wall of the CH Bay and facility pallets.

The WHB has been designed to meet DOE design and associated quality assurance requirements. Table A1-1 summarizes basic design requirements, principal codes, and standards for the WIPP facility. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997a) provided engineering design-basis earthquake and tornado reports. The design-basis earthquake report provides the basis for seismic design of WIPP facility structures, including the WHB foundation. The WIPP design-basis earthquake is 0.1 g. The WIPP design-basis tornado includes a maximum windspeed of 183 mi per hr (mi/hr) (294.5 km/hr), which is the vector sum of all velocity components. It is also limited to a translational velocity of 41 mi/hr (66 km/hr) and a tangential velocity of 124 mi/hr (200 km/hr). Other parameters are a radius of maximum wind of 325 ft (99 m), a pressure drop of 0.5 lb per $in.^2$ (3.4 kilopascals [kPa]), and a rate-of-pressure drop of 0.09 $lb/in.^2/s$ (0.6 kPa/s). A design-basis flood report is not available because flooding is not a credible phenomenon at the WIPP facility. Design calculations for the probable maximum precipitation (**PMP**) event, provided in Appendix D7 of the WIPP RCRA Part B Permit Application (DOE, 1997a), illustrated run-on protection for the WIPP facility.

The WIPP facility does not lie within a 100-year floodplain. There are no major surface-water bodies within 5 mi (8 km) of the site, and the nearest river, the Pecos River, is approximately 12 mi (19 km) away. The general ground elevation in the vicinity of the surface facilities (approximately 3,400 ft [1,036 m] above mean sea level) is about 500 ft (152 m) above the riverbed and 400 ft (122 m) above the 100-year floodplain. Protection from flooding or ponding caused by PMP events is provided by the diversion of water away from the WIPP facility by a system of peripheral interceptor berms and dikes. Additionally, grade elevations of roads and surface facilities are designed so that storm water will not collect within the Property Protection Area under the most severe conditions.

The following are the major pieces of equipment that will be used to manage CH TRU mixed waste in the container storage units. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A1-2.

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TRUPACT-II Type B Packaging

The TRUPACT-II (Figure A1-8a) is a double-contained cylindrical shipping container 8 ft (2.4 m) in diameter and 10 ft (3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,265 lbs (3,300 kg) gross weight in up to fourteen 55-gal (208-L) drums, eight 85-gal (322-L) drums, six 100-gal (379-L) drums, two SWBs, or one TDOP.

HalfPACT Type B Packaging

The HalfPACT (Figure A1-8b) is a double-contained right cylindrical shipping container 7.8 ft (2.4 m) in diameter and 7.6 ft (2.3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,600 lbs (3,500 kg) gross weight in up to seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums.

TRUPACT-III Type B Packaging

The TRUPACT-III (Figure A1-33) is an NRC-certified Type B package designed to meet the containment and shielding requirements of 10 CFR Part 71. The nominal dimensions for a TRUPACT-III are 14 feet 1 inch long, 8 feet 2 inches wide and 8 feet 8 inches high. The TRUPACT-III is specifically certified to safely transport TRU wastes packaged in an SLB2.

This package, unlike the TRUPACT-II or HalfPACT, is horizontally loaded and will be unloaded horizontally as well.

The TRUPACT-III has a bolted overpack cover that is secured to the TRUPACT-III container.

The maximum weight of a TRUPACT-III is 55,116 lbs (25,000 kg) when loaded with the maximum allowable contents of 11,486 lbs (5,210 kg).

Unloading Docks

Each TRUDOCK is designed to accommodate up to two Contact-Handled Packages. The TRUDOCK functions as a work platform, providing TRU mixed waste handling personnel easy access to the container during unloading operations (see Figure A1-1a) (Also see Drawing 41-M-001-W in Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997a)).

The payload transfer station serves as the unloading dock for TRUPACT-III and can accommodate a single TRUPACT-III package.

Forklifts

Forklifts may be used to transfer the Contact-Handled Packages into the WHB Unit and may be used to transfer palletized CH TRU mixed waste containers to the facility transfer vehicle. Another forklift will be used for general-purpose transfer operations. This forklift has attachments and adapters to handle individual TRU mixed waste containers, if required.

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Cranes, Unloading Devices, and Adjustable Center-of-Gravity Lift Fixtures

At each TRUDOCK, an overhead bridge crane is used with a specially designed lift fixture for disassembly of the Contact-Handled Packages. Separate lifting attachments have been specifically designed to accommodate SWBs and TDOPs. The lift fixture, attached to the crane, has built-in level indicators and two counterweights that can be moved to adjust the center of gravity of unbalanced loads and to keep them level.

The TRUPACT-III is unloaded horizontally in Room 108. The Payload Transfer Station, Yard Transfer Vehicle and Facility Transfer Vehicle, or forklift are used to perform the unloading and movement functions. The Payload Transfer Station includes retractable arms that are used to position the SLB2 onto the Facility Transfer Vehicle and facility pallet.

Facility or Containment Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 4-packs, or 3-packs of drums, SWBs, TDOPs, or an SLB2, and has a rated load of 25,000 lbs. (11,430 kg). The facility pallet will accommodate up to four 7-packs, four 3-packs, or four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or an SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A1-10. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. Facility pallets may also be moved by facility transfer vehicles. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Containment pallets are fabricated units having a containment capacity of at least ten percent of the volume of the containers and designed to support a minimum of either a single drum, a single SWB or a single TDOP. The pallets will have a rated load capacity of equal to or greater than the gross weight limit of the container(s) to be supported on the pallet. Loads are secured to the containment pallet during transport. A typical containment pallet is shown in Figure A1-10a. Fork pockets in the side of the pallet allow the containment pallet to be lifted and transferred by forklift. WIPP facility operational documents define the operational load of the containment pallet to assure that the rated load of a containment pallet is not exceeded.

Facility Transfer Vehicle

The facility transfer vehicle is a battery or electric powered automated vehicle that either operates on tracks or has an on-board guidance system that allows the vehicle to operate on the floor of the WHB. It is designed with a flat bed that has adjustable height capability and may transfer waste payloads on facility pallets or off the facility pallet stands in the CH Bay storage area, and on and off the waste shaft conveyance by raising and lowering the bed (see Figure A1-11).

Yard Transfer Vehicle

The Yard Transfer Vehicle (Figure A1-35) transports the TRUPACT-III shipping container from the PAU into the WHB and into Room 108. The Yard Transfer Vehicle is an electric vehicle with a load capacity of 60,000 pounds.

RH TRU Mixed Waste

The RH TRU mixed waste is handled and stored in the RH Complex of the WHB Unit which comprises the following locations: RH Bay (12,552 ft^2 (1,166 m^2)), the Cask Unloading Room (382 ft^2 (36 m^2)), the Hot Cell (1,841 ft^2 (171 m^2)), the Transfer Cell (1,003 ft^2 (93 m^2)) (Figures A1-17a, b and c), and the Facility Cask Loading Room (1,625 ft^2 (151 m^2)) (Figure A1-17d).

The RH Bay (Figure A1-14a) is a high-bay area for receiving casks and subsequent handling operations. The trailer carrying the RH-TRU 72-B or CNS 10-160B shipping cask (Figures A1-18, A1-19, A1-20 and A1-21) enters the RH Bay through a set of double doors on the east side of the WHB. The RH Bay houses the Cask Transfer Car. The RH Bay is served by the RH Bay Overhead Bridge Crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. The storage occurs after the trailer containing the cask is moved into the RH Bay and prior to moving the cask into the Cask Unloading Room to stage the waste for disposal operations. A maximum of two loaded casks and one 55-gallon drum for derived waste (156 ft^3 (4.4 m^3)) may be stored in the RH Bay.

The Cask Unloading Room (Figure A1-17a) provides for transfer of the RH-TRU 72-B cask to the Transfer Cell, or the transfer of drums from the CNS 10-160B cask to the Hot Cell. Storage in the Cask Unloading Room will occur in the RH-TRU 72-B or CNS 10-160B casks. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one cask (74 ft^3 (2.1 m^3)) may be stored in the Cask Unloading Room.

The Hot Cell (Figure A1-17b) is a concrete shielded room in which drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, staged in the Hot Cell, and loaded into a Facility Canister. The loaded Facility Canister is then lowered from the Hot Cell into the Transfer Cell Shuttle Car containing a Shielded Insert. Storage in the Hot Cell occurs in either drums or Facility Canisters. Drums that are stored are either on the drum carriage unit that was removed from the CNS 10-160B cask or in a Facility Canisters. A maximum of 12 55-gallon drums and one 55-gallon drum for derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell.

The Transfer Cell (Figure A1-17c) houses the Transfer Cell Shuttle Car, which moves the RH-TRU 72-B cask or Shielded Insert into position for transferring the canister to the Facility Cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of a waste handling evolution. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in the Transfer Cell Shuttle Car.

The Facility Cask Loading Room (Figure A1-17d) provides for transfer of a canister to the Facility Cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit (**HWDU**). The Facility Cask Loading Room also functions as an air lock between the Waste Shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask (Figure A1-23) in the Facility Cask Loading Room.

Following is a description of major pieces of equipment that are used to manage RH TRU mixed waste in the WHB Unit. A summary of equipment capacities, as required by 20.4.1.500 NMAC, is included in Table A1-3.

Casks

The RH-TRU 72-B cask (Figure A1-20) is a cylinder designed to meet U.S. Department of Transportation (**DOT**) Type B shipping container requirements. It consists of a separate inner vessel within a stainless steel, lead-shielded outer cask protected by impact limiters at each end, made of stainless steel skins filled with polyurethane foam. The inner vessel is made of stainless steel and provides an internal containment boundary and a cavity for the payload. Neither the outer cask nor the inner vessel is vented. Payload capacity of each RH-TRU 72-B shipping cask is 8,000 lbs (3,628 kg). The payload consists of a canister of RH TRU mixed waste, which may contain up to 31.4 ft^3 (0.89 m^3) of directly loaded waste or waste in smaller containers.

The CNS 10-160B cask (Figure A1-21) is designed to meet DOT Type B container requirements and consists of two carbon steel shells and a lead shield, welded to a carbon steel bottom plate. A 12-gauge stainless steel thermal shield surrounds the cask outer shell, which is equipped with two steel-encased, rigid polyurethane foam impact limiters attached to the top and bottom of the cask. The CNS 10-160B cask is not vented. Payload capacity of each CNS 10-160B cask is 14,500 lbs (6,577 kg). The payload consists of up to ten 55-gallon drums.

Shielded Insert

The Shielded Insert (Figure A1-30) is specifically designed to be used in the Transfer Cell to hold and transport loaded Facility Canisters from the Hot Cell until loaded into the Facility Cask. The Shielded Insert, designed and constructed similar to the RH-TRU 72-B shipping cask, has a 29 in. inside diameter with an inside length of 130.5 in. to accommodate the Facility Canister, which is 28.5 in. in diameter by 117.5 in. long. The Shielded Insert is installed on and removed from the Transfer Cell Shuttle Car in the same manner as the RH-TRU 72-B shipping cask.

CNS 10-160B Drum Carriage

The CNS 10-160B drum carriage (Figure A1-25) is a steel device used to handle drums in the CNS 10-160B cask. The drum carriages are stacked two high in the CNS 10-160B cask during shipment. They are removed from the cask using a below-the-hook lifting device termed a pentapod. The drum carriage is rated to lift up to five drums with a maximum weight of 1000 pounds each.

RH Bay Overhead Bridge Crane

In the RH Bay, an overhead bridge crane is used to lift the cask from the trailer and place it on the Cask Transfer Car. It is also used to remove the impact limiters from the casks and the outer lid of the RH-TRU 72-B cask.

Cask Lifting Yoke

The lifting yoke is a lifting fixture that attaches to the RH Bay Overhead Bridge Crane and is designed to lift and rotate the RH-TRU 72-B cask onto the Cask Transfer Car.

Cask Transfer Cars

The Cask Transfer Cars (Figures A1-22a and A1-22b) are self-propelled, rail-guided vehicles that transport casks between the RH Bay and the Cask Unloading Room.

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6.25 Ton Grapple Hoist

A 6.25 Ton Grapple Hoist is used to hoist the canister from the Transfer Cell Shuttle Car into the Facility Cask.

Facility Canister

The Facility Canister is a cylindrical container designed to hold three 55-gallon drums of either RH TRU waste or dunnage (Figure A1-16).

Facility Cask

The Facility Cask body consists of two concentric steel cylinders. The annulus between the cylinders is filled with lead, and gate shield valves are located at either end. Figure A1-23 provides an outline configuration of the Facility Cask. The canister is placed inside the Facility Cask for shielding during canister transfer from the RH Complex to the Underground HWDU for emplacement.

Facility Cask Transfer Car

The Facility Cask Transfer Car (Figure A1-24) is a self-propelled rail car that is used to move the Facility Cask between the Facility Cask Loading Room and the Shaft Station in the underground.

Hot Cell Bridge Crane

The Hot Cell Bridge Crane, outfitted with a rotating block and the Hot Cell Facility Grapple, will be used to lift the CNS 10-160B lid and the drum carriage units from the cask located in the Cask Unloading Room, into the Hot Cell. The Hot Cell Bridge Crane is also used to lift the empty Facility Canisters into place within the Hot Cell, move loaded drums into the Facility Canister, and lower loaded Facility Canisters into the Transfer Cell.

Overhead Powered Manipulator

The Overhead Powered Manipulator is used in the Hot Cell to lift individual drums from the drum carriage unit and lower each drum into the Facility Canister and support miscellaneous Hot Cell operations.

Manipulators

There is a maximum of two operational sets of fixed Manipulators in the Hot Cell. The Manipulators collect swipes of drums as they are being lifted from the drum carriage unit and transfer the swipes to the Shielded Material Transfer Drawer and support Hot Cell operations.

Shielded Material Transfer Drawer

The Shielded Material Transfer Drawer is used to transfer swipe samples obtained by the fixed Manipulators to the Hot Cell Gallery for radiological counting and transferring small equipment into and out of the Hot Cell.

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Closed-Circuit Television Cameras

The Closed-Circuit Television Camera system is used to monitor operations throughout the Hot Cell and Transfer Cell. These cameras are used to perform inspections of waste containers and waste management areas. This camera system is operated from the shielded room in the Facility Cask Loading Room and Hot Cell Gallery. The camera system has a video recording capability as an operational aid.

Transfer Cell Shuttle Car

The Transfer Cell Shuttle Car (Figure A1-31) positions the loaded RH-TRU 72-B cask and Shielded Insert within the Transfer Cell.

Cask Unloading Room Crane

The Cask Unloading Room Crane lifts and suspends the RH-TRU 72-B cask or Shielded Insert from the Transfer Car and lowers the cask or Shielded Insert into the Transfer Cell Shuttle Car.

Facility Cask Rotating Device

The Facility Cask Rotating Device, a floor mounted hydraulically operated structure, is designed to rotate the Facility Cask from the horizontal position to the vertical position for waste canister loading and then back to the horizontal position after the waste canister has been loaded into the Facility Cask (Figure A1-32).

A1-1c(2) Parking Area Container Storage Unit (Parking Area Unit)

The parking area south of the WHB (see Figure A1-2) will be used for storage of waste containers within sealed shipping containers awaiting unloading. The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Unit. The Parking Area Unit provides storage space for up to 6,734 ft^3 (191 m^3) of TRU mixed waste, contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing liquid are provided by the Contact-Handled or Remote-Handled Packaging. Wastes placed in the Parking Area Unit will remain sealed in their Contact-Handled or Remote-Handled Packages, at all times while in this area.

The Nuclear Regulatory Commission (**NRC**) Certificate of Compliance requires that sealed Contact-Handled or Remote-Handled Packages which contain waste be vented every 60 days to avoid unacceptable levels of internal pressure. During normal operations the maximum residence time of any one container in the Parking Area Unit is typically five days. Therefore, during normal waste handling operations, no Contact-Handled or Remote-Handled Packages will require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be handled in accordance with Section A1-1e(2) of this Permit Attachment. Under no circumstances shall a Contact-Handled or Remote-Handled Package be stored in the Parking Area Unit for more than fifty-nine (59) days after the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was sealed at the generator site.

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Parking Area Surge Storage

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the Parking Area. The Permittees may use the Parking Area Surge Storage as specified in Part 3 (see Figure A1-2) only when the maximum capacity in the Parking Area is reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because the Parking Area is full (not applicable to RH TRU waste shipments); or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.2.4) upon using the Parking Area Surge Storage and provide justification for its use.

A1-1d Container Management Practices

20.4.1.500 NMAC (incorporating 40 CFR §264.173) requires that containers be managed in a manner that does not result in spills or leaks. Containers are required to be closed at all times, unless waste is being placed in the container or removed. Because containers at the WIPP will contain radioactive waste, safety concerns require that containers be continuously vented to obviate the buildup of gases within the container. These gases could result from radiolysis, which is the breakdown of moisture by radiation. The vents, which are nominally 0.75 in. (1.9 centimeters [cm]) in diameter, are generally installed on or near the lids of the containers. These vents are filtered so that gas can escape while particulates are retained.

TRU mixed waste containers, containing off-site waste, are never opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Off-normal events could interrupt normal operations in the waste management process line. These off normal events fall into the following categories:

- Waste management system equipment malfunctions
- Waste shipments with unacceptable levels of surface contamination
- Hazardous Waste Manifest discrepancies that are not immediately resolved
- A suspension of emplacement activities for regulatory reasons

Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

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Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

A1-1d(1) Derived Waste

The WIPP facility operational philosophy is to introduce no new hazardous chemical components into TRU mixed waste or TRU mixed waste residues that could be present in the controlled area. This will be accomplished principally through written procedures and the use of Safe Work Permits (**SWP**)[1] and Radiological Work Permits (**RWP**)[2] which govern the activities within a controlled area involving TRU mixed waste. The purpose of this operating philosophy is to avoid generating TRU mixed waste that is compositionally different than the TRU mixed waste shipped to the WIPP facility for disposal.

Some additional TRU mixed waste, such as used personal protective equipment, swipes, and tools, may result from decontamination operations and off-normal events. Such waste will be assumed to be contaminated with RCRA-regulated hazardous constituents in the TRU mixed waste containers from which it was derived. Derived waste may be generated as the result of decontamination activities during the waste handling process. Should decontamination activities be performed, water and a cleaning agent such as those listed in Permit Attachment D will be used. Derived waste will be considered acceptable for management at the WIPP facility, because any TRU mixed waste shipped to the facility will have already been determined to be acceptable and because no new constituents will be added. Data on the derived waste will be entered into the WWIS database. Derived waste will be contained in standard DOT approved Type A containers.

The Safety Analysis Report (DOE 1997b) for packaging requires the lids of TRU mixed waste containers to be vented through high efficiency particulate air (**HEPA**)-grade filters to preclude container pressurization caused by gas generation and to prevent particulate material from escaping. Filtered vents used in CH TRU mixed waste containers (55-gal (208-L) drums, 85-gal (322 L) drums, 100-gal (379-L) drums, TDOPs, and SWBs) have an orifice approximately 0.375-in. (9.53-millimeters) in diameter through which internally generated gas may pass. The filter media can be any material (e.g., composite carbon, sintered metal).

As each derived waste container is filled, it will be closed with a lid containing a HEPA-grade. filter and moved to an Underground Hazardous Waste Disposal Unit (**HWDU**) using the same equipment used for handling TRU mixed waste.

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[1] SWPs are prepared to assure that any hazardous work (not already covered by a procedure) is performed with due precaution. SWPs are issued by the Permittees after a job supervisor completes the proper form detailing the job location, work description, personnel involved, specific hazards involved, and protective requirements. The Permittees review the form, check on the adequacy of the protective measures, and if sufficient, approve the work permit. Conditions of the SWPs must be met while any hazardous work is proceeding. Examples of activities covered by the SWP program include confined space entry, overhead work, and work on energized equipment.

[2] RWPs are used to control entry into and performance of work within a controlled area (**CA**). Managers responsible for work within a CA must generate a work permit that specifies the work scope, limiting conditions, dosimetry, respiratory protection, protective clothing, specific worker qualifications, and radiation safety technician support. RWPs are approved by the Permittees after thorough review. No work can proceed in a CA without a valid RWP.

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A1-1d(2) CH TRU Mixed Waste Handling

CH TRU mixed waste containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers (e.g., TRUPACT-IIs, HalfPACTs, or TRUPACT-IIIs) (see Figure A1-12), at which time they will undergo security and radiological checks and shipping documentation reviews. A forklift will remove the Contact-Handled Packages which will be transported by forklift or Yard Transfer Vehicle through an air lock that is designed to maintain differential pressure in the WHB. The forklift will place the shipping containers at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit or the Yard Transfer Vehicle will locate the TRUPACT-III at the bolting station in Room 108. An external survey of the Contact-Handled Package inner vessel (Figure A1-8a and A1-8b) will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the Vent Hood System (**VHS**), and the contents will be surveyed during and after this process is complete. The VHS[3] is attached to the Contact-Handled Package to provide atmospheric control and confinement of headspace gases at their source. It also prevents potential personnel exposure and facility contamination due to the spread of radiologically contaminated airborne dust particles and minimizes personnel exposure to VOCs.

Contamination surveys at the WIPP facility are based in part on radiological surveys used to indicate potential releases of hazardous constituents from containers by virtue of detection of radioactive contamination (see Permit Attachment G3). Radiological surveys may be applicable to most hazardous constituent releases except the release of gaseous VOCs from TRU mixed waste containers. Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of nongaseous hazardous constituents through the use of surface sampling (swipes) and radioactivity counting. Radiological surveys are used in addition to the more conventional techniques such as visual inspection to identify spills.

Under normal operations, it is not expected that the waste containers will be externally contaminated or that removable surface contamination on the shipping package or the waste containers will be in excess of the DOE's free release limits (i.e.; < 20 disintegrations per minute (**dpm**)[4] per 100 cm^2 alpha or < 200 dpm per 100 cm^2 beta/gamma). In such a case, no further decontamination action is needed. The shipping package and waste container will be handled through the normal process. However, should the magnitude of contamination exceed the free release limits, yet still fall within the criteria for small area "spot" decontamination (i.e., less than or equal to 100 times the free release limit and less than or equal to 6 ft^2 [0.56 m^2]), the shipping package or the waste container will be decontaminated. Decontamination activities will not be

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[3] The TRU mixed waste container headspace may contain radiologically contaminated airborne dust particles.

1. Without the VHS, a potential mechanism will exist to spread contamination (if present) in the immediate CH TRU mixed waste handling area, because lid removal will immediately expose headspace gases to prevailing air currents induced by the building ventilation system.
2. With the VHS, a confined and controlled set of prevailing air currents will be induced by the system blower. The VHS will function as a local exhaust system to effectively control radiologically contaminated airborne dust particles (and VOCs) at essentially atmospheric pressure conditions.
   Functionally, the VHS will draw the TRU mixed waste container headspace gases, convey them through a HEPA filter, and ultimately duct them through the WHB exhaust ventilation system. VOCs will pass through the HEPA filter and will be conveyed to the ventilation exhaust duct system. The system principally consists of a functional aggregation of 1) vent hood assembly, 2) HEPA filter assemblies (to capture any airborne radioactive particles), 3) blower (to provide forced airflow), 4) ductwork, and 5) flexible hose.

[4] The unit "dpm" stands for "disintegration per minute" and is the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

conducted on containers which are not in good condition, or containers which are leaking. Containers which are not in good condition, and containers which are leaking, will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. In addition, if during the waste handling process at the WIPP a waste container is breached, it will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. Should WIPP structures or equipment become contaminated, waste handling operations in the affected area will be immediately suspended.

Decontamination activities will use water and cleaning agents (see Permit Attachment D) so as to not generate any waste that cannot be considered derived waste. Items that are radiologically contaminated are also assumed to be contaminated with the hazardous wastes that are in the container involved in the spill or release. A complete listing of these waste components can be obtained from the WIPP Waste Information System (**WWIS**), as described in Permit Attachment C, for the purpose of characterizing derived waste.

It is assumed that the process of decontamination will remove the hazardous waste constituents along with the radioactive waste constituents. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" will be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses becomes documentation of the condition of the container at the time of emplacement. The presence of hazardous waste constituents on a container after decontamination will be at trace levels and will likely not be visible and will not pose a threat to human health or the environment. These containers will be placed in the underground without further action once the radiological contamination is removed unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed which incorporates the guidance of EPA's SW 846 in selecting random samples over large areas. Selection of constituents for sampling analysis will be based on information (in the WWIS) about the waste that was spilled and information on cleanup procedures. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether further cleaning will be beneficial or whether final clean up shall be deferred until closure. For example, if hazardous constituents react with the floor coating and are essentially nonremovable without removing the coating, then clean up will be deferred until closure when the coatings will be stripped. In any case, appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore, measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

Small area decontamination, if needed, will occur in the area in which it is detected for contamination that is less than 6 ft^2 (0.56 m^2) in area and is less than 100 times the free release limit. The free release limit is defined by DOE Orders as alpha contamination less than 20 dpm/100 cm^2 and beta-gamma contamination less than 200 dpm/100 cm^2. Overpacking would occur in the event the WIPP staff damages an otherwise intact container during handling

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activities. In such a case, a radiological boundary will be established, inside which all activities are carefully controlled in accordance with the protocols for the cleanup of spills or releases. A plan of recovery will be developed and executed, including overpacking or repairing the damaged container. The overpacked or repaired container will be properly labeled and sent underground for disposal. The area will then be decontaminated and verified to be free of contamination using both radiological and hazardous waste sampling techniques (essentially, this is done with "swipes" of the surface for counting in sensitive radiation detection equipment or, if no radioactivity is present, by analysis for hazardous waste by an offsite laboratory).

In the event a large area contamination is discovered within a Contact-Handled Package during unloading, the waste will be left in the Contact-Handled Package and the shipping container will be resealed. The DOE considers such contamination problems the responsibility of the shipping site. Therefore, the shipper will have several options for disposition. These are as follows:

- The Contact-Handled Package can be returned to the shipper for decontamination and repackaging of the waste. Such waste would have to be re-approved prior to shipment to the WIPP.

- Shipment to another DOE site for management in the event the original shipper does not have suitable facilities for decontamination. If the repairing site wishes to return the waste to WIPP, the site will have to meet the characterization requirements of the WAP.

- The waste could go to a third (non-DOE) party for decontamination. In such cases, the repaired shipment would go to the original shipper and be recertified prior to shipment to the WIPP.

Written procedures specify materials, protocols, and steps needed to put an object into a safe configuration for decontamination of surfaces. A RWP will always be prepared prior to decontamination activities. TRU mixed waste products from decontamination will be managed as derived waste.[5]

The TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. A HalfPACT may hold seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. An overhead bridge crane or Facility Transfer Vehicle will be used to remove the contents of the Contact-Handled Package and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

[5] Note that the DOE had previously proposed use of an Overpack and Repair Room to deal with major decontamination and overpacking activities. The DOE has eliminated the need for this area by: 1) limiting the size of contamination events that will be dealt with as described in this section, and 2) by performing overpacking at the point where a need for overpacking is identified instead of moving the waste to another area of the WHB. This strategy minimizes the spread of contamination.

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For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved with the generator before TRU mixed waste is emplaced. Discrepancies that are not resolved within 15 days will be reported to the NMED in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Each facility pallet has two recessed pockets to accommodate two sets of 7-packs (see Figure A1-10), two sets of 4-packs, two sets of 3-packs, or two SWBs stacked two-high, two TDOPs, or any combination thereof. Each facility pallet will accommodate one SLB2. Each stack of waste containers will be secured prior to transport underground. A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room located adjacent to the Waste Shaft. The conveyance loading room serves as an air lock between the CH Bay and the Waste Shaft, preventing excessive air flow between the two areas. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379-L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the Underground HWDUs. Figure A1-13 is a flow diagram of the CH TRU mixed waste handling process.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

Following cask inspections, the shipping cask and trailer are moved into the RH Bay or held in the Parking Area Unit. The waste handling process begins in the RH Bay where the impact limiter(s) are removed from the shipping cask while it is on the trailer. Additional radiological surveys are conducted on the end of the cask previously protected by the impact limiter(s) to verify the absence of contamination. The cask is unloaded from the trailer using the RH Bay Overhead Bridge Crane and placed on a Cask Transfer Car.

Differential air pressure between the RH TRU mixed waste handling locations in the RH Complex protects workers and prevents potential spread of contamination during handling of RH TRU mixed waste. Airflow between key rooms in the WHB is controlled by maintaining differential pressures between the rooms. The CH Receiving Bay is maintained with a negative pressure relative to outside atmosphere. The RH Receiving Bay is maintained with a requirement to be positive pressure relative to the CH Receiving Bay. The RH Hot Cell is

maintained with a negative differential pressure relative to the RH Receiving Bay. The Hot Cell ventilation is exhausted through high-efficiency particulate air filters prior to venting through the WHB filtered exhaust.

RH-TRU 72-B Cask Unloading

The Cask Transfer Car then moves the RH-TRU 72-B cask to a work stand in the RH Bay. The work stand allows access to the head area of the RH-TRU 72-B cask for conducting radiological surveys, performing physical inspections or minor maintenance, and decontamination, if necessary. The outer lid bolts on the RH-TRU 72-B cask are removed, and the outer lid is removed to provide access to the lid of the cask inner containment vessel. The RH-TRU 72-B cask is moved into the Cask Unloading Room by a Cask Transfer Car and is positioned under the Cask Unloading Room Bridge Crane. The Cask Unloading Room Bridge Crane attaches to the RH-TRU 72-B cask and lifts and suspends the RH-TRU 72-B cask to clear the Cask Transfer Car. The RH-TRU 72-B cask is aligned over the Cask Unloading Room port.

The Cask Unloading Room shield valve is opened, and the cask is lowered through the port into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. After the cask is lowered into the Transfer Cell Shuttle Car, the bolts on the lid of the cask inner containment vessel are loosened by a robotic Manipulator. The Transfer Cell Shuttle Car is then aligned directly under the Transfer Cell shield valve in preparation for removing the inner vessel lid and transferring the canister to the Facility Cask. Operations in the Transfer Cell are monitored by closed-circuit video cameras.

Using the remotely-operated fixed 6.25 Ton Grapple Hoist in the Facility Cask Loading Room, the inner vessel lid is lifted clear of the RH-TRU 72-B cask, and the robotic Manipulator takes swipe samples and places them in a swipe delivery system for counting outside the Transfer Cell. If found to be contaminated above acceptable levels, the Permittees have the option to decontaminate or return the RH TRU Canister to the generator/storage site or another site for remediation. If no contamination is found, the Transfer Cell Shuttle Car moves a short distance, and the inner vessel lid is lowered onto a stand on the Transfer Cell Shuttle Car. The canister is transferred to the Facility Cask as described below.

CNS 10-160B Cask Unloading

After the lid bolts are removed, the CNS 10-160B cask is moved using the Cask Transfer Car from the RH Bay into the Cask Unloading Room and centered beneath the Hot Cell shield plug port. The Cask Unloading Room shield door is closed, and the inner and outer Hot Cell shield plugs are removed simultaneously and set aside on the floor of the Hot Cell using the remotely operated Hot Cell Bridge Crane. The Hot Cell Bridge Crane is then lowered through the Hot Cell port and is connected to the CNS 10-160B cask lid rigging or lifting device. The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid through the Hot Cell port and sets the lid aside on the Hot Cell floor.

Operations in the Hot Cell are monitored by closed-circuit television cameras. The drum carriage unit lifting fixture (hereafter referred to as lifting fixture) is attached to the Hot Cell Bridge Crane and lowered through the Hot Cell port. The lifting fixture is connected to the upper drum carriage unit contained in the CNS 10-160B cask. The Hot Cell Bridge Crane lifts the upper drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets

it near the Hot Cell inspection station. The Hot Cell Bridge Crane again lowers the lifting fixture through the Hot Cell port and connects to the lower drum carriage unit. The Hot Cell Bridge Crane lifts the lower drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets it near the upper drum carriage unit.

The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid from the Hot Cell floor, lowers it through the Hot Cell port and onto the top of the CNS 10-160B cask. The inner and outer Hot Cell shield plugs are replaced simultaneously. The Cask Unloading Room shield door is opened, and the CNS 10-160B cask is moved into the RH Bay using the Cask Transfer Car. The CNS 10-160B cask is inspected and surveyed, the lid and impact limiter are reinstalled on the CNS 10-160B cask, and it is prepared for transportation off-site.

The Hot Cell Bridge Crane connects to an empty Facility Canister, places it into a sleeve at the inspection station, and removes the canister lid. The Overhead Powered Manipulator or Hot Cell Crane lifts one drum from the drum carriage unit. The Hot Cell Manipulators collect swipe samples from the drum and transfer the swipes via the Transfer Drawer to the Hot Cell Gallery for counting. If the 55-gallon drums are contaminated, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. The drum identification number is recorded, and the recorded numbers are verified against the WWIS. If there are any discrepancies, the drum(s) in question are stored within the Hot Cell, and the generator/storage site is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Either the Overhead Powered Manipulator or Hot Cell Bridge Crane lowers the drum into the Facility Canister. This process is repeated to place three drums in the Facility Canister. The Hot Cell Bridge Crane or powered Manipulator lifts the canister lid and places it onto the Facility Canister. The lid is locked in place using a Manipulator. Each CNS 10-160B cask shipment will contain up to ten drums. Drums will be managed in sets of three. If there is a tenth drum, it will be placed in a Facility Canister or stored until WIPP receipt of the next CNS 10-160B cask shipment. The Hot Cell Bridge Crane lifts the Facility Canister and lowers it into the Transfer Cell.

To prepare to transfer a loaded Facility Canister from the Hot Cell to the Transfer Cell, a Shielded Insert is placed onto a Cask Transfer Car in the RH Bay. The Cask Transfer Car is then moved into the Cask Unloading Room and positioned under the Cask Unloading Room Bridge Crane. The Bridge Crane attaches to the Shielded Insert. The Cask Unloading Room Bridge Crane lifts and suspends the Shielded Insert clear of the Cask Transfer Car. The Shielded Insert is aligned over the Cask Unloading Room port. The floor valve is opened, and the Shielded Insert is lowered into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. The Shielded Insert is positioned under the Hot Cell port.

The Hot Cell Bridge Crane lifts a loaded, closed Facility Canister and positions it over the Hot Cell port. The Hot Cell shield valve is opened, and the crane lowers the Facility Canister through the port into the Shielded Insert positioned in the Transfer Cell Shuttle Car in the Transfer Cell. The Hot Cell Bridge Crane is disconnected from the Facility Canister and raised until the crane hook clears the Hot Cell shield valve. The Hot Cell shield valve is then closed.

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Transfer of Disposal Canister into the Facility Cask

The transfer of a canister into the Facility Cask from the Transfer Cell is monitored by closed-circuit television cameras. The Transfer Cell Shuttle Car positions the RH-TRU 72-B cask or Shielded Insert under the Facility Cask Loading Room port and the shield valve is opened. Then the remotely operated 6.25 Ton Grapple Hoist attaches to the canister, and the canister is lifted through the open shield valve into the vertically-oriented Facility Cask located on the Cask Transfer Car in the Facility Cask Loading Room. During this cask-to-cask transfer, the telescoping port shield is in contact with the underside of the Facility Cask to assure shielding continuity, as does the shield bell located above the Facility Cask.

For canisters received at the WIPP from the generator site in a RH-TRU 72-B cask, the identification number is verified using cameras, which also provide images of the canister surfaces during the lifting operation. Identification numbers are verified against the WWIS. If there are any discrepancies, the canister is returned to the RH-TRU 72-B cask, returned to the Parking Area Unit, and the generator is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72). As the canister is being lifted from the RH-TRU 72-B cask into the Facility Cask, additional swipe samples may be taken.

Transfer of the Canister to the Underground

When the canister is fully within the Facility Cask, the lower shield valve is closed. The 6.25 Ton Grapple Hoist detaches from the canister and is raised until the 6.25 Ton Grapple Hoist clears the Facility Cask, at which time the upper shield valve is closed. The 6.25 Ton Grapple Hoist and shield bell are then raised clear of the Facility Cask, and the telescoping port shield is retracted. The Facility Cask Rotating Device rotates the Facility Cask until it is in the horizontal position on the Facility Cask Transfer Car. The shield doors on the Facility Cask Loading Room are opened, and the facility Cask Transfer Car moves onto the waste shaft conveyance and is lowered to the waste Shaft Station underground. At the waste Shaft Station underground, the Facility Cask Transfer Car moves the Facility Cask from the waste shaft conveyance. A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU.

Returning the Empty Cask

The empty RH-TRU 72-B cask or Shielded Insert is returned to the RH Bay by reversing the process. In the RH Bay, swipe samples are collected from inside the empty cask. If necessary, the inside of the cask is decontaminated. The RH-TRU 72-B cask lids are replaced, and the cask is replaced on the trailer using the RH Bay Bridge Crane. The impact limiters are replaced, and the trailer and the RH-TRU 72-B cask are then moved out of the RH Bay. The Shielded Insert is stored in the RH Bay until needed.

A1-1d(4) Handling Waste in Shielded Containers

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with

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the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

A1-1e Inspections

Inspection of containers and container storage area are required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174). These inspections are described in this section.

A1-1e(1) WHB Unit

The waste containers in storage will be inspected visually or by closed-circuit television camera prior to each movement and, at a minimum, weekly, to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. Waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. This visual inspection of CH TRU mixed waste containers shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If waste handling operations should stop for any reason with containers located at the TRUDOCK while still in the Contact-Handled Package, primary waste container inspections will not be accomplished until the containers of waste are removed from the Contact-Handled Package. If the lid to the Contact-Handled Package inner container vessel is removed, radiological checks (swipes of Contact-Handled Package inner surfaces) will be used to determine if there is contamination within the Contact-Handled Package. Such contamination could indicate a waste container leak or spill. Using radiological surveys, a

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detected spill or leak of a radioactive contamination from a waste container will also be assumed to be a hazardous waste spill or release.

Waste containers residing within a Contact-Handled Package are not inspected, as described in the first bullet in Section A1-1e(2).

Waste containers will be inspected prior to reentering the waste management process line for downloading to the underground. Waste containers stored in this area will be inspected at least once weekly.

Loaded RH-TRU 72-B and CNS 10-160B casks will be inspected when present in the RH Bay. Physical or closed-circuit television camera inspections of the RH Complex are conducted as described in Table D-1a. Canisters loaded in an RH-TRU 72-B cask are inspected in the Transfer Cell during transfer from the cask to the Facility Cask. Waste containers received in CNS 10-160B casks are inspected in the Hot Cell during transfer from the cask to the Facility Canister by camera and/or visual inspection (through shield windows).

A1-1e(2) Parking Area Unit

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded, stored Contact-Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit (Figure A1-2). Inspections of the Contact-Handled or Remote-Handled Packages stored in the Parking Area Unit will focus on the inventory and integrity of the shipping containers and the spacing between Contact-Handled and Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Contact-Handled and Remote-Handled Packages located in the Parking Area Unit will be inspected weekly during use and prior to each reuse.

Inspection of waste containers is not possible when the containers are in their shipping container (e.g., casks, TRUPACT-II or HalfPACTs). Inspections can be accomplished by bringing the shipping containers into the WHB Unit and opening them and lifting the waste containers out for inspection. The DOE, however, believes that removing containers strictly for the purposes of inspection results in unnecessary worker exposures and subjects the waste to additional handling. The DOE has proposed that waste containers need not be inspected at all until they are ready to be removed from the shipping container for emplacement underground. Because shipping containers are sealed and are of robust design, no harm can come to the waste while in the shipping containers and the waste cannot leak or otherwise be released to the environment. Contact-Handled or Remote-Handled Packages shall be opened every 60 days for the purposes of venting, so that the longest waste would be uninspected would be for 60 days from the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was closed at the generator site. Venting the Contact-Handled or Remote-Handled Packages involves removing the outer lid and installing a tool in the port of the inner lid.

The following strategy will be used for inspecting waste containers that will be retained within their shipping containers for an extended period of time:

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- If the reason for retaining the TRU mixed waste containers in the shipping container is due to an unresolved manifest discrepancy, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period or within 30 days after receipt at the WIPP, whichever comes sooner. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers in the Contact-Handled or Remote-Handled Package is due to an equipment malfunction that prevents unloading the waste in the WHB Unit, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period. In this case, the DOE would have to ship the TRU mixed waste containers back with sufficient time for the generator to vent the shipment within the 60 day limit. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers is due to an equipment malfunction that prevents the timely movement of the waste containers into the underground, the waste containers will be kept in the Contact-Handled or Remote-Handled Package until day 30 (after receipt at the WIPP) or the expiration of the 60 day limit, whichever comes sooner. At that time the Contact-Handled or Remote-Handled Package will be moved into the WHB. Contact-Handled TRU mixed waste containers will be removed and placed in one of the permitted storage areas in the WHB Unit. The Remote-Handled Package will be vented, however, the containers will not be removed from the shipping package. If there is no additional space within the permitted storage areas of the WHB Unit, the DOE will discuss an emergency permit with the NMED for the purposes of storing the waste elsewhere in the WHB Unit. Waste containers will be inspected when removed from the Contact-Handled Packaging and weekly while in storage in the WHB Unit. Contact-Handled or Remote-Handled Packages will be inspected weekly while they contain TRU mixed waste containers as discussed above.

The DOE believes that this strategy minimizes both the amount of shipping that is necessary and the amount of waste handling, while maintaining a reasonable inspection schedule. The DOE will stop shipments of waste for any equipment outage that will extend beyond three days.

A1-1f Containment

The WHB Unit has concrete floors, which are sealed with a coating that is designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor. The floor coating consists of Carboline® 1340 clear primer-sealer on top of prepared concrete, Carboline® 191 primer epoxy, and Carboline® 195 surface epoxy. The manufacturer's chemical resistance guide shows "Very Good" for acids and "Excellent" for alkalies, solvents, salt, and water. Uses are indicated for nuclear power plants, industrial equipment and components, chemical processing plants, and pulp and paper mills for protection of structural steel and concrete. During the Disposal Phase, should the floors need to be re-coated, any floor coating used in the WHB Unit TRU mixed waste handling areas will be compatible with the TRU mixed waste constituents and will have

chemical resistance at least equivalent to the Carboline® products. Figure A1-1 shows where TRU mixed waste handling activities discussed in this section occur.

During normal operations, the floor of the storage areas within the WHB Unit shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. Floor areas of the WHB Unit in use during off-normal events will be inspected prior to use and weekly thereafter. All TRU mixed waste containers located in the permitted storage areas shall be elevated at least 6 in. (15 cm) from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packaging shall be stored at a designated storage area inside the WHB Unit so as to preclude exposure to the elements.

Secondary containment at the CH Bay Storage Area inside the WHB Unit shall be provided by the WHB Unit floor (See Figure A1-1). The WHB Unit is engineered such that during normal operations, the floor capacity is sufficient to contain liquids upon release. Secondary Containment at the Derived Waste Storage Area of the WHB Unit will be provided by a polyethylene standard drum pallet. The Parking Area Unit and TRUDOCK Storage Area of the WHB Unit require no engineered secondary containment since no waste is to be stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging.

Calculations to determine the floor surface area required to provide secondary containment in the event of a release are based on the maximum quantity of liquid which could be present within ten percent of one percent of the volume of all the containers or one percent of the capacity of the largest single container, whichever is greater.

Secondary containment at storage locations inside the RH Bay and Cask Unloading Room is provided by the cask. Secondary containment at storage locations inside the Transfer Cell is provided by the RH-TRU 72-B cask or Shielded Insert. Secondary containment at storage locations in the Facility Cask Loading Room is provided by the Facility Cask. In the Hot Cell, waste containers are stored in either the drum carriage unit or in canister sleeves. The Lower Hot Cell provides secondary containment as described in section A1-f(2). In addition, the RH Bay, Hot Cell, and Transfer Cell contain 220-gallon (833-L) (Hot Cell), 11,400-gallon (43,152-L) (RH Bay), and 220-gallon (833-L) (Transfer Cell) sumps, respectively, to collect any liquids.

A1-1f(1) Secondary Containment Requirements for the WHB Unit

The maximum volume of TRU mixed waste on facility pallets that will be stored in the CH Bay Storage and Surge Storage Areas of the WHB is 18 facility pallets @ 2 TDOPs per pallet = 36 TDOPs of waste. 36 TDOPs @ 1,200 gal (4,540 L) per TDOP = 43,200 gal (163,440L) waste container capacity. 43,200 gal (163,440 L) x ten percent of the total volume = 4,320 gal (16,344 L) of waste. Since 4,320 gal (16,344 L) is greater than 1,200 gal (4,540 L), the configuration of possible TDOPs in the storage area is used for the calculation of secondary containment requirements. 4,320 gal (16,344 L) of liquid x one percent liquids = 43.2 gal (163.4 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Derived Waste Storage Area of the WHB Unit is one SWB. 1 SWBs @ 496 gal (1,878 L) per SWB = 496 gal (1,878 L) waste container capacity. Since the maximum storage volume of 496 gal (1,878 L) is equal to the volume of the largest single container, the volume of the a single SWB is used for the

calculation of secondary containment requirements. 496 gal (1,878 L) of liquid x one percent liquids = 4.96 gal (18.8 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Hot Cell is 13 RH TRU drums @ 55 gal (210 L) per drum = 715 (2,730 L) of waste in drums. 715 gal (2,730 L) of waste x ten percent of total volume = 71.5 gal (273 L) of waste. Secondary containment for liquids will need to have a capacity of 71.5 gal (273 L). Since 71.5 gal (273 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

The maximum volume of TRU mixed waste that will be stored in the Transfer Cell is one RH-TRU 72-B Canister or one Facility Canister @ 235 gal (890 L) per canister x ten percent of total volume = 23.5 gal (8.90 L) of waste. Since 23.5 gal (8.90 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

A1-1f(2) Secondary Containment Description

The following is a calculation of the surface area the quantities of liquid would cover. Using a conversion factor of 0.1337 ft^3/gal (0.001 m^3/L) and assuming the spill is 0.0033 ft (0.001 m) thick, the following calculation can be used:

gallons × cubic feet per gallon ÷ thickness in feet = area covered in square feet

CH Bay Storage Area

43.2 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 1,750 ft^2 (162.7 m^2)

Hot Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

Transfer Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

The WHB Unit has 33,175 ft^2 (3,082 m^2) of floor space, the CH Bay Storage Area has 26,151 ft^2 (2,430 m^2) of floor space. The CH Bay Storage Area requires 1,750 ft^2 (162.7 m^2) for containment, Thus, the floor area of the CH Bay Storage Area of the WHB Unit provide sufficient secondary containment to contain a release of ten percent of one percent of the volume of all of the containers, or one percent of the capacity of the largest container, whichever is greater.

The Hot Cell and Transfer Cell are the only portions of the RH Complex managing RH TRU mixed waste outside of casks or canisters. The Hot Cell has 1,841 ft^2 (171 m^2) of floor space and the Transfer Cell has 1,003 ft^2 (93 m^2) of floor space. The Hot Cell and Transfer Cell require only 95 ft^2 for containment, therefore there is sufficient floor space to contain a release of ten percent of one percent of containers in these storage areas.

In addition, both the Hot Cell and the Transfer Cell each contain a 220 gal (833 L) sump that will collect any liquids that spill from containers.

Derived Waste Storage Area

The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which provides approximately 50 gal (190 L) of secondary containment capacity. Thus the secondary containment capacity of the standard drum pallet is sufficient to contain a release of ten percent of one percent of the largest container (4.96 gal or 18.8 L).

Parking Area Unit

Containers of TRU mixed waste to be stored in the Parking Area Unit will be in Contact-Handled or Remote-Handled Packages. There will be no additional requirements for engineered secondary containment systems.

A1-1g Special Requirements for Ignitable, Reactive, and Incompatible Waste

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 264.177). Permit Part 2 precludes ignitable, reactive, or incompatible waste at the WIPP. No additional measures are required.

A1-1h Closure

Clean closure is planned in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.178) for all permitted container storage areas. The applicable areas and the plans for clean closure are detailed in Permit Attachment G.

A1-1i Control of Run On

The WHB Unit is located indoors which prevents run-on from a precipitation event. In addition, the CH TRU containers are stored on facility pallets, containment pallets, or standard drum pallets, which elevate the CH TRU mixed waste containers at least 6 in. (15 cm) off the floor, or in Contact-Handled or Remote-Handled Packages, so that any firewater released in the building will not pool around containers. Within the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room, waste containers are stored in casks or Shielded Inserts and protected from any potential run on. Any firewater released in the building will not pool around the waste containers as they are stored in casks, or Shielded Inserts. Within the Hot Cell, there is no source of water during operations. However, control of run-on is provided by the Lower Hot Cell, which lies below a sloped floor surrounded by a grating and canister sleeves in the Hot Cell above.

In the Parking Area Unit, the containers of TRU mixed waste are always in Contact-Handled or Remote-Handled Packages which protect them from precipitation and run on. Therefore, the WIPP container storage units will comply with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(4)).

02052

References

DOE, 1997a. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Rev. 6.5, 1997.

DOE, 1997b. Waste Isolation Pilot Plant Safety Analysis Report (DOE/WIPP-95-2065, Rev. 1), U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1997.

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TABLES

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Table A1-1
Basic Design Requirements, Principal Codes, and Standards

	Structure/Supports			Liquid and Process Air Handling Processing and storage equipment							Air Hdlg Ducting & Fans	HVAC filters		Mechanical Handling Equipment			Instrumentation and Electrical			Quality Assurance Program	
					Piping & Valves																
	DBE DBT ACI-318 AISC	ANSI A58.1	Site-specific Require-ments	Vessel ASME VIII NFPA[e]	ANSI BBB,1 NFPA[e]	UP	Pumps API-610 NFPA[e]	Storage Tanks API-650 or API-620	Heat Exchgrs ASME VIII TEMA	All Other Equip-ment Mfrs Std	ARI SMACNA AMCA	Pre-filters ASHRAE 52.68	HEPA Filters MIL F 51068C ANSI N 509 ANSI N 510	Crane and Related equipment CMAA	CMAA AISC AWS	All Other Equip-meant Mfrs STD	A-NE	ANSI Sods or Nat'l Elect-trial Code	IA/ Mfrs Std	ANSI/ASME NQA-1 and Supple-ments	Com. and Industry Practices
Design Class I	X		a	X f			X	X	X		X c	X c,d	X c	X	X		X	X		X	
Design Class Ii	a,b	X	a	X	X		X	X	X		X c	X c	X c	X	X			X	X	X	
Design Class Iiia	a	X	a	a	X		a			X	X c	X c	X c	a	a	X		X	X	X	
Design Class Iii		X	g		a	X				X	X	X	X			X		X	X		X

X = Minimum Requirements

[a] Requirements to be determined on a case-by-case basis.
[b] Required for structure and supports needed for confinement and control of radioactivity.
[c] Except structures and supports that are designed to withstand a design-basis earthquake (DBE)/design-basis tornado (DBT) when specified in column 1 of this table.
[d] Underwriter's Laboratory (UL) Class I Listed.
[e] For fire-protection systems.
[f] American Society for Mechanical Engineers (ASME) III for other Class I vessels.
[g] Design of underground structures, mining equipment, and facilities are basically governed by the MSHA and experience in local mines.

ACI = American Concrete Institute
AISC = American Institute of Steel Construction
AMCA = Air Moving and Conditioning Association
ANSI = American National Standards Institute
API = American Petroleum Institute
ARI = Air Conditioning and Refrigeration Institute
ASHRAE = American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.
AWS = American Welding Society
CMAA = Crane Manufacturers Association
DBE = Design-basis earthquake
DBT = Design-basis tornado
HEPA = High-efficiency particulate air
HVAC = Heating, Ventilation, and Air-Conditioning
A = Institute of Electronics and Electronic Engineers
IA = Instrument Society of America
MFR = Manufacturer
MIL = Military (specification)
MSHA = Mine Safety and Health Administration
NFPA = National Fire Protection Association
NQA = Nuclear Quality Assurance (Standard)
SMACNA = Sheet Metal and Air Conditioning Contractors National Association, Inc.
STD = Standard
TEMA = Tubular Exchanger Manufacturers Association
UP = Uniform Plumbing Code

Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

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Table A1-3
RH TRU Mixed Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
RH Bay Overhead Bridge Crane	140 tons main hoist 25 tons auxiliary hoist
RH-TRU 72-B Cask Transfer Car	20 tons
CNS 10-160B Cask Transfer Car	35 tons
Transfer Cell Shuttle Car	29 tons
Hot Cell Bridge Crane	15 tons
Overhead Powered Manipulator	2.5 tons
Facility Cask Rotating Device	No specific load rating
Cask Unloading Room Crane	25 tons
6.25 Ton Grapple Hoist	6.25 tons
Facility Cask Transfer Car	40 tons
MAXIMUM GROSS WEIGHTS OF RH TRU CONTAINERS	
RH TRU Canister	8,000 lbs
55-Gallon Drum	1,000 lbs
Facility Canister	10,000 lbs
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
RH-TRU 72-B Cask	37,000 lbs
CNS 10-160B Cask	57,500 lbs
Facility Cask	67,700 lbs
Shielded Insert	26,300 lbs

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FIGURES

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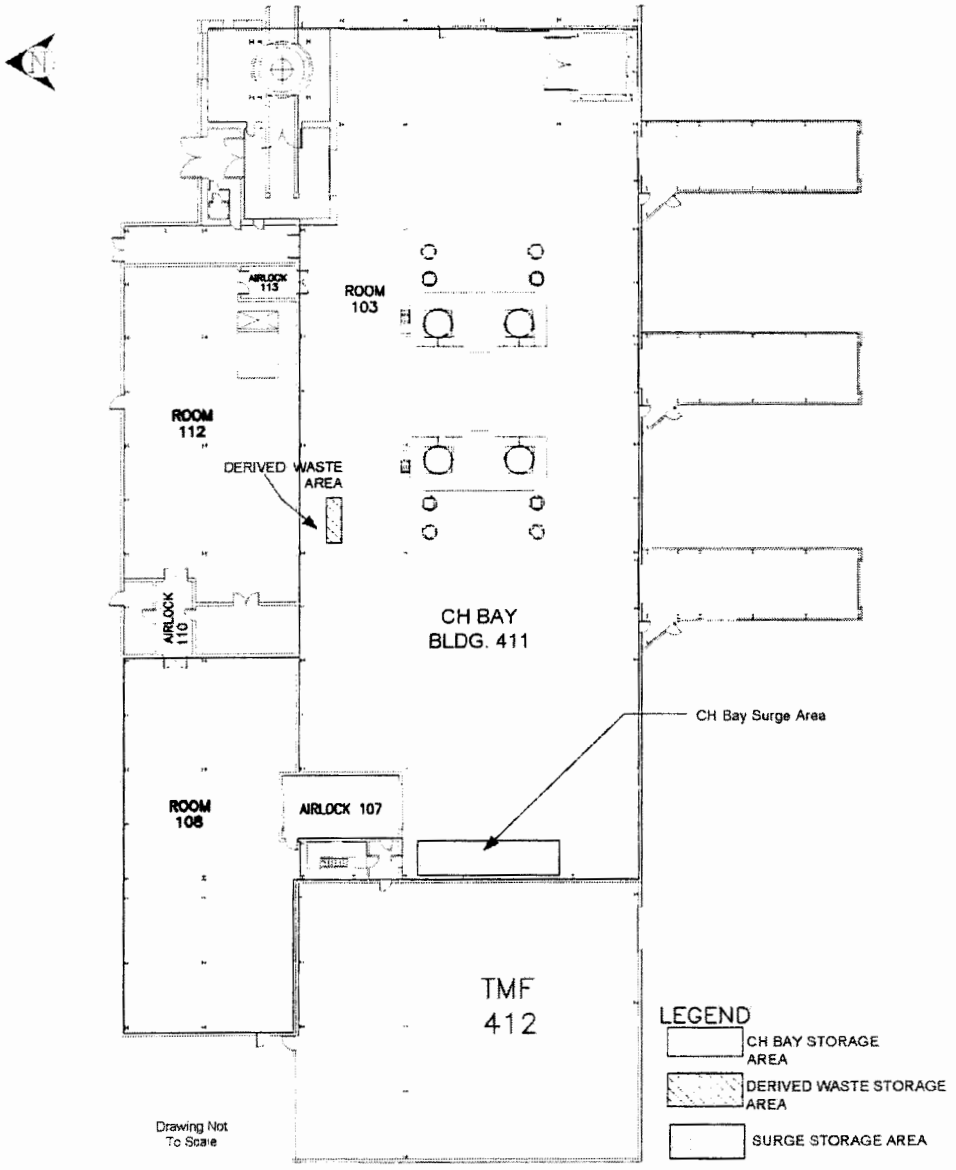


Figure A1-1
Waste Handling Building - CH TRU Mixed Waste Container Storage and Surge Areas

92063

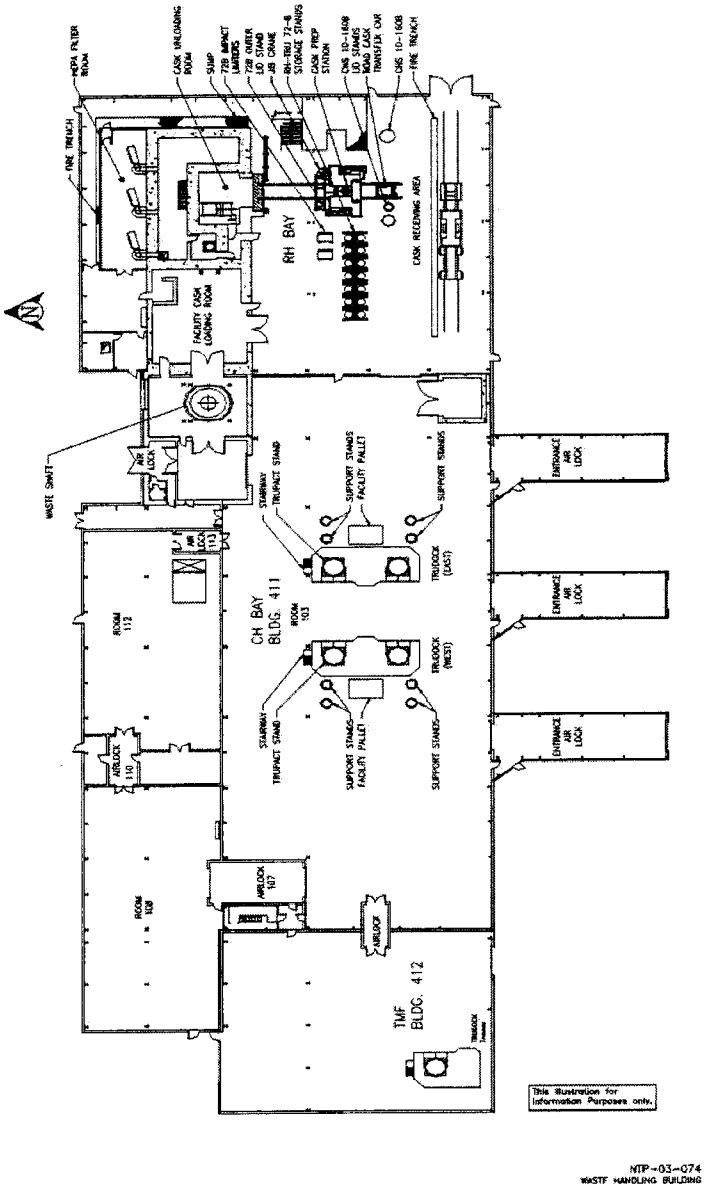


Figure A1-1a
Waste Handling Building Plan (Ground Floor)

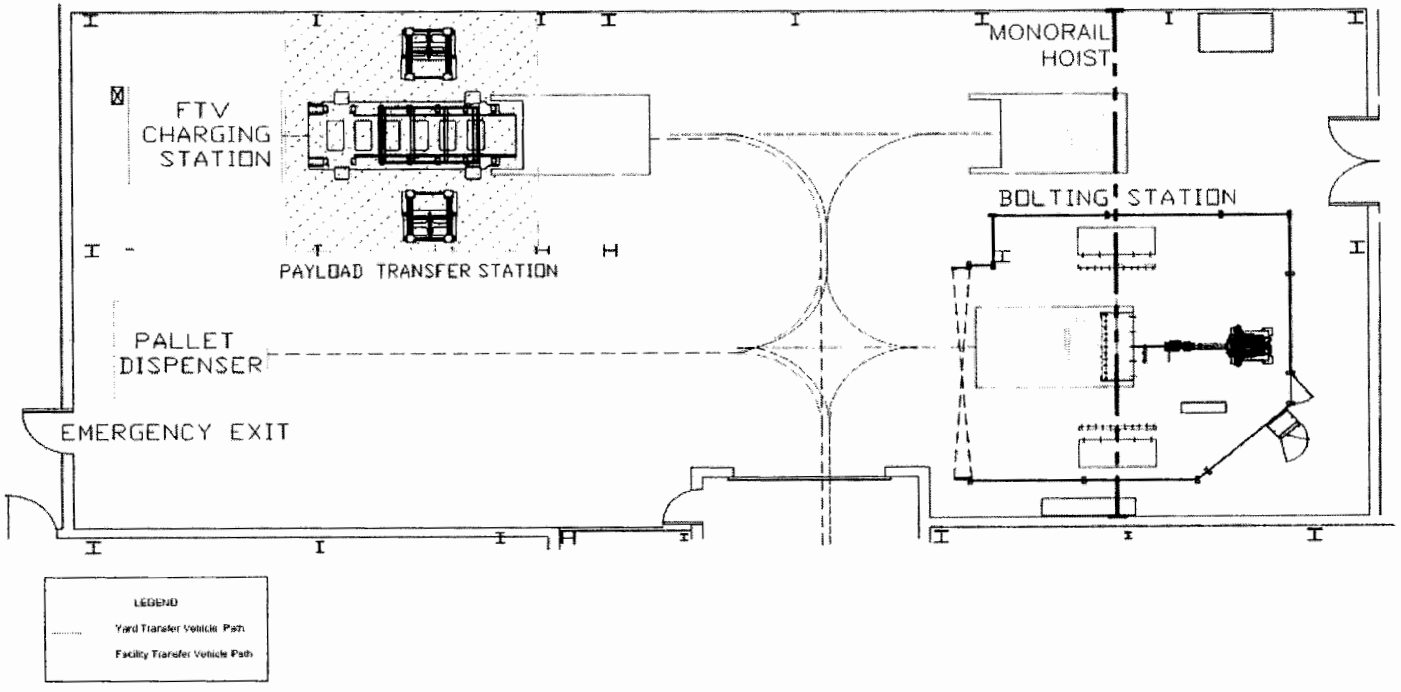


Figure A1-1b
Waste Handling Building Plan (Room 108 Detail)

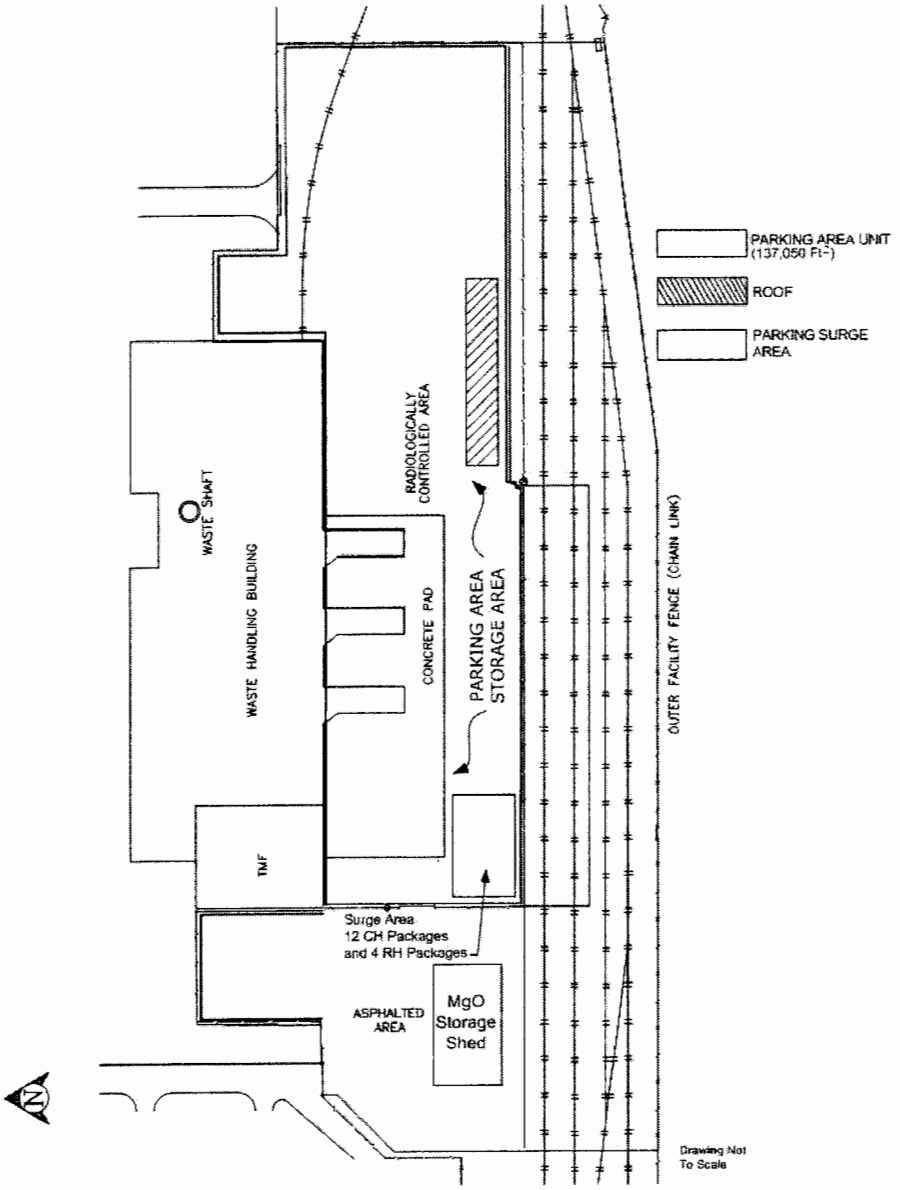


Figure A1-2
Parking Area - Container Storage and Surge Areas

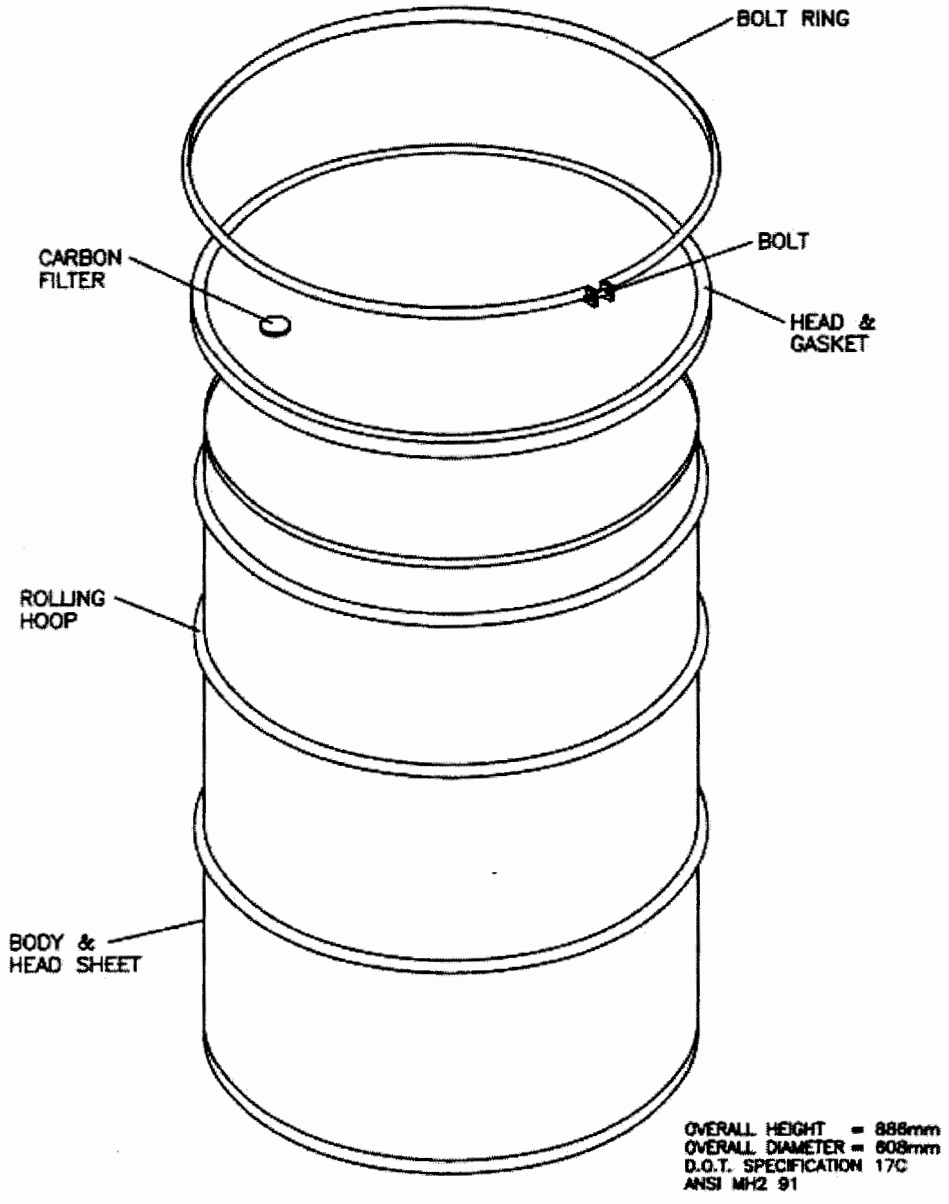


Figure A1-3
Standard 55-Gallon Drum (Typical)

02067

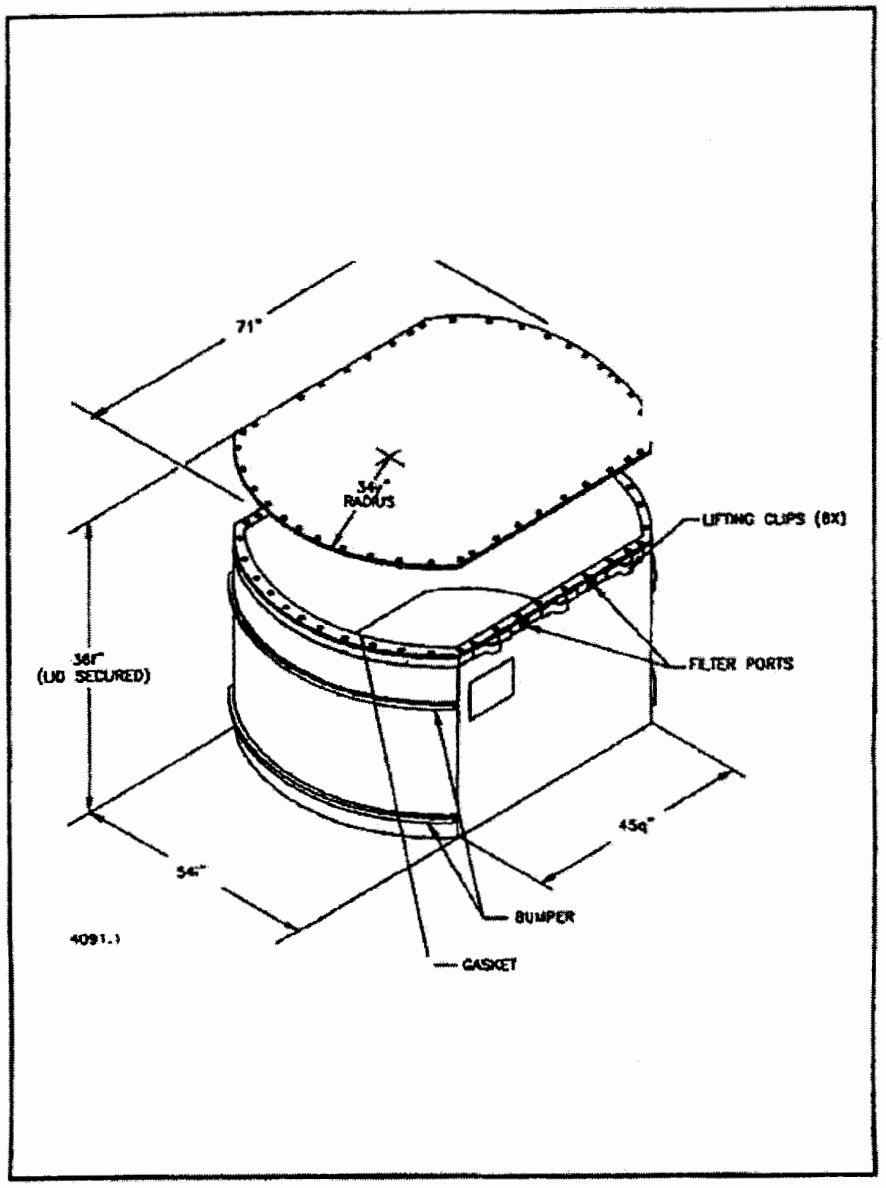


Figure A1-4
Standard Waste Box

02068

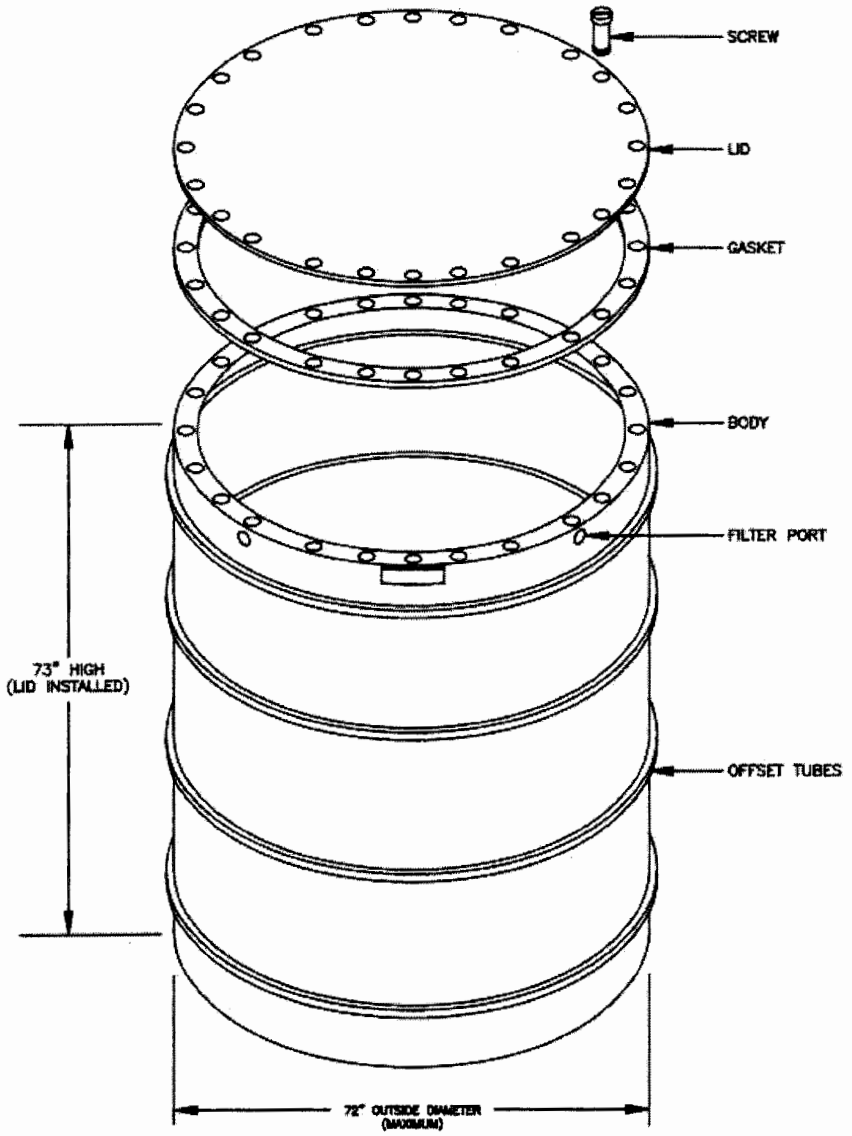


Figure A1-5
Ten-Drum Overpack

92869

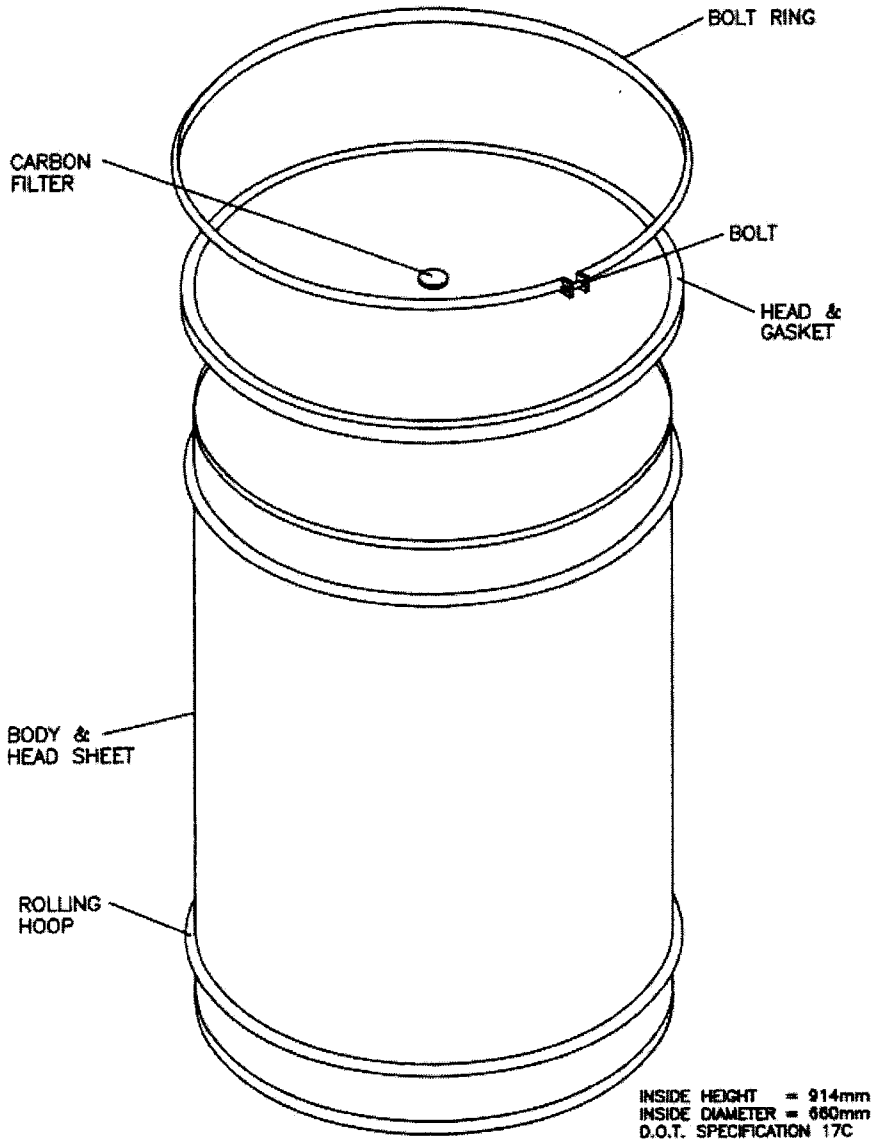


Figure A1-6
85-Gallon Drum

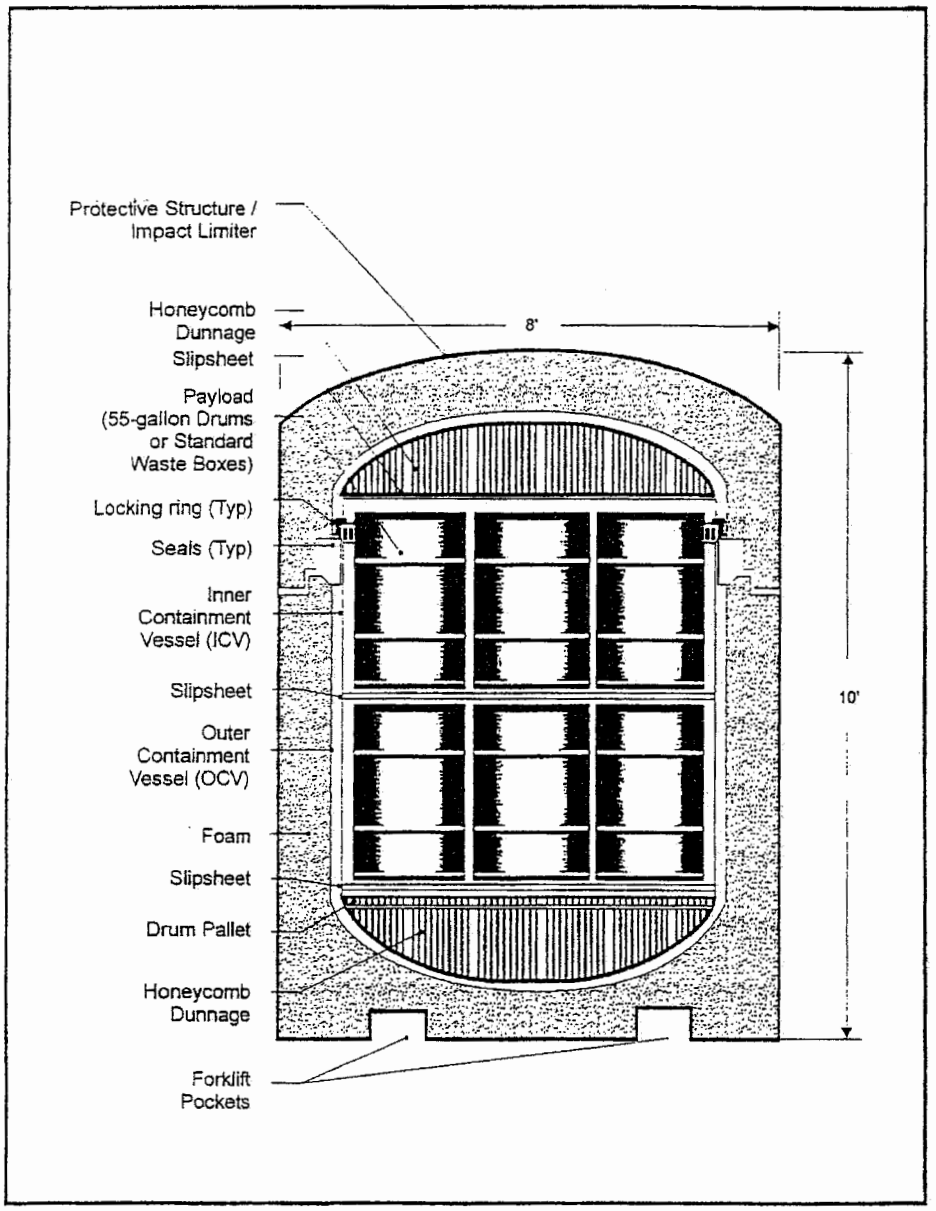


Figure A1-8a
TRUPACT-II Shipping Container for CH Transuranic Mixed Waste (Schematic)

02571

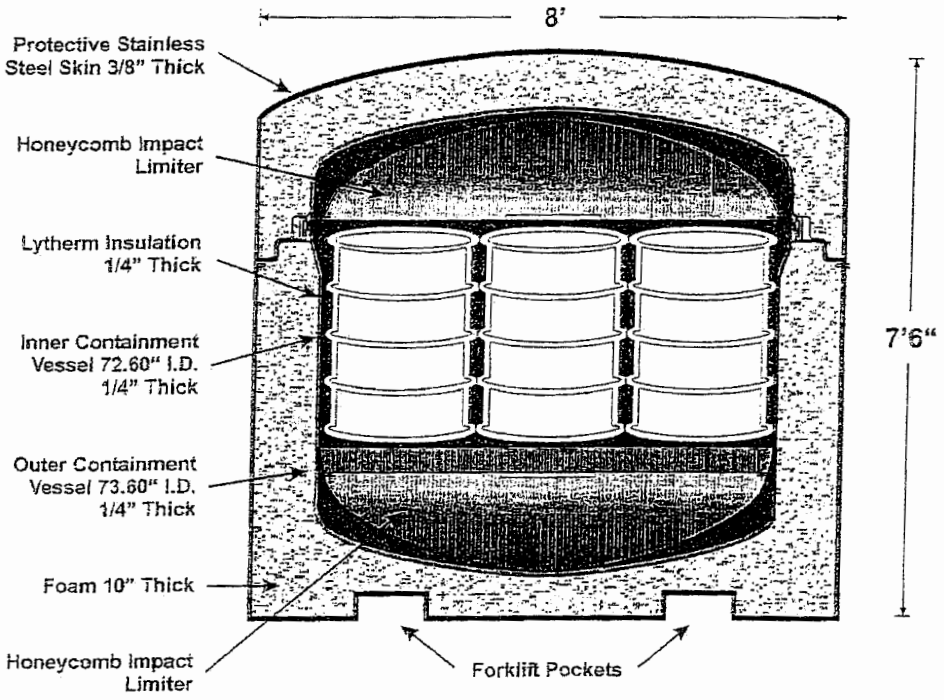


Figure A1-8b
Typical HalfPACT Shipping Container for CH Transuranic Mixed Waste (Schematic)

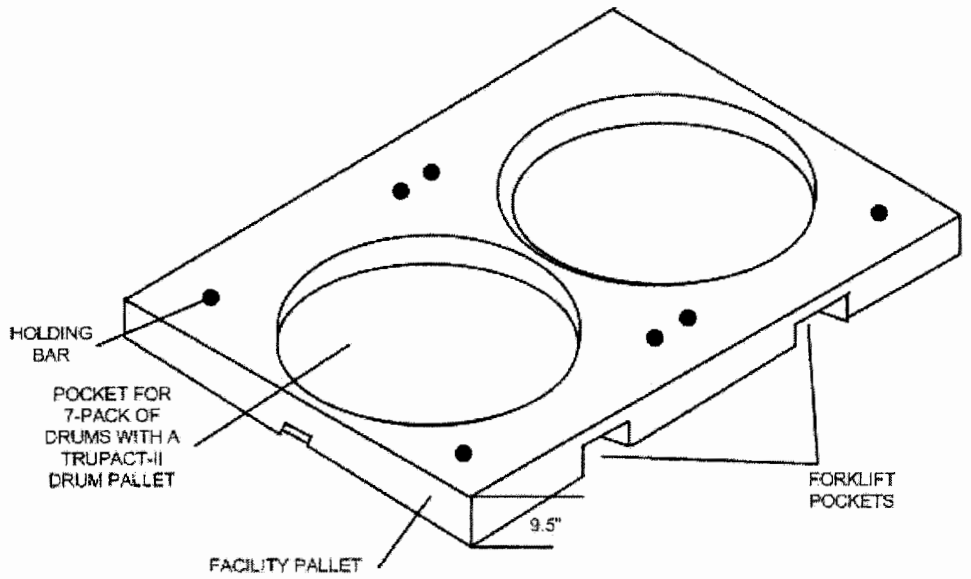


Figure A1-10
Facility Pallet for Seven-Pack of Drums

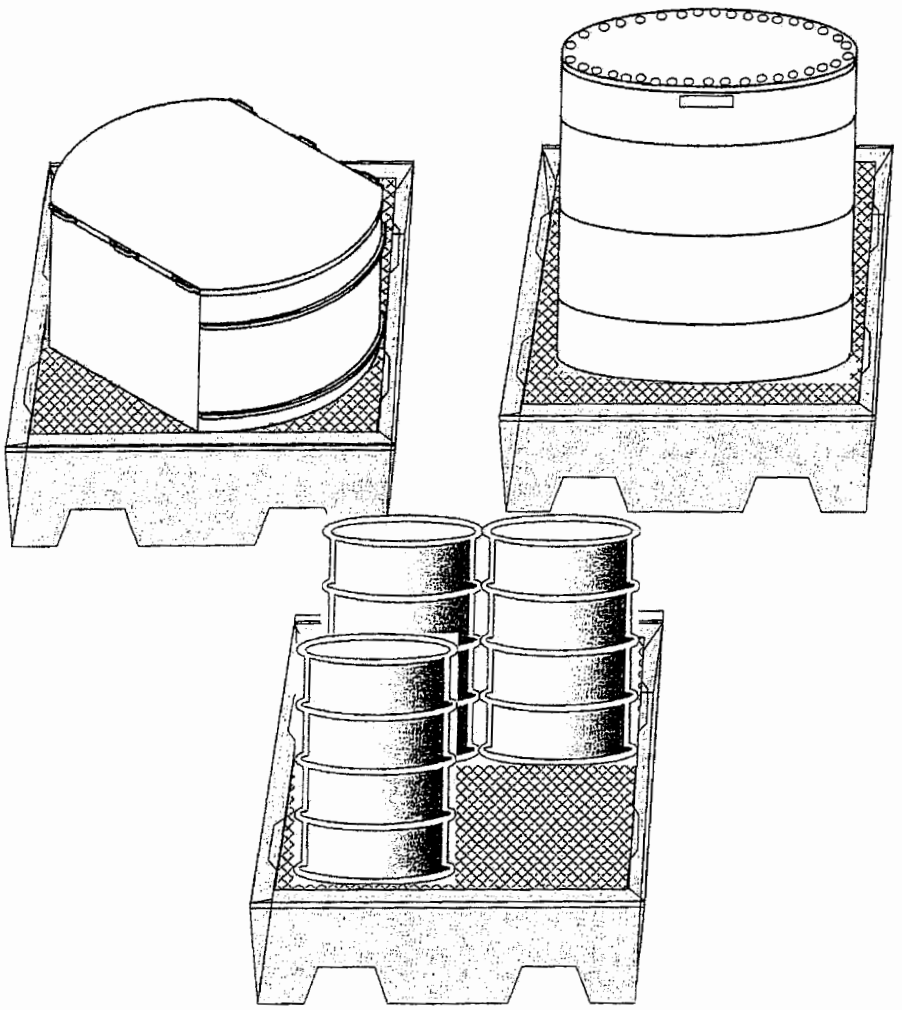


Figure A1-10a
Typical Containment Pallet

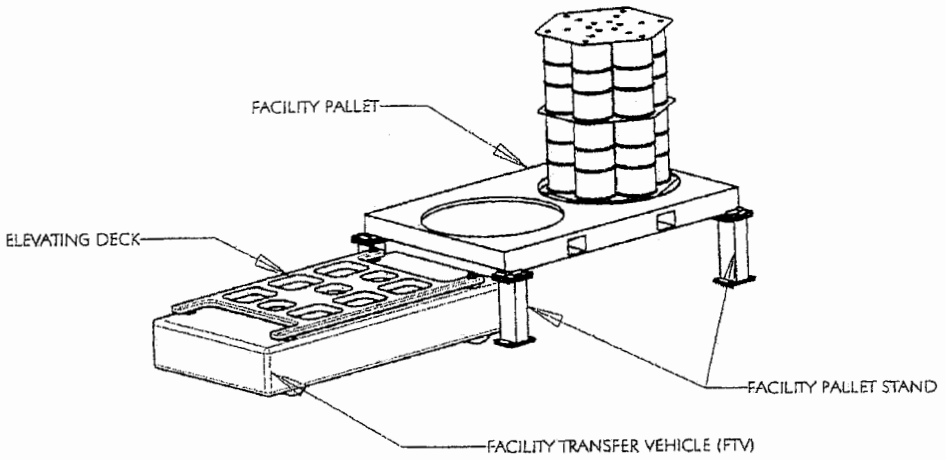


Figure A1-11
Facility Transfer Vehicle, Facility Pallet, and Typical Pallet Stand

02075

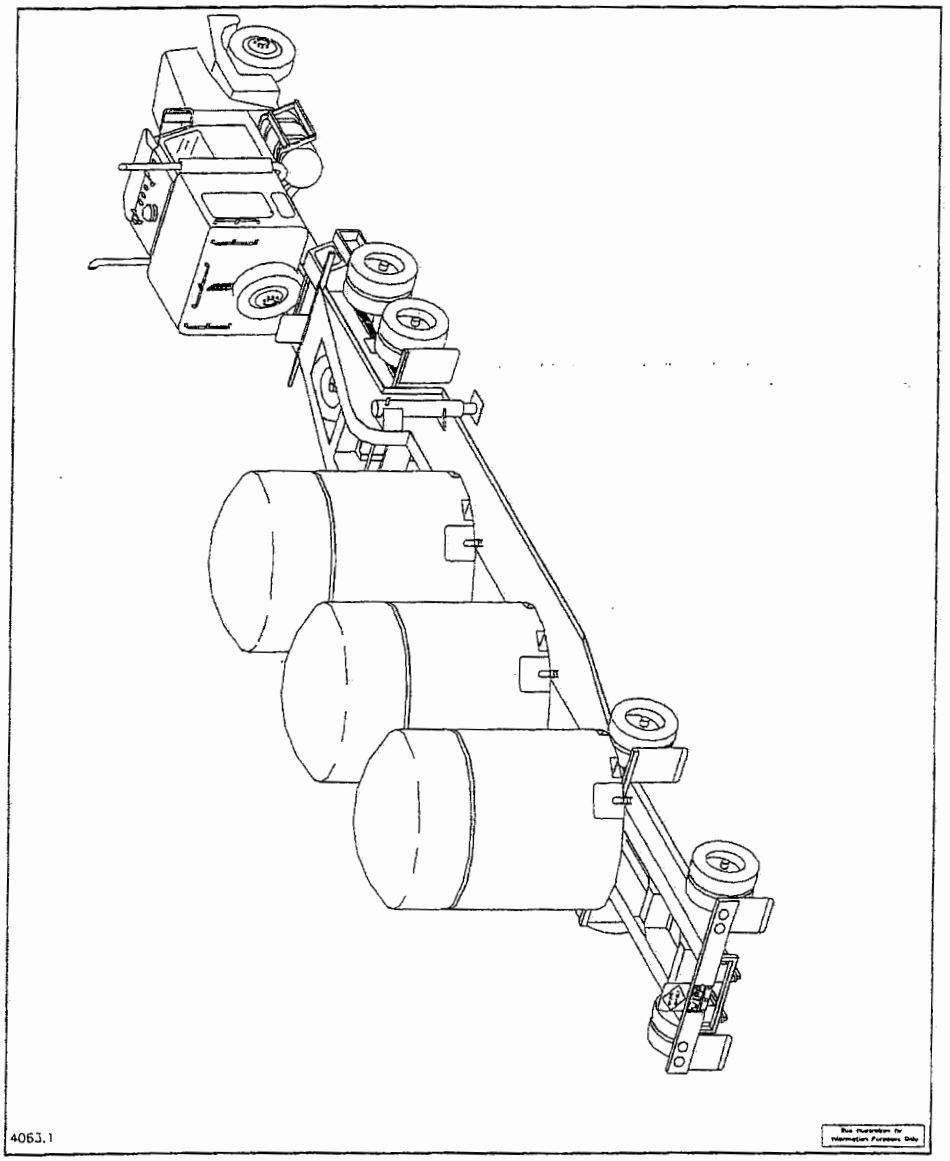


Figure A1-12
TRUPACT-II Containers on Trailer

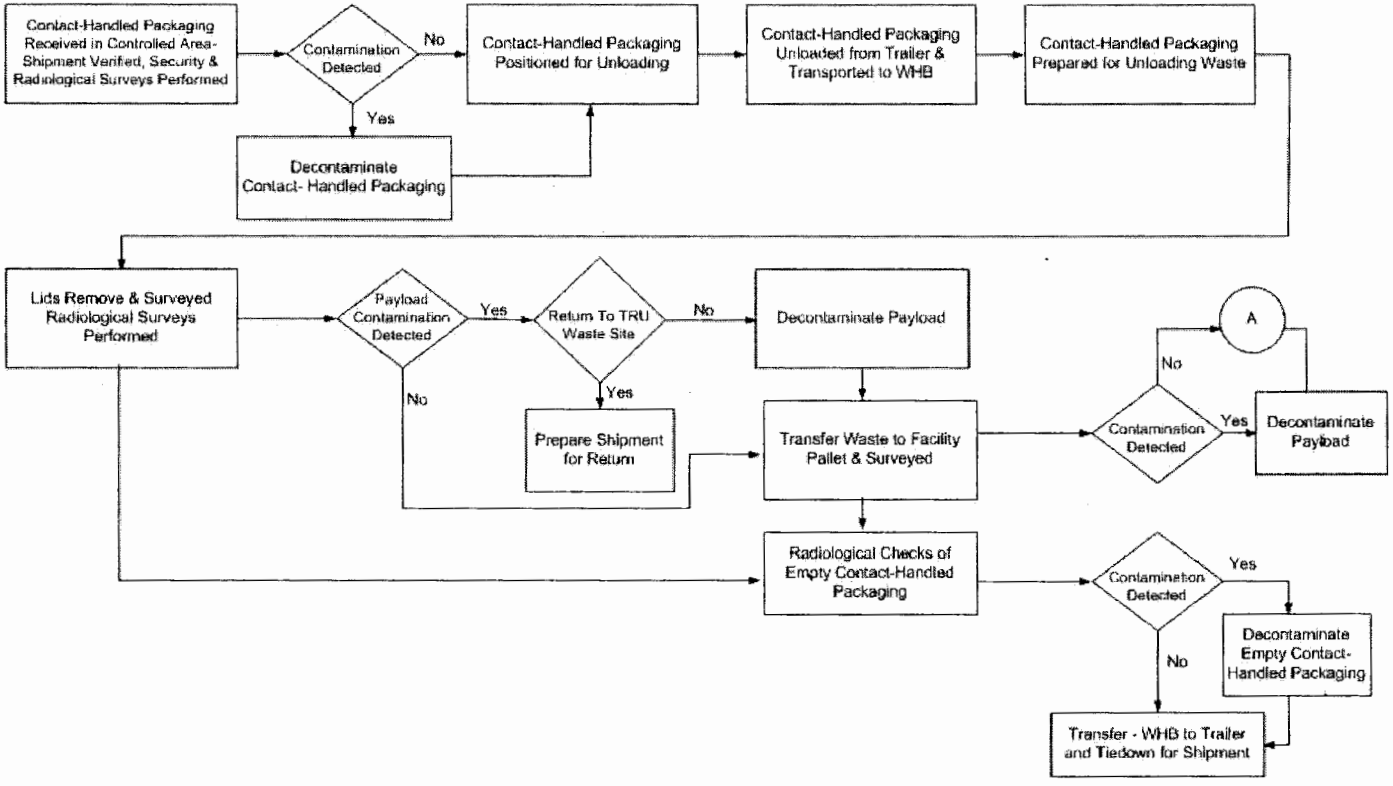


Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

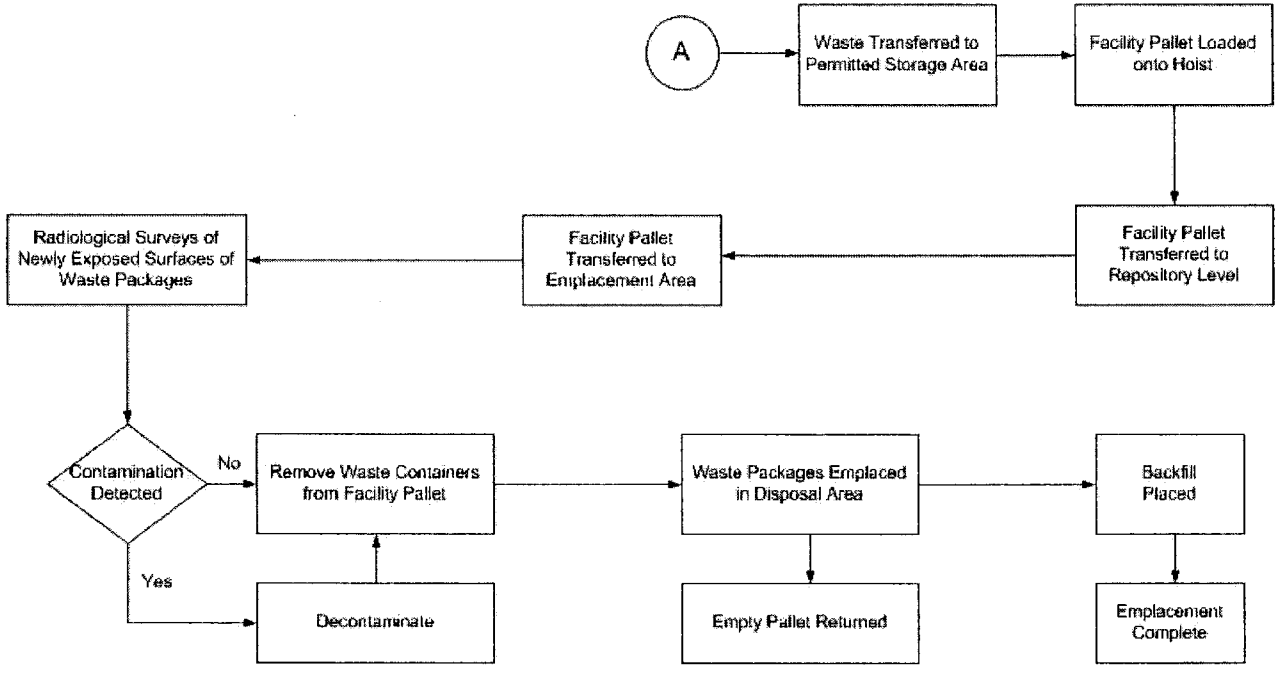


Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

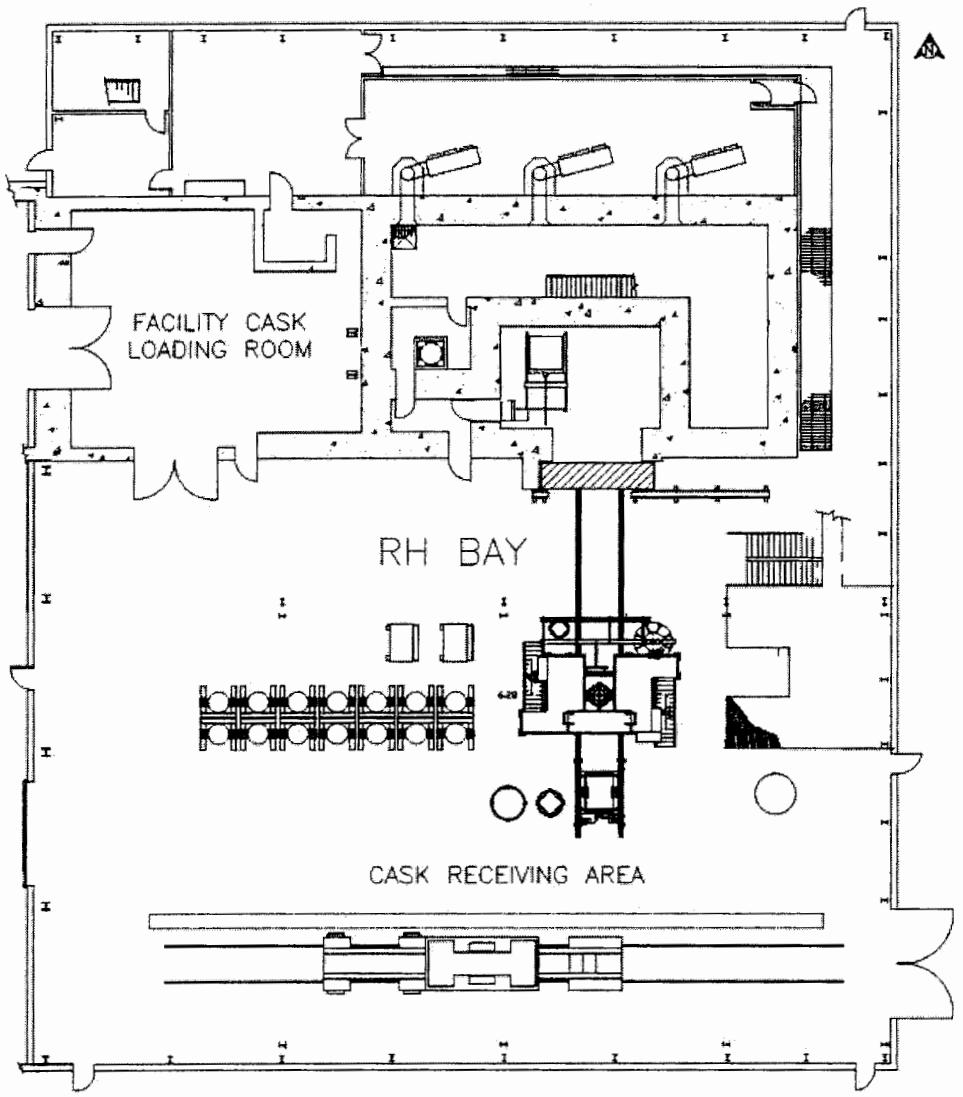


Figure A1-14a
RH Bay Ground Floor

32879

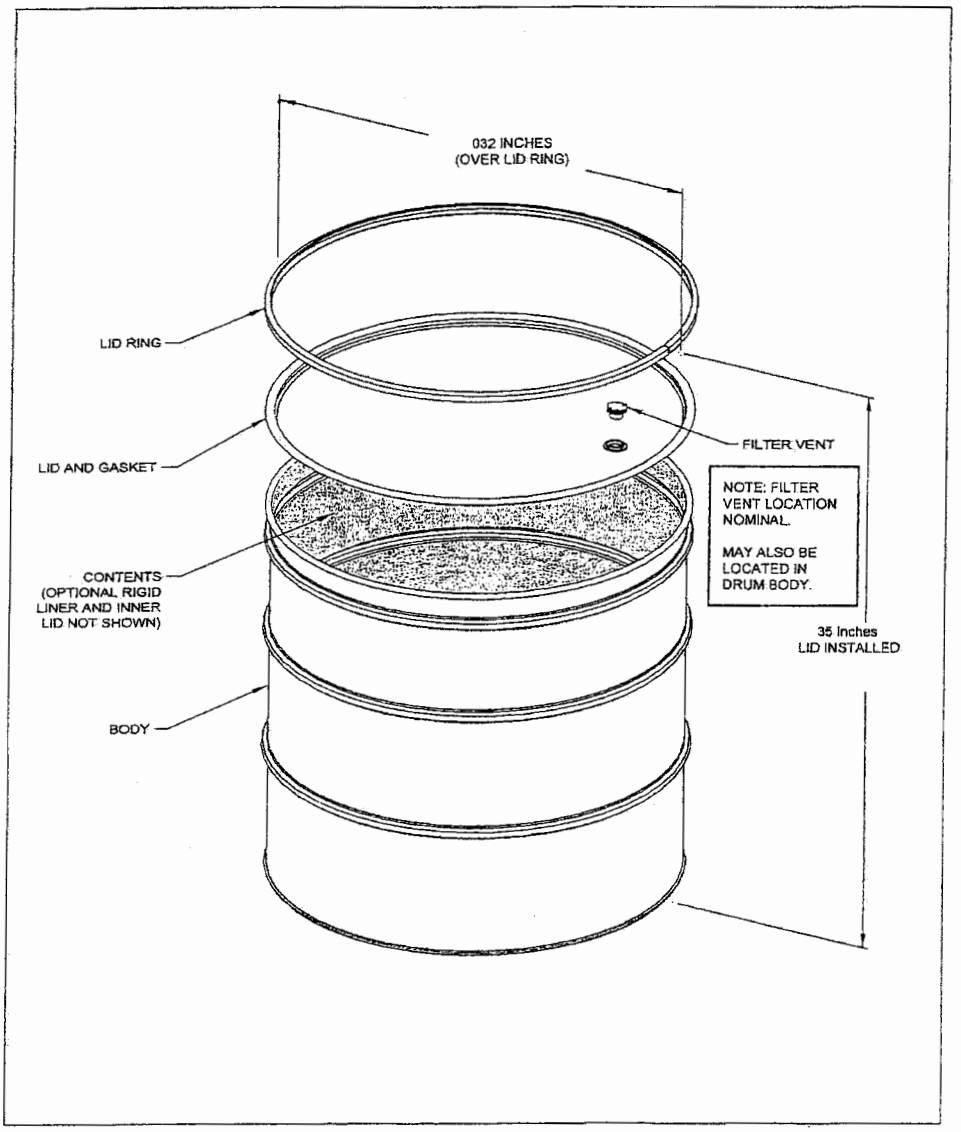
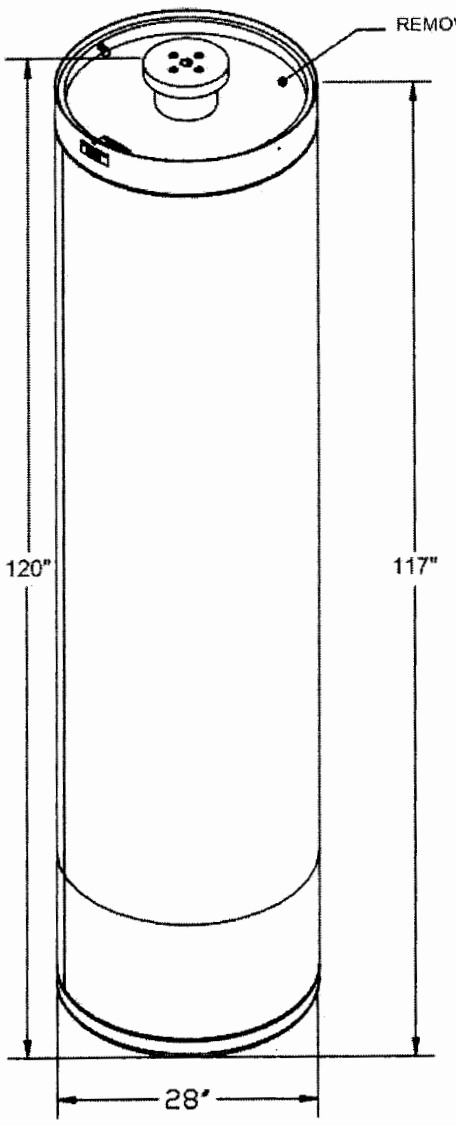


Figure A1-15
100-Gallon Drum

02086



NOTE: CANISTER USED TO HANDLE TYPE A DRUMS ONLY.

Figure A1-16
Facility Canister Assembly

02081

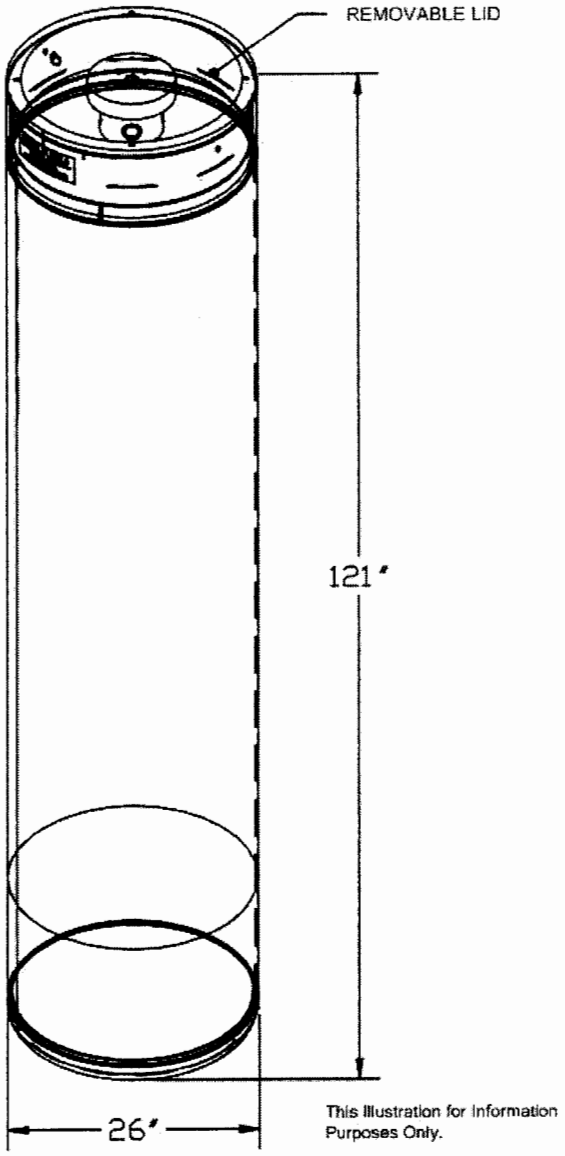


Figure A1-16a
RH-TRU 72-B Canister Assembly

02082

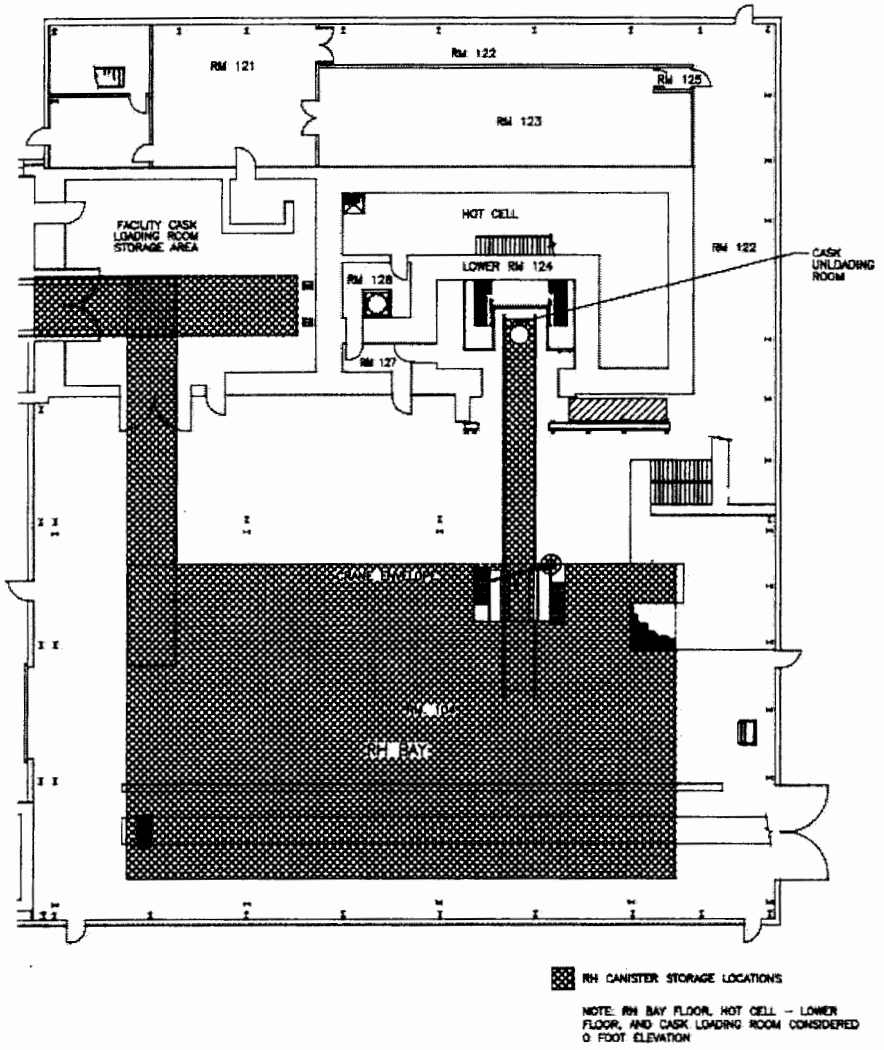


Figure A1-17a
RH Bay, Cask Unloading Room, Hot Cell, Facility Cask Loading Room

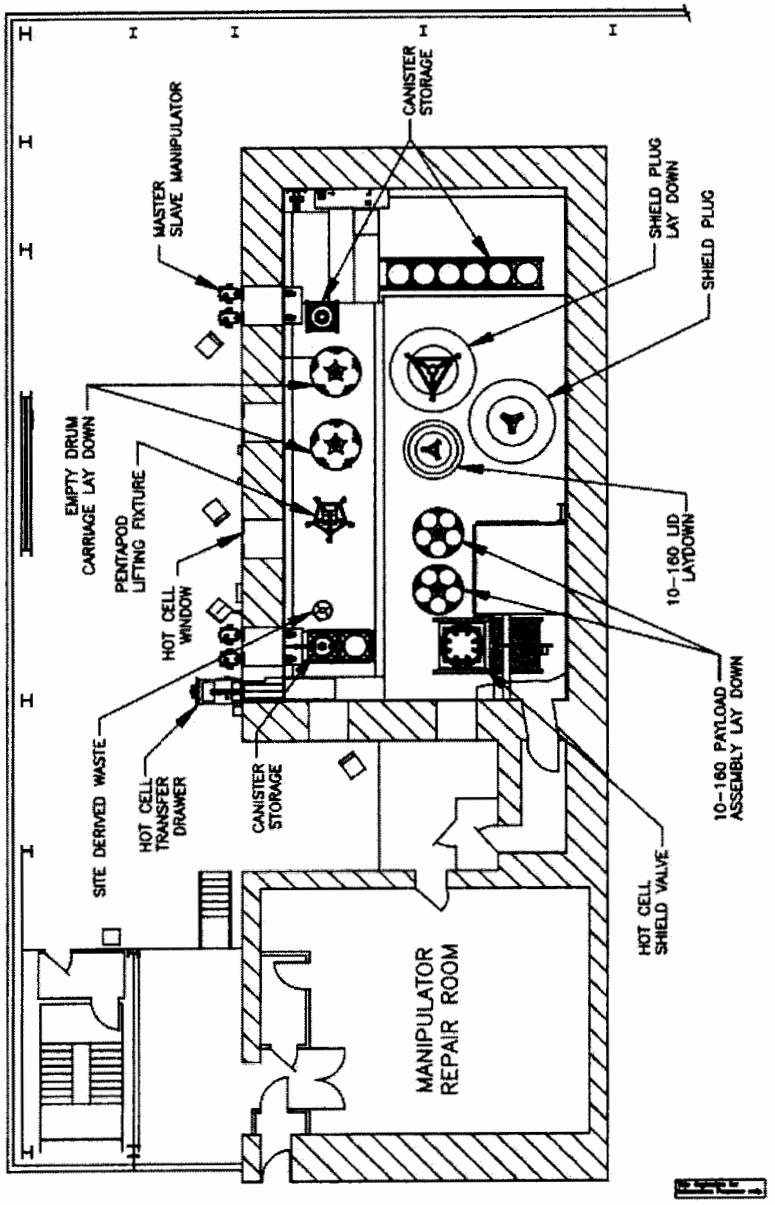


Figure A1-17b
RH Hot Cell Storage Area

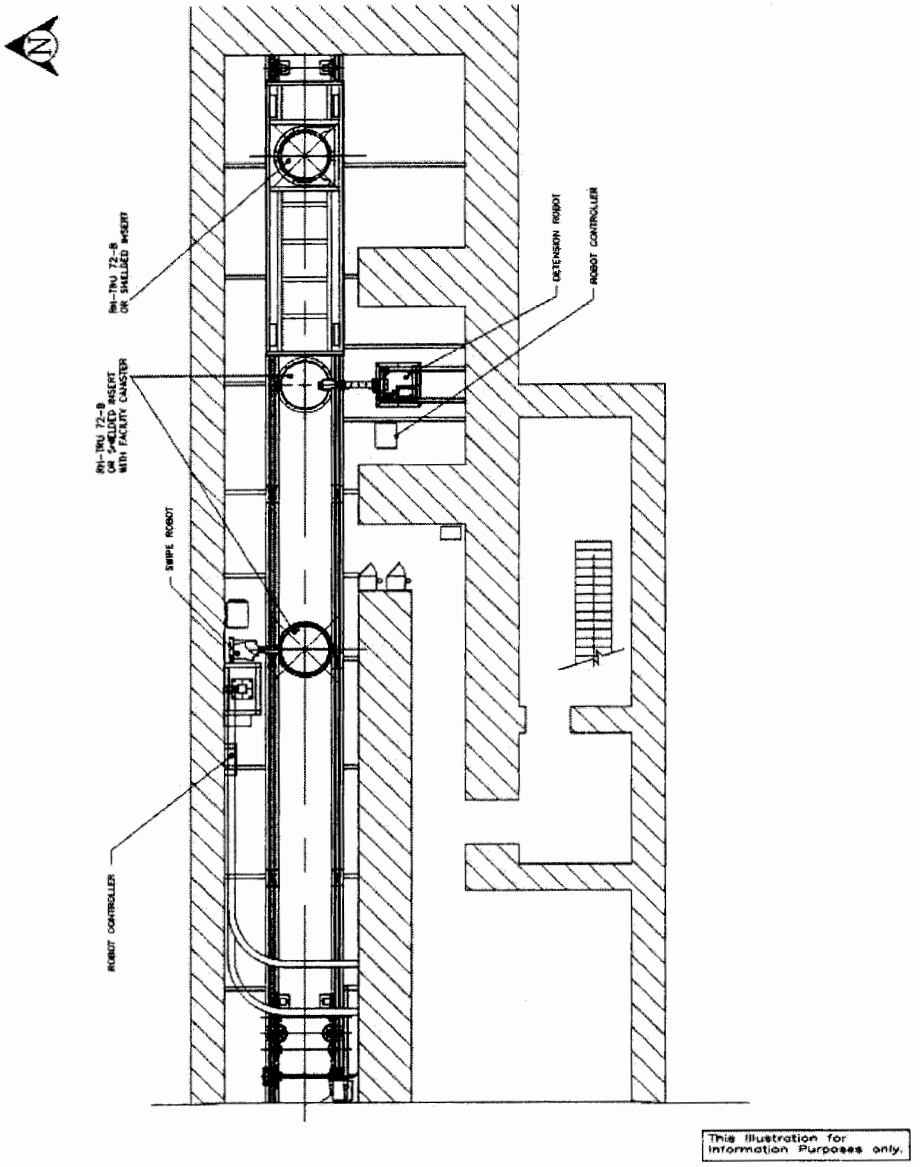


Figure A1-17c
RH Canister Transfer Cell Storage Area

92085

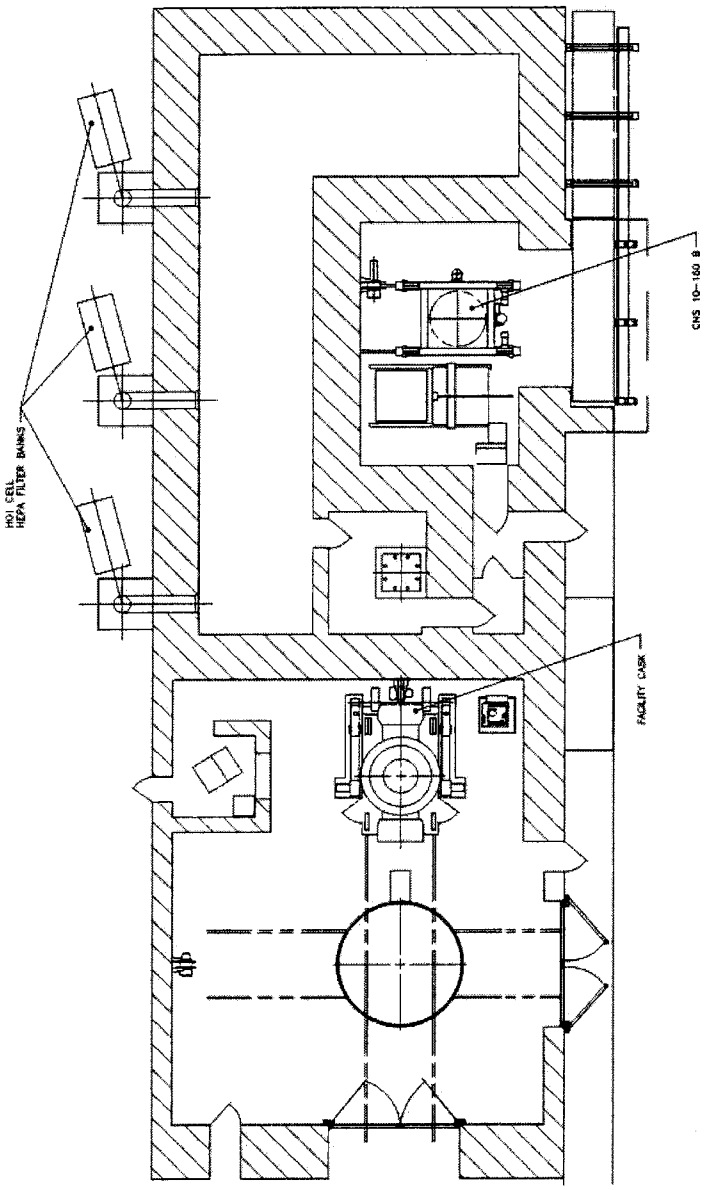


Figure A1-17d
RH Facility Cask Loading Room Storage Area

02066

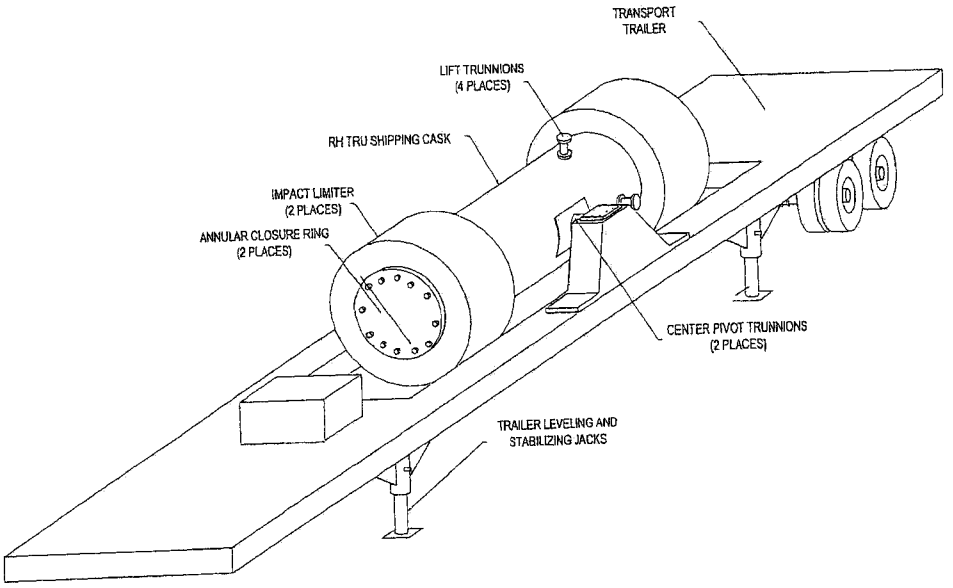


Figure A1-18
RH-TRU 72-B Shipping Cask on Trailer

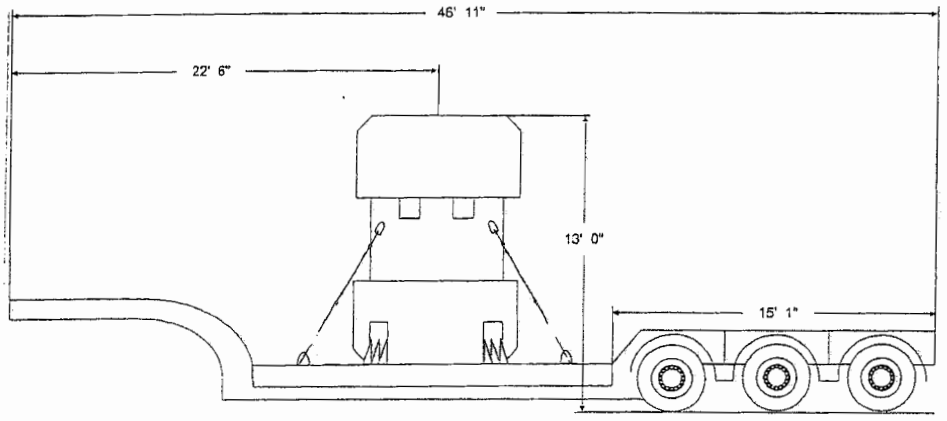


Figure A1-19
CNS 10-160B Shipping Cask on Trailer

02068

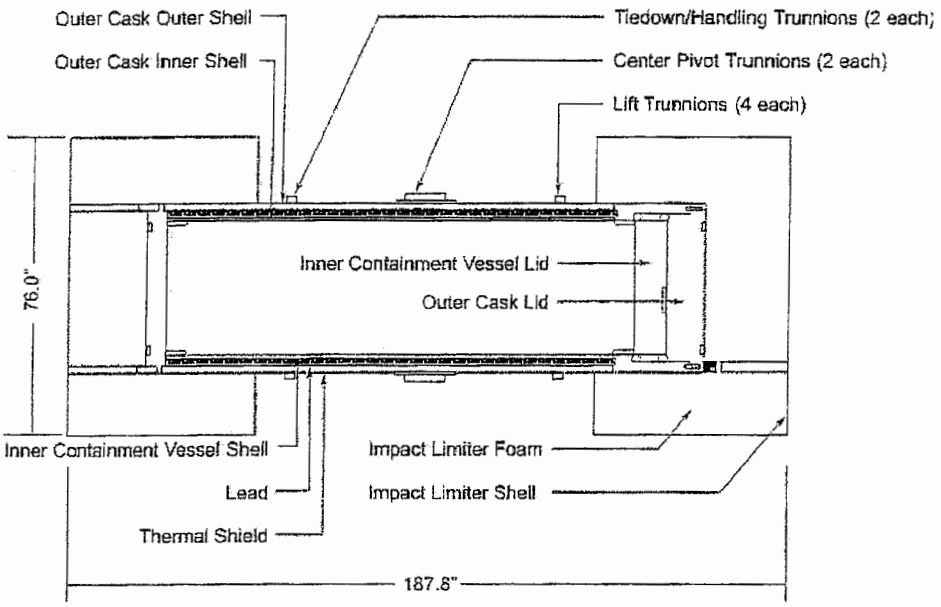


Figure A1-20
RH-TRU 72-B Shipping Cask for RH Transuranic Waste (Schematic)

Field Code Changed

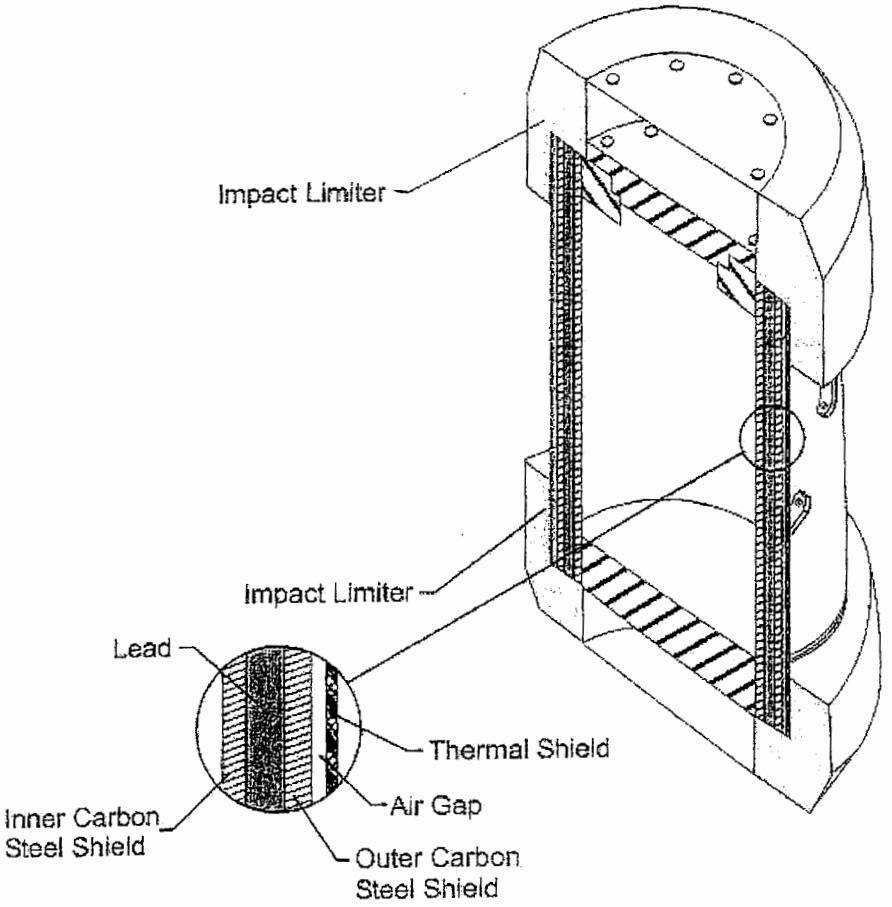


Figure A1-21
CNS 10-160B Shipping Cask for RH Transuranic Waste (Schematic)

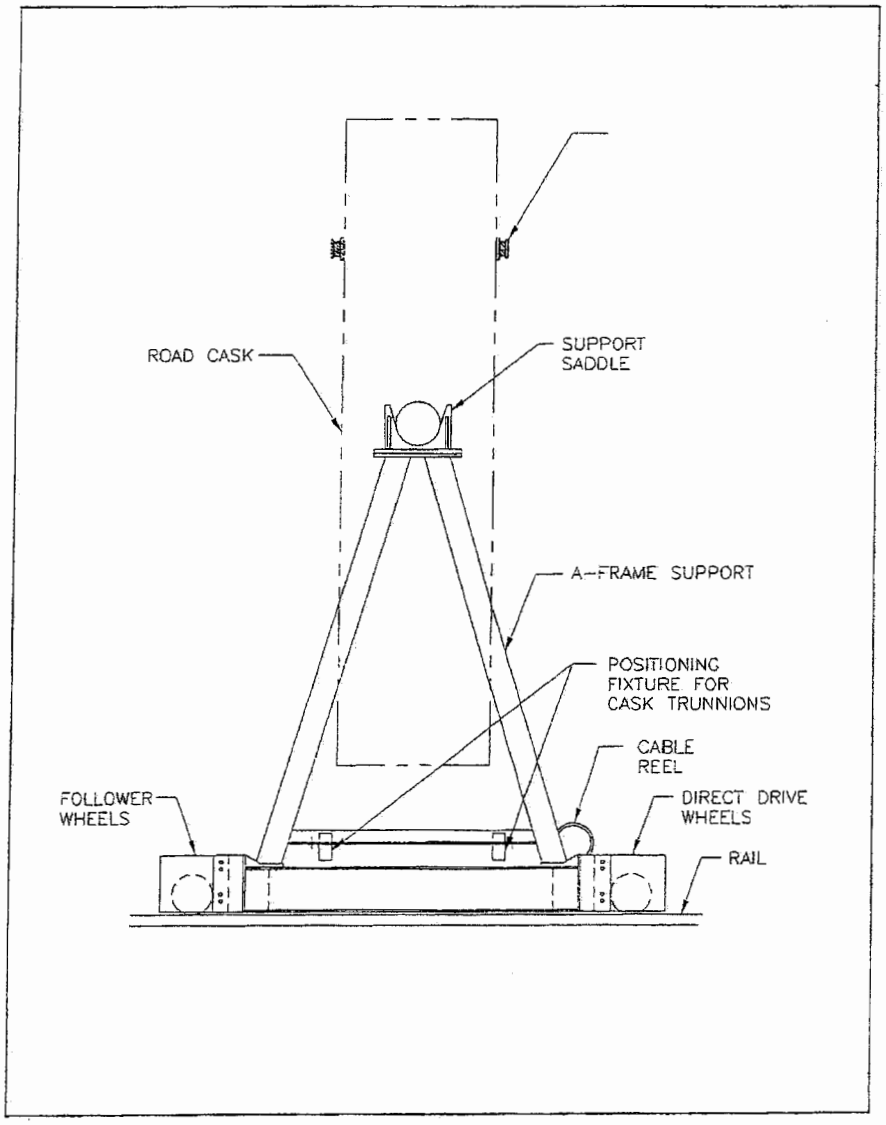
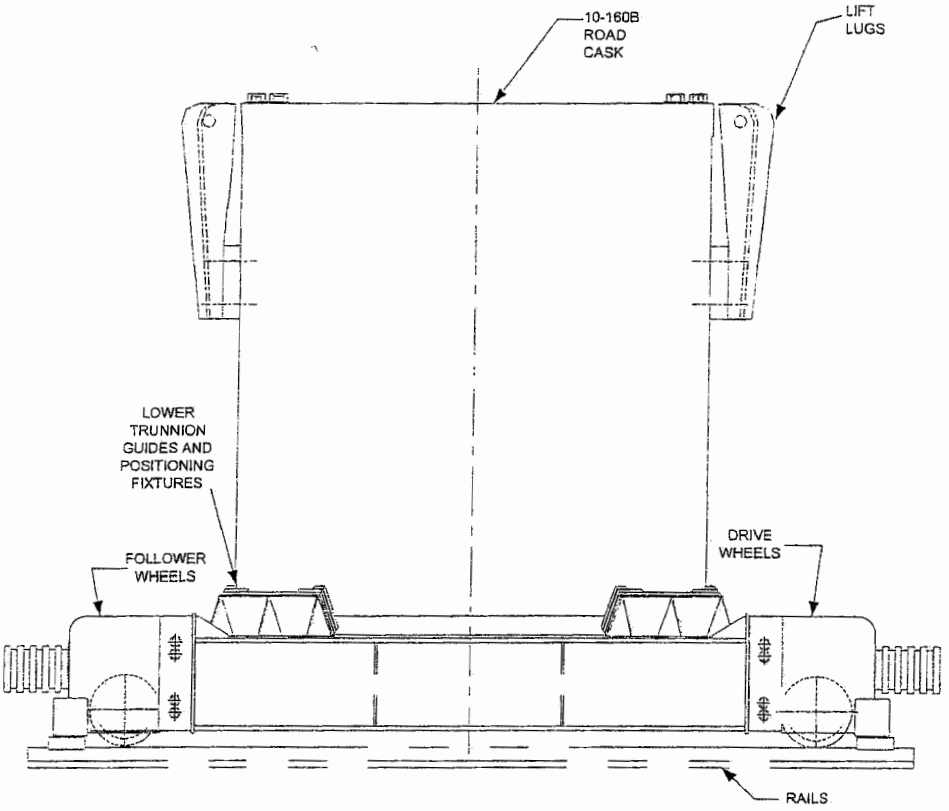


Figure A1-22a
RH-TRU 72-B Cask Transfer Car

02291



This Illustration for Information Purposes Only

Figure A1-22b
CNS 10-160B Cask Transfer Car

02892

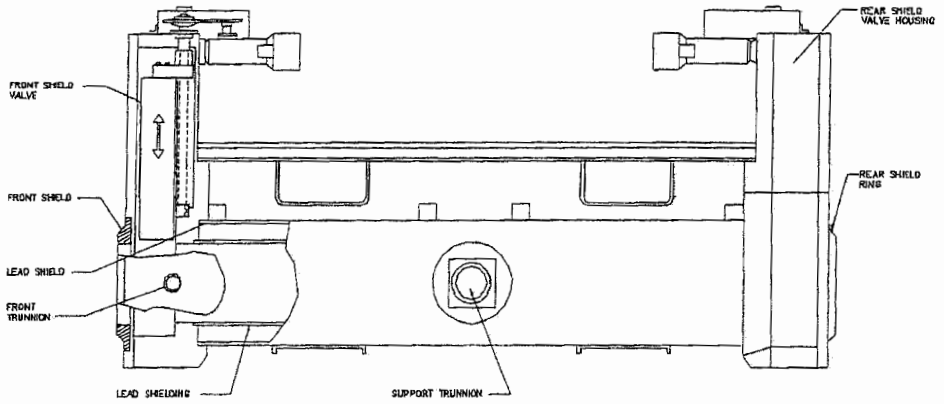


Figure A1-23
RH Transuranic Waste Facility Cask

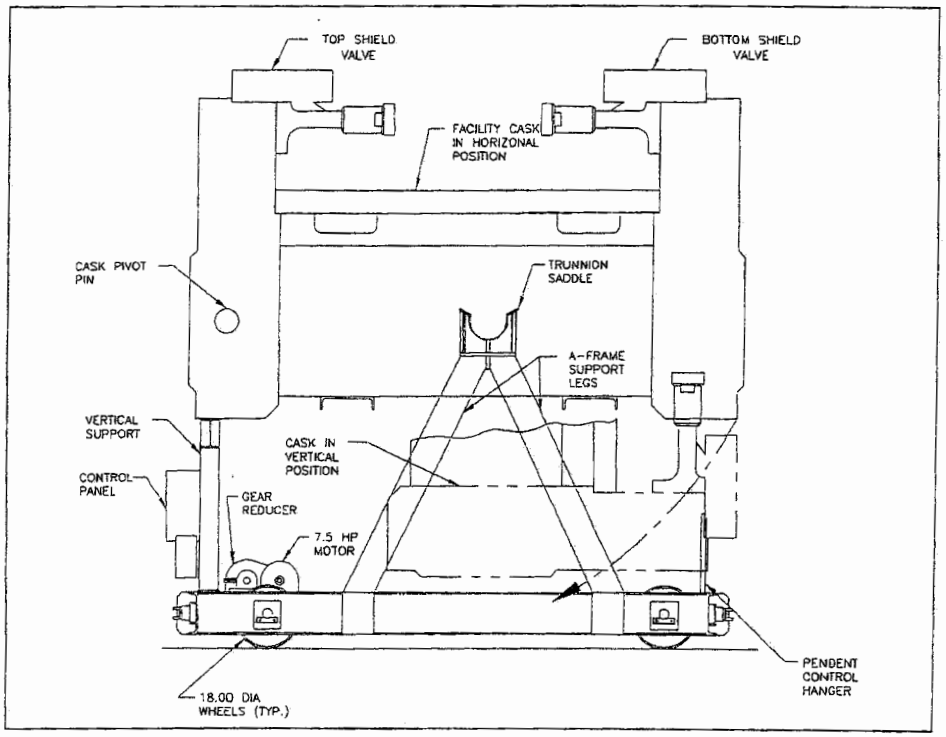


Figure A1-24
RH Facility Cask Transfer Car (Side View)

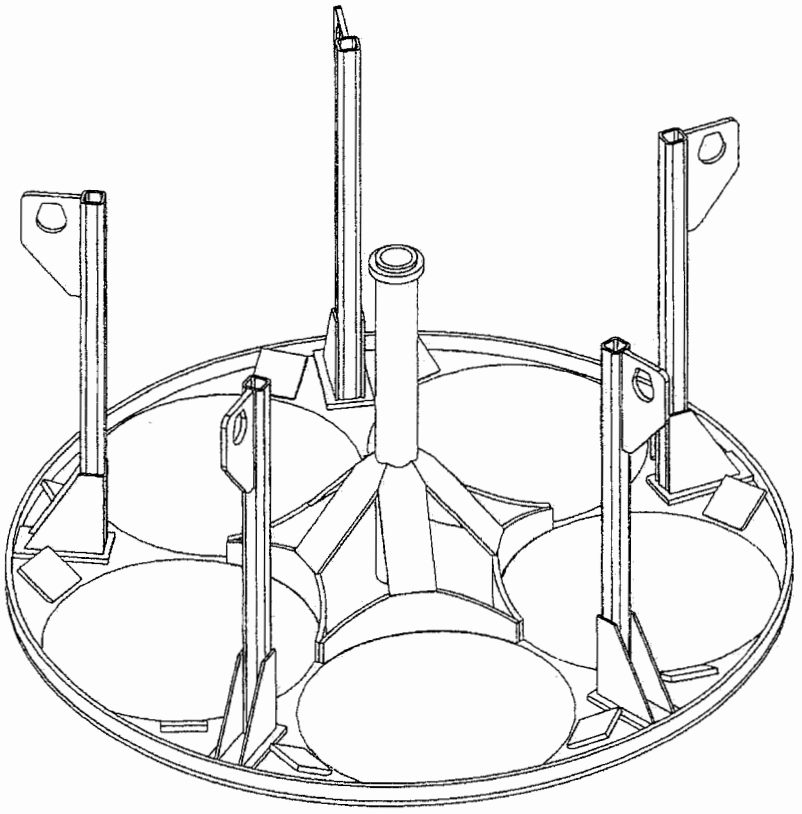


Figure A1-25
CNS 10-160B Drum Carriage

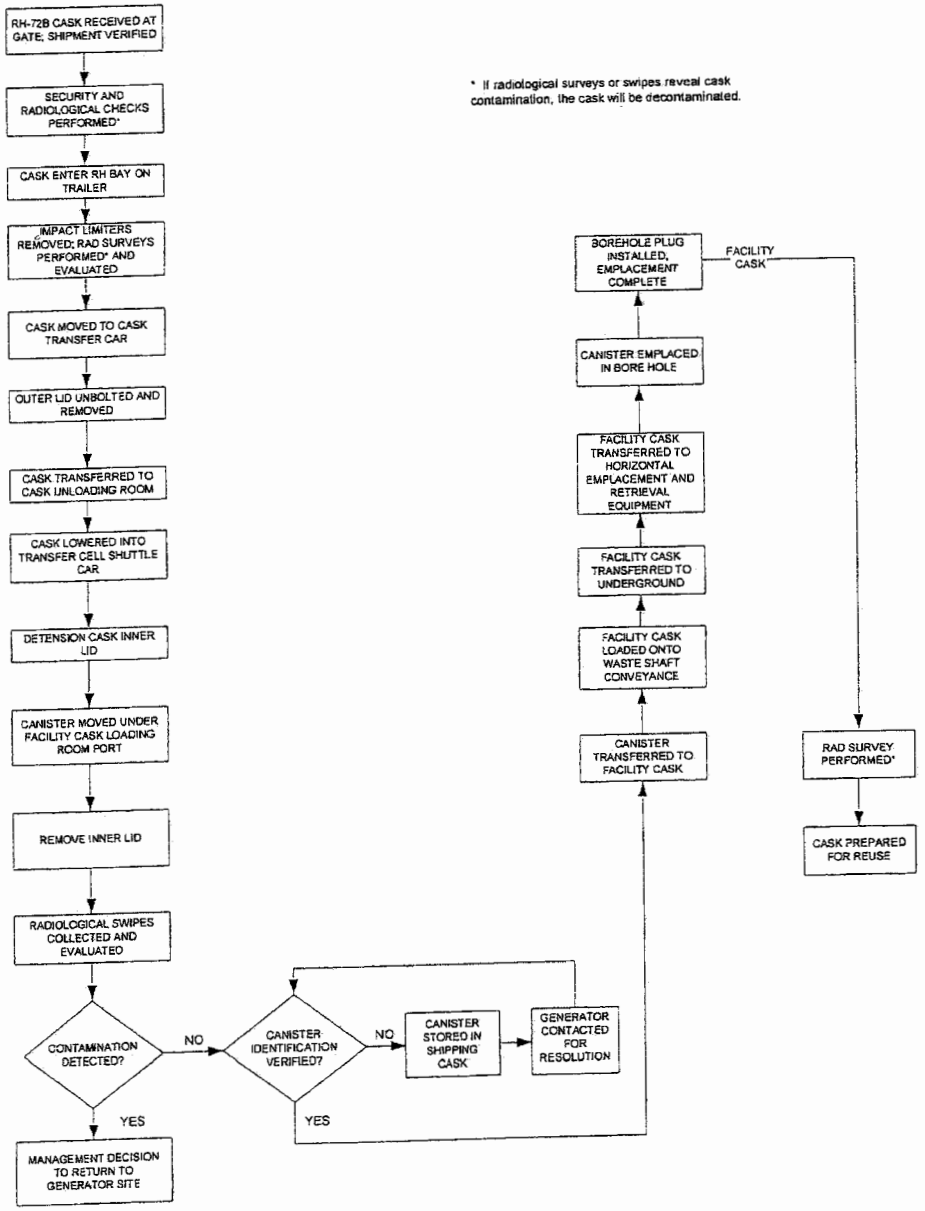


Figure A1-26
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for RH-TRU 72-B Shipping Cask

02096

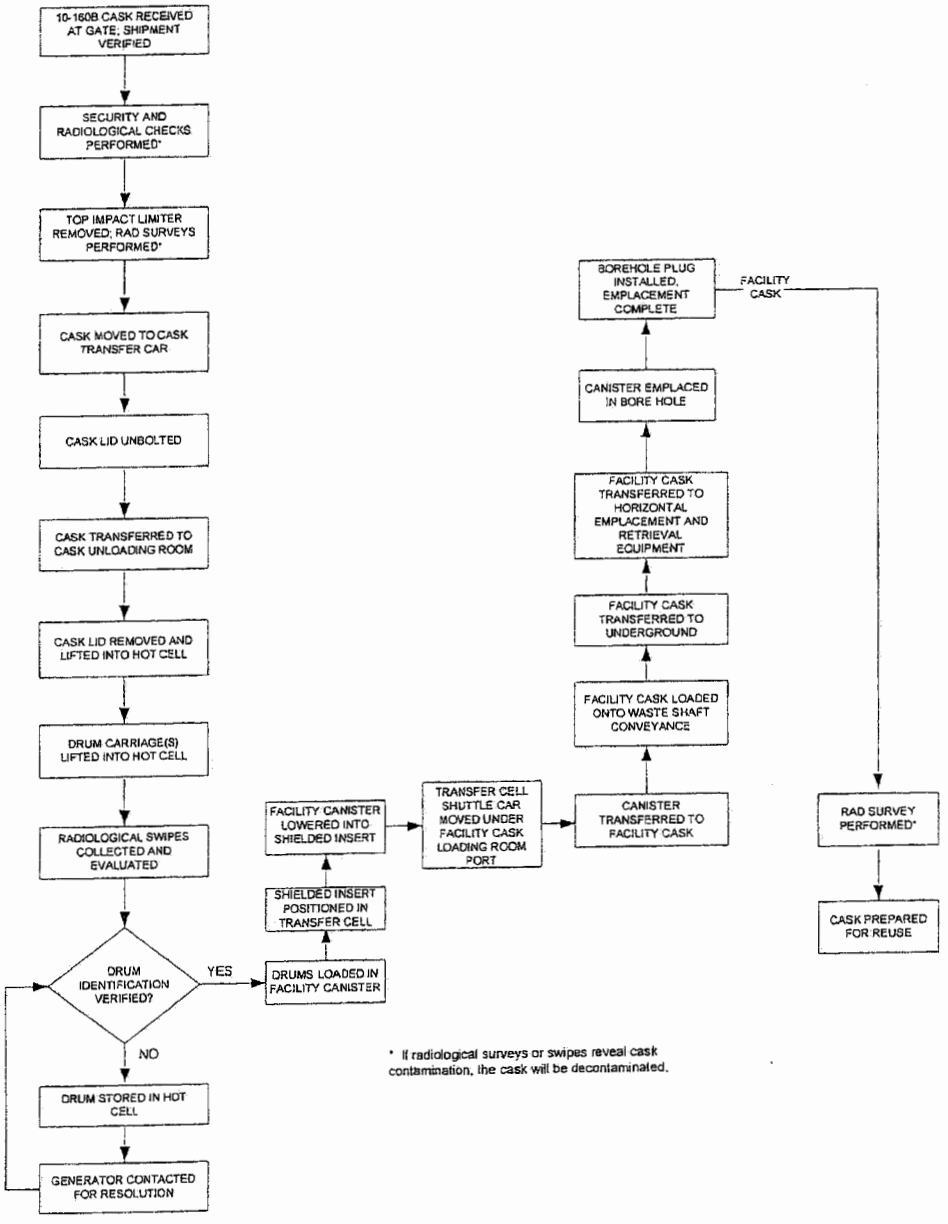


Figure A1-27
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for CNS 10-160B Shipping Cask

02097

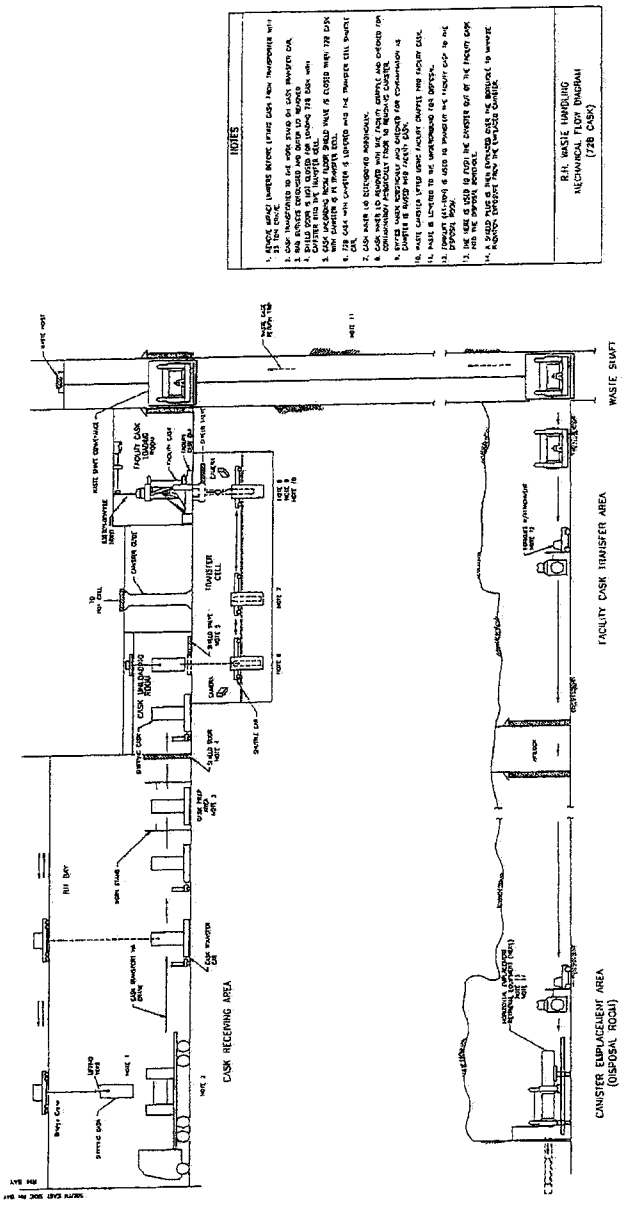


Figure A1-28
Schematic of the RH Transuranic Mixed Waste Process for RH-TRU 72-B Shipping Cask

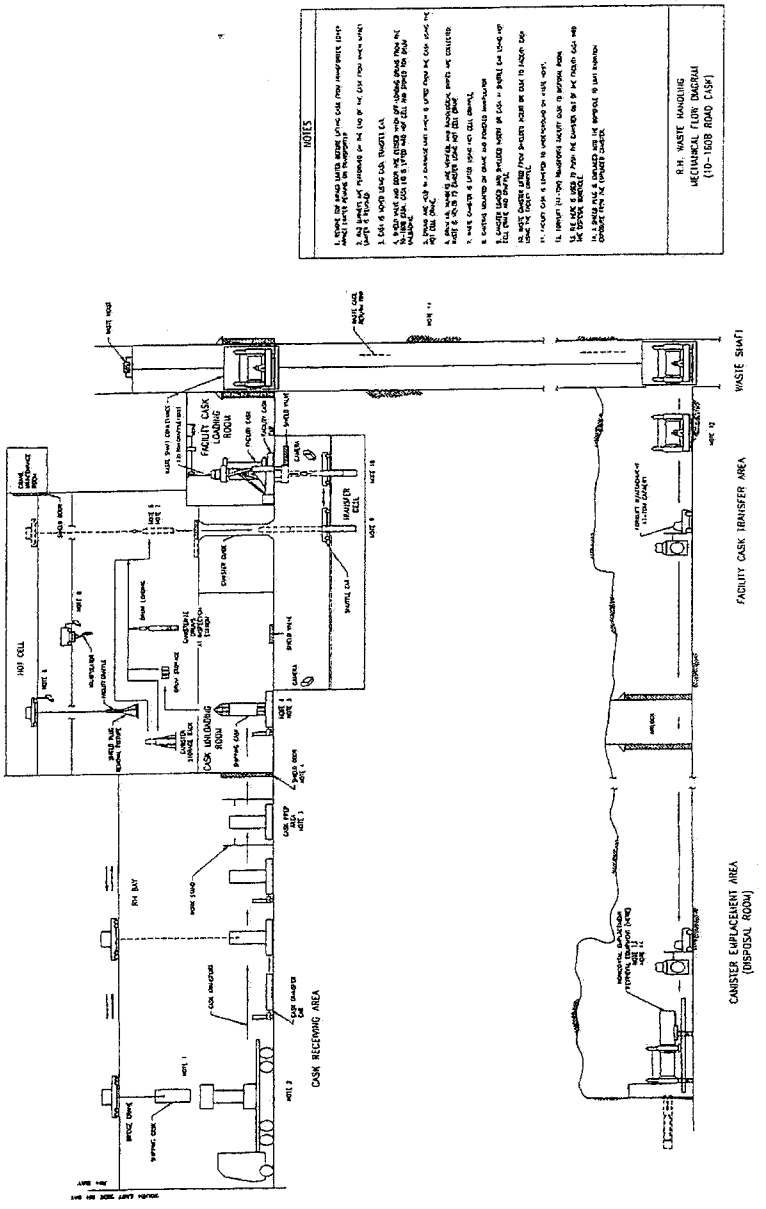


Figure A1-29
Schematic of the RH Transuranic Mixed Waste Process for CNS 10-160B Shipping Cask

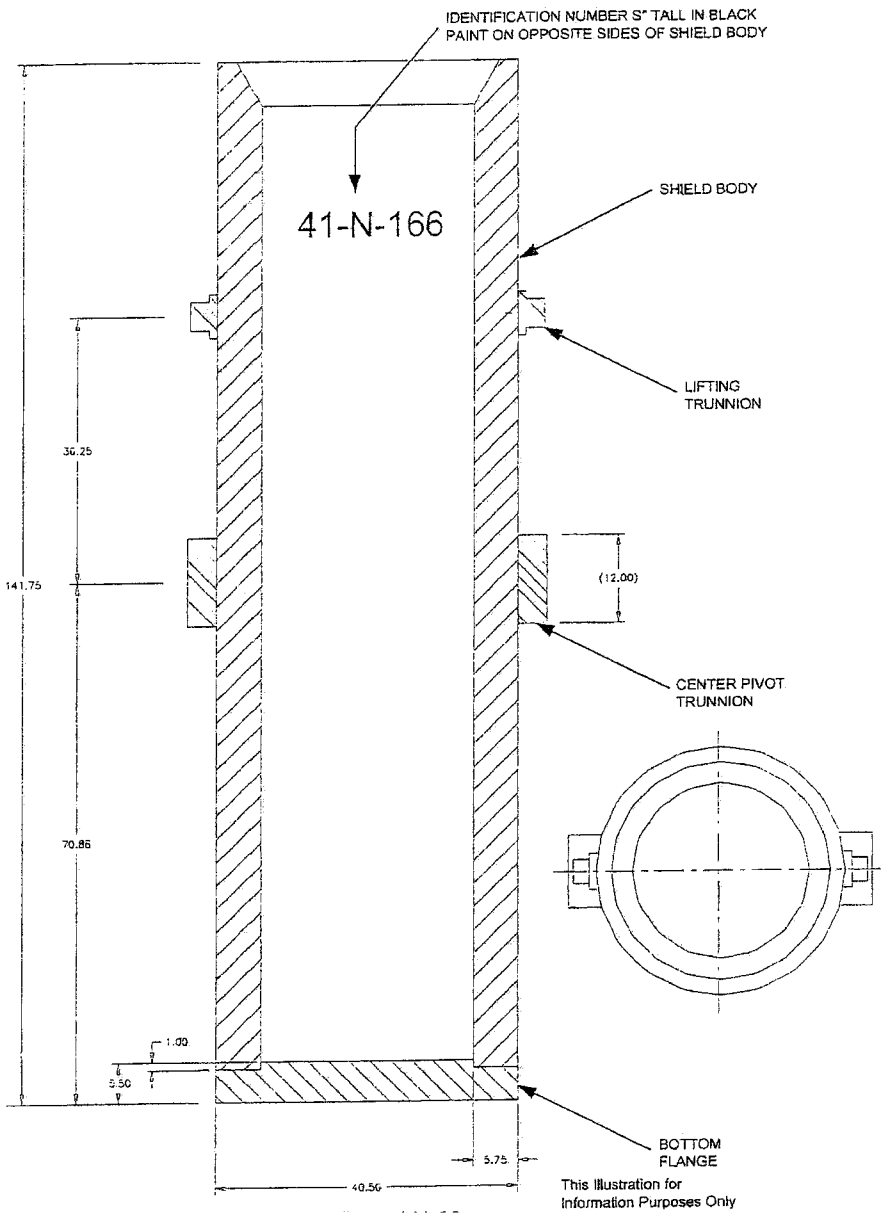


Figure A1-30
RH Shielded Insert Assembly

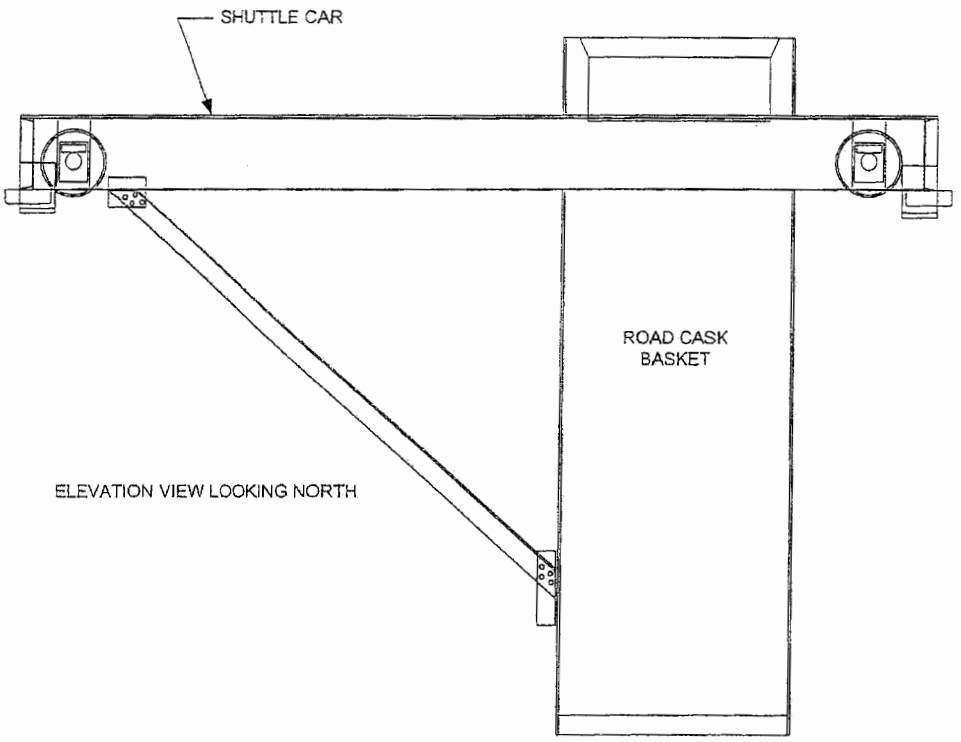
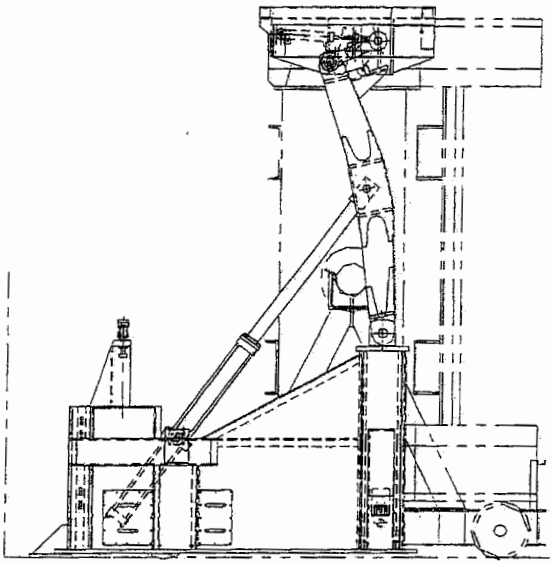
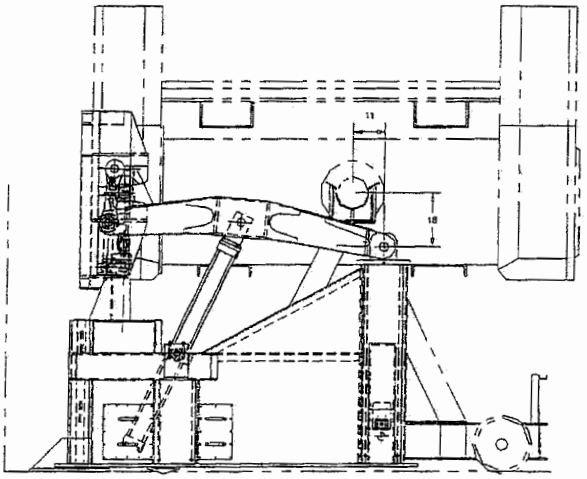


Figure A1-31
Transfer Cell Shuttle Car



FRONT ELEVATION
CASK VERTICAL



FRONT ELEVATION
CASK HORIZONTAL

This illustration for
Information Purposes Only

Figure A1-32
Facility Rotating Device

Field Code Changed

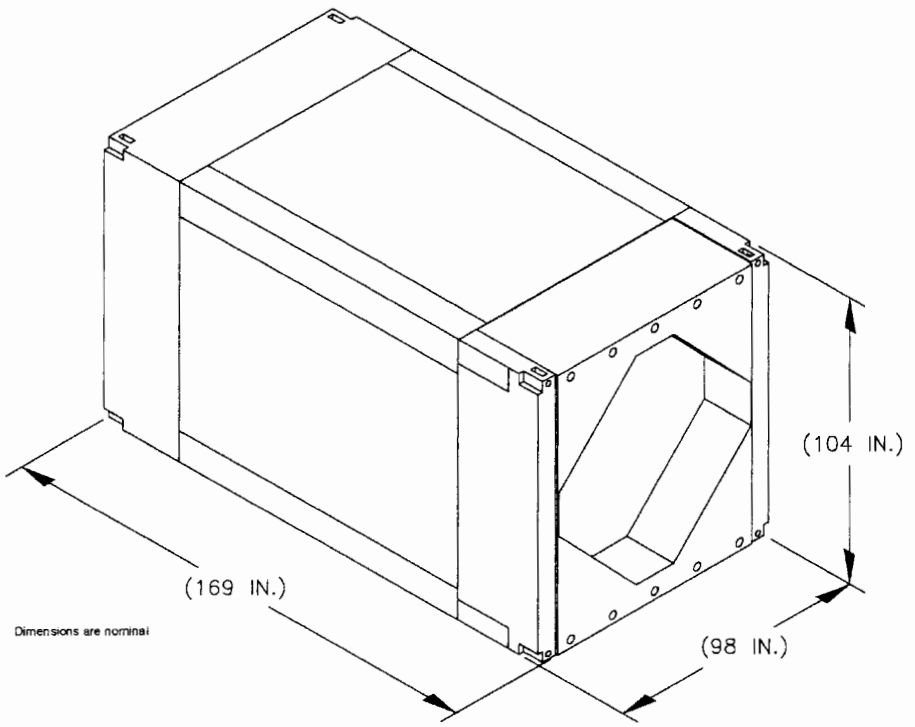


Figure A1-33
Typical TRUPACT-III

Field Code Changed

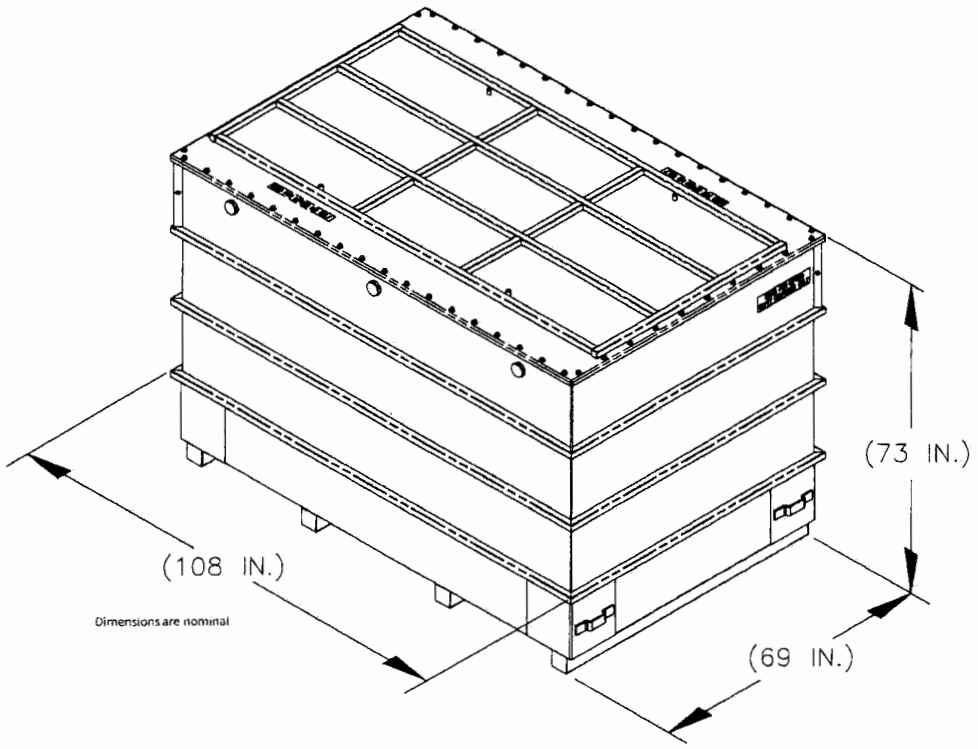


Figure A1-34
Typical Standard Large Box 2

Field Code Changed

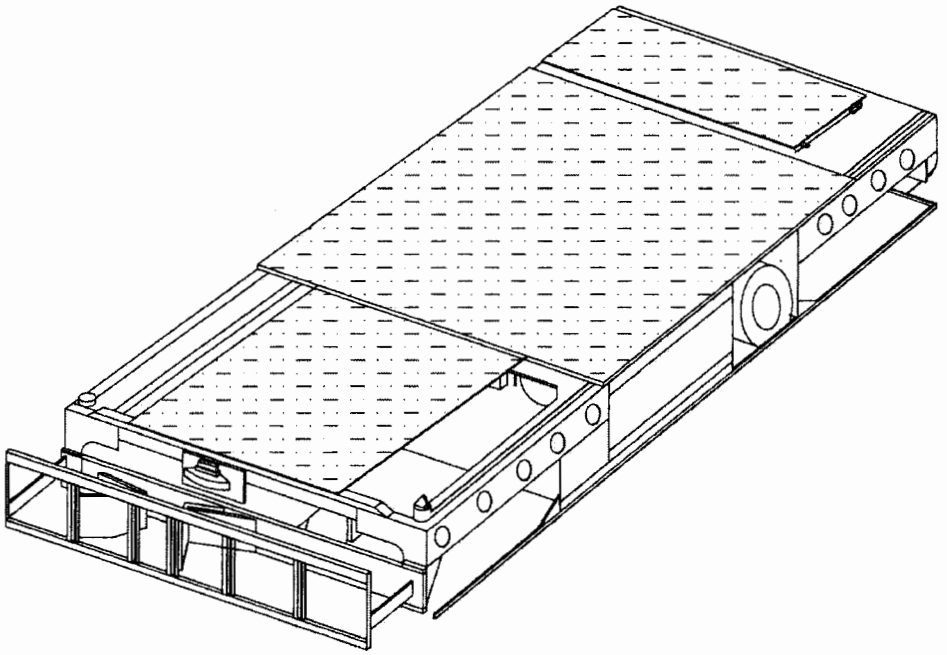


Figure A1-35
Typical Yard Transfer Vehicle

Field Code Changed

032105

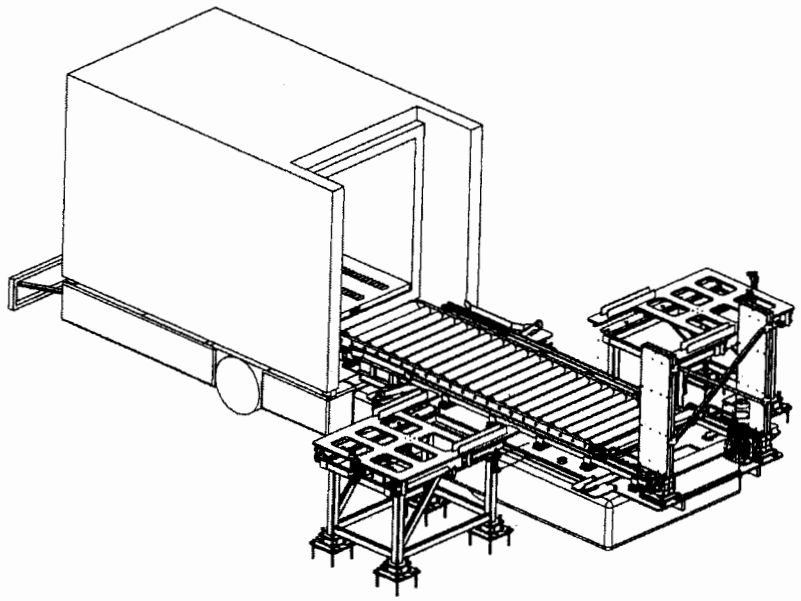


Figure A1-36
Payload Transfer Station

Field Code Changed

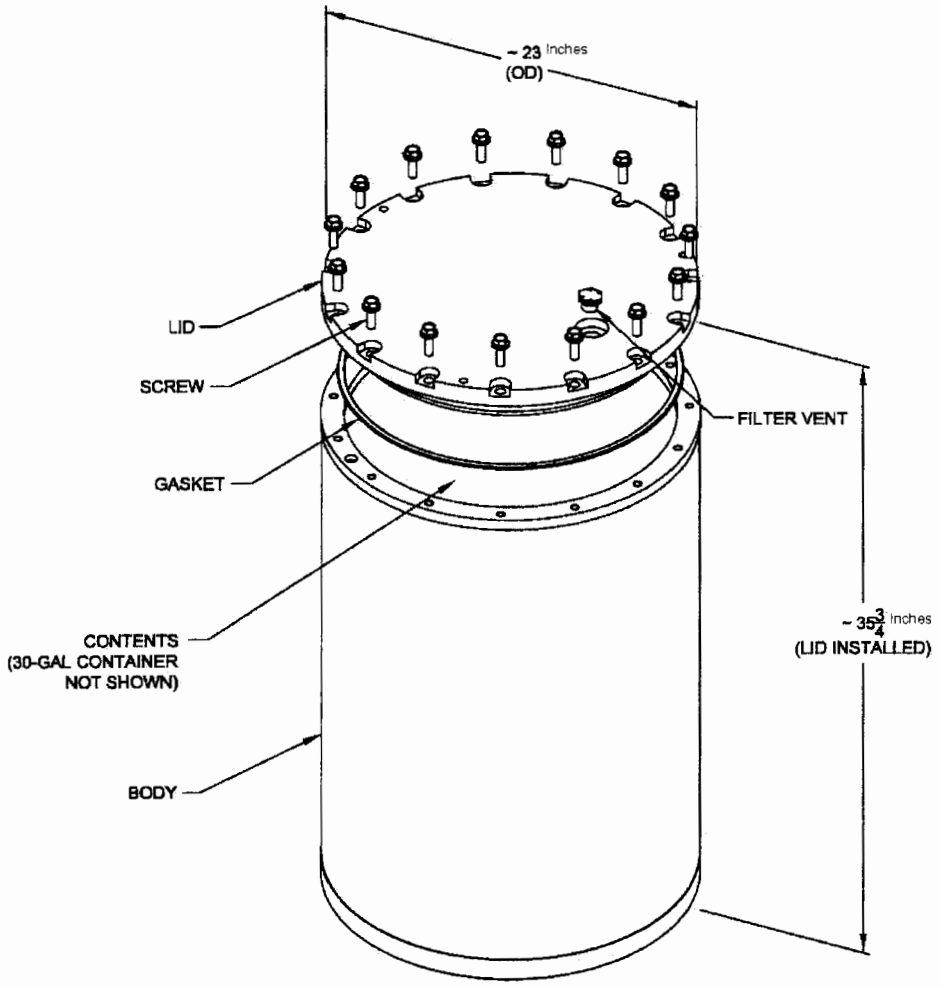


Figure A1-37
Typical Shielded Container

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CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

Introduction

Management and storage of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under 20.4.1.500 NMAC. The technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.170 to 264.178 are applied to the operation of the Waste Handling Building Container Storage Unit (**WHB Unit**)(Figure A1-1), and the Parking Area Container Storage Unit (**Parking Area Unit**)(Figure A1-2). This Permit Attachment describes the container storage units, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1 NMAC. The configuration of the WIPP facility consists of completed structures, including all buildings and systems for the operation of the facility.

A1-1 Container Storage

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

A1-1a Containers with Liquid

The Permit Treatment, Storage, and Disposal Facility (**TSDF**) Waste Acceptance Criteria (**WAC**) and the Waste Analysis Plan (Permit Attachment C) prohibit the shipment of waste to the WIPP with liquid in excess of one percent of the volume of the waste container (e.g., drum, standard waste box [**SWB**], or canister). Since the maximum amount of liquid is one percent, calculations made to determine the secondary containment as required by 20.4.1.500 NMAC (incorporating §264.175) are based on ten percent of one percent of the volume of the containers, or one percent of the largest container, whichever is greater.

A1-1b Description of Containers

20.4.1.500 NMAC (incorporating 40 CFR §264.171) requires that containers holding waste be in good condition. Waste containers shall be in good condition prior to shipment from the generator sites, i.e., containers will be of high integrity, intact, and free of surface contamination above DOE limits. The Manager of the DOE Carlsbad Field Office has the authority to suspend a generator's certification to ship TRU mixed waste to the WIPP facility should the generator fail to meet this requirement. The containers will be certified free of surface contamination above DOE limits upon shipment. This condition shall be verified upon receipt of the waste at WIPP. The level of rigor applied in these areas to ensure container integrity and the absence of external contamination on both ends of the transportation process will ensure that waste containers entering the waste management process line at WIPP meet the applicable Resource Conservation and Recovery Act (**RCRA**) requirements for container condition.

A1-1b(1) CH TRU Mixed Waste Containers

Contact handled (**CH**) TRU mixed waste containers will be either 55-gal (208-L) drums singly or arranged into 7-packs, 85-gal (322-L) drums singly or arranged into 4-packs, 100-gal (379 L)

drums singly or arranged into 3-packs, ten-drum overpacks (**TDOP**), standard large box 2s (**SLB2**), or SWBs. A summary description of each CH TRU mixed waste container type is provided below.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (**DOT**) specification 7A regulations.

A standard 55-gal (208-L) drum has a gross internal volume of 7.4 cubic feet (ft^3) (0.21 cubic meters (m^3)). Figure A1-3 shows a standard TRU mixed waste drum. One or more filtered vents (as described in Section A1-1d(1)) will be installed in the drum lid to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

Standard 55-gal (208-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

Standard 55-gal (208-L) drums may be used to collect derived waste.

Standard Waste Boxes

The SWBs meet all the requirements of DOT specification 7A regulations.

One or more filtered vents (as described in Section A1-1d(1)) will be installed in the SWB body and located near the top of the SWB to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. They have an internal volume of 66.3 ft^3 (1.88 m^3). Figure A1-4 shows a SWB.

The SWB is the largest container that may be used to collect derived waste.

Ten-Drum Overpack

The TDOP is a metal container, similar to a SWB, that meets DOT specification 7A and is certified to be noncombustible and to meet all applicable requirements for Type A packaging. The TDOP is a welded-steel, right circular cylinder, approximately 74 inches (in.) (1.9 meters (m)) high and 71 in. (1.8 m) in diameter (Figure A1-5). The maximum loaded weight of a TDOP is 6,700 pounds (lbs) (3,040 kilograms (kg)). A bolted lid on one end is removable; sealing is accomplished by clamping a neoprene gasket between the lid and the body. One or more filter vents are located near the top of the TDOP on the body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. A TDOP may contain up to ten standard 55-gal (208-L) drums or one SWB. TDOPs may be used to overpack drums or SWBs containing CH TRU mixed waste. The TDOP may also be direct loaded with CH TRU mixed waste. Figure A1-5 shows a TDOP.

Eighty-Five Gallon Drum

The 85-gal (322-L) drums meet the requirements for DOT specification 7A regulations. An 85-gal (322-L) drum has a gross internal volume of 11.4 ft^3 (0.32 m^3). One or more filtered vents

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(as described in Section A1-1d(1)) will be installed in the 85-gal drum to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

85-gal (322-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

The 85-gal (322-L) drum, which is shown in Figure A1-6, will be used for overpacking contaminated 55-gal (208 L) drums at the WIPP facility. The 85-gal drum may also be direct loaded with CH TRU mixed waste.

85-gal (322-L) drums may be used to collect derived waste.

100-Gallon Drum

100-gal (379-L) drums meet the requirements for DOT specification 7A regulations.

A 100-gal (379-L) drum has a gross internal volume of 13.4 ft^3 (0.38 m^3). One or more filtered vents (as described in Section A1-1d(1) will be installed in the drum lid or body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

100-gal (379-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

100-gal (379-L) drums may be direct loaded.

Standard Large Box 2

The SLB2 meets the requirements of DOT specification 7A requirements. The SLB2 is a welded steel container with a gross internal volume of 261 ft^3 (7.39 m^3).

One or more filtered vents will be installed in the SLB2 body and located near the top of the SLB2 to prevent the escape of radioactive particulates and to prevent internal pressurization. Figure A1-34 shows an SLB2.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers, which are received in HalfPACTs, and 55-gallon drums, which are received in a CNS 10-160B cask.

RH TRU Canister

The RH TRU Canister is a steel single shell container which is constructed to be of high integrity. An example canister is depicted in Figure A1-16a. The RH TRU Canister is vented and

will have a nominal internal volume of 31.4 ft^3 (0.89 m^3) and shall contain waste packaged in small containers (e.g., drums) or waste loaded directly into the canister.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (DOT) specification 7A regulations. A detailed description of a standard 55-gallon drum is provided above. Up to ten 55-gallon drums containing RH TRU mixed waste are arranged on two drum carriage units in the CNS 10-160B cask (up to five drums per drum carriage unit). The drums are transferred to an RH TRU mixed waste Facility Canister that will contain three drums.

Shielded Container

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste.

A1-1b(3) Container Compatibility

All containers will be made of steel, and some will contain rigid, molded polyethylene liners. The compatibility study, documented in Appendix C1 of the WIPP RCRA Part B Permit Application (DOE, 1997a), included container materials to assure containers are compatible with the waste. Therefore, these containers meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

A1-1c Description of the Container Storage Units

A1-1c(1) Waste Handling Building Container Storage Unit (WHB Unit)

The Waste Handling Building (**WHB**) is the surface facility where TRU mixed waste handling activities will take place (Figure A1-1a). The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters (m^2)) of which 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for handling and storage of RH TRU mixed waste, as shown in Figures A1-1, A1-14a, and A1-17a, b, c, and d. These areas are being permitted as the WHB Unit. The concrete floors are sealed with a coating that is sufficiently impervious to the chemicals in TRU mixed waste to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(1)).

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CH Bay Surge Storage Area

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the CH Bay Storage Area. The Permittees may use the CH Bay Surge Storage Area as specified in Part 3 (see Figure A1-1) only when the maximum capacities in the CH Bay Storage Area (except for the Shielded Storage Room) and the Parking Area Unit are reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because Parking Area Container Storage Unit Surge Storage is in use; or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.1.4) upon using the CH Bay Surge Storage and provide justification for its use.

CH TRU Mixed Waste

The Contact-Handled Packages used to transport TRU mixed waste containers will be received through one of three air-lock entries to the CH Bay of the WHB Unit. The WHB heating, ventilation and air conditioning (**HVAC**) system maintains the interior of the WHB at a pressure lower than the ambient atmosphere to ensure that air flows into the WHB, preventing the inadvertent release of any hazardous or radioactive constituents contamination as the result of a contamination event. The doors at each end of the air lock are interlocked to prevent both from opening simultaneously and equalizing CH Bay pressure with outside atmospheric pressure.

- TRUPACT-II and HalfPACT Management

  The CH Bay houses two TRUPACT-II Docks (**TRUDOCKs**), each equipped with overhead cranes for opening and unloading Contact-Handled Packages. The TRUDOCKs are within the TRUDOCK Storage Area of the WHB Unit. The cranes are rated to lift the Contact-Handled Packaging lids as well as their contents. The cranes are designed to remain on their tracks and hold their load even in the event of a design-basis earthquake.

  Upon receipt and removal of CH TRU mixed waste containers from the Contact-Handled Packaging, the waste containers are required to be in good condition as provided in Permit Part 3. The waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are good condition prior to storage. Waste containers will also

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be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the Contact-Handled Package to a third party contractor. Decontamination activities will not be conducted on containers which are not in good condition, or which are leaking. If local decontamination activities are opted for, the work will be conducted in the WHB Unit on the TRUDOCK. These processes are described in Section A1-1d.

Once unloaded from the Contact-Handled Packaging, CH TRU mixed waste containers (7-packs, 3-packs, 4-packs, SWBs, or TDOPs) are placed in one of two positions on the facility pallet or on a containment pallet. The waste containers are stacked, on the facility pallets (one- or two-high, depending on weight considerations). Waste on containment pallets will be stacked one-high. The use of facility or containment pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage.

In addition, four Contact-Handled Packages, containing up to eight 7-packs, 3-packs, 4-packs, SWBs, or four TDOPs, may occupy positions at the TRUDOCKs. If waste containers are left in this area, they will be in the Contact-Handled Package with or without the shipping container lids removed. The maximum volume of waste in containers in four Contact-Handled Packages is 640 ft^3 (18.1 m^3).

- TRUPACT-III Management

The TRUPACT-III containing one SLB2 will be transferred to a Yard Transfer Vehicle in the Parking Area Unit using a forklift. The Yard Transfer Vehicle then transports the TRUPACT-III into the CH Bay through one of the airlocks and into Room 108 for unloading (Figure A1-1b). The TRUPACT-III is first transported to the bolting station where the overpack cover and closure lid are removed using a bolting robot, or manually as required, and a monorail hoist The TRUPACT-III is then moved to the payload transfer station where the SLB2 is removed from the TRUPACT-III.

The SLB2 will be visually inspected for physical damage in a similar manner as containers removed from a TRUPACT-II or HalfPACT (i.e., severe rusting, apparent structural defects, or signs of pressurization) and for leakage to ensure it is in good condition. The SLB2 will also be checked for external surface contamination. If the SLB2 is not in good condition, the Permittees will repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the SLB2 to a third-party contractor. If local decontamination activities are opted for, the work will be conducted in the WHB Unit.

Once the SLB2 is unloaded from the TRUPACT-III in Room 108, it will be placed on a facility pallet and moved to a pallet stand or floor storage location in the CH Bay for storage or to the conveyance loading room for waste emplacement.

The CH Bay Storage Area, which is shown in Figure A1-1, will be clearly marked to indicate the lateral limits of the storage area. This CH Bay Storage Area will have a maximum capacity of 13 pallets (4,160 ft^3 [118 m^3]) of TRU mixed waste containers during normal operations.

The Derived Waste Storage Area of the WHB Unit is on the north wall of the CH Bay. This area will contain containers up to the volume of a SWB for collecting derived waste from all TRU mixed waste handling processes in the WHB Unit. The Derived Waste Storage Area is being permitted to allow containers in size up to a SWB to be used to accumulate derived waste. The volume of TRU mixed waste stored in this area will be up to 66.3 ft^3 (1.88 m^3). The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which are polyethylene trays with a grated deck, which will elevate the derived waste containers approximately 6 in. (15 cm) from the floor surface, and provide approximately 50 gal (190 L) of secondary containment capacity.

Aisle space shall be maintained in all WHB Unit TRU mixed waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire-fighting personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space of 44 in. (1.1 m) between facility pallets will be maintained in all WHB Unit TRU mixed waste storage areas. An aisle space of 60 in. (1.5 m) will be maintained between the west wall of the CH Bay and facility pallets.

The WHB has been designed to meet DOE design and associated quality assurance requirements. Table A1-1 summarizes basic design requirements, principal codes, and standards for the WIPP facility. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997a) provided engineering design-basis earthquake and tornado reports. The design-basis earthquake report provides the basis for seismic design of WIPP facility structures, including the WHB foundation. The WIPP design-basis earthquake is 0.1 g. The WIPP design-basis tornado includes a maximum windspeed of 183 mi per hr (mi/hr) (294.5 km/hr), which is the vector sum of all velocity components. It is also limited to a translational velocity of 41 mi/hr (66 km/hr) and a tangential velocity of 124 mi/hr (200 km/hr). Other parameters are a radius of maximum wind of 325 ft (99 m), a pressure drop of 0.5 lb per $in.^2$ (3.4 kilopascals [kPa]), and a rate-of-pressure drop of 0.09 $lb/in.^2/s$ (0.6 kPa/s). A design-basis flood report is not available because flooding is not a credible phenomenon at the WIPP facility. Design calculations for the probable maximum precipitation (**PMP**) event, provided in Appendix D7 of the WIPP RCRA Part B Permit Application (DOE, 1997a), illustrated run-on protection for the WIPP facility.

The WIPP facility does not lie within a 100-year floodplain. There are no major surface-water bodies within 5 mi (8 km) of the site, and the nearest river, the Pecos River, is approximately 12 mi (19 km) away. The general ground elevation in the vicinity of the surface facilities (approximately 3,400 ft [1,036 m] above mean sea level) is about 500 ft (152 m) above the riverbed and 400 ft (122 m) above the 100-year floodplain. Protection from flooding or ponding caused by PMP events is provided by the diversion of water away from the WIPP facility by a system of peripheral interceptor berms and dikes. Additionally, grade elevations of roads and surface facilities are designed so that storm water will not collect within the Property Protection Area under the most severe conditions.

The following are the major pieces of equipment that will be used to manage CH TRU mixed waste in the container storage units. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A1-2.

TRUPACT-II Type B Packaging

The TRUPACT-II (Figure A1-8a) is a double-contained cylindrical shipping container 8 ft (2.4 m) in diameter and 10 ft (3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,265 lbs (3,300 kg) gross weight in up to fourteen 55-gal (208-L) drums, eight 85-gal (322-L) drums, six 100-gal (379-L) drums, two SWBs, or one TDOP.

HalfPACT Type B Packaging

The HalfPACT (Figure A1-8b) is a double-contained right cylindrical shipping container 7.8 ft (2.4 m) in diameter and 7.6 ft (2.3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,600 lbs (3,500 kg) gross weight in up to seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums.

TRUPACT-III Type B Packaging

The TRUPACT-III (Figure A1-33) is an NRC-certified Type B package designed to meet the containment and shielding requirements of 10 CFR Part 71. The nominal dimensions for a TRUPACT-III are 14 feet 1 inch long, 8 feet 2 inches wide and 8 feet 8 inches high. The TRUPACT-III is specifically certified to safely transport TRU wastes packaged in an SLB2.

This package, unlike the TRUPACT-II or HalfPACT, is horizontally loaded and will be unloaded horizontally as well.

The TRUPACT-III has a bolted overpack cover that is secured to the TRUPACT-III container.

The maximum weight of a TRUPACT-III is 55,116 lbs (25,000 kg) when loaded with the maximum allowable contents of 11,486 lbs (5,210 kg).

Unloading Docks

Each TRUDOCK is designed to accommodate up to two Contact-Handled Packages. The TRUDOCK functions as a work platform, providing TRU mixed waste handling personnel easy access to the container during unloading operations (see Figure A1-1a) (Also see Drawing 41-M-001-W in Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997a)).

The payload transfer station serves as the unloading dock for TRUPACT-III and can accommodate a single TRUPACT-III package.

Forklifts

Forklifts may be used to transfer the Contact-Handled Packages into the WHB Unit and may be used to transfer palletized CH TRU mixed waste containers to the facility transfer vehicle. Another forklift will be used for general-purpose transfer operations. This forklift has attachments and adapters to handle individual TRU mixed waste containers, if required.

Cranes, Unloading Devices, and Adjustable Center-of-Gravity Lift Fixtures

At each TRUDOCK, an overhead bridge crane is used with a specially designed lift fixture for disassembly of the Contact-Handled Packages. Separate lifting attachments have been specifically designed to accommodate SWBs and TDOPs. The lift fixture, attached to the crane, has built-in level indicators and two counterweights that can be moved to adjust the center of gravity of unbalanced loads and to keep them level.

The TRUPACT-III is unloaded horizontally in Room 108. The Payload Transfer Station, Yard Transfer Vehicle and Facility Transfer Vehicle, or forklift are used to perform the unloading and movement functions. The Payload Transfer Station includes retractable arms that are used to position the SLB2 onto the Facility Transfer Vehicle and facility pallet.

Facility or Containment Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 4-packs, or 3-packs of drums, SWBs, TDOPs, or an SLB2, and has a rated load of 25,000 lbs. (11,430 kg). The facility pallet will accommodate up to four 7-packs, four 3-packs, or four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or an SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A1-10. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. Facility pallets may also be moved by facility transfer vehicles. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Containment pallets are fabricated units having a containment capacity of at least ten percent of the volume of the containers and designed to support a minimum of either a single drum, a single SWB or a single TDOP. The pallets will have a rated load capacity of equal to or greater than the gross weight limit of the container(s) to be supported on the pallet. Loads are secured to the containment pallet during transport. A typical containment pallet is shown in Figure A1-10a. Fork pockets in the side of the pallet allow the containment pallet to be lifted and transferred by forklift. WIPP facility operational documents define the operational load of the containment pallet to assure that the rated load of a containment pallet is not exceeded.

Facility Transfer Vehicle

The facility transfer vehicle is a battery or electric powered automated vehicle that either operates on tracks or has an on-board guidance system that allows the vehicle to operate on the floor of the WHB. It is designed with a flat bed that has adjustable height capability and may transfer waste payloads on facility pallets or off the facility pallet stands in the CH Bay storage area, and on and off the waste shaft conveyance by raising and lowering the bed (see Figure A1-11).

Yard Transfer Vehicle

The Yard Transfer Vehicle (Figure A1-35) transports the TRUPACT-III shipping container from the PAU into the WHB and into Room 108. The Yard Transfer Vehicle is an electric vehicle with a load capacity of 60,000 pounds.

RH TRU Mixed Waste

The RH TRU mixed waste is handled and stored in the RH Complex of the WHB Unit which comprises the following locations: RH Bay (12,552 ft^2 (1,166 m^2)), the Cask Unloading Room (382 ft^2 (36 m^2)), the Hot Cell (1,841 ft^2 (171 m^2)), the Transfer Cell (1,003 ft^2 (93 m^2)) (Figures A1-17a, b and c), and the Facility Cask Loading Room (1,625 ft^2 (151 m^2)) (Figure A1-17d).

The RH Bay (Figure A1-14a) is a high-bay area for receiving casks and subsequent handling operations. The trailer carrying the RH-TRU 72-B or CNS 10-160B shipping cask (Figures A1-18, A1-19, A1-20 and A1-21) enters the RH Bay through a set of double doors on the east side of the WHB. The RH Bay houses the Cask Transfer Car. The RH Bay is served by the RH Bay Overhead Bridge Crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. The storage occurs after the trailer containing the cask is moved into the RH Bay and prior to moving the cask into the Cask Unloading Room to stage the waste for disposal operations. A maximum of two loaded casks and one 55-gallon drum for derived waste (156 ft^3 (4.4 m^3)) may be stored in the RH Bay.

The Cask Unloading Room (Figure A1-17a) provides for transfer of the RH-TRU 72-B cask to the Transfer Cell, or the transfer of drums from the CNS 10-160B cask to the Hot Cell. Storage in the Cask Unloading Room will occur in the RH-TRU 72-B or CNS 10-160B casks. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one cask (74 ft^3 (2.1 m^3)) may be stored in the Cask Unloading Room.

The Hot Cell (Figure A1-17b) is a concrete shielded room in which drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, staged in the Hot Cell, and loaded into a Facility Canister. The loaded Facility Canister is then lowered from the Hot Cell into the Transfer Cell Shuttle Car containing a Shielded Insert. Storage in the Hot Cell occurs in either drums or Facility Canisters. Drums that are stored are either on the drum carriage unit that was removed from the CNS 10-160B cask or in a Facility Canisters. A maximum of 12 55-gallon drums and one 55-gallon drum for derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell.

The Transfer Cell (Figure A1-17c) houses the Transfer Cell Shuttle Car, which moves the RH-TRU 72-B cask or Shielded Insert into position for transferring the canister to the Facility Cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of a waste handling evolution. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in the Transfer Cell Shuttle Car.

The Facility Cask Loading Room (Figure A1-17d) provides for transfer of a canister to the Facility Cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit (**HWDU**). The Facility Cask Loading Room also functions as an air lock between the Waste Shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask (Figure A1-23) in the Facility Cask Loading Room.

Following is a description of major pieces of equipment that are used to manage RH TRU mixed waste in the WHB Unit. A summary of equipment capacities, as required by 20.4.1.500 NMAC, is included in Table A1-3.

Casks

The RH-TRU 72-B cask (Figure A1-20) is a cylinder designed to meet U.S. Department of Transportation (**DOT**) Type B shipping container requirements. It consists of a separate inner vessel within a stainless steel, lead-shielded outer cask protected by impact limiters at each end, made of stainless steel skins filled with polyurethane foam. The inner vessel is made of stainless steel and provides an internal containment boundary and a cavity for the payload. Neither the outer cask nor the inner vessel is vented. Payload capacity of each RH-TRU 72-B shipping cask is 8,000 lbs (3,628 kg). The payload consists of a canister of RH TRU mixed waste, which may contain up to 31.4 ft^3 (0.89 m^3) of directly loaded waste or waste in smaller containers.

The CNS 10-160B cask (Figure A1-21) is designed to meet DOT Type B container requirements and consists of two carbon steel shells and a lead shield, welded to a carbon steel bottom plate. A 12-gauge stainless steel thermal shield surrounds the cask outer shell, which is equipped with two steel-encased, rigid polyurethane foam impact limiters attached to the top and bottom of the cask. The CNS 10-160B cask is not vented. Payload capacity of each CNS 10-160B cask is 14,500 lbs (6,577 kg). The payload consists of up to ten 55-gallon drums.

Shielded Insert

The Shielded Insert (Figure A1-30) is specifically designed to be used in the Transfer Cell to hold and transport loaded Facility Canisters from the Hot Cell until loaded into the Facility Cask. The Shielded Insert, designed and constructed similar to the RH-TRU 72-B shipping cask, has a 29 in. inside diameter with an inside length of 130.5 in. to accommodate the Facility Canister, which is 28.5 in. in diameter by 117.5 in. long. The Shielded Insert is installed on and removed from the Transfer Cell Shuttle Car in the same manner as the RH-TRU 72-B shipping cask.

CNS 10-160B Drum Carriage

The CNS 10-160B drum carriage (Figure A1-25) is a steel device used to handle drums in the CNS 10-160B cask. The drum carriages are stacked two high in the CNS 10-160B cask during shipment. They are removed from the cask using a below-the-hook lifting device termed a pentapod. The drum carriage is rated to lift up to five drums with a maximum weight of 1000 pounds each.

RH Bay Overhead Bridge Crane

In the RH Bay, an overhead bridge crane is used to lift the cask from the trailer and place it on the Cask Transfer Car. It is also used to remove the impact limiters from the casks and the outer lid of the RH-TRU 72-B cask.

Cask Lifting Yoke

The lifting yoke is a lifting fixture that attaches to the RH Bay Overhead Bridge Crane and is designed to lift and rotate the RH-TRU 72-B cask onto the Cask Transfer Car.

Cask Transfer Cars

The Cask Transfer Cars (Figures A1-22a and A1-22b) are self-propelled, rail-guided vehicles that transport casks between the RH Bay and the Cask Unloading Room.

6.25 Ton Grapple Hoist

A 6.25 Ton Grapple Hoist is used to hoist the canister from the Transfer Cell Shuttle Car into the Facility Cask.

Facility Canister

The Facility Canister is a cylindrical container designed to hold three 55-gallon drums of either RH TRU waste or dunnage (Figure A1-16).

Facility Cask

The Facility Cask body consists of two concentric steel cylinders. The annulus between the cylinders is filled with lead, and gate shield valves are located at either end. Figure A1-23 provides an outline configuration of the Facility Cask. The canister is placed inside the Facility Cask for shielding during canister transfer from the RH Complex to the Underground HWDU for emplacement.

Facility Cask Transfer Car

The Facility Cask Transfer Car (Figure A1-24) is a self-propelled rail car that is used to move the Facility Cask between the Facility Cask Loading Room and the Shaft Station in the underground.

Hot Cell Bridge Crane

The Hot Cell Bridge Crane, outfitted with a rotating block and the Hot Cell Facility Grapple, will be used to lift the CNS 10-160B lid and the drum carriage units from the cask located in the Cask Unloading Room, into the Hot Cell. The Hot Cell Bridge Crane is also used to lift the empty Facility Canisters into place within the Hot Cell, move loaded drums into the Facility Canister, and lower loaded Facility Canisters into the Transfer Cell.

Overhead Powered Manipulator

The Overhead Powered Manipulator is used in the Hot Cell to lift individual drums from the drum carriage unit and lower each drum into the Facility Canister and support miscellaneous Hot Cell operations.

Manipulators

There is a maximum of two operational sets of fixed Manipulators in the Hot Cell. The Manipulators collect swipes of drums as they are being lifted from the drum carriage unit and transfer the swipes to the Shielded Material Transfer Drawer and support Hot Cell operations.

Shielded Material Transfer Drawer

The Shielded Material Transfer Drawer is used to transfer swipe samples obtained by the fixed Manipulators to the Hot Cell Gallery for radiological counting and transferring small equipment into and out of the Hot Cell.

Closed-Circuit Television Cameras

The Closed-Circuit Television Camera system is used to monitor operations throughout the Hot Cell and Transfer Cell. These cameras are used to perform inspections of waste containers and waste management areas. This camera system is operated from the shielded room in the Facility Cask Loading Room and Hot Cell Gallery. The camera system has a video recording capability as an operational aid.

Transfer Cell Shuttle Car

The Transfer Cell Shuttle Car (Figure A1-31) positions the loaded RH-TRU 72-B cask and Shielded Insert within the Transfer Cell.

Cask Unloading Room Crane

The Cask Unloading Room Crane lifts and suspends the RH-TRU 72-B cask or Shielded Insert from the Transfer Car and lowers the cask or Shielded Insert into the Transfer Cell Shuttle Car.

Facility Cask Rotating Device

The Facility Cask Rotating Device, a floor mounted hydraulically operated structure, is designed to rotate the Facility Cask from the horizontal position to the vertical position for waste canister loading and then back to the horizontal position after the waste canister has been loaded into the Facility Cask (Figure A1-32).

A1-1c(2) Parking Area Container Storage Unit (Parking Area Unit)

The parking area south of the WHB (see Figure A1-2) will be used for storage of waste containers within sealed shipping containers awaiting unloading. The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Unit. The Parking Area Unit provides storage space for up to 6,734 ft^3 (191 m^3) of TRU mixed waste, contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing liquid are provided by the Contact-Handled or Remote-Handled Packaging. Wastes placed in the Parking Area Unit will remain sealed in their Contact-Handled or Remote-Handled Packages, at all times while in this area.

The Nuclear Regulatory Commission (**NRC**) Certificate of Compliance requires that sealed Contact-Handled or Remote-Handled Packages which contain waste be vented every 60 days to avoid unacceptable levels of internal pressure. During normal operations the maximum residence time of any one container in the Parking Area Unit is typically five days. Therefore, during normal waste handling operations, no Contact-Handled or Remote-Handled Packages will require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be handled in accordance with Section A1-1e(2) of this Permit Attachment. Under no circumstances shall a Contact-Handled or Remote-Handled Package be stored in the Parking Area Unit for more than fifty-nine (59) days after the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was sealed at the generator site.

Parking Area Surge Storage

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the Parking Area. The Permittees may use the Parking Area Surge Storage as specified in Part 3 (see Figure A1-2) only when the maximum capacity in the Parking Area is reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because the Parking Area is full (not applicable to RH TRU waste shipments); or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.2.4) upon using the Parking Area Surge Storage and provide justification for its use.

A1-1d Container Management Practices

20.4.1.500 NMAC (incorporating 40 CFR §264.173) requires that containers be managed in a manner that does not result in spills or leaks. Containers are required to be closed at all times, unless waste is being placed in the container or removed. Because containers at the WIPP will contain radioactive waste, safety concerns require that containers be continuously vented to obviate the buildup of gases within the container. These gases could result from radiolysis, which is the breakdown of moisture by radiation. The vents, which are nominally 0.75 in. (1.9 centimeters [cm]) in diameter, are generally installed on or near the lids of the containers. These vents are filtered so that gas can escape while particulates are retained.

TRU mixed waste containers, containing off-site waste, are never opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Off-normal events could interrupt normal operations in the waste management process line. These off normal events fall into the following categories:

- Waste management system equipment malfunctions
- Waste shipments with unacceptable levels of surface contamination
- Hazardous Waste Manifest discrepancies that are not immediately resolved
- A suspension of emplacement activities for regulatory reasons

Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

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Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

A1-1d(1) Derived Waste

The WIPP facility operational philosophy is to introduce no new hazardous chemical components into TRU mixed waste or TRU mixed waste residues that could be present in the controlled area. This will be accomplished principally through written procedures and the use of Safe Work Permits (**SWP**)[1] and Radiological Work Permits (**RWP**)[2] which govern the activities within a controlled area involving TRU mixed waste. The purpose of this operating philosophy is to avoid generating TRU mixed waste that is compositionally different than the TRU mixed waste shipped to the WIPP facility for disposal.

Some additional TRU mixed waste, such as used personal protective equipment, swipes, and tools, may result from decontamination operations and off-normal events. Such waste will be assumed to be contaminated with RCRA-regulated hazardous constituents in the TRU mixed waste containers from which it was derived. Derived waste may be generated as the result of decontamination activities during the waste handling process. Should decontamination activities be performed, water and a cleaning agent such as those listed in Permit Attachment D will be used. Derived waste will be considered acceptable for management at the WIPP facility, because any TRU mixed waste shipped to the facility will have already been determined to be acceptable and because no new constituents will be added. Data on the derived waste will be entered into the WWIS database. Derived waste will be contained in standard DOT approved Type A containers.

The Safety Analysis Report (DOE 1997b) for packaging requires the lids of TRU mixed waste containers to be vented through high efficiency particulate air (**HEPA**)-grade filters to preclude container pressurization caused by gas generation and to prevent particulate material from escaping. Filtered vents used in CH TRU mixed waste containers (55-gal (208-L) drums, 85-gal (322 L) drums, 100-gal (379-L) drums, TDOPs, and SWBs) have an orifice approximately 0.375-in. (9.53-millimeters) in diameter through which internally generated gas may pass. The filter media can be any material (e.g., composite carbon, sintered metal).

As each derived waste container is filled, it will be closed with a lid containing a HEPA-grade. filter and moved to an Underground Hazardous Waste Disposal Unit (**HWDU**) using the same equipment used for handling TRU mixed waste.

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[1] SWPs are prepared to assure that any hazardous work (not already covered by a procedure) is performed with due precaution. SWPs are issued by the Permittees after a job supervisor completes the proper form detailing the job location, work description, personnel involved, specific hazards involved, and protective requirements. The Permittees review the form, check on the adequacy of the protective measures, and if sufficient, approve the work permit. Conditions of the SWPs must be met while any hazardous work is proceeding. Examples of activities covered by the SWP program include confined space entry, overhead work, and work on energized equipment.

[2] RWPs are used to control entry into and performance of work within a controlled area (**CA**). Managers responsible for work within a CA must generate a work permit that specifies the work scope, limiting conditions, dosimetry, respiratory protection, protective clothing, specific worker qualifications, and radiation safety technician support. RWPs are approved by the Permittees after thorough review. No work can proceed in a CA without a valid RWP.

A1-1d(2) CH TRU Mixed Waste Handling

CH TRU mixed waste containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers (e.g., TRUPACT-IIs, HalfPACTs, or TRUPACT-IIIs) (see Figure A1-12), at which time they will undergo security and radiological checks and shipping documentation reviews. A forklift will remove the Contact-Handled Packages which will be transported by forklift or Yard Transfer Vehicle through an air lock that is designed to maintain differential pressure in the WHB. The forklift will place the shipping containers at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit or the Yard Transfer Vehicle will locate the TRUPACT-III at the bolting station in Room 108. An external survey of the Contact-Handled Package inner vessel (Figure A1-8a and A1-8b) will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the Vent Hood System (**VHS**), and the contents will be surveyed during and after this process is complete. The VHS[3] is attached to the Contact-Handled Package to provide atmospheric control and confinement of headspace gases at their source. It also prevents potential personnel exposure and facility contamination due to the spread of radiologically contaminated airborne dust particles and minimizes personnel exposure to VOCs.

Contamination surveys at the WIPP facility are based in part on radiological surveys used to indicate potential releases of hazardous constituents from containers by virtue of detection of radioactive contamination (see Permit Attachment G3). Radiological surveys may be applicable to most hazardous constituent releases except the release of gaseous VOCs from TRU mixed waste containers. Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of nongaseous hazardous constituents through the use of surface sampling (swipes) and radioactivity counting. Radiological surveys are used in addition to the more conventional techniques such as visual inspection to identify spills.

Under normal operations, it is not expected that the waste containers will be externally contaminated or that removable surface contamination on the shipping package or the waste containers will be in excess of the DOE's free release limits (i.e.; < 20 disintegrations per minute (**dpm**)[4] per 100 cm^2 alpha or < 200 dpm per 100 cm^2 beta/gamma). In such a case, no further decontamination action is needed. The shipping package and waste container will be handled through the normal process. However, should the magnitude of contamination exceed the free release limits, yet still fall within the criteria for small area "spot" decontamination (i.e., less than or equal to 100 times the free release limit and less than or equal to 6 ft^2 [0.56 m^2]), the shipping package or the waste container will be decontaminated. Decontamination activities will not be

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[3] The TRU mixed waste container headspace may contain radiologically contaminated airborne dust particles.
1. Without the VHS, a potential mechanism will exist to spread contamination (if present) in the immediate CH TRU mixed waste handling area, because lid removal will immediately expose headspace gases to prevailing air currents induced by the building ventilation system.
2. With the VHS, a confined and controlled set of prevailing air currents will be induced by the system blower. The VHS will function as a local exhaust system to effectively control radiologically contaminated airborne dust particles (and VOCs) at essentially atmospheric pressure conditions.
   Functionally, the VHS will draw the TRU mixed waste container headspace gases, convey them through a HEPA filter, and ultimately duct them through the WHB exhaust ventilation system. VOCs will pass through the HEPA filter and will be conveyed to the ventilation exhaust duct system. The system principally consists of a functional aggregation of 1) vent hood assembly, 2) HEPA filter assemblies (to capture any airborne radioactive particles), 3) blower (to provide forced airflow), 4) ductwork, and 5) flexible hose.

[4] The unit "dpm" stands for "disintegration per minute" and is the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

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conducted on containers which are not in good condition, or containers which are leaking. Containers which are not in good condition, and containers which are leaking, will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. In addition, if during the waste handling process at the WIPP a waste container is breached, it will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. Should WIPP structures or equipment become contaminated, waste handling operations in the affected area will be immediately suspended.

Decontamination activities will use water and cleaning agents (see Permit Attachment D) so as to not generate any waste that cannot be considered derived waste. Items that are radiologically contaminated are also assumed to be contaminated with the hazardous wastes that are in the container involved in the spill or release. A complete listing of these waste components can be obtained from the WIPP Waste Information System (**WWIS**), as described in Permit Attachment C, for the purpose of characterizing derived waste.

It is assumed that the process of decontamination will remove the hazardous waste constituents along with the radioactive waste constituents. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" will be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses becomes documentation of the condition of the container at the time of emplacement. The presence of hazardous waste constituents on a container after decontamination will be at trace levels and will likely not be visible and will not pose a threat to human health or the environment. These containers will be placed in the underground without further action once the radiological contamination is removed unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed which incorporates the guidance of EPA's SW 846 in selecting random samples over large areas. Selection of constituents for sampling analysis will be based on information (in the WWIS) about the waste that was spilled and information on cleanup procedures. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether further cleaning will be beneficial or whether final clean up shall be deferred until closure. For example, if hazardous constituents react with the floor coating and are essentially nonremovable without removing the coating, then clean up will be deferred until closure when the coatings will be stripped. In any case, appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore, measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

Small area decontamination, if needed, will occur in the area in which it is detected for contamination that is less than 6 ft^2 (0.56 m^2) in area and is less than 100 times the free release limit. The free release limit is defined by DOE Orders as alpha contamination less than 20 dpm/100 cm^2 and beta-gamma contamination less than 200 dpm/100 cm^2. Overpacking would occur in the event the WIPP staff damages an otherwise intact container during handling

activities. In such a case, a radiological boundary will be established, inside which all activities are carefully controlled in accordance with the protocols for the cleanup of spills or releases. A plan of recovery will be developed and executed, including overpacking or repairing the damaged container. The overpacked or repaired container will be properly labeled and sent underground for disposal. The area will then be decontaminated and verified to be free of contamination using both radiological and hazardous waste sampling techniques (essentially, this is done with "swipes" of the surface for counting in sensitive radiation detection equipment or, if no radioactivity is present, by analysis for hazardous waste by an offsite laboratory).

In the event a large area contamination is discovered within a Contact-Handled Package during unloading, the waste will be left in the Contact-Handled Package and the shipping container will be resealed. The DOE considers such contamination problems the responsibility of the shipping site. Therefore, the shipper will have several options for disposition. These are as follows:

- The Contact-Handled Package can be returned to the shipper for decontamination and repackaging of the waste. Such waste would have to be re-approved prior to shipment to the WIPP.
- Shipment to another DOE site for management in the event the original shipper does not have suitable facilities for decontamination. If the repairing site wishes to return the waste to WIPP, the site will have to meet the characterization requirements of the WAP.
- The waste could go to a third (non-DOE) party for decontamination. In such cases, the repaired shipment would go to the original shipper and be recertified prior to shipment to the WIPP.

Written procedures specify materials, protocols, and steps needed to put an object into a safe configuration for decontamination of surfaces. A RWP will always be prepared prior to decontamination activities. TRU mixed waste products from decontamination will be managed as derived waste.[5]

The TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. A HalfPACT may hold seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. An overhead bridge crane or Facility Transfer Vehicle will be used to remove the contents of the Contact-Handled Package and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

[5] Note that the DOE had previously proposed use of an Overpack and Repair Room to deal with major decontamination and overpacking activities. The DOE has eliminated the need for this area by: 1) limiting the size of contamination events that will be dealt with as described in this section, and 2) by performing overpacking at the point where a need for overpacking is identified instead of moving the waste to another area of the WHB. This strategy minimizes the spread of contamination.

For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved with the generator before TRU mixed waste is emplaced. Discrepancies that are not resolved within 15 days will be reported to the NMED in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Each facility pallet has two recessed pockets to accommodate two sets of 7-packs (see Figure A1-10), two sets of 4-packs, two sets of 3-packs, or two SWBs stacked two-high, two TDOPs, or any combination thereof. Each facility pallet will accommodate one SLB2. Each stack of waste containers will be secured prior to transport underground. A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room located adjacent to the Waste Shaft. The conveyance loading room serves as an air lock between the CH Bay and the Waste Shaft, preventing excessive air flow between the two areas. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379-L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the Underground HWDUs. Figure A1-13 is a flow diagram of the CH TRU mixed waste handling process.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

Following cask inspections, the shipping cask and trailer are moved into the RH Bay or held in the Parking Area Unit. The waste handling process begins in the RH Bay where the impact limiter(s) are removed from the shipping cask while it is on the trailer. Additional radiological surveys are conducted on the end of the cask previously protected by the impact limiter(s) to verify the absence of contamination. The cask is unloaded from the trailer using the RH Bay Overhead Bridge Crane and placed on a Cask Transfer Car.

Differential air pressure between the RH TRU mixed waste handling locations in the RH Complex protects workers and prevents potential spread of contamination during handling of RH TRU mixed waste. Airflow between key rooms in the WHB is controlled by maintaining differential pressures between the rooms. The CH Receiving Bay is maintained with a negative pressure relative to outside atmosphere. The RH Receiving Bay is maintained with a requirement to be positive pressure relative to the CH Receiving Bay. The RH Hot Cell is

maintained with a negative differential pressure relative to the RH Receiving Bay. The Hot Cell ventilation is exhausted through high-efficiency particulate air filters prior to venting through the WHB filtered exhaust.

RH-TRU 72-B Cask Unloading

The Cask Transfer Car then moves the RH-TRU 72-B cask to a work stand in the RH Bay. The work stand allows access to the head area of the RH-TRU 72-B cask for conducting radiological surveys, performing physical inspections or minor maintenance, and decontamination, if necessary. The outer lid bolts on the RH-TRU 72-B cask are removed, and the outer lid is removed to provide access to the lid of the cask inner containment vessel. The RH-TRU 72-B cask is moved into the Cask Unloading Room by a Cask Transfer Car and is positioned under the Cask Unloading Room Bridge Crane. The Cask Unloading Room Bridge Crane attaches to the RH-TRU 72-B cask and lifts and suspends the RH-TRU 72-B cask to clear the Cask Transfer Car. The RH-TRU 72-B cask is aligned over the Cask Unloading Room port.

The Cask Unloading Room shield valve is opened, and the cask is lowered through the port into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. After the cask is lowered into the Transfer Cell Shuttle Car, the bolts on the lid of the cask inner containment vessel are loosened by a robotic Manipulator. The Transfer Cell Shuttle Car is then aligned directly under the Transfer Cell shield valve in preparation for removing the inner vessel lid and transferring the canister to the Facility Cask. Operations in the Transfer Cell are monitored by closed-circuit video cameras.

Using the remotely-operated fixed 6.25 Ton Grapple Hoist in the Facility Cask Loading Room, the inner vessel lid is lifted clear of the RH-TRU 72-B cask, and the robotic Manipulator takes swipe samples and places them in a swipe delivery system for counting outside the Transfer Cell. If found to be contaminated above acceptable levels, the Permittees have the option to decontaminate or return the RH TRU Canister to the generator/storage site or another site for remediation. If no contamination is found, the Transfer Cell Shuttle Car moves a short distance, and the inner vessel lid is lowered onto a stand on the Transfer Cell Shuttle Car. The canister is transferred to the Facility Cask as described below.

CNS 10-160B Cask Unloading

After the lid bolts are removed, the CNS 10-160B cask is moved using the Cask Transfer Car from the RH Bay into the Cask Unloading Room and centered beneath the Hot Cell shield plug port. The Cask Unloading Room shield door is closed, and the inner and outer Hot Cell shield plugs are removed simultaneously and set aside on the floor of the Hot Cell using the remotely operated Hot Cell Bridge Crane. The Hot Cell Bridge Crane is then lowered through the Hot Cell port and is connected to the CNS 10-160B cask lid rigging or lifting device. The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid through the Hot Cell port and sets the lid aside on the Hot Cell floor.

Operations in the Hot Cell are monitored by closed-circuit television cameras. The drum carriage unit lifting fixture (hereafter referred to as lifting fixture) is attached to the Hot Cell Bridge Crane and lowered through the Hot Cell port. The lifting fixture is connected to the upper drum carriage unit contained in the CNS 10-160B cask. The Hot Cell Bridge Crane lifts the upper drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets

it near the Hot Cell inspection station. The Hot Cell Bridge Crane again lowers the lifting fixture through the Hot Cell port and connects to the lower drum carriage unit. The Hot Cell Bridge Crane lifts the lower drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets it near the upper drum carriage unit.

The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid from the Hot Cell floor, lowers it through the Hot Cell port and onto the top of the CNS 10-160B cask. The inner and outer Hot Cell shield plugs are replaced simultaneously. The Cask Unloading Room shield door is opened, and the CNS 10-160B cask is moved into the RH Bay using the Cask Transfer Car. The CNS 10-160B cask is inspected and surveyed, the lid and impact limiter are reinstalled on the CNS 10-160B cask, and it is prepared for transportation off-site.

The Hot Cell Bridge Crane connects to an empty Facility Canister, places it into a sleeve at the inspection station, and removes the canister lid. The Overhead Powered Manipulator or Hot Cell Crane lifts one drum from the drum carriage unit. The Hot Cell Manipulators collect swipe samples from the drum and transfer the swipes via the Transfer Drawer to the Hot Cell Gallery for counting. If the 55-gallon drums are contaminated, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. The drum identification number is recorded, and the recorded numbers are verified against the WWIS. If there are any discrepancies, the drum(s) in question are stored within the Hot Cell, and the generator/storage site is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Either the Overhead Powered Manipulator or Hot Cell Bridge Crane lowers the drum into the Facility Canister. This process is repeated to place three drums in the Facility Canister. The Hot Cell Bridge Crane or powered Manipulator lifts the canister lid and places it onto the Facility Canister. The lid is locked in place using a Manipulator. Each CNS 10-160B cask shipment will contain up to ten drums. Drums will be managed in sets of three. If there is a tenth drum, it will be placed in a Facility Canister or stored until WIPP receipt of the next CNS 10-160B cask shipment. The Hot Cell Bridge Crane lifts the Facility Canister and lowers it into the Transfer Cell.

To prepare to transfer a loaded Facility Canister from the Hot Cell to the Transfer Cell, a Shielded Insert is placed onto a Cask Transfer Car in the RH Bay. The Cask Transfer Car is then moved into the Cask Unloading Room and positioned under the Cask Unloading Room Bridge Crane. The Bridge Crane attaches to the Shielded Insert. The Cask Unloading Room Bridge Crane lifts and suspends the Shielded Insert clear of the Cask Transfer Car. The Shielded Insert is aligned over the Cask Unloading Room port. The floor valve is opened, and the Shielded Insert is lowered into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. The Shielded Insert is positioned under the Hot Cell port.

The Hot Cell Bridge Crane lifts a loaded, closed Facility Canister and positions it over the Hot Cell port. The Hot Cell shield valve is opened, and the crane lowers the Facility Canister through the port into the Shielded Insert positioned in the Transfer Cell Shuttle Car in the Transfer Cell. The Hot Cell Bridge Crane is disconnected from the Facility Canister and raised until the crane hook clears the Hot Cell shield valve. The Hot Cell shield valve is then closed.

Transfer of Disposal Canister into the Facility Cask

The transfer of a canister into the Facility Cask from the Transfer Cell is monitored by closed-circuit television cameras. The Transfer Cell Shuttle Car positions the RH-TRU 72-B cask or Shielded Insert under the Facility Cask Loading Room port and the shield valve is opened. Then the remotely operated 6.25 Ton Grapple Hoist attaches to the canister, and the canister is lifted through the open shield valve into the vertically-oriented Facility Cask located on the Cask Transfer Car in the Facility Cask Loading Room. During this cask-to-cask transfer, the telescoping port shield is in contact with the underside of the Facility Cask to assure shielding continuity, as does the shield bell located above the Facility Cask.

For canisters received at the WIPP from the generator site in a RH-TRU 72-B cask, the identification number is verified using cameras, which also provide images of the canister surfaces during the lifting operation. Identification numbers are verified against the WWIS. If there are any discrepancies, the canister is returned to the RH-TRU 72-B cask, returned to the Parking Area Unit, and the generator is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72). As the canister is being lifted from the RH-TRU 72-B cask into the Facility Cask, additional swipe samples may be taken.

Transfer of the Canister to the Underground

When the canister is fully within the Facility Cask, the lower shield valve is closed. The 6.25 Ton Grapple Hoist detaches from the canister and is raised until the 6.25 Ton Grapple Hoist clears the Facility Cask, at which time the upper shield valve is closed. The 6.25 Ton Grapple Hoist and shield bell are then raised clear of the Facility Cask, and the telescoping port shield is retracted. The Facility Cask Rotating Device rotates the Facility Cask until it is in the horizontal position on the Facility Cask Transfer Car. The shield doors on the Facility Cask Loading Room are opened, and the facility Cask Transfer Car moves onto the waste shaft conveyance and is lowered to the waste Shaft Station underground. At the waste Shaft Station underground, the Facility Cask Transfer Car moves the Facility Cask from the waste shaft conveyance. A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU.

Returning the Empty Cask

The empty RH-TRU 72-B cask or Shielded Insert is returned to the RH Bay by reversing the process. In the RH Bay, swipe samples are collected from inside the empty cask. If necessary, the inside of the cask is decontaminated. The RH-TRU 72-B cask lids are replaced, and the cask is replaced on the trailer using the RH Bay Bridge Crane. The impact limiters are replaced, and the trailer and the RH-TRU 72-B cask are then moved out of the RH Bay. The Shielded Insert is stored in the RH Bay until needed.

A1-1d(4) Handling Waste in Shielded Containers

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Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with

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the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

A1-1e Inspections

Inspection of containers and container storage area are required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174). These inspections are described in this section.

A1-1e(1) WHB Unit

The waste containers in storage will be inspected visually or by closed-circuit television camera prior to each movement and, at a minimum, weekly, to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. Waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. This visual inspection of CH TRU mixed waste containers shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If waste handling operations should stop for any reason with containers located at the TRUDOCK while still in the Contact-Handled Package, primary waste container inspections will not be accomplished until the containers of waste are removed from the Contact-Handled Package. If the lid to the Contact-Handled Package inner container vessel is removed, radiological checks (swipes of Contact-Handled Package inner surfaces) will be used to determine if there is contamination within the Contact-Handled Package. Such contamination could indicate a waste container leak or spill. Using radiological surveys, a

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detected spill or leak of a radioactive contamination from a waste container will also be assumed to be a hazardous waste spill or release.

Waste containers residing within a Contact-Handled Package are not inspected, as described in the first bullet in Section A1-1e(2).

Waste containers will be inspected prior to reentering the waste management process line for downloading to the underground. Waste containers stored in this area will be inspected at least once weekly.

Loaded RH-TRU 72-B and CNS 10-160B casks will be inspected when present in the RH Bay. Physical or closed-circuit television camera inspections of the RH Complex are conducted as described in Table D-1a. Canisters loaded in an RH-TRU 72-B cask are inspected in the Transfer Cell during transfer from the cask to the Facility Cask. Waste containers received in CNS 10-160B casks are inspected in the Hot Cell during transfer from the cask to the Facility Canister by camera and/or visual inspection (through shield windows).

A1-1e(2) Parking Area Unit

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded, stored Contact-Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit (Figure A1-2). Inspections of the Contact-Handled or Remote-Handled Packages stored in the Parking Area Unit will focus on the inventory and integrity of the shipping containers and the spacing between Contact-Handled and Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Contact-Handled and Remote-Handled Packages located in the Parking Area Unit will be inspected weekly during use and prior to each reuse.

Inspection of waste containers is not possible when the containers are in their shipping container (e.g., casks, TRUPACT-II or HalfPACTs). Inspections can be accomplished by bringing the shipping containers into the WHB Unit and opening them and lifting the waste containers out for inspection. The DOE, however, believes that removing containers strictly for the purposes of inspection results in unnecessary worker exposures and subjects the waste to additional handling. The DOE has proposed that waste containers need not be inspected at all until they are ready to be removed from the shipping container for emplacement underground. Because shipping containers are sealed and are of robust design, no harm can come to the waste while in the shipping containers and the waste cannot leak or otherwise be released to the environment. Contact-Handled or Remote-Handled Packages shall be opened every 60 days for the purposes of venting, so that the longest waste would be uninspected would be for 60 days from the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was closed at the generator site. Venting the Contact-Handled or Remote-Handled Packages involves removing the outer lid and installing a tool in the port of the inner lid.

The following strategy will be used for inspecting waste containers that will be retained within their shipping containers for an extended period of time:

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- If the reason for retaining the TRU mixed waste containers in the shipping container is due to an unresolved manifest discrepancy, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period or within 30 days after receipt at the WIPP, whichever comes sooner. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers in the Contact-Handled or Remote-Handled Package is due to an equipment malfunction that prevents unloading the waste in the WHB Unit, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period. In this case, the DOE would have to ship the TRU mixed waste containers back with sufficient time for the generator to vent the shipment within the 60 day limit. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers is due to an equipment malfunction that prevents the timely movement of the waste containers into the underground, the waste containers will be kept in the Contact-Handled or Remote-Handled Package until day 30 (after receipt at the WIPP) or the expiration of the 60 day limit, whichever comes sooner. At that time the Contact-Handled or Remote-Handled Package will be moved into the WHB. Contact-Handled TRU mixed waste containers will be removed and placed in one of the permitted storage areas in the WHB Unit. The Remote-Handled Package will be vented, however, the containers will not be removed from the shipping package. If there is no additional space within the permitted storage areas of the WHB Unit, the DOE will discuss an emergency permit with the NMED for the purposes of storing the waste elsewhere in the WHB Unit. Waste containers will be inspected when removed from the Contact-Handled Packaging and weekly while in storage in the WHB Unit. Contact-Handled or Remote-Handled Packages will be inspected weekly while they contain TRU mixed waste containers as discussed above.

The DOE believes that this strategy minimizes both the amount of shipping that is necessary and the amount of waste handling, while maintaining a reasonable inspection schedule. The DOE will stop shipments of waste for any equipment outage that will extend beyond three days.

A1-1f Containment

The WHB Unit has concrete floors, which are sealed with a coating that is designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor. The floor coating consists of Carboline® 1340 clear primer-sealer on top of prepared concrete, Carboline® 191 primer epoxy, and Carboline® 195 surface epoxy. The manufacturer's chemical resistance guide shows "Very Good" for acids and "Excellent" for alkalies, solvents, salt, and water. Uses are indicated for nuclear power plants, industrial equipment and components, chemical processing plants, and pulp and paper mills for protection of structural steel and concrete. During the Disposal Phase, should the floors need to be re-coated, any floor coating used in the WHB Unit TRU mixed waste handling areas will be compatible with the TRU mixed waste constituents and will have

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chemical resistance at least equivalent to the Carboline® products. Figure A1-1 shows where TRU mixed waste handling activities discussed in this section occur.

During normal operations, the floor of the storage areas within the WHB Unit shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. Floor areas of the WHB Unit in use during off-normal events will be inspected prior to use and weekly thereafter. All TRU mixed waste containers located in the permitted storage areas shall be elevated at least 6 in. (15 cm) from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packaging shall be stored at a designated storage area inside the WHB Unit so as to preclude exposure to the elements.

Secondary containment at the CH Bay Storage Area inside the WHB Unit shall be provided by the WHB Unit floor (See Figure A1-1). The WHB Unit is engineered such that during normal operations, the floor capacity is sufficient to contain liquids upon release. Secondary Containment at the Derived Waste Storage Area of the WHB Unit will be provided by a polyethylene standard drum pallet. The Parking Area Unit and TRUDOCK Storage Area of the WHB Unit require no engineered secondary containment since no waste is to be stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging.

Calculations to determine the floor surface area required to provide secondary containment in the event of a release are based on the maximum quantity of liquid which could be present within ten percent of one percent of the volume of all the containers or one percent of the capacity of the largest single container, whichever is greater.

Secondary containment at storage locations inside the RH Bay and Cask Unloading Room is provided by the cask. Secondary containment at storage locations inside the Transfer Cell is provided by the RH-TRU 72-B cask or Shielded Insert. Secondary containment at storage locations in the Facility Cask Loading Room is provided by the Facility Cask. In the Hot Cell, waste containers are stored in either the drum carriage unit or in canister sleeves. The Lower Hot Cell provides secondary containment as described in section A1-f(2). In addition, the RH Bay, Hot Cell, and Transfer Cell contain 220-gallon (833-L) (Hot Cell), 11,400-gallon (43,152-L) (RH Bay), and 220-gallon (833-L) (Transfer Cell) sumps, respectively, to collect any liquids.

A1-1f(1) Secondary Containment Requirements for the WHB Unit

The maximum volume of TRU mixed waste on facility pallets that will be stored in the CH Bay Storage and Surge Storage Areas of the WHB is 18 facility pallets @ 2 TDOPs per pallet = 36 TDOPs of waste. 36 TDOPs @ 1,200 gal (4,540 L) per TDOP = 43,200 gal (163,440L) waste container capacity. 43,200 gal (163,440 L) x ten percent of the total volume = 4,320 gal (16,344 L) of waste. Since 4,320 gal (16,344 L) is greater than 1,200 gal (4,540 L), the configuration of possible TDOPs in the storage area is used for the calculation of secondary containment requirements. 4,320 gal (16,344 L) of liquid x one percent liquids = 43.2 gal (163.4 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Derived Waste Storage Area of the WHB Unit is one SWB. 1 SWBs @ 496 gal (1,878 L) per SWB = 496 gal (1,878 L) waste container capacity. Since the maximum storage volume of 496 gal (1,878 L) is equal to the volume of the largest single container, the volume of the a single SWB is used for the

calculation of secondary containment requirements. 496 gal (1,878 L) of liquid x one percent liquids = 4.96 gal (18.8 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Hot Cell is 13 RH TRU drums @ 55 gal (210 L) per drum = 715 (2,730 L) of waste in drums. 715 gal (2,730 L) of waste x ten percent of total volume = 71.5 gal (273 L) of waste. Secondary containment for liquids will need to have a capacity of 71.5 gal (273 L). Since 71.5 gal (273 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

The maximum volume of TRU mixed waste that will be stored in the Transfer Cell is one RH-TRU 72-B Canister or one Facility Canister @ 235 gal (890 L) per canister x ten percent of total volume = 23.5 gal (8.90 L) of waste. Since 23.5 gal (8.90 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

A1-1f(2) Secondary Containment Description

The following is a calculation of the surface area the quantities of liquid would cover. Using a conversion factor of 0.1337 ft^3/gal (0.001 m^3/L) and assuming the spill is 0.0033 ft (0.001 m) thick, the following calculation can be used:

gallons × cubic feet per gallon ÷ thickness in feet = area covered in square feet

CH Bay Storage Area

43.2 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 1,750 ft^2 (162.7 m^2)

Hot Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

Transfer Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

The WHB Unit has 33,175 ft^2 (3,082 m^2) of floor space, the CH Bay Storage Area has 26,151 ft^2 (2,430 m^2) of floor space. The CH Bay Storage Area requires 1,750 ft^2 (162.7 m^2) for containment, Thus, the floor area of the CH Bay Storage Area of the WHB Unit provide sufficient secondary containment to contain a release of ten percent of one percent of the volume of all of the containers, or one percent of the capacity of the largest container, whichever is greater.

The Hot Cell and Transfer Cell are the only portions of the RH Complex managing RH TRU mixed waste outside of casks or canisters. The Hot Cell has 1,841 ft^2 (171 m^2) of floor space and the Transfer Cell has 1,003 ft^2 (93 m^2) of floor space. The Hot Cell and Transfer Cell require only 95 ft^2 for containment, therefore there is sufficient floor space to contain a release of ten percent of one percent of containers in these storage areas.

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In addition, both the Hot Cell and the Transfer Cell each contain a 220 gal (833 L) sump that will collect any liquids that spill from containers.

Derived Waste Storage Area

The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which provides approximately 50 gal (190 L) of secondary containment capacity. Thus the secondary containment capacity of the standard drum pallet is sufficient to contain a release of ten percent of one percent of the largest container (4.96 gal or 18.8 L).

Parking Area Unit

Containers of TRU mixed waste to be stored in the Parking Area Unit will be in Contact-Handled or Remote-Handled Packages. There will be no additional requirements for engineered secondary containment systems.

A1-1g Special Requirements for Ignitable, Reactive, and Incompatible Waste

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 264.177). Permit Part 2 precludes ignitable, reactive, or incompatible waste at the WIPP. No additional measures are required.

A1-1h Closure

Clean closure is planned in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.178) for all permitted container storage areas. The applicable areas and the plans for clean closure are detailed in Permit Attachment G.

A1-1i Control of Run On

The WHB Unit is located indoors which prevents run-on from a precipitation event. In addition, the CH TRU containers are stored on facility pallets, containment pallets, or standard drum pallets, which elevate the CH TRU mixed waste containers at least 6 in. (15 cm) off the floor, or in Contact-Handled or Remote-Handled Packages, so that any firewater released in the building will not pool around containers. Within the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room, waste containers are stored in casks or Shielded Inserts and protected from any potential run on. Any firewater released in the building will not pool around the waste containers as they are stored in casks, or Shielded Inserts. Within the Hot Cell, there is no source of water during operations. However, control of run-on is provided by the Lower Hot Cell, which lies below a sloped floor surrounded by a grating and canister sleeves in the Hot Cell above.

In the Parking Area Unit, the containers of TRU mixed waste are always in Contact-Handled or Remote-Handled Packages which protect them from precipitation and run on. Therefore, the WIPP container storage units will comply with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(4)).

References

DOE, 1997a. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Rev. 6.5, 1997.

DOE, 1997b. Waste Isolation Pilot Plant Safety Analysis Report (DOE/WIPP-95-2065, Rev. 1), U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1997.

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TABLES

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Table A1-1
Basic Design Requirements, Principal Codes, and Standards

	Structure/Supports			Liquid and Process Air Handling Processing and storage equipment						Air Hdlg Ducting & Fans	HVAC filters		Mechanical Handling Equipment			Instrumentation and Electrical			Quality Assurance Program	
					Piping & Valves															
	DBE DBT ACI-318 AISC	ANSI A58.1	Site-specific Require-ments	Vessel ASME VIII NFPA[e]	ANSI BBB,1 NFPA[e]	UP	Pumps API-610 NFPA[e]	Storage Tanks API-650 or API-620	Heat Exchgrs ASME VIII TEMA	All Other Equip-ment Mfrs Std	ARI SMACNA AMCA	Pre-filters ASHRAE 52.68	HEPA Filters MIL F 51068C ANSI N 509 ANSI N 510	Crane and Related equipment CMAA	CMAA AISC AWS	All Other Equip-meant Mfrs STD	A-NE	ANSI Sods or Nat'l Elect-trial Code	IA/ Mfrs Std	ANSI/ASME NQA-1 and Supple-ments	Com. and Industry Practices
Design Class I	X		a	X [f]			X	X	X		X [c]	X [c,d]	X [c]	X	X		X	X		X	
Design Class II	a,b	X	a	X	X		X	X	X		X [c]	X [c]	X [c]	X	X			X	X	X	
Design Class IIa	a	X	a	a	X		a			X	X [c]	X [c]	X [c]	a	a	X		X	X	X	
Design Class IIi		X	g		a	X				X	X	X	X			X		X	X		X

X = Minimum Requirements

[a] Requirements to be determined on a case-by-case basis.
[b] Required for structure and supports needed for confinement and control of radioactivity.
[c] Except structures and supports that are designed to withstand a design-basis earthquake (DBE)/design-basis tornado (DBT) when specified in column 1 of this table.
[d] Underwriter's Laboratory (UL) Class I Listed.
[e] For fire-protection systems.
[f] American Society for Mechanical Engineers (ASME) III for other Class I vessels.
[g] Design of underground structures, mining equipment, and facilities are basically governed by the MSHA and experience in local mines.

ACI = American Concrete Institute
AISC = American Institute of Steel Construction
AMCA = Air Moving and Conditioning Association
ANSI = American National Standards Institute
API = American Petroleum Institute
ARI = Air Conditioning and Refrigeration Institute
ASHRAE = American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.
AWS = American Welding Society
CMAA = Crane Manufacturers Association
DBE = Design-basis earthquake
DBT = Design-basis tornado
HEPA = High-efficiency particulate air
HVAC = Heating, Ventilation, and Air-Conditioning
A = Institute of Electronics and Electronic Engineers
IA = Instrument Society of America
MFR = Manufacturer
MIL = Military (specification)
MSHA = Mine Safety and Health Administration
NFPA = National Fire Protection Association
NQA = Nuclear Quality Assurance (Standard)
SMACNA = Sheet Metal and Air Conditioning Contractors National Association, Inc.
STD = Standard
TEMA = Tubular Exchanger Manufacturers Association
UP = Uniform Plumbing Code

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Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

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Table A1-3
RH TRU Mixed Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
RH Bay Overhead Bridge Crane	140 tons main hoist 25 tons auxiliary hoist
RH-TRU 72-B Cask Transfer Car	20 tons
CNS 10-160B Cask Transfer Car	35 tons
Transfer Cell Shuttle Car	29 tons
Hot Cell Bridge Crane	15 tons
Overhead Powered Manipulator	2.5 tons
Facility Cask Rotating Device	No specific load rating
Cask Unloading Room Crane	25 tons
6.25 Ton Grapple Hoist	6.25 tons
Facility Cask Transfer Car	40 tons
MAXIMUM GROSS WEIGHTS OF RH TRU CONTAINERS	
RH TRU Canister	8,000 lbs
55-Gallon Drum	1,000 lbs
Facility Canister	10,000 lbs
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
RH-TRU 72-B Cask	37,000 lbs
CNS 10-160B Cask	57,500 lbs
Facility Cask	67,700 lbs
Shielded Insert	26,300 lbs

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FIGURES

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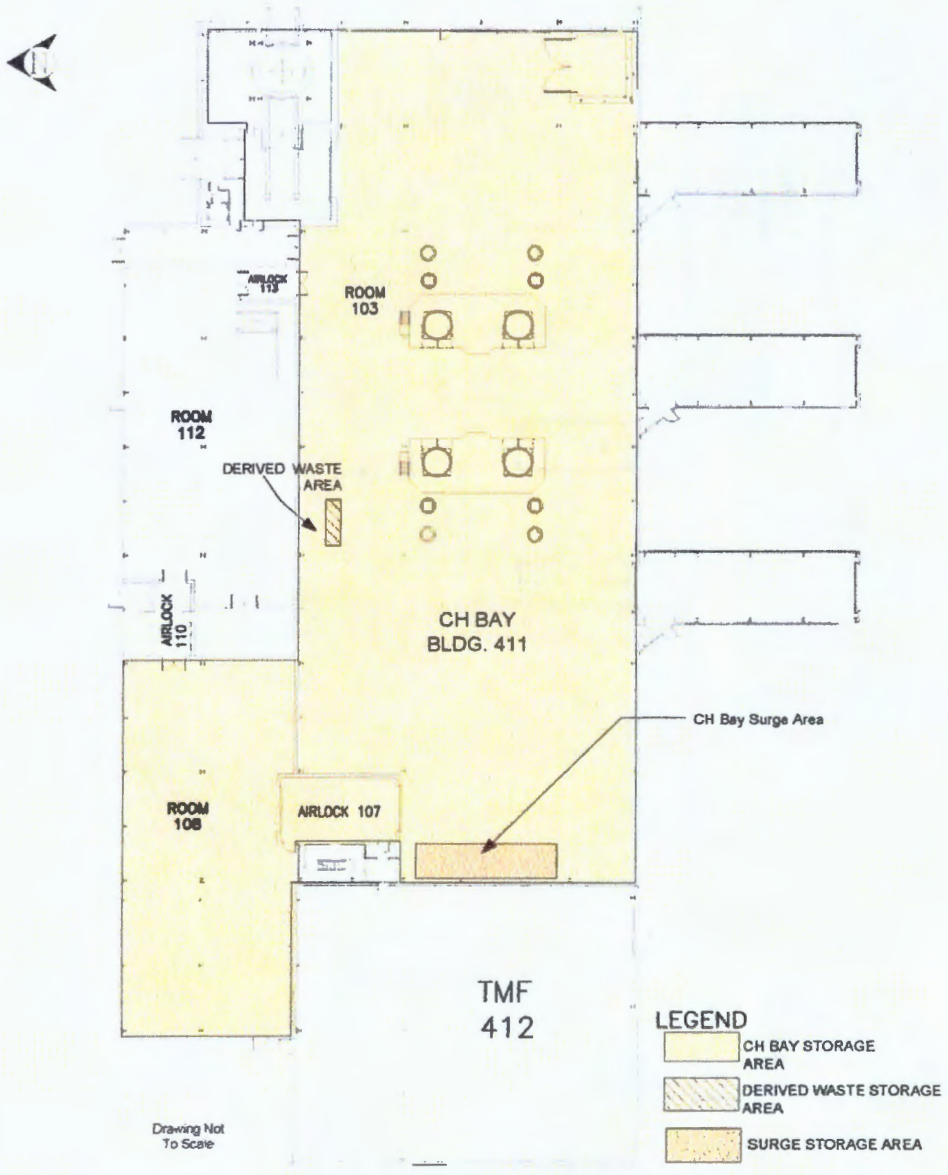


Figure A1-1
Waste Handling Building - CH TRU Mixed Waste Container Storage and Surge Areas

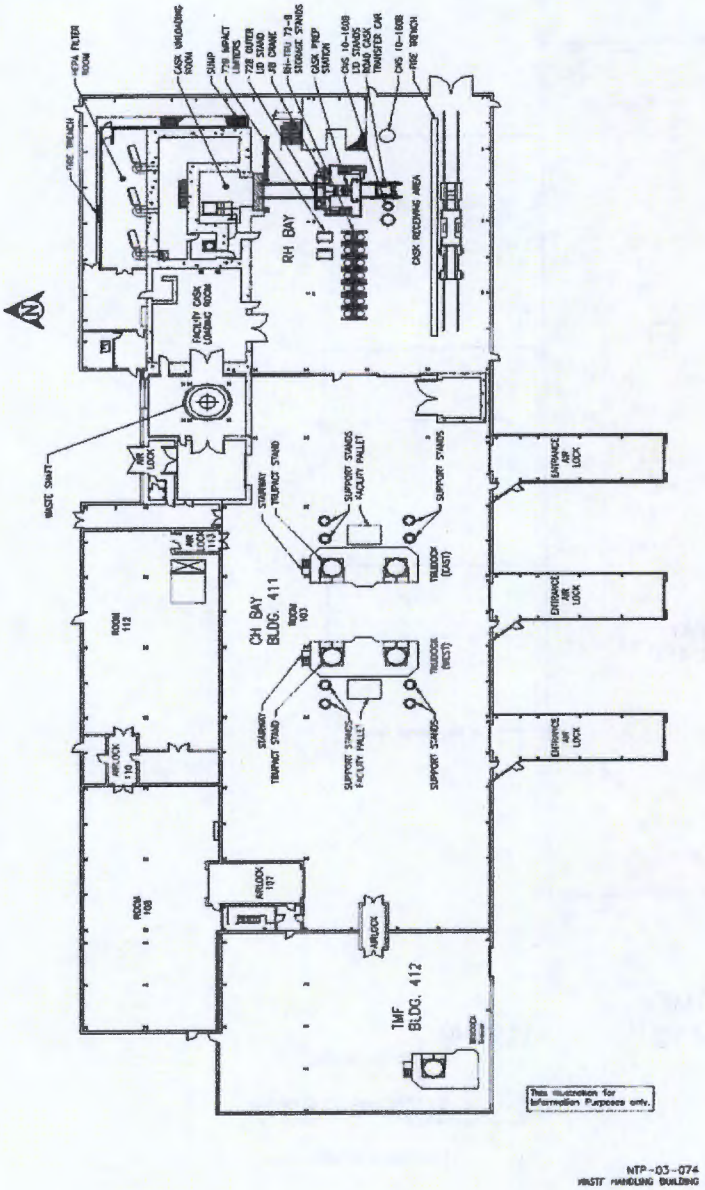


Figure A1-1a
Waste Handling Building Plan (Ground Floor)

02153

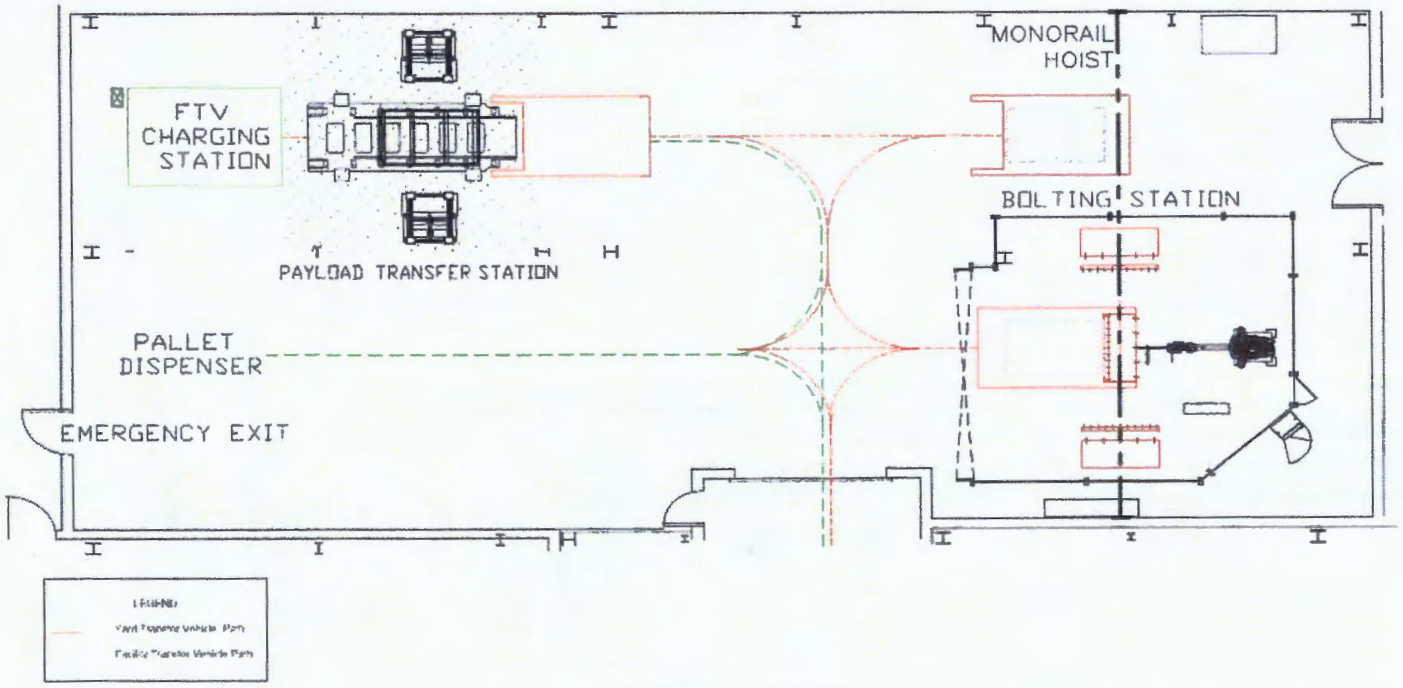


Figure A1-1b
Waste Handling Building Plan (Room 108 Detail)

022514

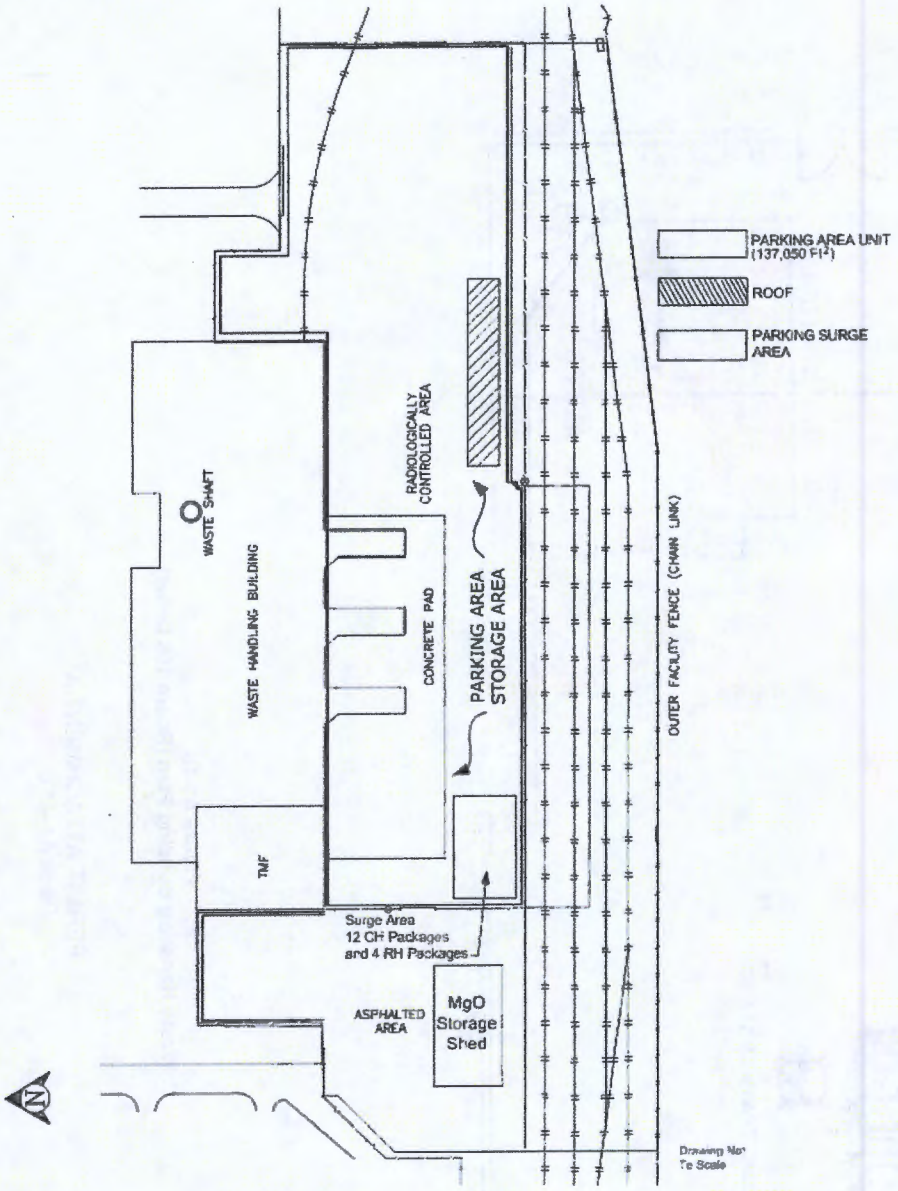


Figure A1-2
Parking Area - Container Storage and Surge Areas

02155

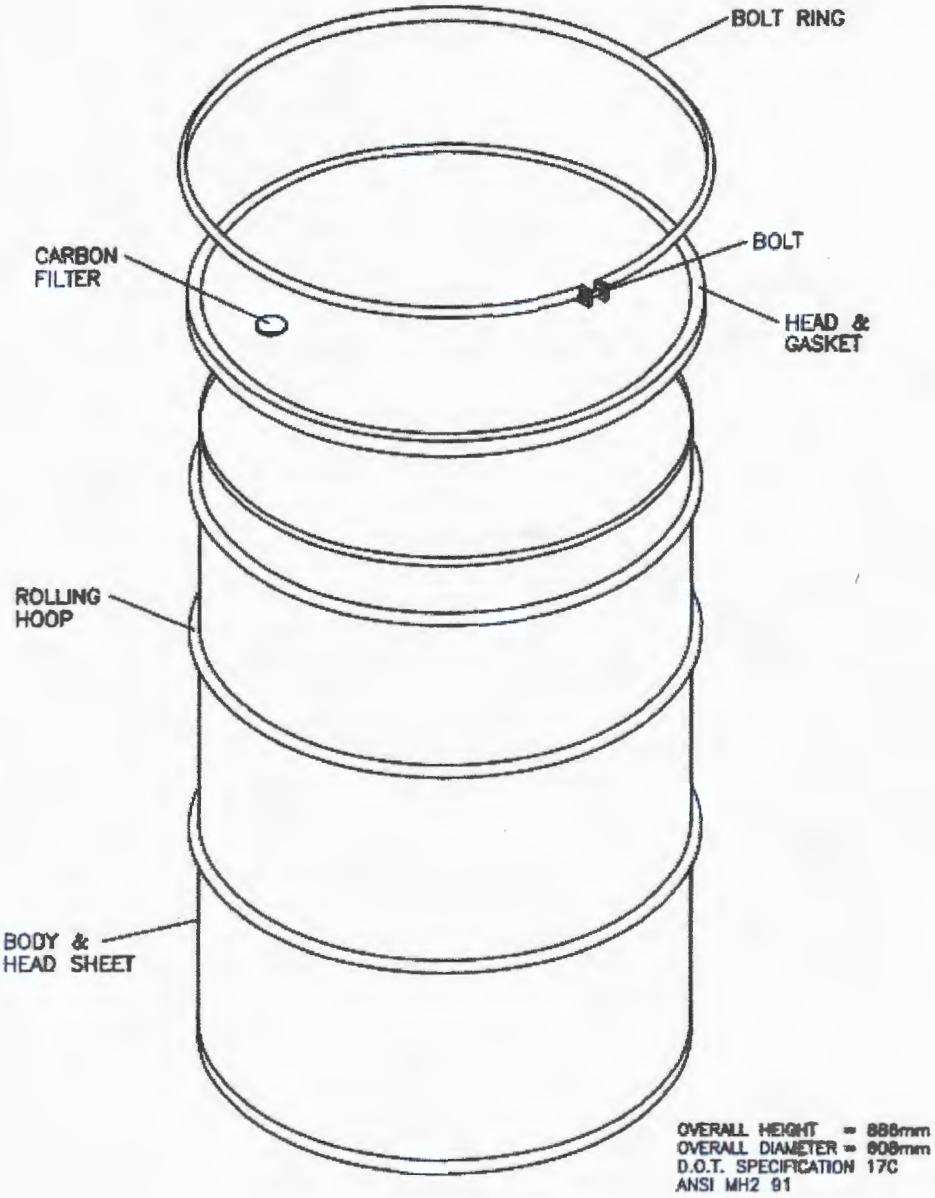


Figure A1-3
Standard 55-Gallon Drum (Typical)

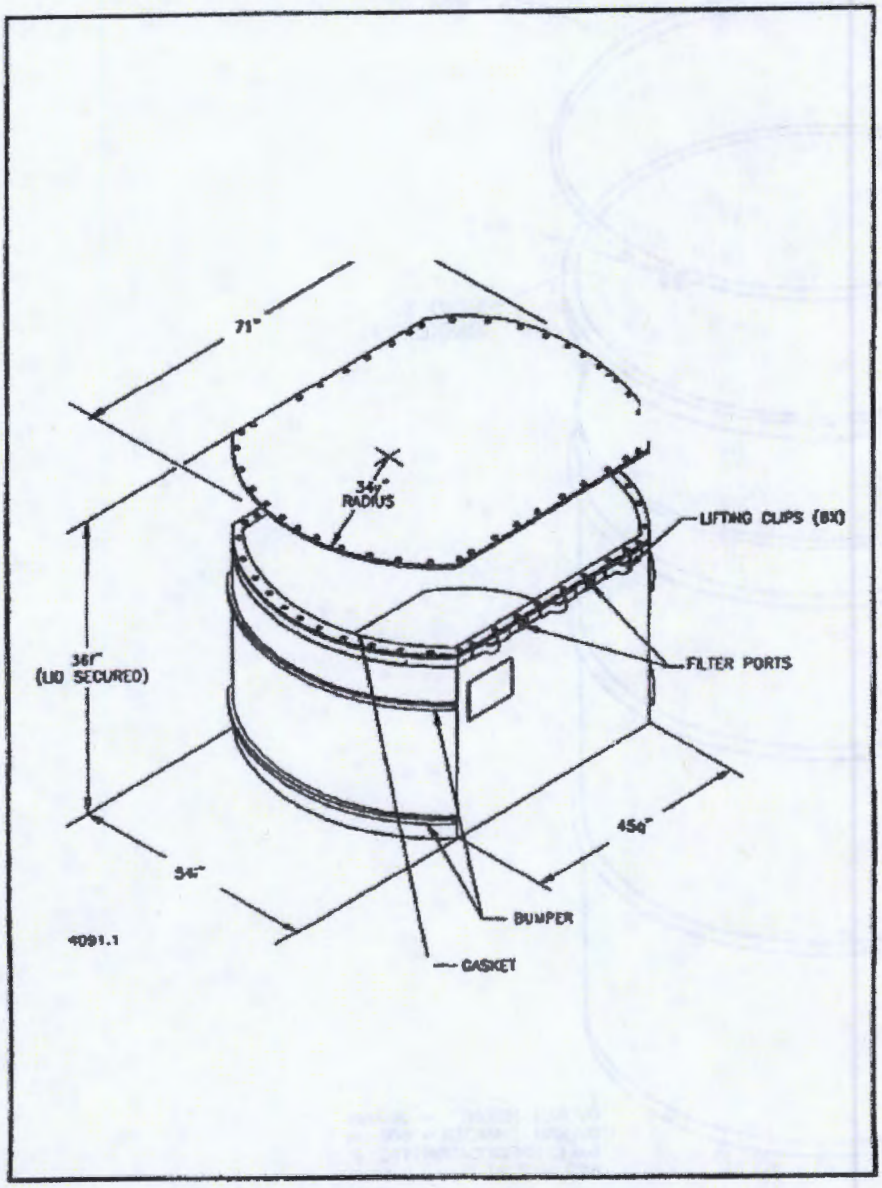


Figure A1-4
Standard Waste Box

02157

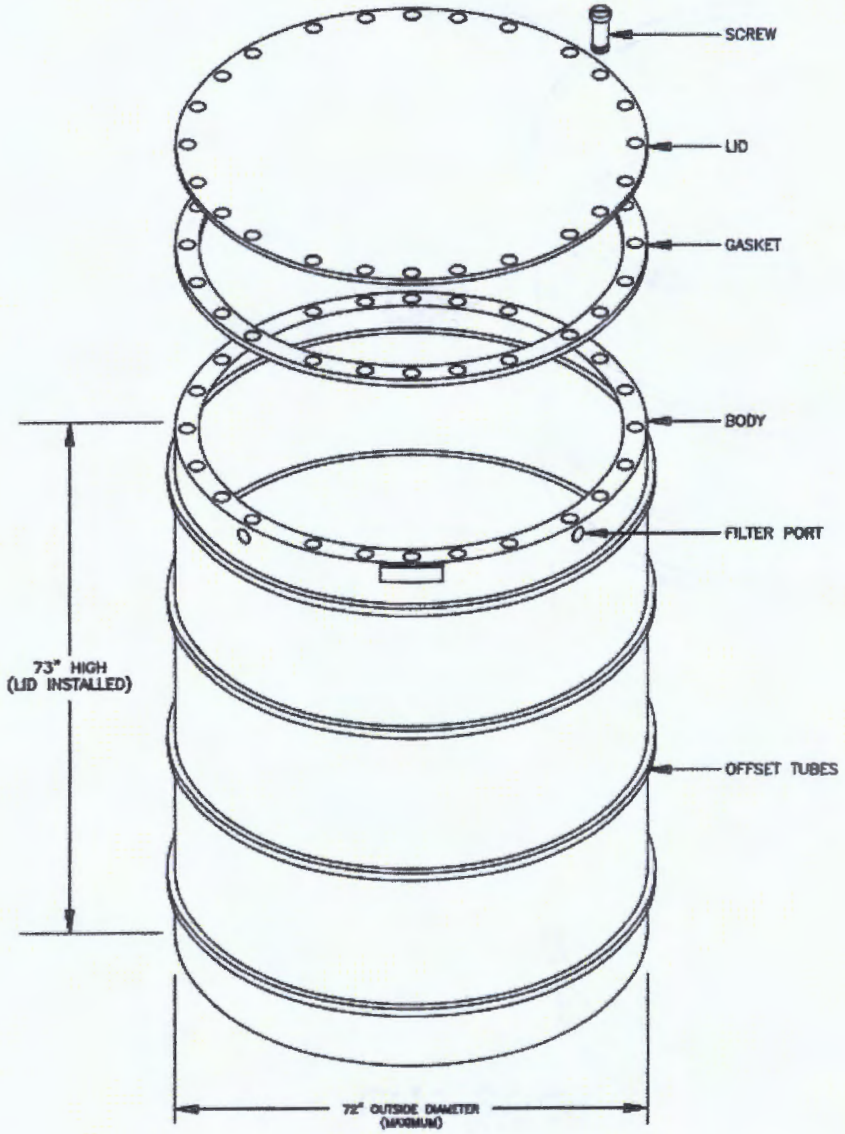


Figure A1-5
Ten-Drum Overpack

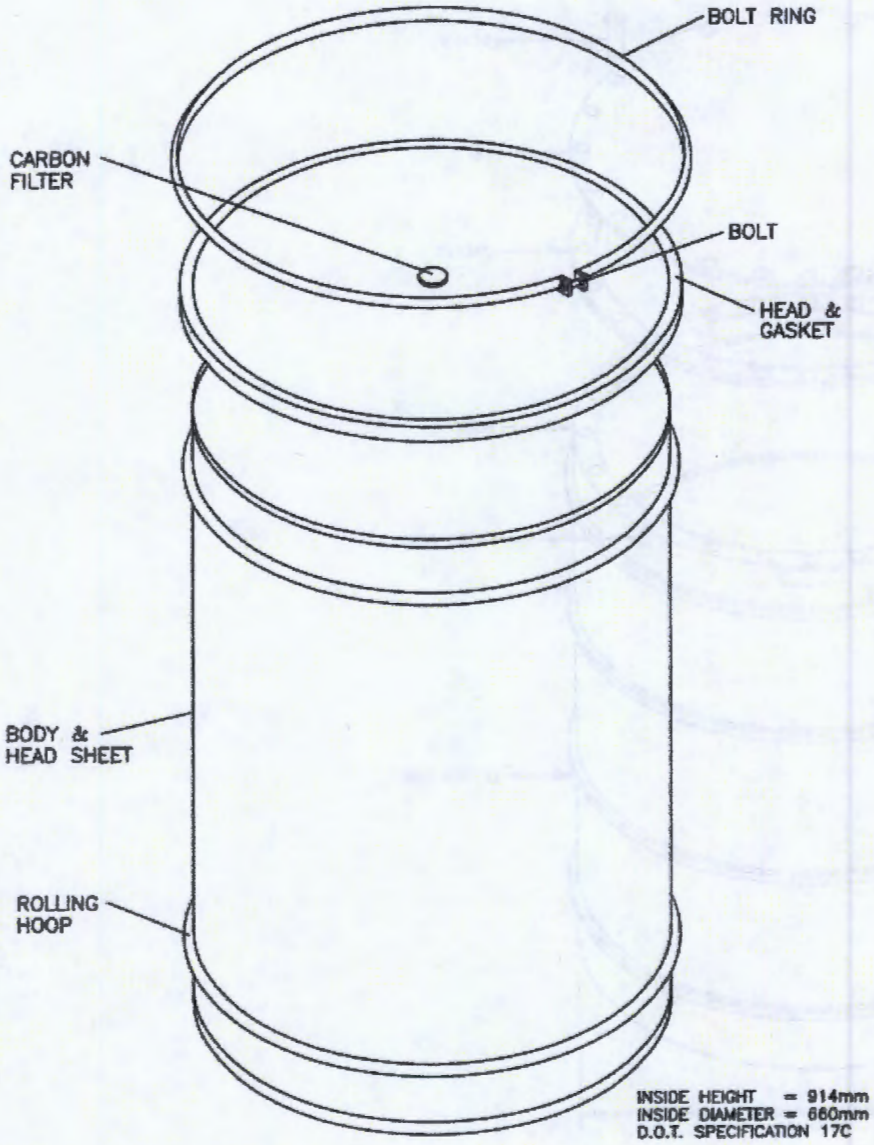


Figure A1-6
85-Gallon Drum

02159

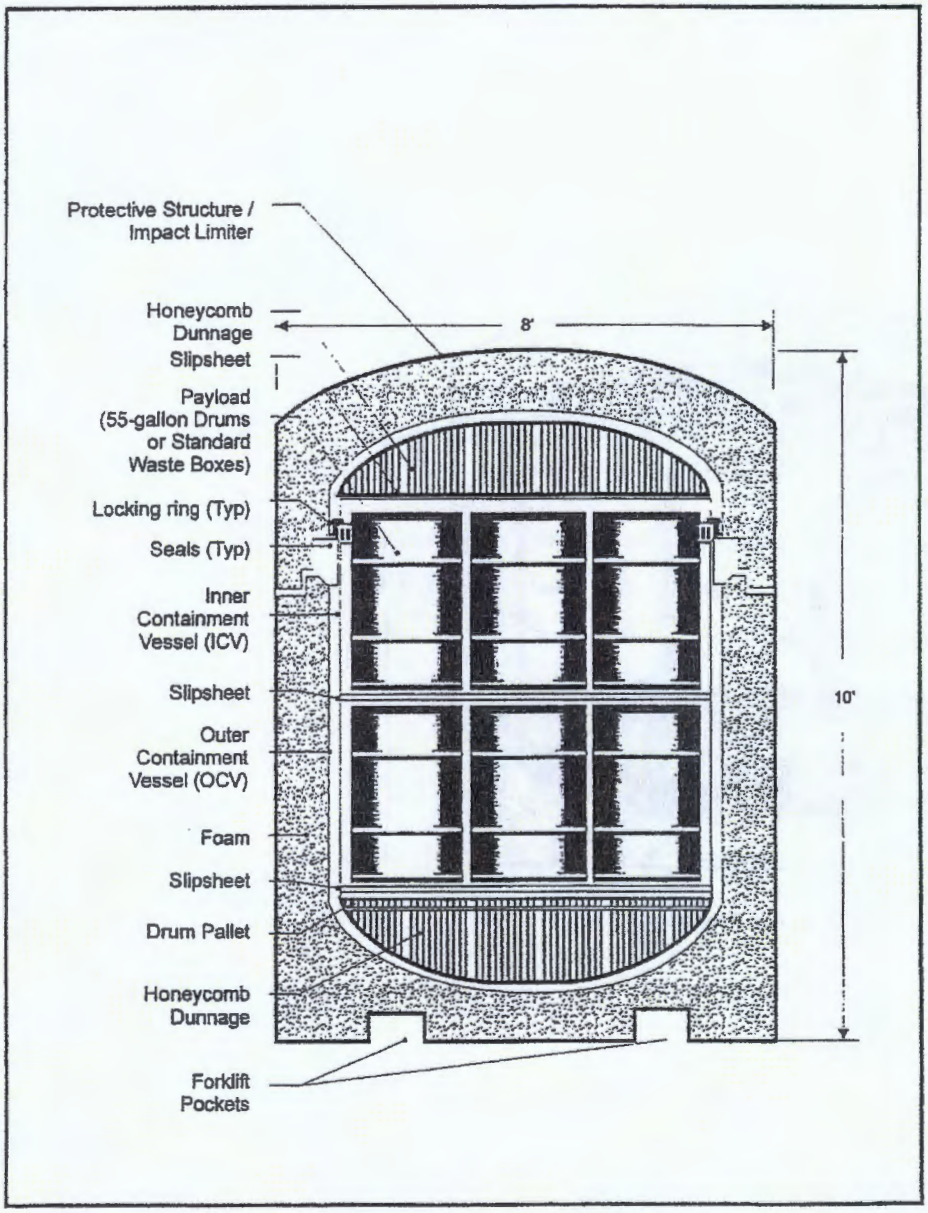


Figure A1-8a
TRUPACT-II Shipping Container for CH Transuranic Mixed Waste (Schematic)

02160

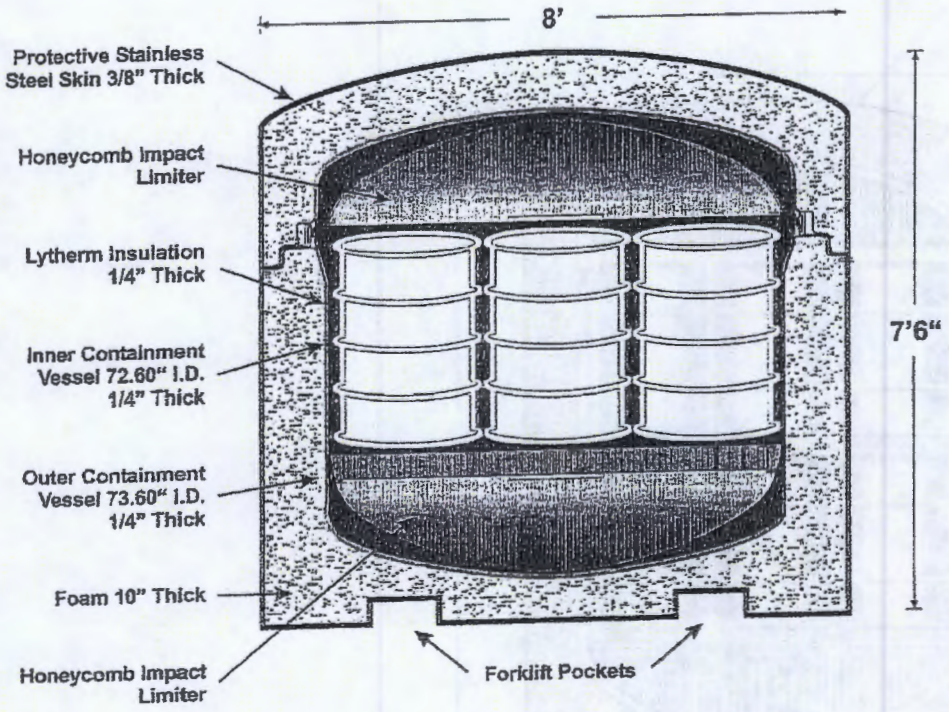


Figure A1-8b
Typical HalfPACT Shipping Container for CH Transuranic Mixed Waste (Schematic)

02161

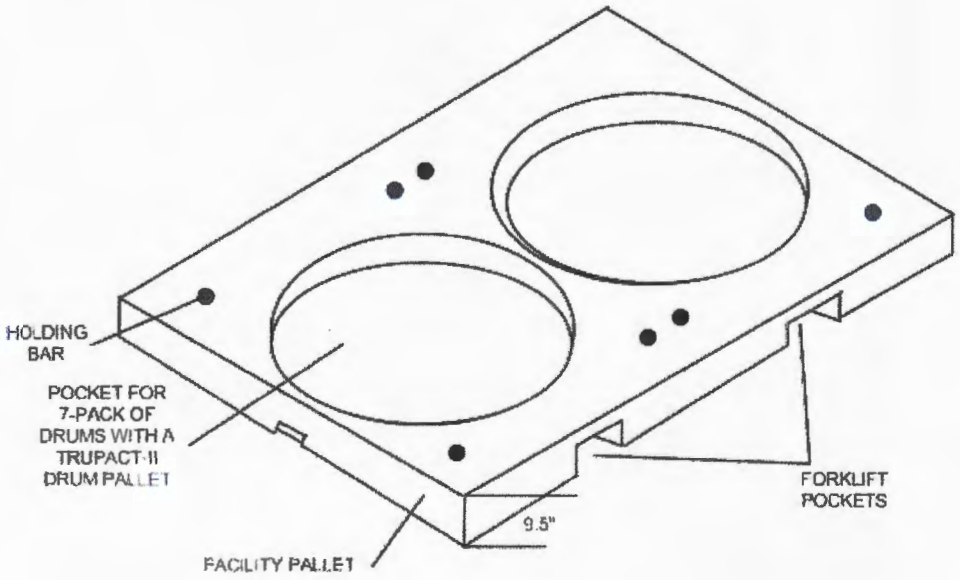


Figure A1-10
Facility Pallet for Seven-Pack of Drums

: 02162

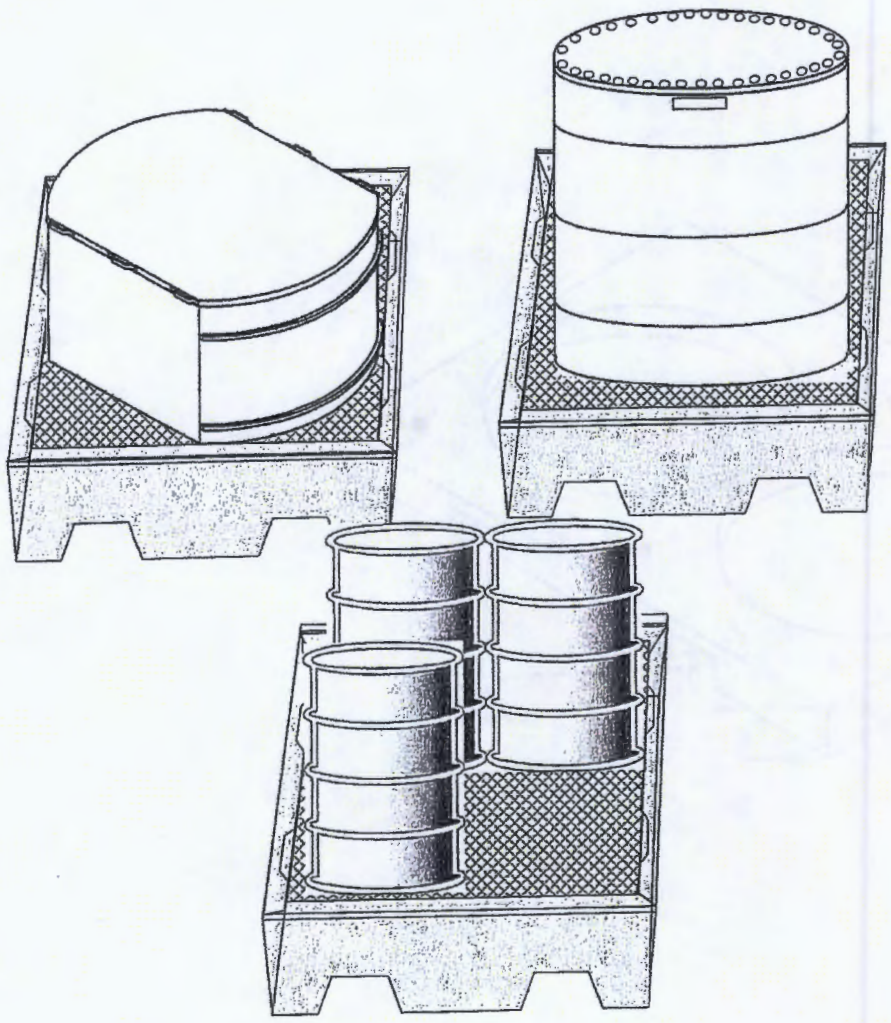


Figure A1-10a
Typical Containment Pallet

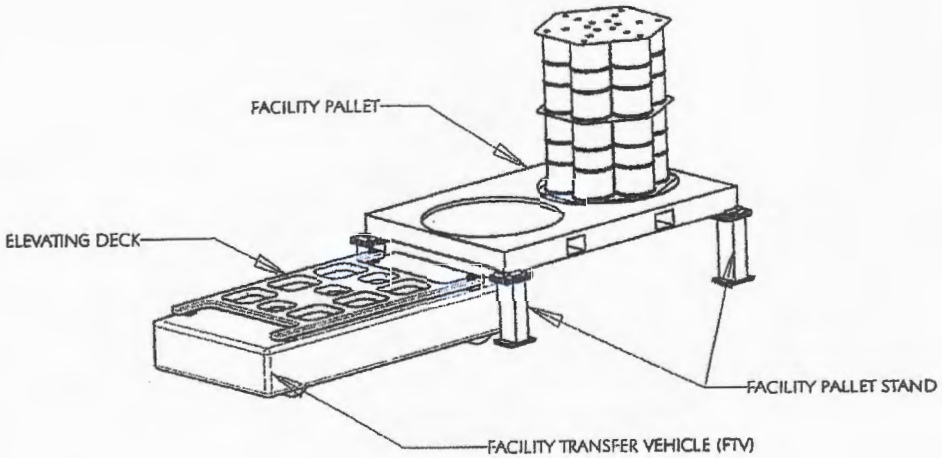


Figure A1-11
Facility Transfer Vehicle, Facility Pallet, and Typical Pallet Stand

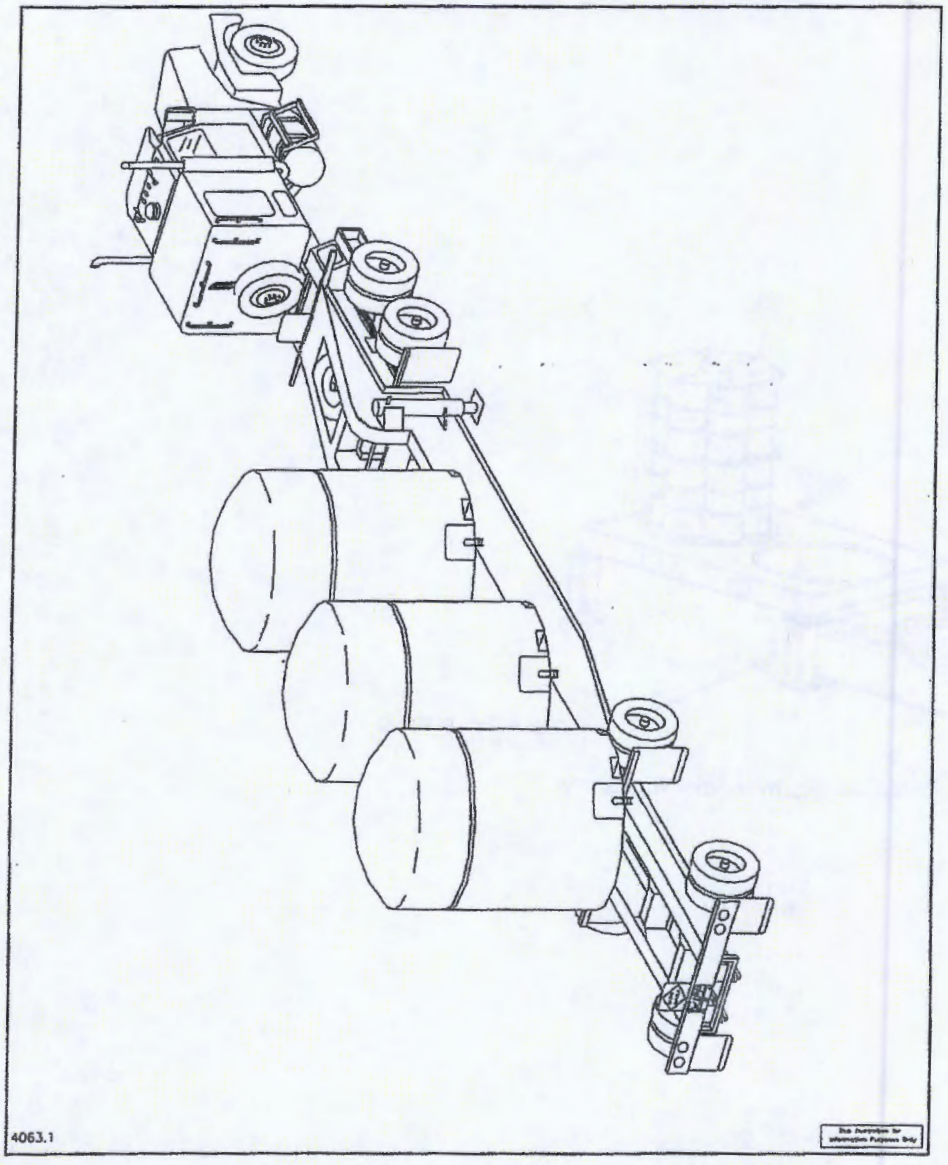


Figure A1-12
TRUPACT-II Containers on Trailer

02165

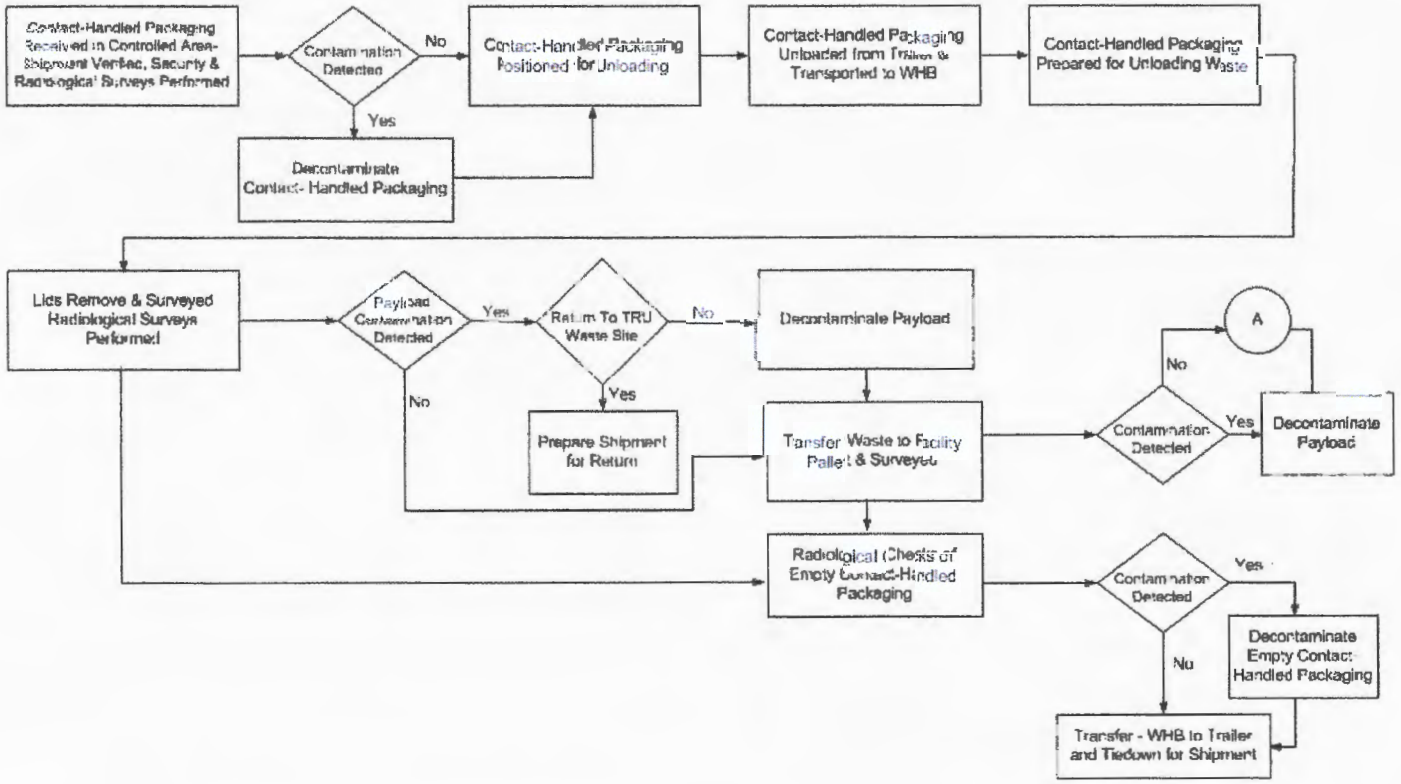


Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

391726

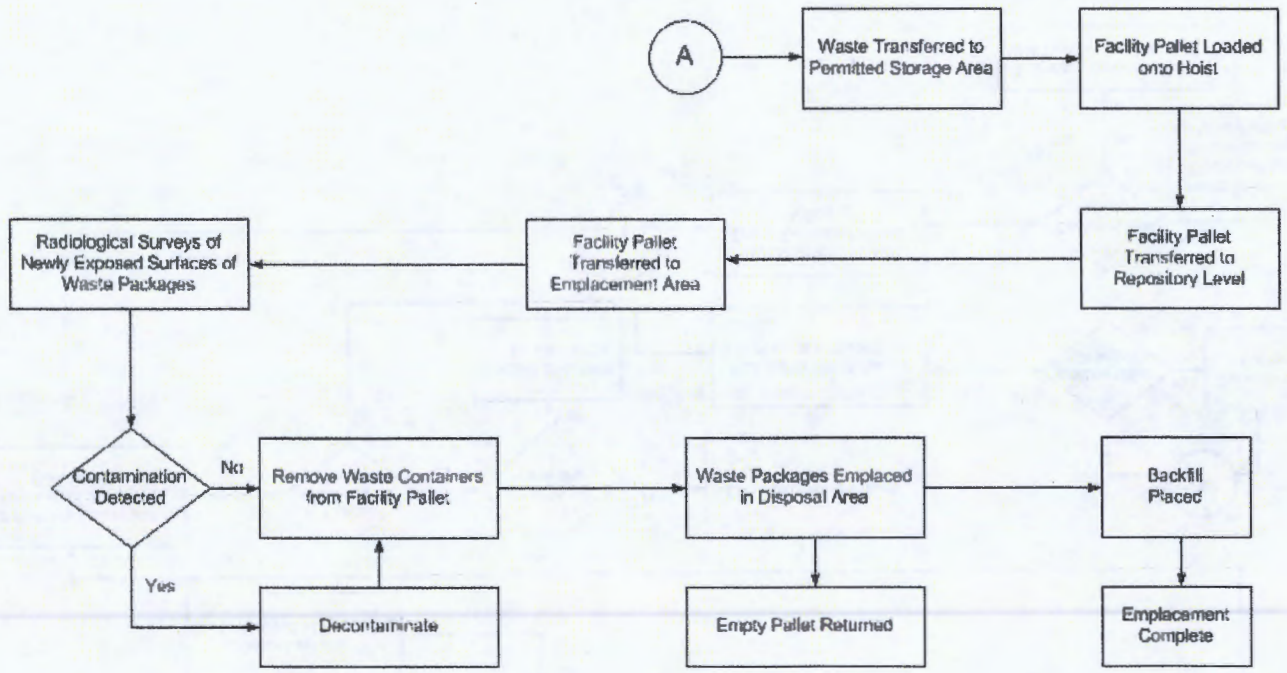


Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

021167

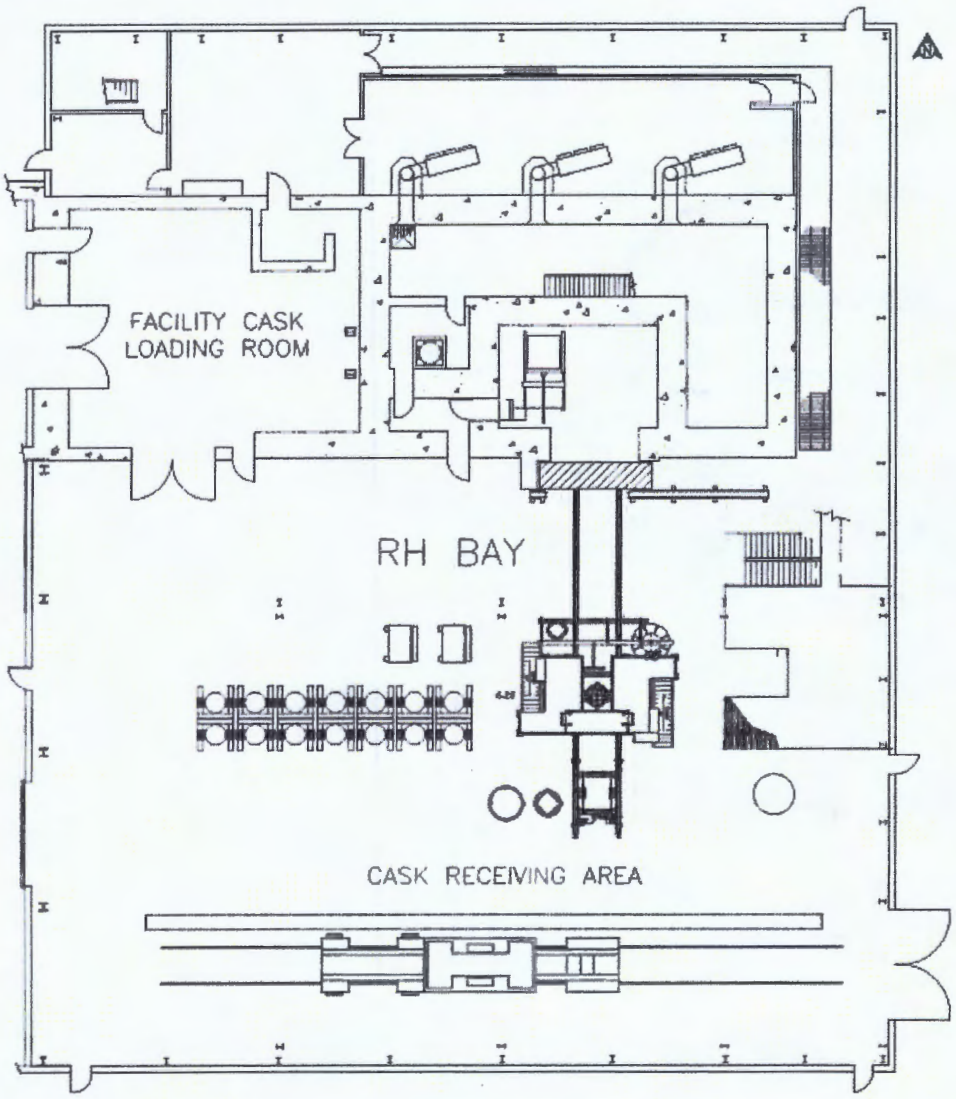


Figure A1-14a
RH Bay Ground Floor

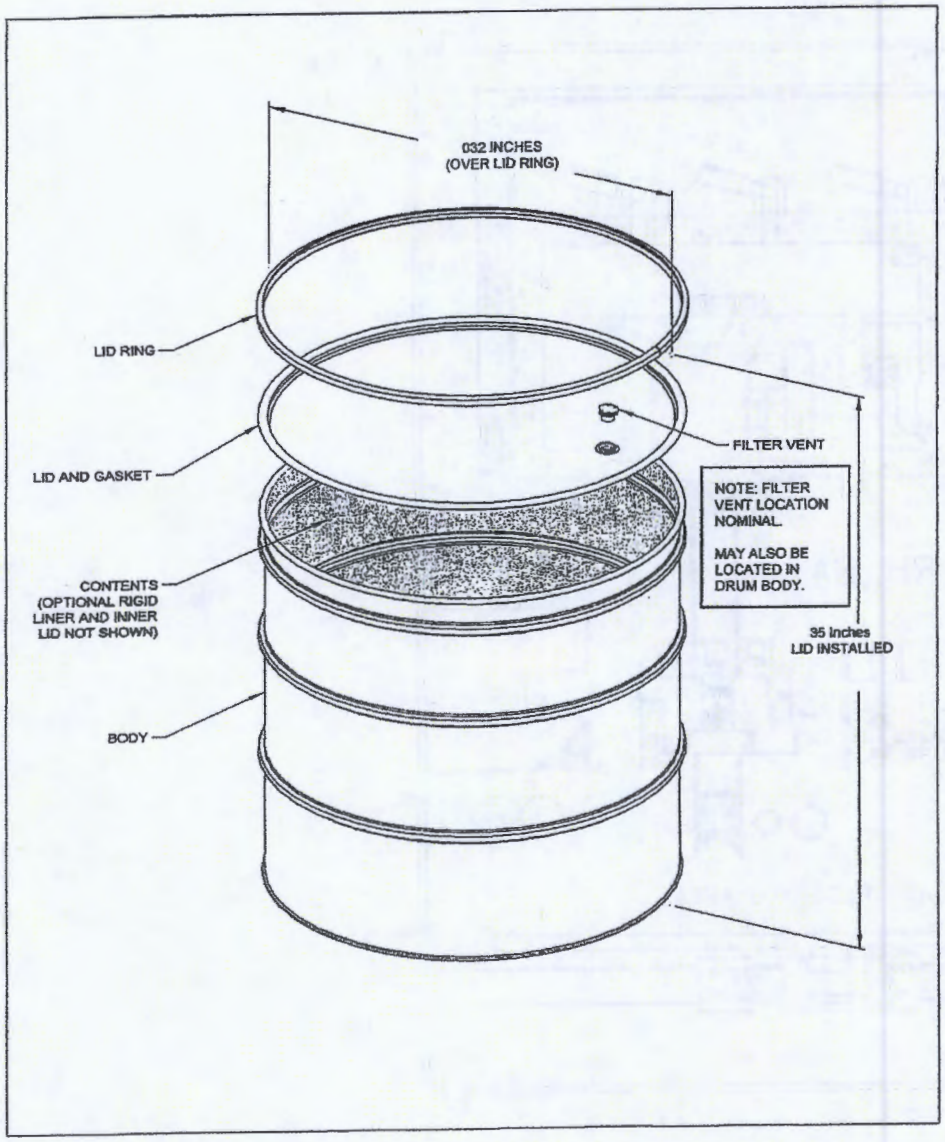
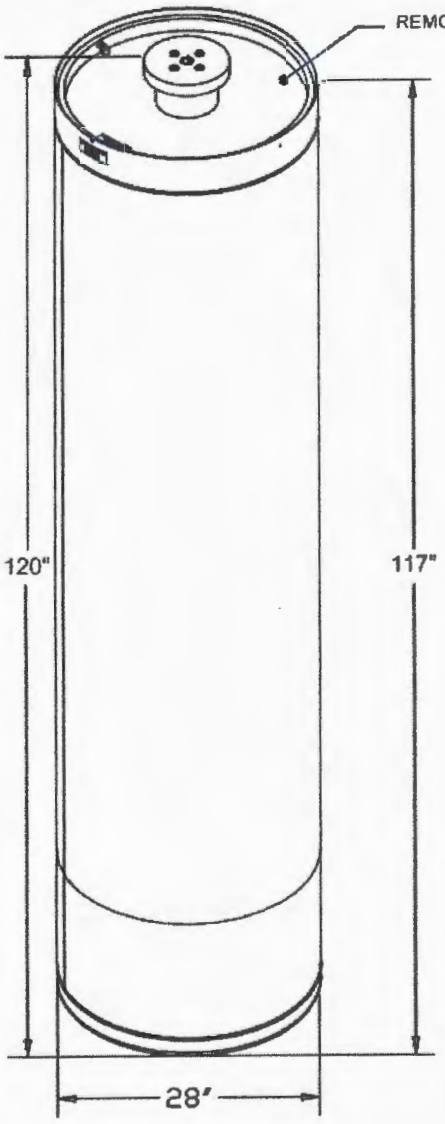


Figure A1-15
100-Gallon Drum



NOTE: CANISTER USED TO HANDLE TYPE A DRUMS ONLY.

Figure A1-16
Facility Canister Assembly

02170

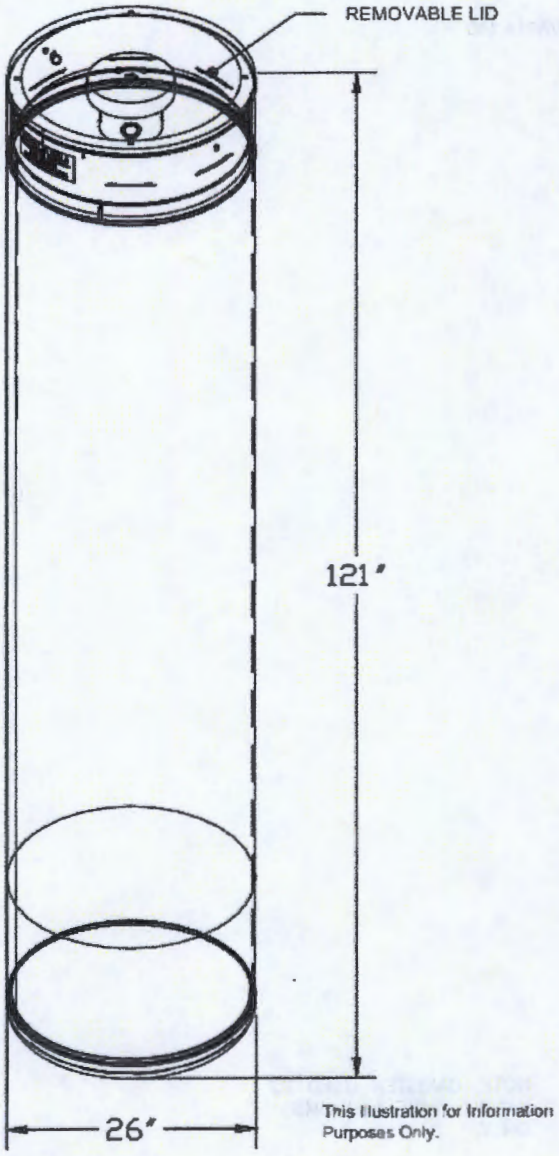


Figure A1-16a
RH-TRU 72-B Canister Assembly

02171

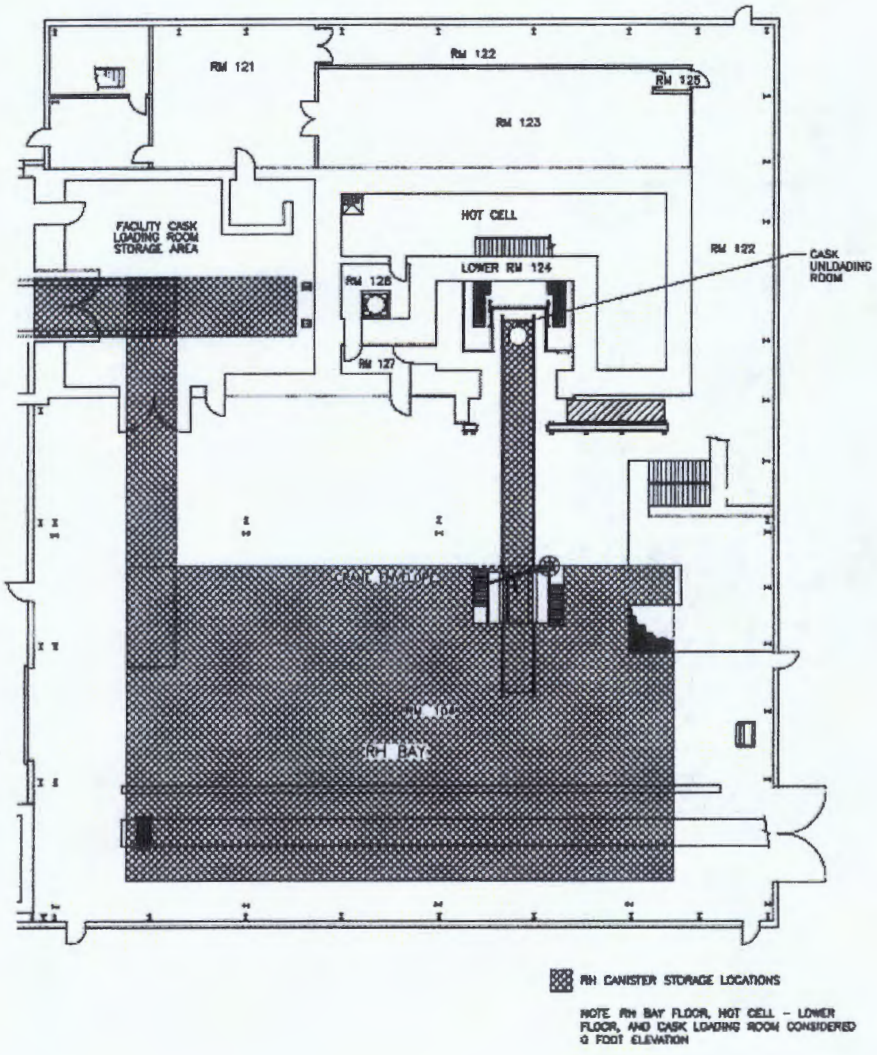


Figure A1-17a
RH Bay, Cask Unloading Room, Hot Cell, Facility Cask Loading Room

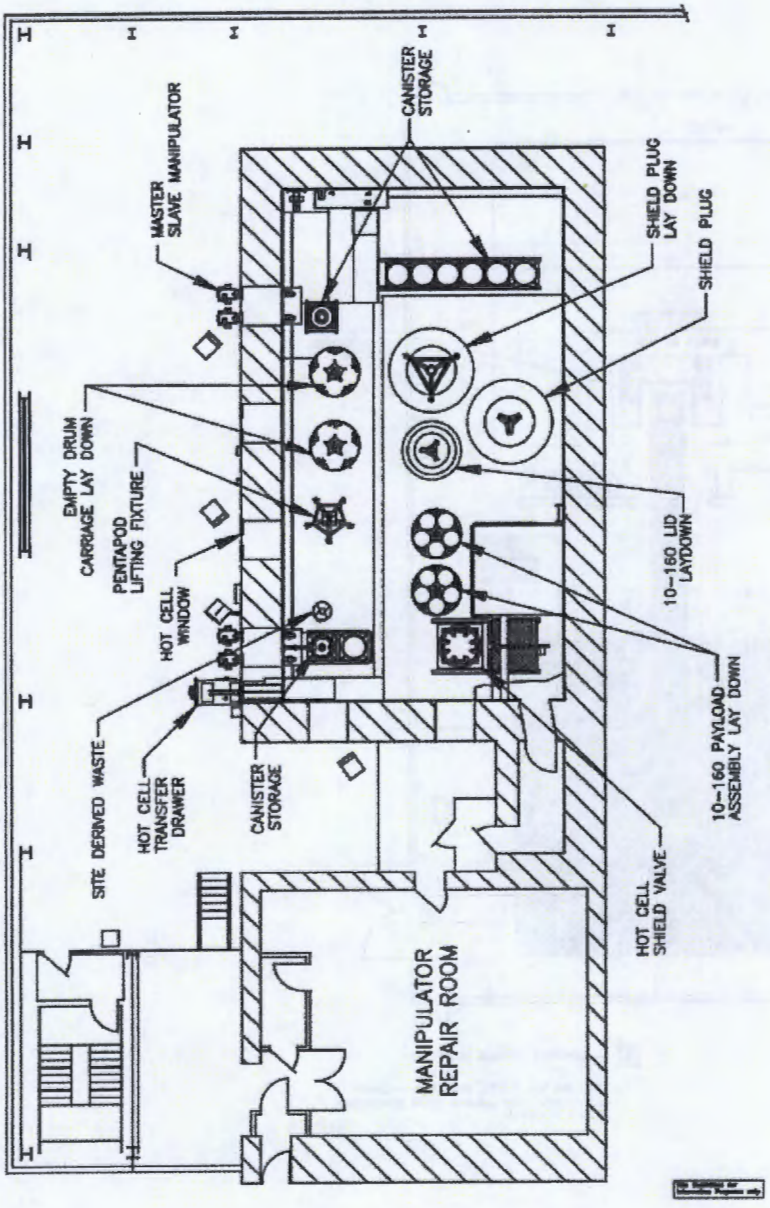


Figure A1-17b
RH Hot Cell Storage Area

02173

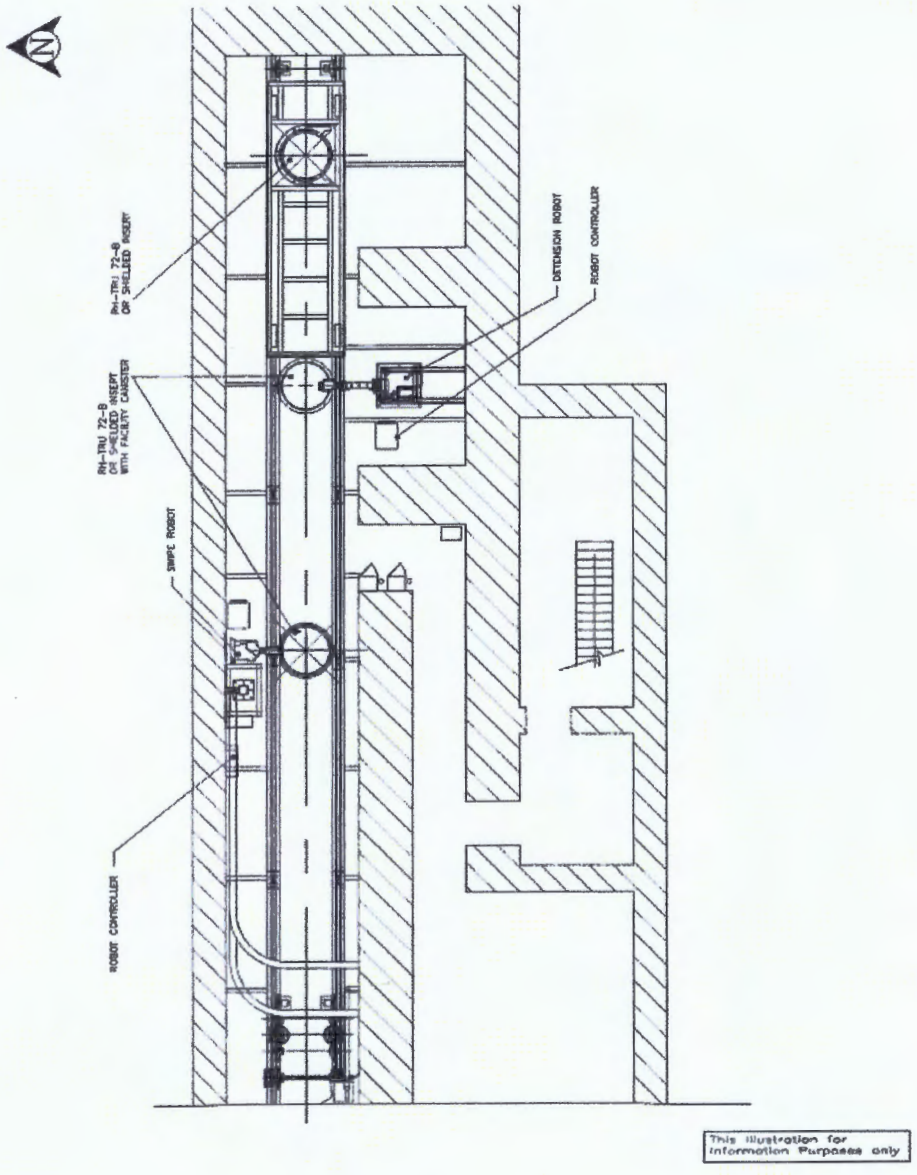


Figure A1-17c
RH Canister Transfer Cell Storage Area

02174

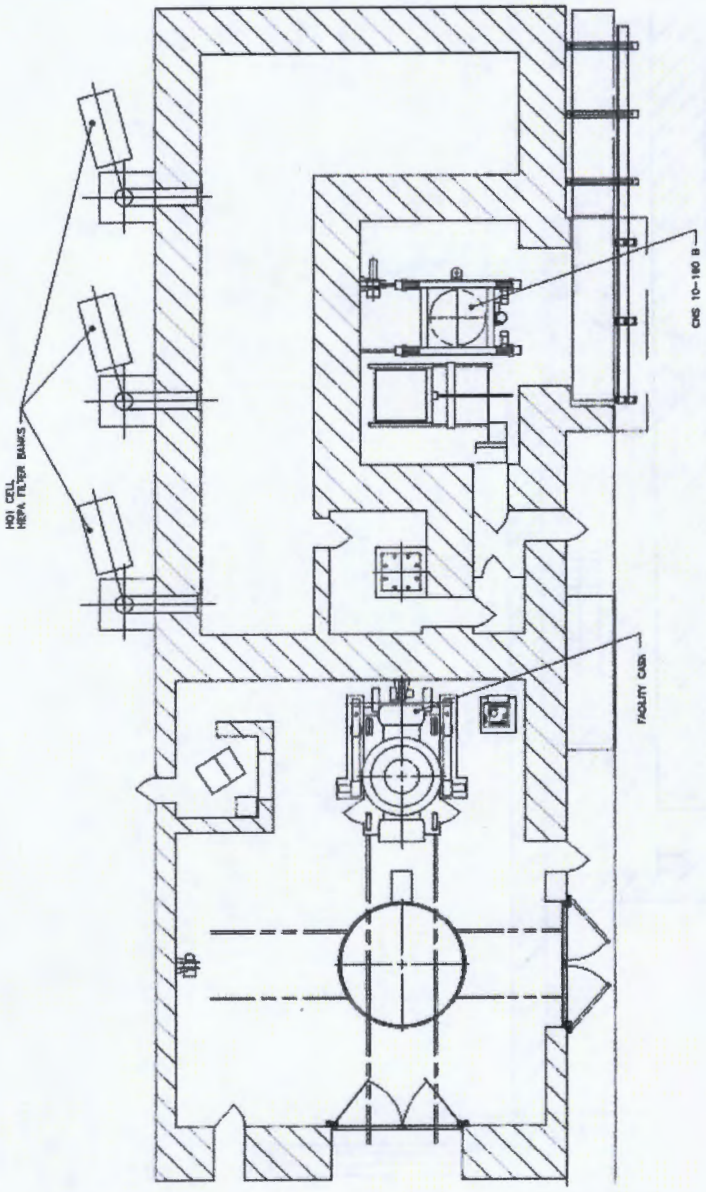


Figure A1-17d
RH Facility Cask Loading Room Storage Area

: 02175

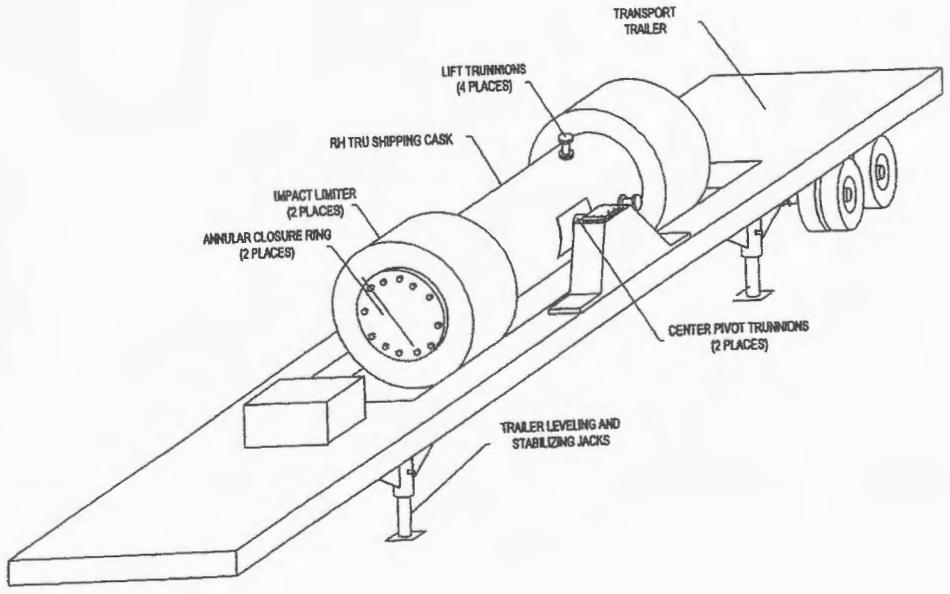


Figure A1-18
RH-TRU 72-B Shipping Cask on Trailer

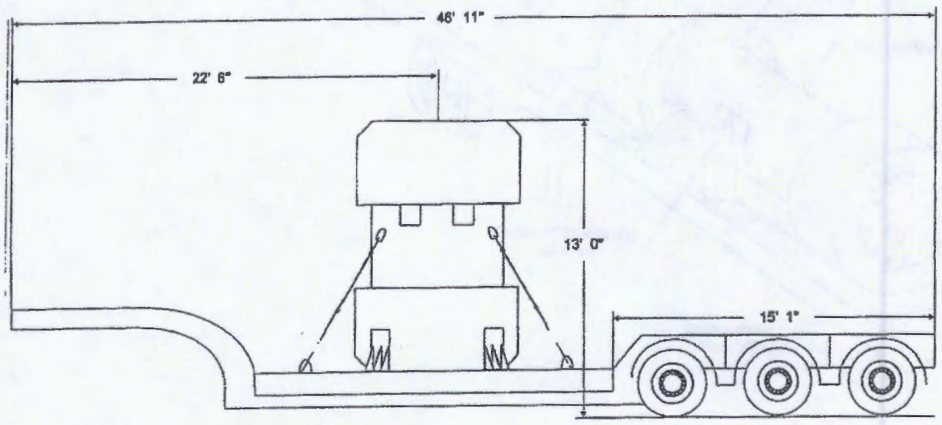


Figure A1-19
CNS 10-160B Shipping Cask on Trailer

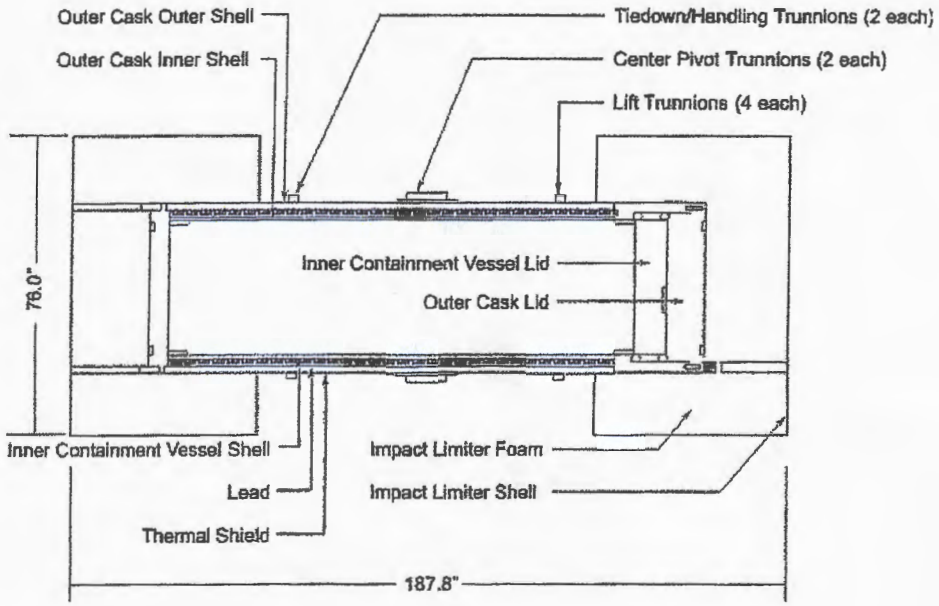


Figure A1-20
RH-TRU 72-B Shipping Cask for RH Transuranic Waste (Schematic)

Field Code Changed

02178

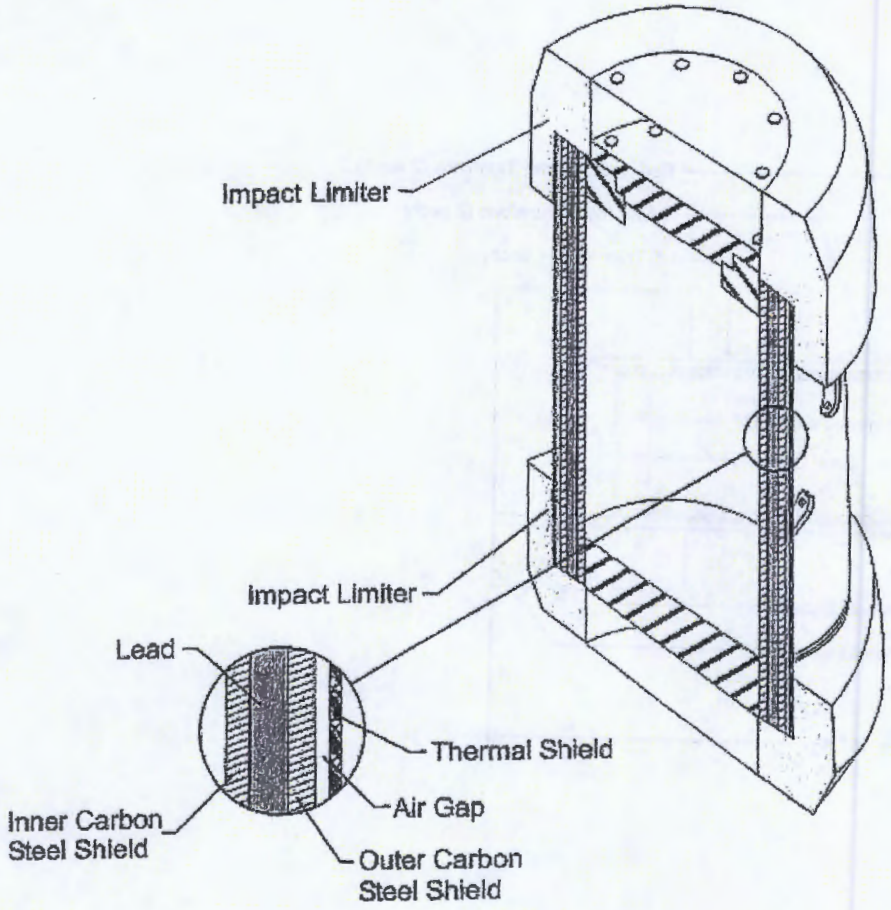


Figure A1-21
CNS 10-160B Shipping Cask for RH Transuranic Waste (Schematic)

02179

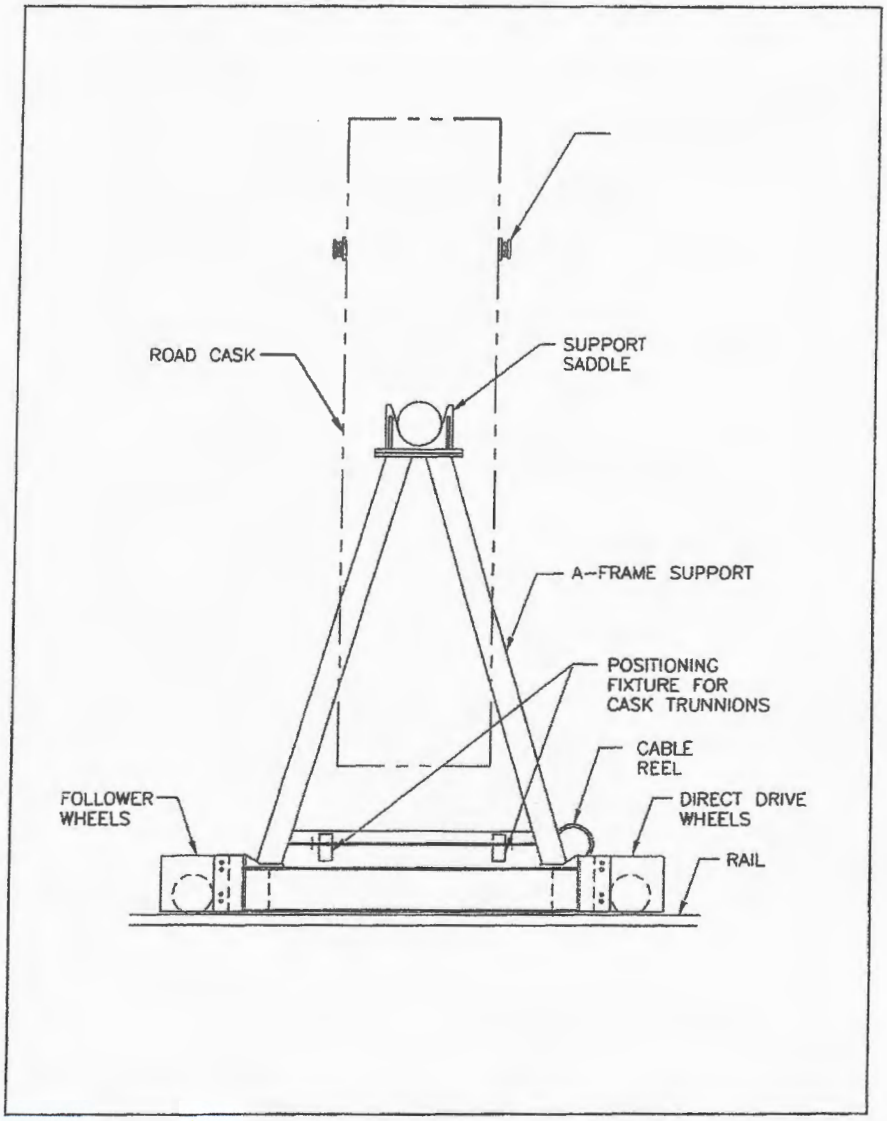


Figure A1-22a
RH-TRU 72-B Cask Transfer Car

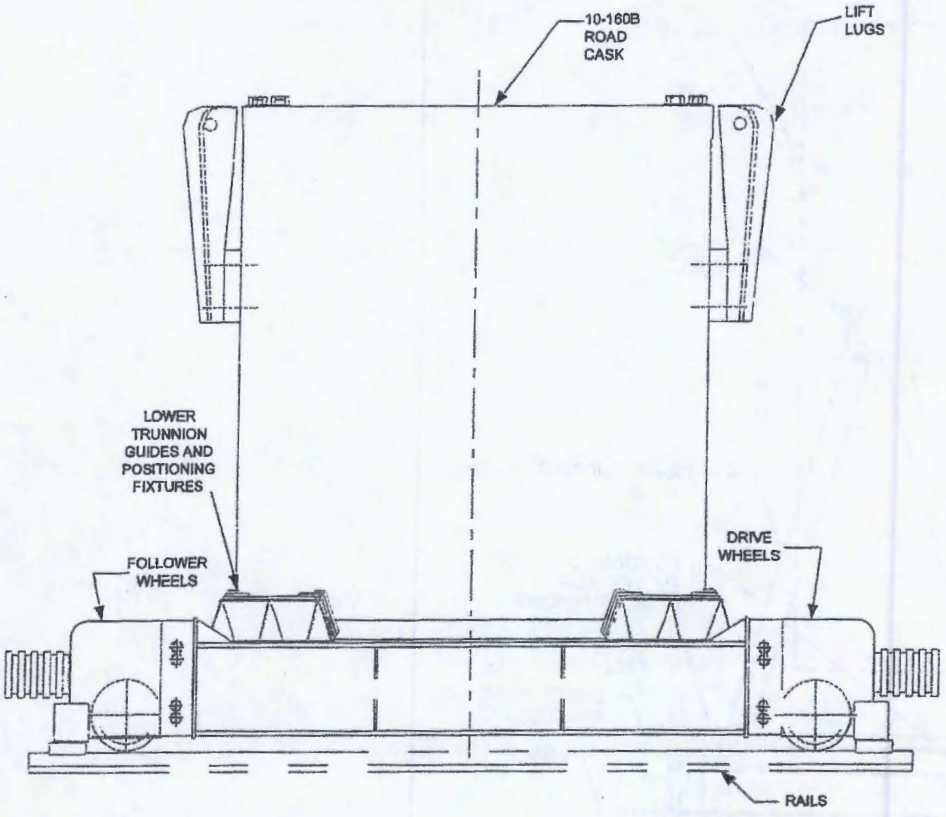


Figure A1-22b
CNS 10-160B Cask Transfer Car

02181

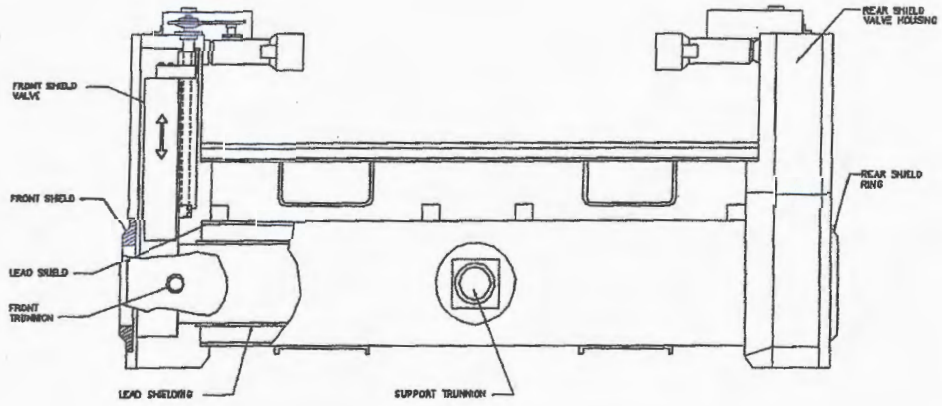


Figure A1-23
RH Transuranic Waste Facility Cask

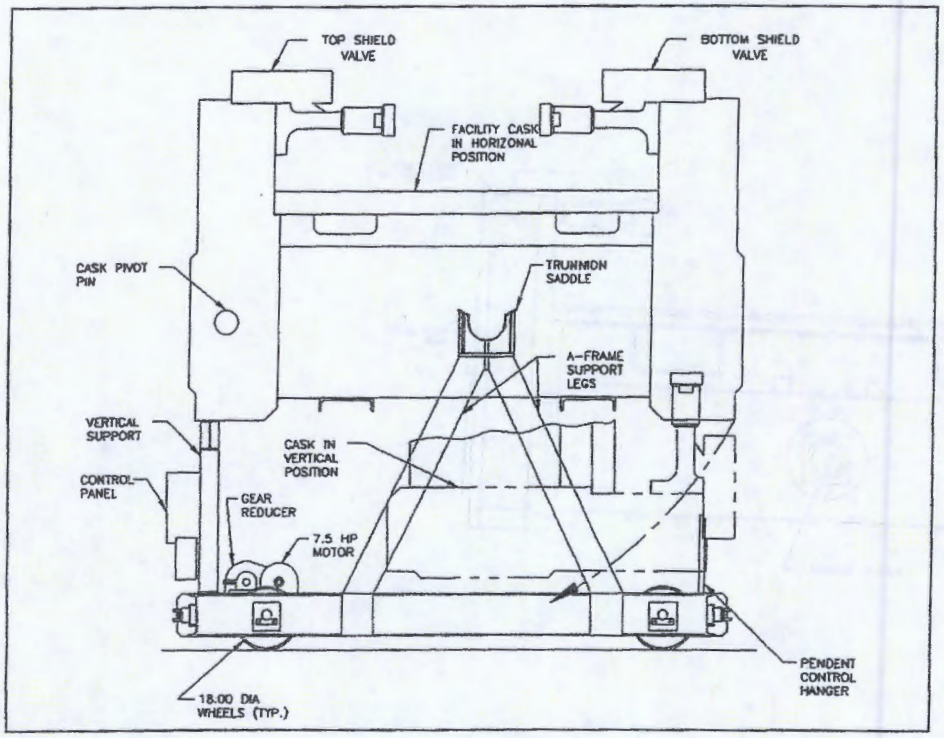


Figure A1-24
RH Facility Cask Transfer Car (Side View)

02183

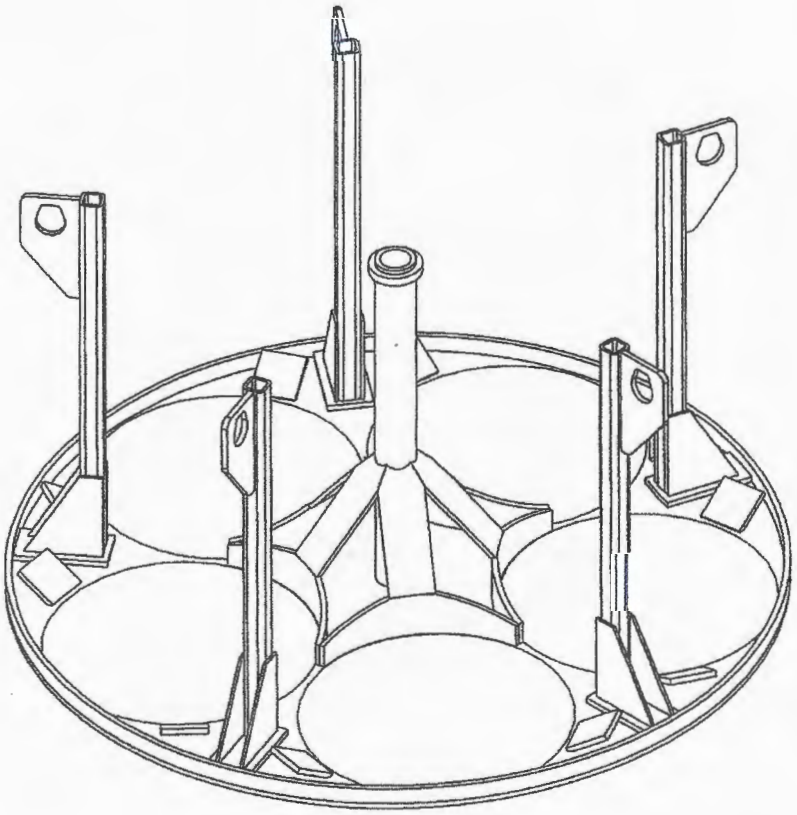


Figure A1-25
CNS 10-160B Drum Carriage

0218

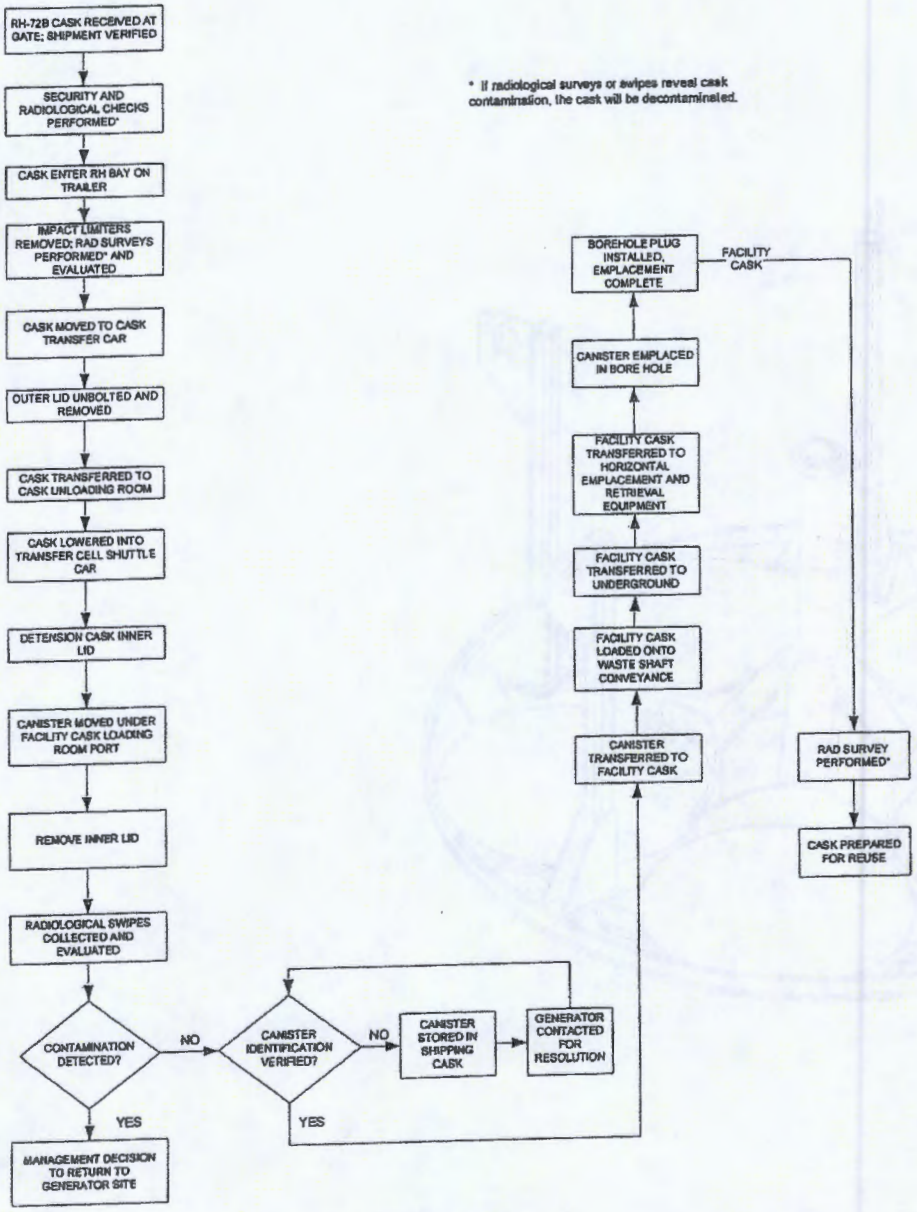


Figure A1-26
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for RH-TRU 72-B Shipping Cask

02185

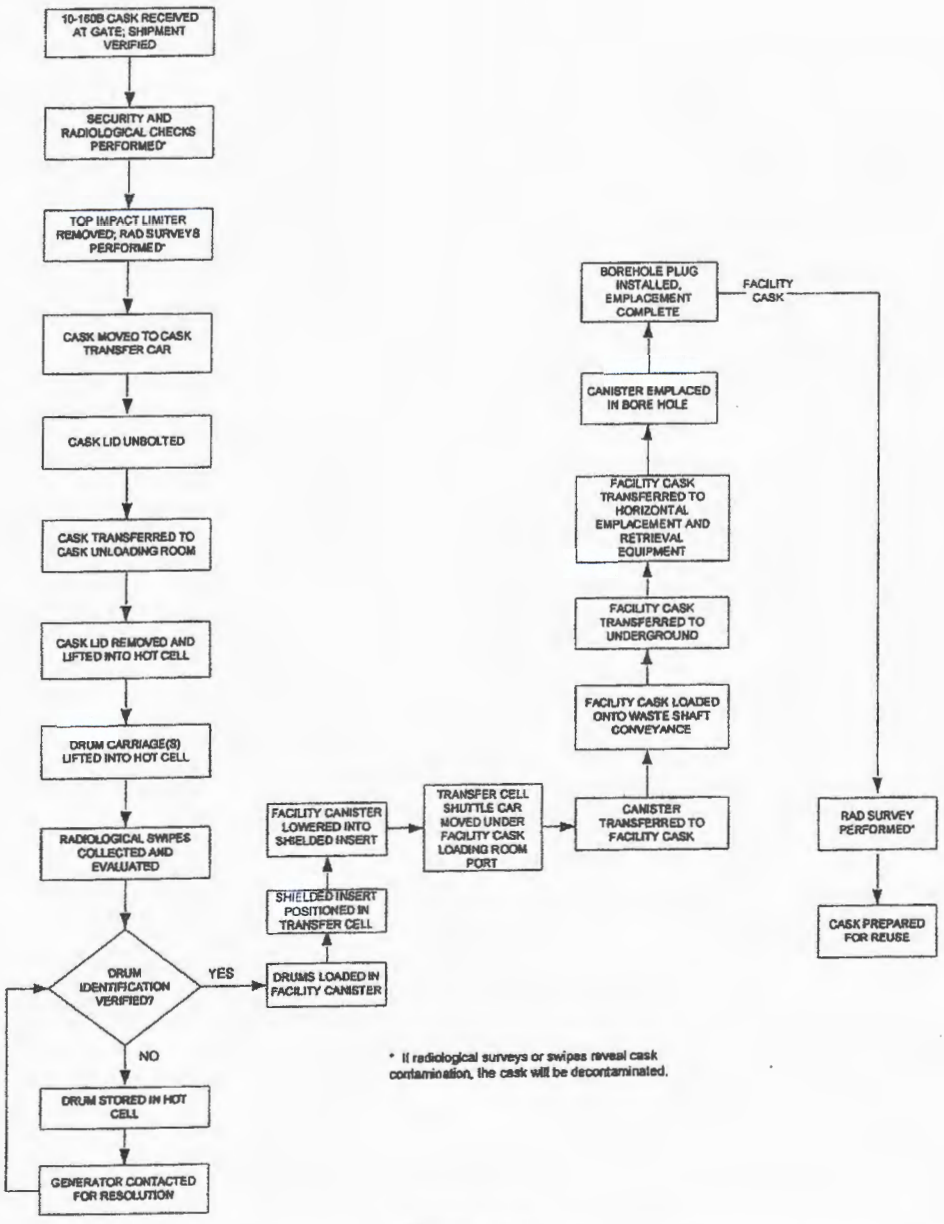


Figure A1-27
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for CNS 10-160B Shipping Cask

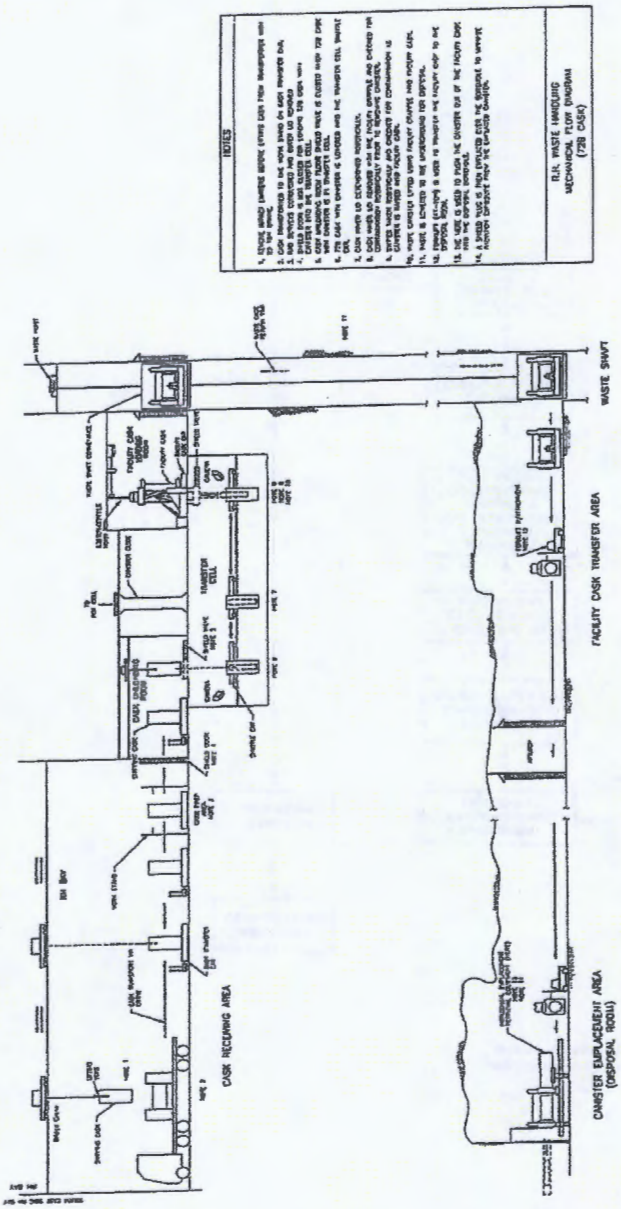


Figure A1-28
Schematic of the RH Transuranic Mixed Waste Process for RH-TRU 72-B Shipping Cask

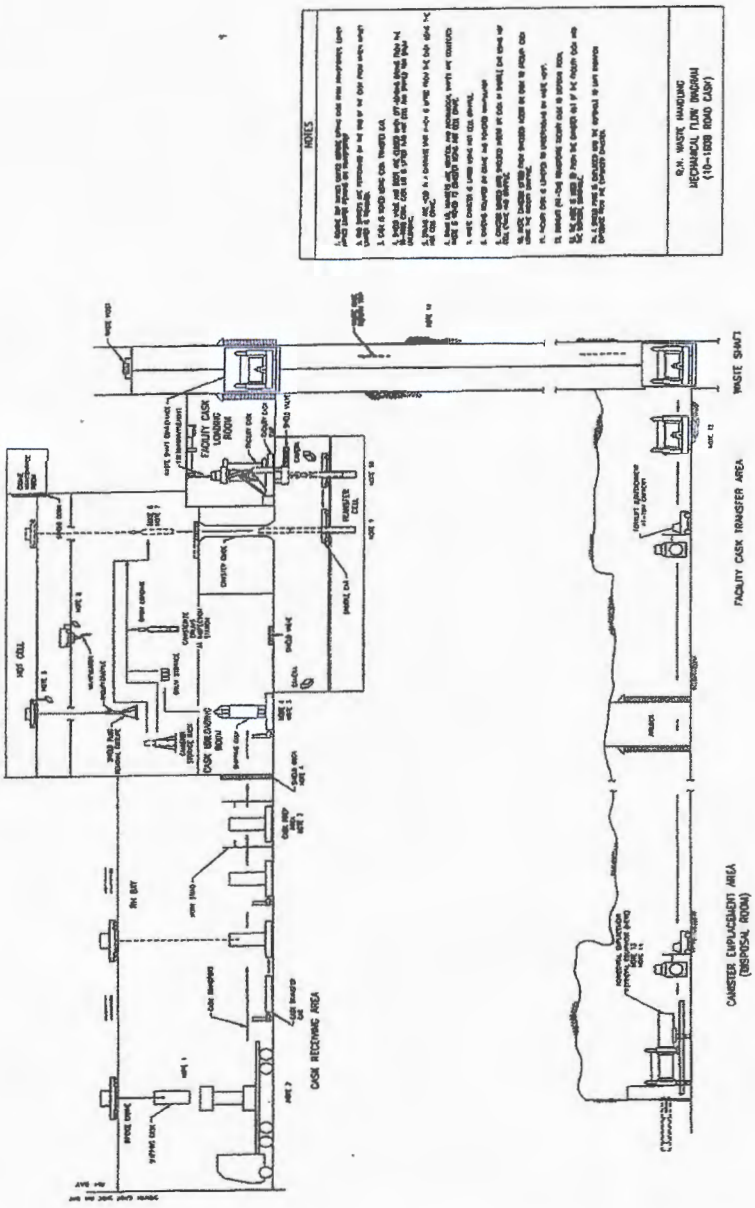


Figure A1-29
Schematic of the RH Transuranic Mixed Waste Process for CNS 10-160B Shipping Cask

02188

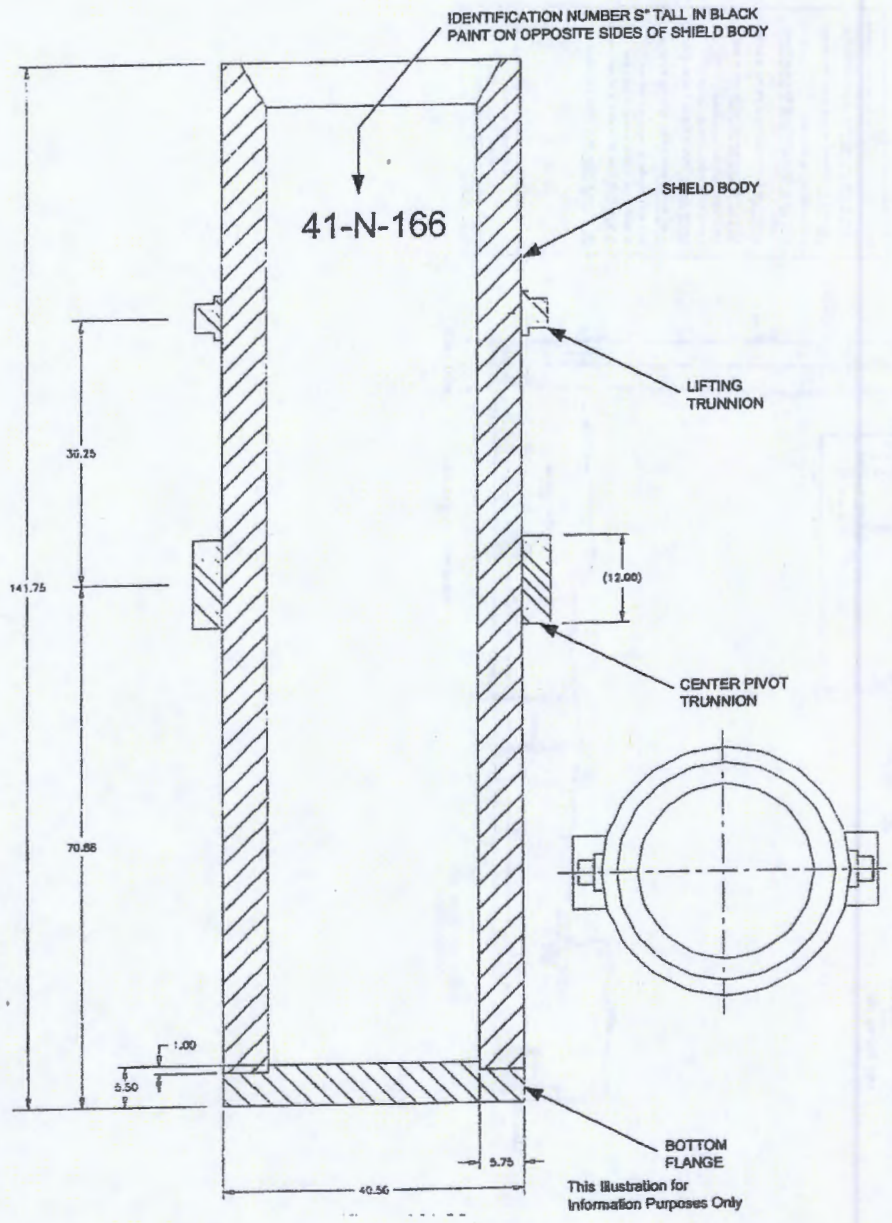


Figure A1-30
RH Shielded Insert Assembly

02189

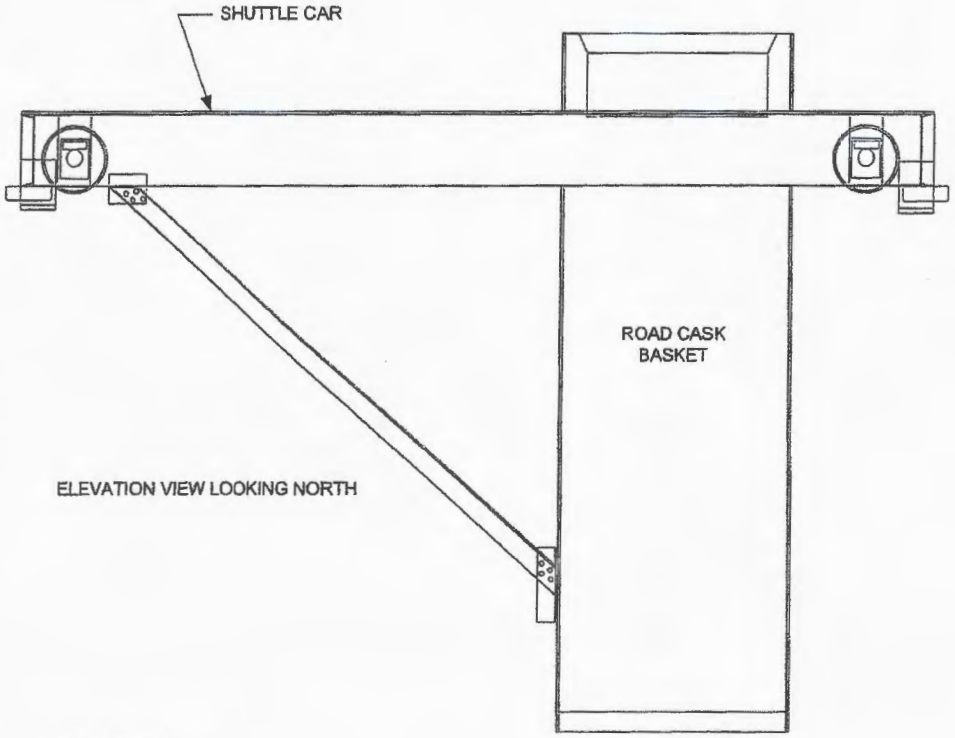
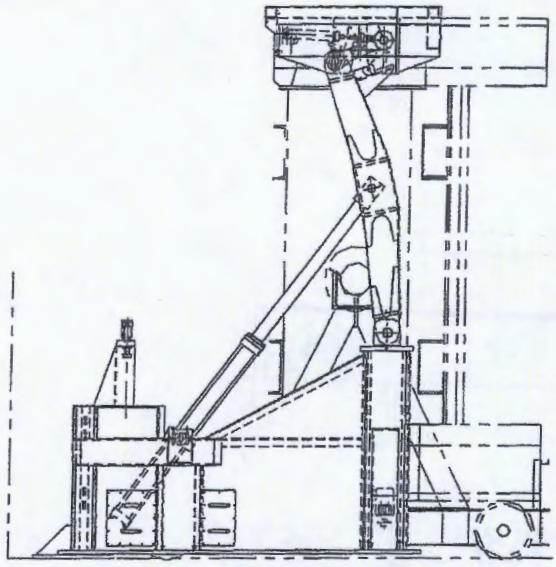
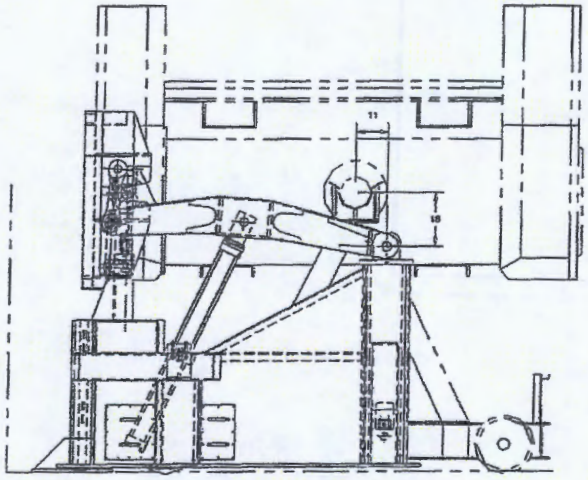


Figure A1-31
Transfer Cell Shuttle Car



FRONT ELEVATION
CASK VERTICAL



FRONT ELEVATION
CASK HORIZONTAL

This illustration for
Information Purposes Only

Figure A1-32
Facility Rotating Device

Field Code Changed

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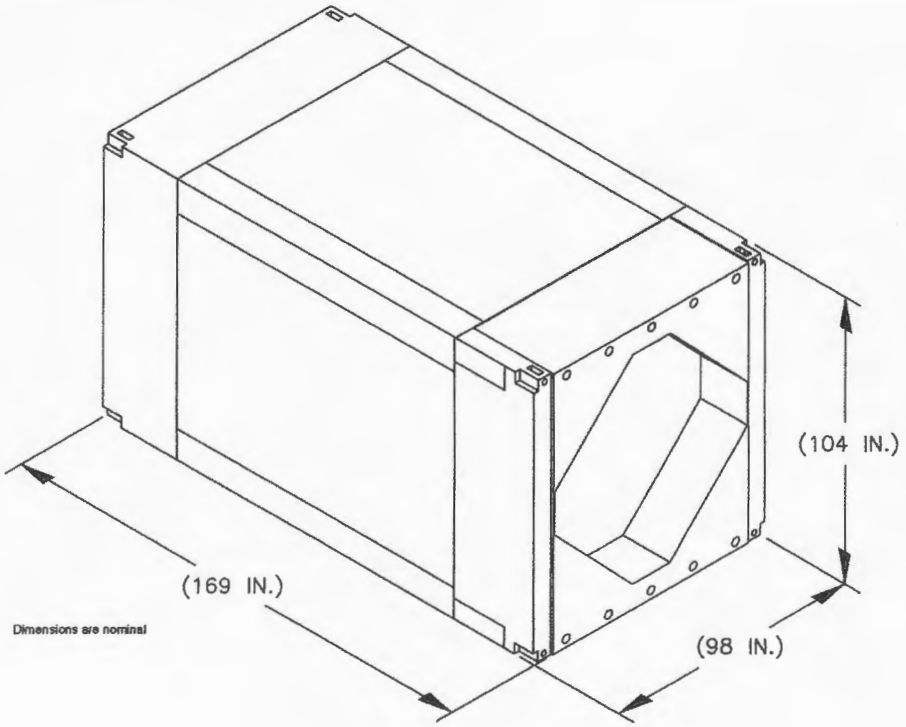

Figure A1-33
Typical TRUPACT-III

Field Code Changed

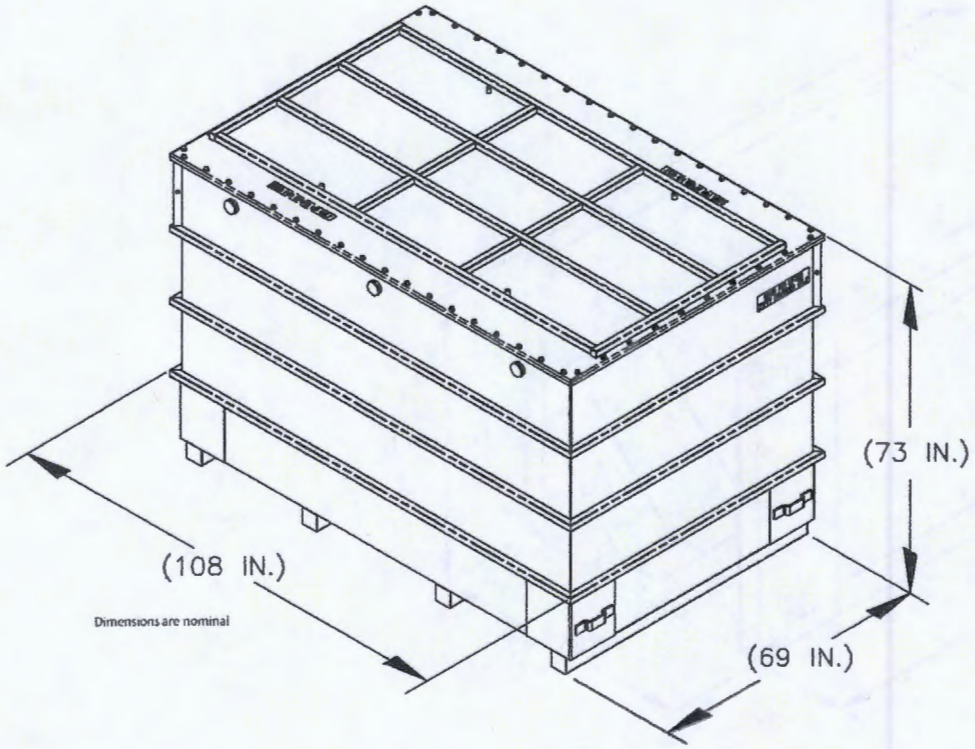

Figure A1-34
Typical Standard Large Box 2

Field Code Changed

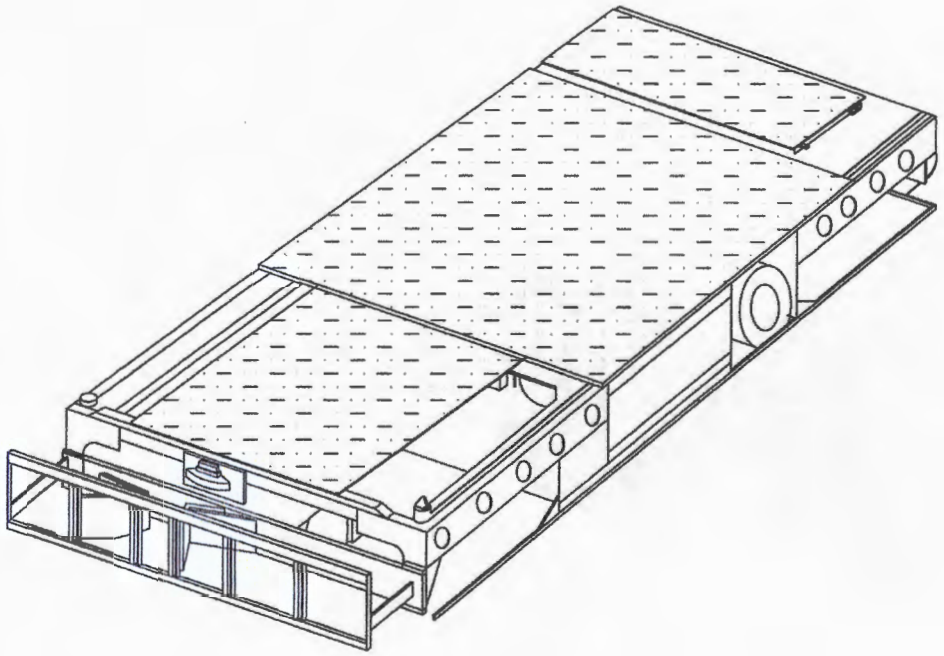

Figure A1-35
Typical Yard Transfer Vehicle

Field Code Changed

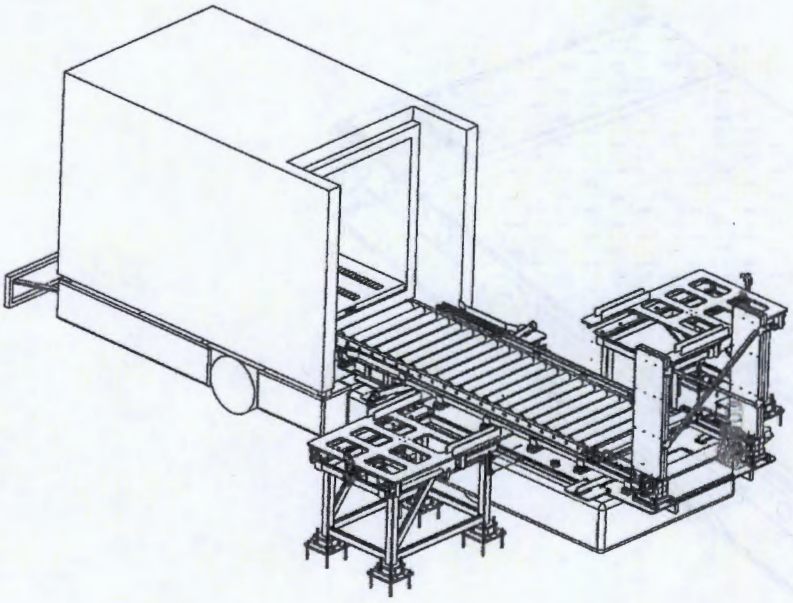

Figure A1-36
Payload Transfer Station

Field Code Changed

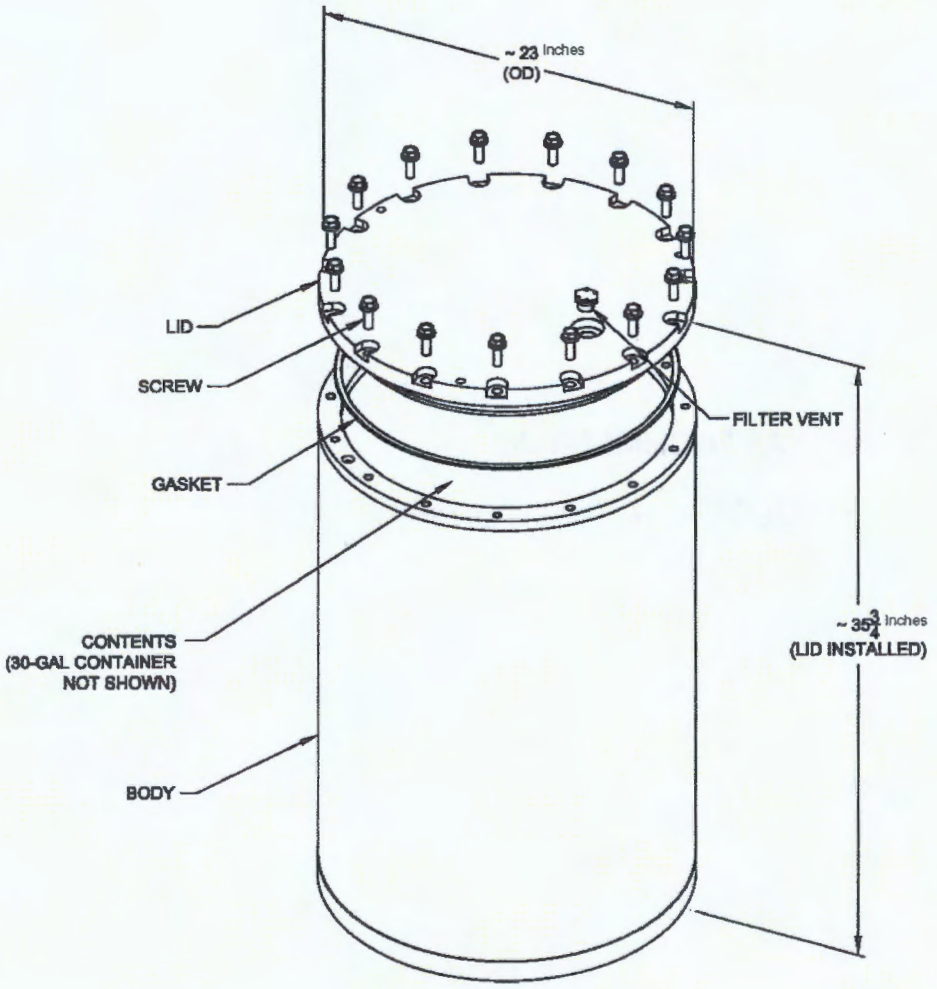

Figure A1-37
Typical Shielded Container

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

A2-1 Description of the Geologic Repository

Management, storage, and disposal of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) geologic repository is subject to regulation under 20.4.1.500 NMAC. The WIPP is a geologic repository mined within a bedded salt formation, which is defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10) as a miscellaneous unit. As such, HWMUs within the repository are eligible for permitting according to 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and are regulated under 20.4.1.500 NMAC, Miscellaneous Units.

As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the Underground Hazardous Waste Disposal Units (**HWDUs**) in the geologic repository, will be met.

The Disposal Phase will consist of receiving contact-handled (**CH**) and remote-handled (**RH**) TRU mixed waste shipping containers, unloading and transporting the waste containers to the Underground HWDUs, emplacing the waste in the Underground HWDUs, and subsequently achieving closure of the Underground HWDUs in compliance with applicable State and Federal regulations.

The WIPP geologic repository is mined within a 2,000-feet (ft) (610-meters (m))-thick bedded-salt formation called the Salado Formation. The Underground HWDUs (miscellaneous units) are located 2,150 ft (655 m) beneath the ground surface. TRU mixed waste management activities underground will be confined to the southern portion of the 120-acre (48.6 hectares) mined area during the Disposal Phase. During the term of this Permit, disposal of TRU mixed waste will occur only in the HWDUs designated as Panels 5 through 8 and in any currently active panel (See Figure A2-1). RH TRU mixed waste disposal began in Panel 4. The Permittees may also request in the future a Permit to allow disposal of containers of TRU mixed waste in the areas designated as Panels 9 and 10 in Figure A2-1. This Permit, during its 10-year term, authorizes the excavation of Panels 6 through 10 and the disposal of waste in Panels 1 through 8.

Panels 1 through 8 will consist of seven rooms and two access drifts each. Panels 9 and 10 have yet to be designed. Access drifts connect the rooms and have the same cross section (see Section A2-2a(3)). The closure system installed in each HWDU after it is filled will prevent anyone from entering the HWDU and will restrict ventilation airflow. The point of compliance for air emissions from the Underground is Sampling Station VOC-A, as defined in Permit Attachment N (Volatile Organic Compound Monitoring Plan). Sampling Station VOC-A is the location where the concentration of volatile organic compounds (VOCs) in the air emissions from the Underground HWDUs will be measured and then compared to the VOC concentration of concern as required by Permit Part 4.

Four shafts connect the underground area with the surface. The Waste Shaft Conveyance headframe and hoist are located within the Waste Handling Building (**WHB**) and will be used to transport containers of TRU mixed waste, equipment, and materials to the repository horizon. The waste hoist can also be used to transport personnel. The Air Intake Shaft and the Salt Handling Shaft provide ventilation to all areas of the mine except for the Waste Shaft Station.

This area is ventilated by the Waste Shaft itself. The Salt Handling Shaft is also used to hoist mined salt to the surface and serves as the principal personnel transport shaft. The Exhaust Shaft serves as a common exhaust air duct for all areas of the mine. The relationship between the WIPP surface facility, the four shafts, and the geologic repository horizon is shown on Figure A2-2.

The HWDUs identified as Panels 1 through 8 (Figure A2-1) provide room for up to 5,244,900 cubic feet (ft^3) (148,500 cubic meters (m^3)) of CH TRU mixed waste. The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Panels 4 through 8 provide room for up to 93,050 ft^3 (2,635 m^3) of RH TRU mixed waste. RH TRU mixed waste may be disposed of in up to 730 boreholes per panel, subject to the limitations in Permit Part 4, Section 4.1.1.2.ii. These boreholes shall be drilled on nominal eight-foot centers, horizontally, about mid-height in the ribs of a disposal room. The thermal loading from RH TRU mixed waste shall not exceed 10 kilowatts per acre when averaged over the area of a panel, as shown in Permit Attachment A3, plus 100 feet of each of a Panel's adjoining barrier pillars.

The WIPP facility is located in a sparsely populated area with site conditions favorable to isolation of TRU mixed waste from the biosphere. Geologic and hydrologic characteristics of the site related to its TRU mixed waste isolation capabilities are discussed in Addendum L1 of the WIPP Hazardous Waste Facility Permit Amended Renewal Application (DOE, 2009). Hazard prevention programs are described in this Permit Attachment. Contingency and emergency response actions to minimize impacts of unanticipated events, such as spills, are described in Permit Attachment D. The closure plan for the WIPP facility is described in Permit Attachment G.

A2-2 Geologic Repository Design and Process Description

A2-2a Geologic Repository Design and Construction

The WIPP facility, when operated in compliance with the Permit, will ensure safe operations and be protective of human health and the environment.

As a part of the design validation process, geomechanical tests were conducted in SPDV test rooms. During the tests, salt creep rates were measured. Separation of bedding planes and fracturing were also observed. Consequently, a ground-control strategy was implemented. The ground-control program at the WIPP facility mitigates the potential for roof or rib falls and maintains normal excavation dimensions, as long as access to the excavation is possible.

A2-2a(1) CH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage CH TRU waste in the geologic repository. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A2-1.

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2

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(**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Backfill

Magnesium oxide (**MgO**) will be used as a backfill in order to provide chemical control over the solubility of radionuclides in order to comply with the requirements of 40 CFR §191.13. The MgO backfill will be purchased prepackaged in the proper containers for emplacement in the underground. Purchasing prepackaged backfill eliminates handling and placement problems associated with bulk materials, such as dust creation. In addition, prepackaged materials will be easier to emplace, thus reducing potential worker exposure to radiation. Should a backfill container be breached, MgO is benign and cleanup is simple. No hazardous waste would result from a spill of backfill.

The MgO backfill will be managed in accordance with Specification D-0101 (MgO Backfill Specification) and WP05-WH1025 (CH Waste Downloading and Emplacement). These documents are kept on file at the WIPP facility by the Permittees.

Backfill will be handled in accordance with standard operating procedures. Typical emplacement configurations are shown in Figures A2-5 and A2-5a. Some emplacement configurations may include the use of MgO emplacement racks, as shown in Figure A2-5a.

Quality control will be provided within standard operating procedures to record that the correct number of sacks are placed and that the condition of the sacks is acceptable.

Backfill placed in this manner is protected until exposed when sacks are broken during creep closure of the room and compaction of the backfill and waste. Backfill in sacks utilizes existing techniques and equipment and eliminates operational problems such as dust creation and introducing additional equipment and operations into waste handling areas. There are no mine operational considerations (e.g. ventilation flow and control) when backfill is placed in this manner.

The Waste Shaft Conveyance

The hoist systems in the shafts and all shaft furnishings are designed to resist the dynamic forces of the hoisting system and to withstand a design-basis earthquake of 0.1 g. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided engineering design-basis earthquake report which provides the basis for seismic design of WIPP facility structures. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system (such as overtravel, overspeed, power loss, circuitry failure, or starting in a wrong direction) and will trigger an alarm that automatically shuts down the hoist.

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The waste hoist moves the Waste Shaft Conveyance and is a multirope, friction-type hoist. A counterweight is used to balance the waste shaft conveyance. The waste shaft conveyance (outside dimensions) is 30 ft (9 m) high by 10 ft (3 m) wide by 15 ft (4.5 m) deep and can carry a payload of 45 tons (40,824 kg). During loading and unloading operations, it is steadied by fixed guides. The hoist's maximum rope speed is 500 ft (152.4 m) per min.

The Waste Shaft hoist system has two sets of brakes, with two units per set, plus a motor that is normally used to stop the hoist. The brakes are designed so that either set, acting alone, can stop a fully loaded conveyance under all emergency conditions.

The Underground Waste Transporter

The underground waste transporter is a commercially available diesel-powered tractor. The trailer was designed specifically for the WIPP for transporting facility pallets from the waste shaft conveyance to the Underground HWDU in use. This transporter is shown in Figure A2-6.

Underground Forklifts

CH TRU mixed waste containers loaded on slipsheets will be removed from the facility pallets using forklifts with a push-pull attachment (Figure A2-7) attached to the forklift-truck front carriage. The push-pull attachment grips the edge of the slipsheet (on which the waste containers sit) to pull the containers onto the platen. After the forklift moves the waste containers to the emplacement location, the push-pull attachment pushes the containers into position. The use of the push-pull attachment prevents direct contact between waste containers and forklift tines. SWBs and TDOPs may also be removed from the facility pallet by using forklifts equipped with special adapters for these containers. These special adapters will prevent direct contact between SWBs or TDOPs and forklift tines. In addition, the low clearance forklift that is used to emplace MgO may be used to emplace waste if necessary.

A forklift will be used to offload the SLB2 from the underground transporter and emplace the waste container in the waste stack.

A2-2a(2) Shafts

The WIPP facility uses four shafts: the Waste Shaft, the Salt Handling Shaft, the Air Intake Shaft, and the Exhaust Shaft. These shafts are vertical openings that extend from the surface to the repository level.

The Waste Shaft is located beneath the WHB and is 19 to 20 ft (5.8 to 6.1 m) in diameter. The Salt Handling Shaft, located north of the Waste Shaft beneath the salt handling headframe, is 10 to 12 ft (3 to 3.6 m) in diameter. Salt mined from the repository horizon is removed through the Salt Handling Shaft. The Salt Handling Shaft is the main personnel and materials hoist and also serves as a secondary-supply air duct for the underground areas. The Air Intake Shaft, northwest of the WHB, varies in diameter from 16 ft 7 in. (4.51 m) to 20 ft 3 in. (6.19 m) and is the primary source of fresh air underground. The Exhaust Shaft, east of the WHB, is 14 to 15 ft (4.3 to 4.6 m) in diameter and serves as the exhaust duct for the underground air.

Openings excavated in salt experience closure because of salt creep (or time-dependent deformation at constant load). The closure affects the design of all of the openings discussed in this section. Underground excavation dimensions, therefore, are nominal, because they change

with time. The unlined portions of the shafts have larger diameters than the lined portions, which allows for closure caused by salt creep. Each shaft includes a shaft collar, a shaft lining, and a shaft key section. The Final Design Validation Report in Appendix D1 of the WIPP RCRA Part B Permit Application (DOE, 1997) discusses the shafts and shaft components in greater detail.

The reinforced-concrete shaft collars extend from the surface to the top of the underlying consolidated sediments. Each collar serves to retain adjacent unconsolidated sands and soils and to prevent surface runoff from entering the shafts. The shaft linings extend from the base of the collar to the top of the salt beds approximately 850 ft (259 m) below the surface. Grout injected behind the shaft lining retards water seeping into the shafts from water-bearing formations, and the liner is designed to withstand the natural water pressure associated with these formations. The shaft liners are concrete, except in the Salt Handling Shaft, where a steel shaft liner has been grouted in place.

The shaft key is a circular reinforced concrete section emplaced in each shaft below the liner in the base of the Rustler and extending about 50 ft (15 m) into the Salado. The key functions to resist lateral pressures and assures that the liner will not separate from the host rocks or fail under tension. This design feature also aids in preventing the shaft from becoming a route for groundwater flow into the underground facility.

On the inside surface of each shaft, excluding the Salt Handling Shaft, there are three water-collection rings: one just below the Magenta, one just below the Culebra, and one at the lowermost part of the key section. These collection rings will collect water that may seep into the shaft through the liner. The Salt Handling Shaft has a single water collection ring in the lower part of the key section. Water collection rings are drained by tubes to the base of the shafts where the water is accumulated.

WIPP shafts and other underground facilities are, for all practical purposes, dry. Minor quantities of water (which accumulate in some shaft sumps) are insufficient to affect the waste disposal area. This water is collected, brought to the surface, and disposed of in accordance with current standards and regulations.

The Waste Shaft is protected from precipitation by the roof of the waste shaft conveyance headframe tower. The Exhaust Shaft is configured at the top with a 14 ft- (4.3 m-) diameter duct that diverts air into the exhaust filtration system or to the atmosphere, as appropriate. The Salt Handling and Air Intake Shaft collars are open except for the headframes. Rainfall into the shafts is evaporated by ventilation air.

The waste hoist system in the Waste Shaft and all Waste Shaft furnishings are designed to resist the dynamic forces of the hoisting system, which are greater than the seismic forces on the underground facilities. In addition the Waste Shaft conveyance headframe is designed to withstand the design-basis earthquake (**DBE**). Maximum operating speed of the hoist is 500 ft (152.4 m) per minute. During loading and unloading operations, the waste hoist is steadied by fixed guides. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system, such as overtravel, overspeed, power loss, or circuitry failure. The control response is to annunciate the condition and shut the hoist down. Operator response is required to recover from the automatic shutdown. Waste hoist operation is continuously monitored by the CMS. A battery powered FM transmitter/receiver allows communication between the hoist conveyance and the hoist house.

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The waste hoist has two pairs of brake calipers acting on independent brake paths. The hoist motor is normally used for braking action of the hoist. The brakes are used to hold the hoist in position during normal operations and to stop the hoist under emergency conditions. Each pair of brake calipers is capable of holding the hoist in position during normal operating conditions and stopping the hoist under emergency conditions. In the event of power failure, the brakes will set automatically.

The waste hoist is protected by a fixed automatic fire suppression system. Portable fire extinguishers are also provided on the hoist floor and in equipment areas.

A2-2a(3) Subsurface Structures

The subsurface structures in the repository, located at 2,150 ft (655 m) below the surface, include the HWDUs, the northern experimental areas, and the support areas. Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided details of the underground layout. Figure A2-8 shows the proposed waste emplacement configuration for the HWDUs.

The status of important underground equipment, including fixed fire-protection systems, the ventilation system, and contamination detection systems, will be monitored by a central monitoring system, located in the Support Building adjacent to the WHB. Backup power will be provided as discussed below. The subsurface support areas are constructed and maintained to conform to Federal mine safety codes.

Underground Hazardous Waste Disposal Units (HWDUs)

During the terms of this and the preceding Permit, the volume of CH TRU mixed waste emplaced in the repository will not exceed 5,244,900 ft^3 (148,500 m^3) and the volume of RH TRU mixed waste shall not exceed 93,050 ft^3 (2,635 m^3). CH TRU mixed waste will be disposed of in Underground HWDUs identified as Panels 1 through 8. RH TRU mixed waste may be disposed of in Panels 4 through 8.

Main entries and cross cuts in the repository provide access and ventilation to the HWDUs. The main entries link the shaft pillar/service area with the TRU mixed waste management area and are separated by pillars. Each of the Underground HWDUs labeled Panels 1 through 8 will have seven rooms. The locations of these HWDUs are shown in Figure A2-1. The rooms will have nominal dimensions of 13 ft (4.0 m) high by 33 ft (10 m) wide by 300 ft (91 m) long and will be supported by 100 ft- (30 m-) wide pillars.

As currently planned, future Permits may allow disposal of TRU mixed waste containers in two additional panels, identified as Panels 9 and 10. Disposal of TRU mixed waste in Panels 9 and 10 is prohibited under this Permit. If waste volumes disposed of in the eight panels fail to reach the stated design capacity, the Permittees may request a Permit to allow disposal of TRU mixed waste in the four main entries and crosscuts adjacent to the waste panels (referred to as the disposal area access drifts). These areas are labeled Panels 9 and 10 in Figure A2-1. A permit modification or future permit would be submitted describing the condition of those drifts and the controls exercised for personnel safety and environmental protection while disposing of waste in these areas. These areas have the following nominal dimensions:

The E-140 waste transport route south of the Waste Shaft Station is mined to be 25 ft wide nominally and its height ranges from about 14 ft to 20 ft.

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The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

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RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room when waste disposal is taking place and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. Flexible flashing attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. The filled rooms will be isolated from the ventilation system, while the active rooms that are actively being filled will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

Overall, there are six possible modes of exhaust fan operation:

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2 main fans in operation
1 main fan in operation
1 filtration fan in filtered operation
1 filtration fan in unfiltered operation
2 filtration fans in unfiltered operation
1 main and 1 filtration fan (unfiltered) in operation

Under some circumstances (such as power outages and maintenance activities, etc.), all mine ventilation may be discontinued for short periods of time.

In the normal mode, two main surface exhaust fans, located near the Exhaust Shaft, will provide continuous ventilation of the underground areas. All underground flows join at the bottom of the Exhaust Shaft before discharge to the atmosphere.

Outside air will be supplied to the mining areas and the waste disposal areas through the Air Intake Shaft, the Salt Handling Shaft, and access entries. A small quantity of outside air will flow down the Waste Shaft to ventilate the Waste Shaft station. The ventilation system is designed to operate with the Air Intake Shaft as the primary source of fresh air. Under these circumstances, sufficient air will be available to simultaneously conduct all underground operations (e.g., waste handling, mining, experimentation, and support). Ventilation may be supplied by operating fans in the configurations listed in the above description of the ventilation modes.

If the nominal flow of 425,000 cfm (12,028 m^3/min) is not available (i.e., only one of the main ventilation fans is available) underground operations may proceed, but the number of activities that can be performed in parallel may be limited depending on the quantity of air available. Ventilation may be supplied by operating one or two of the filtration exhaust fans. To accomplish this, the isolation dampers will be opened, which will permit air to flow from the main exhaust duct to the filter outlet plenum. The filtration fans may also be operated to bypass the HEPA plenum. The isolation dampers of the filtration exhaust fan(s) to be employed will be opened, and the selected fan(s) will be switched on. In this mode, underground operations will be limited, because filtration exhaust fans cannot provide sufficient airflow to support the use of diesel equipment.

In the filtration mode, the exhaust air will pass through two identical filter assemblies, with only one of the three Exhaust Filter Building filtration fans operating (all other fans are stopped). This system provides a means for removing the airborne particulates that may contain radioactive and hazardous waste contaminants in the reduced exhaust flow before they are discharged through the exhaust stack to the atmosphere. The filtration mode is activated manually or automatically if the radiation monitoring system detects abnormally high concentrations of airborne radioactive particulates (an alarm is received from the continuous air monitor in the exhaust drift of the active waste panel) or a waste handling incident with the potential for a waste container breach is observed. The filtration mode is not initiated by the release of gases such as VOCs.

If utility power fails, the exhaust filter system goes into the fail-safe position, and the system high-efficiency particulate-air filter dampers are placed into filtration position. When power is restored by the diesel generators, a decision is made whether to remain in filtration mode and energize a filtration fan or to realign the dampers into the minimum exhaust mode. Without any indication of a radiological release, the decision is usually the latter. TRU mixed waste handling and related operations cease upon loss of utility power and are not resumed until normal utility

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power is returned. As specified in Part 2, all waste handling equipment will "fail safe," meaning that it will retain its load during a power outage.

Underground Ventilation Normal Mode Redundancy

The underground ventilation system has been provided redundancy in normal ventilation mode by the addition of a third main fan. Ductwork leading to that new fan ties into the existing main exhaust duct.

Electrical System

The WIPP facility uses electrical power (utility power) supplied by the regional electric utility company. If there is a loss of utility power, TRU mixed waste handling and related operations will cease.

Backup, alternating current power will be provided on site by two 1,100-kilowatt diesel generators. These units provide 480-volt power with a high degree of reliability. Each of the diesel generators can carry predetermined equipment loads while maintaining additional power reserves. Predetermined loads include lighting and ventilation for underground facilities, lighting and ventilation for the TRU mixed waste handling areas, and the Air Intake Shaft hoist. The diesel generator can be brought on line within 30 minutes either manually or from the control panel in the Central Monitoring Room (CMR).

Uninterruptible power supply (**UPS**) units are also on line providing power to predetermined monitoring systems. These systems ensure that the power to the radiation detection system for airborne contamination, the local processing units, the computer room, and the CMR will always be available, even during the interval between the loss of off-site power and initiation of backup diesel generator power.

A2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table A2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure A2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the Facility Cask is loaded, the Facility Cask Transfer Car moves onto the waste shaft conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste shaft conveyance to provide forklift access to the Facility Cask.

Horizontal Emplacement and Retrieval Equipment or Functionally Equivalent Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) or functionally equivalent equipment (Figure A2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

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A2-2b Geologic Repository Process Description

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste shaft conveyance and is lowered to the waste shaft station underground. At the waste shaft station underground, the Facility Cask is moved from the waste shaft conveyance by the Facility Cask Transfer Car (Figure A2-16). A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU. There, the Facility Cask is placed on the HERE (Figure A2-17). The HERE is used to emplace the RH TRU mixed waste canister into the borehole. The borehole will be visually inspected for obstructions prior to aligning the HERE and emplacement of the RH TRU mixed waste canister. The Facility Cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear Facility Cask shield valve. The shield valves on the Facility Cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the Facility Cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the Facility Cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure A2-18). The transfer mechanism is retracted, the shield valves close on the Facility Cask, and the Facility Cask is removed from the HERE.

A shield plug is a concrete filled cylindrical steel shell (Figure A2-21) approximately 61 in. long and 29 in. in diameter, made of concrete shielding material inside a 0.24 in. thick steel shell with a removable pintle at one end. Each shield plug has integral forklift pockets and weighs approximately 3,750 lbs. The shield plug is inserted with the pintle end closest to the HERE to provide the necessary shielding , limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr . Additional shielding is provided at the direction of the Radiological Control Technician based on dose rate surveys following shield plug emplacement. This additional shielding is provided by the manual emplacement of one or more shield plug supplemental shielding plates and a retainer (Figures A2-19 and A2-20).

The amount of RH TRU mixed waste disposal in each panel is limited based on thermal and geomechanical considerations and shall not exceed 10 kilowatts per acre as described in Permit Attachment A2-1. RH TRU mixed waste emplacement boreholes shall be drilled in the ribs of the panels at a nominal spacing of 8 ft (2.4 m) center-to-center, horizontally.

Figures A1-26 and A1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and CNS 10-160B casks, respectively.

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers, at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping

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containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one three-pack of shielded containers or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste shaft conveyance, and the facility pallet will be transferred from the waste shaft conveyance onto the transporter (see Figure A2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement. The underground waste transporter is equipped with a fire suppression system, rupture-resistant diesel fuel tanks, and reinforced fuel lines to minimize the potential for a fire involving the fuel system.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment or, in the case of an SLB2, the SLB2 will be lifted from the facility pallet and placed directly on the floor of the emplacement room. The waste will be emplaced room by room in Panels 1 through 8. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade and, if necessary, bulkheads will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

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The emplacement of CH TRU mixed waste into the HWDUs will typically be in the order received and unloaded from the Contact Handled Packaging. There is no specification for the amount of space to be maintained between the waste containers themselves, or between the waste containers and the walls. Containers will be stacked in the best manner to provide stability for the stack (which is up to three containers high) and to make best use of available space. It is anticipated that the space between the wall and the container could be from 8 to 18 in. (20 to 46 cm). This space is a function of disposal room wall irregularities, container type, and sequence of emplacement. Bags of backfill will occupy some of this space. Space is required over the stacks of containers to assure adequate ventilation for waste handling operations. A minimum of 16 in. (41 cm) was specified in the Final Design Validation Report (Appendix D1, Chapter 12 of the WIPP RCRA Part B Permit Application (DOE, 1997)) to maintain air flow. Typically, the space above a stack of containers will be 36 to 48 in. (90 to 122 cm). However 18 in. (0.45 m) will contain backfill material consisting of bags of Magnesium Oxide (MgO). Figure A2-8 shows a typical container configuration, although this figure does not mix containers on any row. Such mixing, while inefficient, will be allowed to assure timely movement of waste into the underground. No aisle space will be maintained for personnel access to emplaced waste containers. No roof maintenance behind stacks of waste is planned.

The anticipated schedule for the filling of each of the Underground HWDUs known as Panels 1 through 8 is shown in Permit Attachment G, Table G-1. Panel closure in accordance with the Closure Plan in Permit Attachment G and Permit Attachment G1 is estimated to require an additional 150 days.

Figure A2-12 is a flow diagram of the CH TRU mixed waste handling process.

A2-3 Waste Characterization

TRU mixed waste characterization is described in Permit Attachment C.

A2-4 Treatment Effectiveness

TRU mixed waste treatment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), for which a permit is required, will not be performed at the WIPP facility.

A2-5 Maintenance, Monitoring, and Inspection

A2-5a Maintenance

A2-5a(1) Ground-Control Program

The ground-control program at the WIPP facility will ensure that any room in an HWDU in which waste will be placed will be sufficiently supported to assure compliance with the applicable portions of the Land Withdrawal Act (**LWA**), which requires a regular review of roof-support plans and practices by the Mine Safety and Health Administration (**MSHA**). Support is installed to the requirements of 30 CFR §57, Subpart B.

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A2-5b Monitoring

A2-5b(1) Groundwater Monitoring

Groundwater monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 5 and Permit Attachment L of this permit.

A2-5b(2) Geomechanical Monitoring

The geomechanical monitoring program at the WIPP facility is an integral part of the ground-control program (See Figure A2-13). HWDUs, drifts, and geomechanical test rooms will be monitored to provide confirmation of structural integrity. Geomechanical data on the performance of the repository shafts and excavated areas will be collected as part of the geotechnical field-monitoring program. The results of the geotechnical investigations will be reported annually. The report will describe monitoring programs and geomechanical data collected during the previous year.

A2-5b(2)(a) Description of the Geomechanical Monitoring System

The Geomechanical Monitoring System (**GMS**) provides in situ data to support the continuous assessment of the design for underground facilities. Specifically, the GMS provides for:

- Early detection of conditions that could affect operational safety
- Evaluation of disposal room closure that ensures adequate access
- Guidance for design modifications and remedial actions
- Data for interpreting the behavior of underground openings, in comparison with established design criteria

The instrumentation in Table A2-2 is available for use in support of the geomechanical program.

The minimum instrumentation for each of the eight panels will be one borehole extensometer installed in the roof at the center of each disposal room. The roof extensometers will monitor the dilation of the immediate salt roof beam and possible bed separations along clay seams. Additional instrumentation will be installed as conditions warrant.

Remote polling of the geomechanical instrumentation will be performed at least once every month. This frequency may be increased to accommodate any changes that may develop.

The results from the remotely read instrumentation will be evaluated after each scheduled polling. Documentation of the results will be provided annually in the Geotechnical Analysis Report.

Data from remotely read instrumentation will be maintained as part of a geotechnical instrumentation system. The instrumentation system provides for data maintenance, retrieval, and presentation. The Permittees will retrieve the data from the instrumentation system and verify data accuracy by confirming the measurements were taken in accordance with applicable instructions and equipment calibration is known. Next, the Permittees will review the data after

each polling to assess the performance of the instrument and of the excavation. Anomalous data will be investigated to determine the cause (instrumentation problem, error in recording, changing rock conditions). The Permittees will calculate various parameters such as the change between successive readings and deformation rates. This assessment will be reported to the Permittees' cognizant ground control engineer and operations personnel. The Permittees will investigate unexpected deformation to determine if remediation is needed.

The stability of an open panel excavation is generally determined by the rock deformation rate. The excavation may be unstable when there is a continuous increase in the deformation rate that cannot be controlled by the installed support system. The Permittees will evaluate the performance of the excavation. These evaluations assess the effectiveness of the roof support system and estimate the stand-up time of the excavation. If an open panel shows the trend is toward adverse (unstable) conditions, the results will be reported to determine if it is necessary to terminate waste disposal activities in the open panel. This report of the trend toward adverse conditions in an open HWDU will also be provided to the Secretary of the NMED within seven (7) calendar days of issuance of the report.

A2-5b(2)(b) System Experience

Much experience in the use of geomechanical instrumentation was gained as the result of performance monitoring of Panel 1, which began at the time of completion of the panel excavation in 1988. The monitoring system installed at that time involved simple measurements and observations (e.g., vertical and horizontal convergence rates, and visual inspections). Minimal maintenance of instrumentation is required, and the instrumentation is easily replaced if it malfunctions. Conditions throughout Panel 1 are well known. The monitoring program continues to provide data to compare the performance of Panel 1 with that established elsewhere in the underground. Panel 1 performance is characterized by the following:

The development of bed separations and lateral shifts at the interfaces of the salt and the clays underlying the anhydrites "a" and "b."

Room closures. A closure due only to the roof movement will be separated from the total closure.

The behavior of the pillars.

Fracture development in the roof and floor.

Distribution of load on the support system.

Roof conditions are assessed from observation boreholes and extensometer measurements. Measurements of room closure, rock displacements, and observations of fracture development in the immediate roof beam are made and used to evaluate the performance of a panel. A description of the Panel 1 monitoring program was presented to the members of the Geotechnical Experts Panel (in 1991) who concurred that it was adequate to determine deterioration within the rooms and that it will provide early warning of deteriorating conditions.

The assessment and evaluation of the condition of WIPP excavations is an interactive, continuous process using the data from the monitoring programs. Criteria for corrective action are continually reevaluated and reassessed based on total performance to date. Actions taken

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are based on these analyses and planned utilization of the excavation. Because WIPP excavations are in a natural geologic medium, there is inherent variability from point to point. The principle adopted is to anticipate potential ground control requirements and implement them in a timely manner rather than to wait until a need arises.

A2-5b(3) Volatile Organic Compound Monitoring

The volatile organic compound monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 4 and Permit Attachment N of this permit.

A2-5c Inspection

The inspection of the WIPP Underground HWDUs will be conducted in accordance with Part 2 and Permit Attachment E of this permit.

References

DOE, 1997. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Revision 6.5, 1997.

DOE, 2009. WIPP Hazardous Waste Facility Permit Amended Renewal Application, Carlsbad, New Mexico, September 2009.

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TABLES

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

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Table A2-2
Instrumentation Used in Support of the Geomechanical Monitoring System

Instrument Type	Features	Parameter Measured	Range
Borehole Extensometer	The extensometer provides for monitoring the deformation parallel to the borehole axis. Units suitable for up to 5 measurements anchors in addition to the reference head. Maximum borehole depths shall be 50 feet.	Cumulative Deformation	0-2 inches
Borehole Television Camera	Closed circuit television may be used for monitoring areas otherwise inaccessible, such as boreholes or shafts.	Video Image	N/A
Convergence Points and Tape Extensometers	Mechanically anchored eyebolts to which a portable tape extensometer is attached.	Cumulative Deformation	2-50 feet
Convergence Meters	Includes wire and sonic meters. Mounted on rigid plates anchored to the rock surface.	Cumulative Deformation	2-50 feet
Inclinometers	Both vertical and horizontal inclinometers are used. Traversing type of system in which a probe is moved periodically through casing located in the borehole whose inclination is being measured.	Cumulative Deformation	0-30 degrees
Rock Bolt Load Cells	Spool type units suitable for use with rock bolts. Tensile stress is inferred from strain gauges mounted on the surface of the spool.	Load	0-300 kips
Earth Pressure Cells	Installed between concrete keys and rock. Preferred type is a hydraulic pressure plate connected to a vibrating wire transmitter.	Lithostatic Pressure	0-1000 psi
Piezometer Pressure Transducers	Located in shafts and of robust design and construction. Periodic checks on operability required.	Fluid Pressure	0-500 psi
Strain Gauges	Installed within the concrete shaft key. Suitably sealed for the environment. Two types used--surface mounted and embedded.	Cumulative Deformation	0-3000 µin/in (embedded) 0-2500 µin/in (surface)

Table A2-3
RH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
41-Ton Forklift	82,000 lbs
Maximum Gross Weights of RH TRU Containers	
RH TRU Facility Canister	10,000 lbs
55-Gallon Drum	1,000 lbs
RH TRU Canister	8,000 lbs
Maximum Net Empty Weights of Equipment	
Facility Cask	67,700 lbs

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FIGURES

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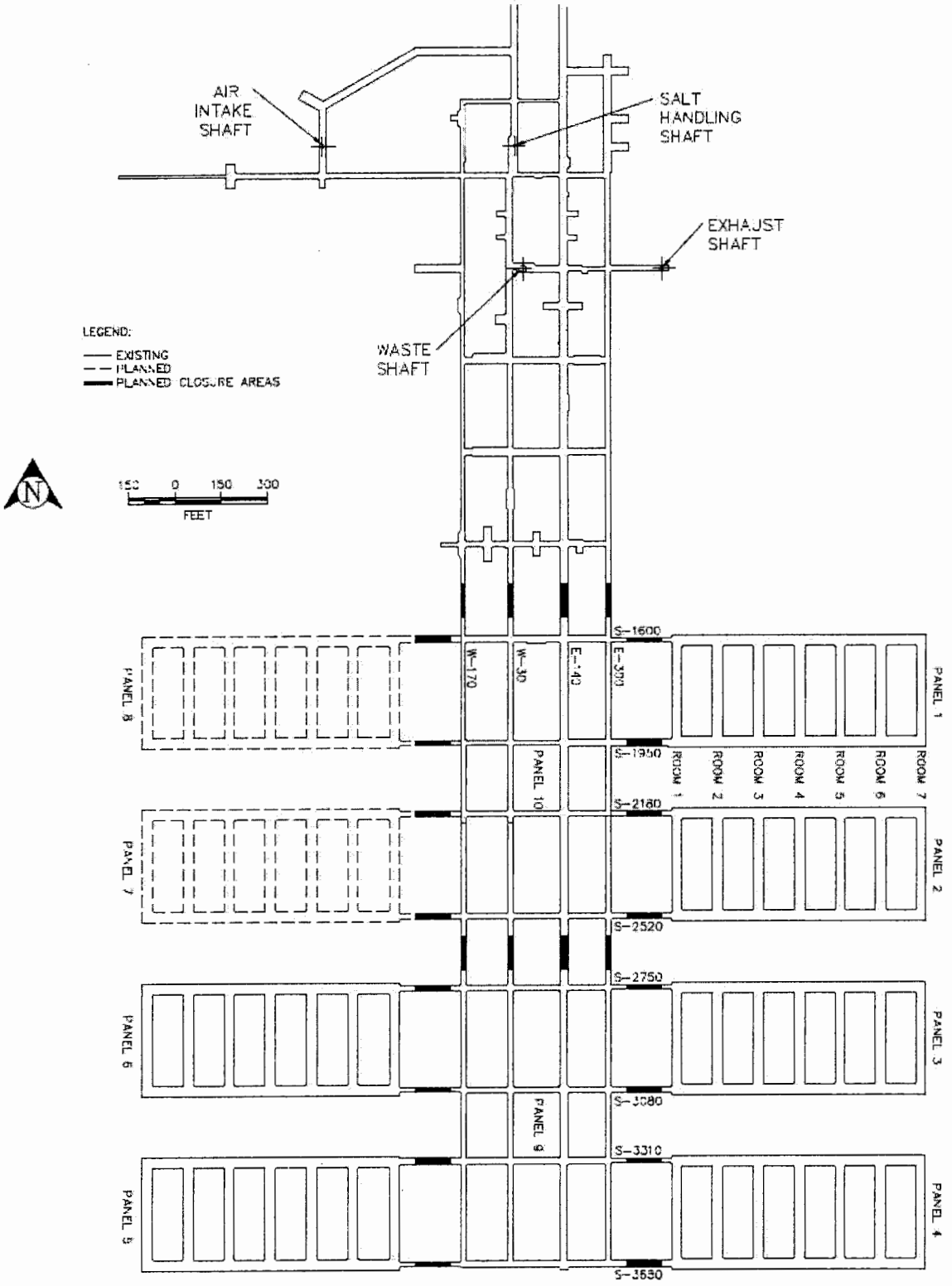

Figure A2-1
Repository Horizon

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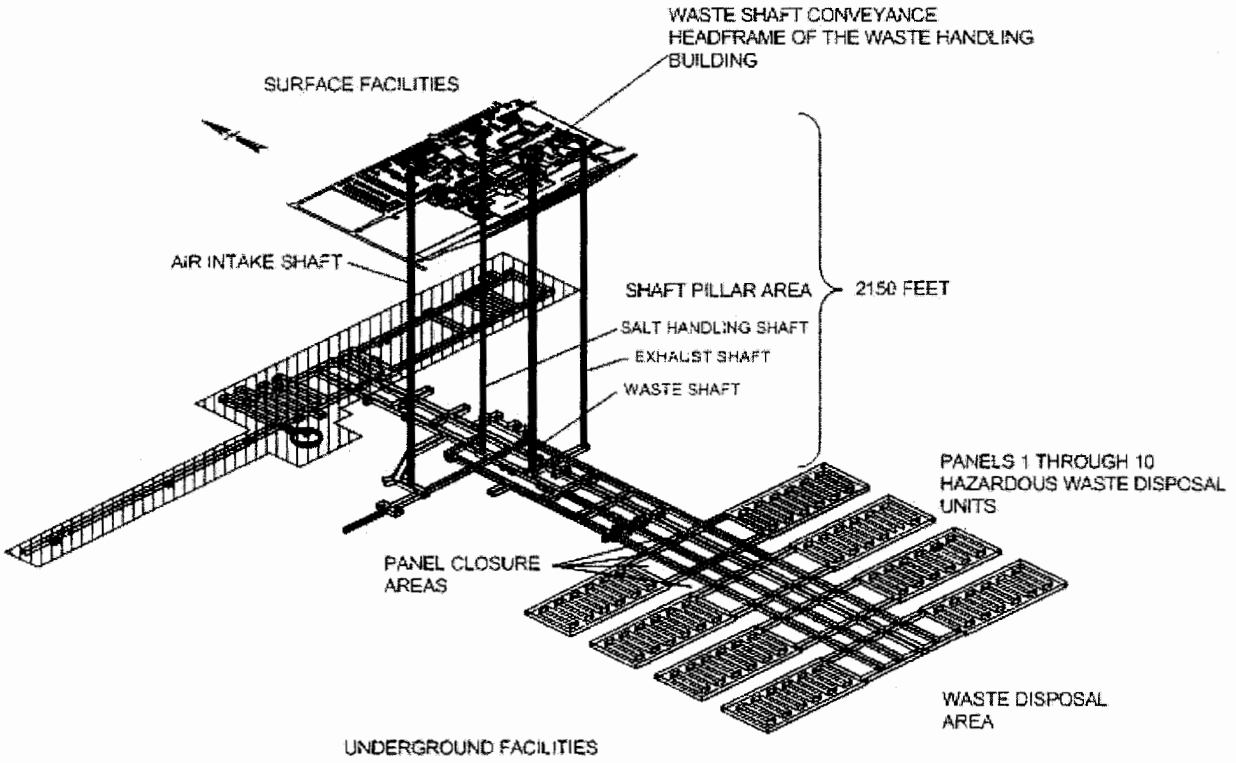

Figure A2-2
Spatial View of the Miscellaneous Unit and Waste Handling Facility

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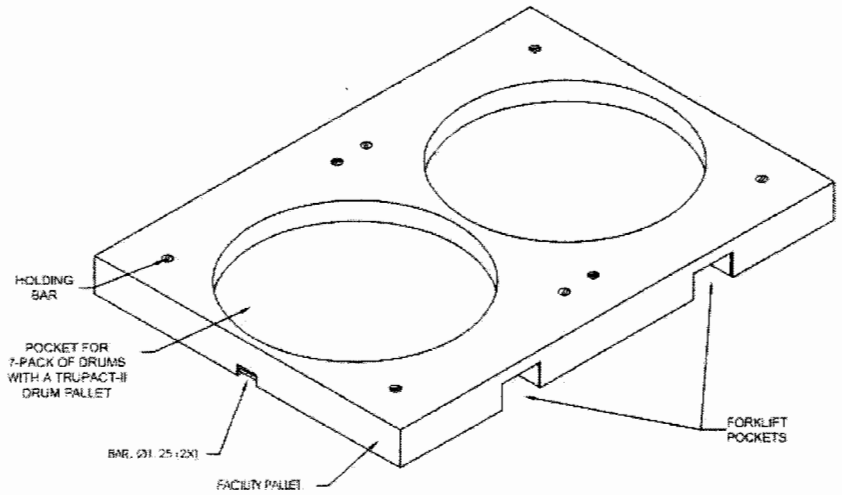

Figure A2-3
Facility Pallet for Seven-Pack of Drums

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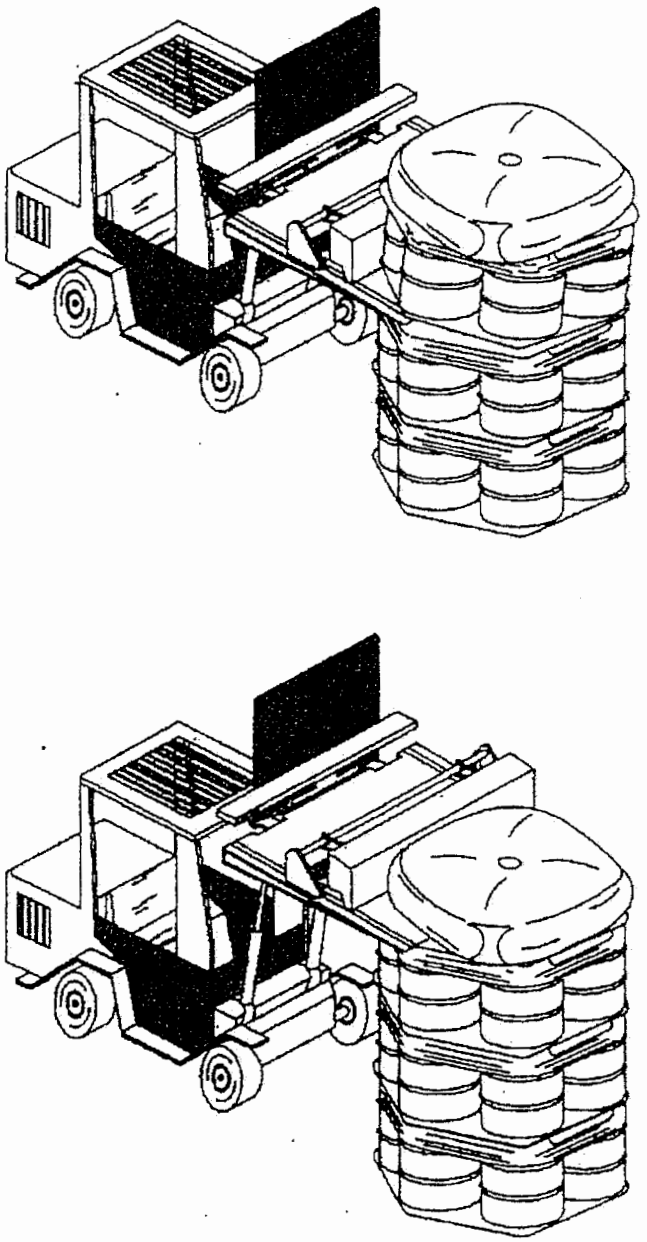

Figure A2-5
Typical Backfill Sacks Emplaced on Drum Stacks

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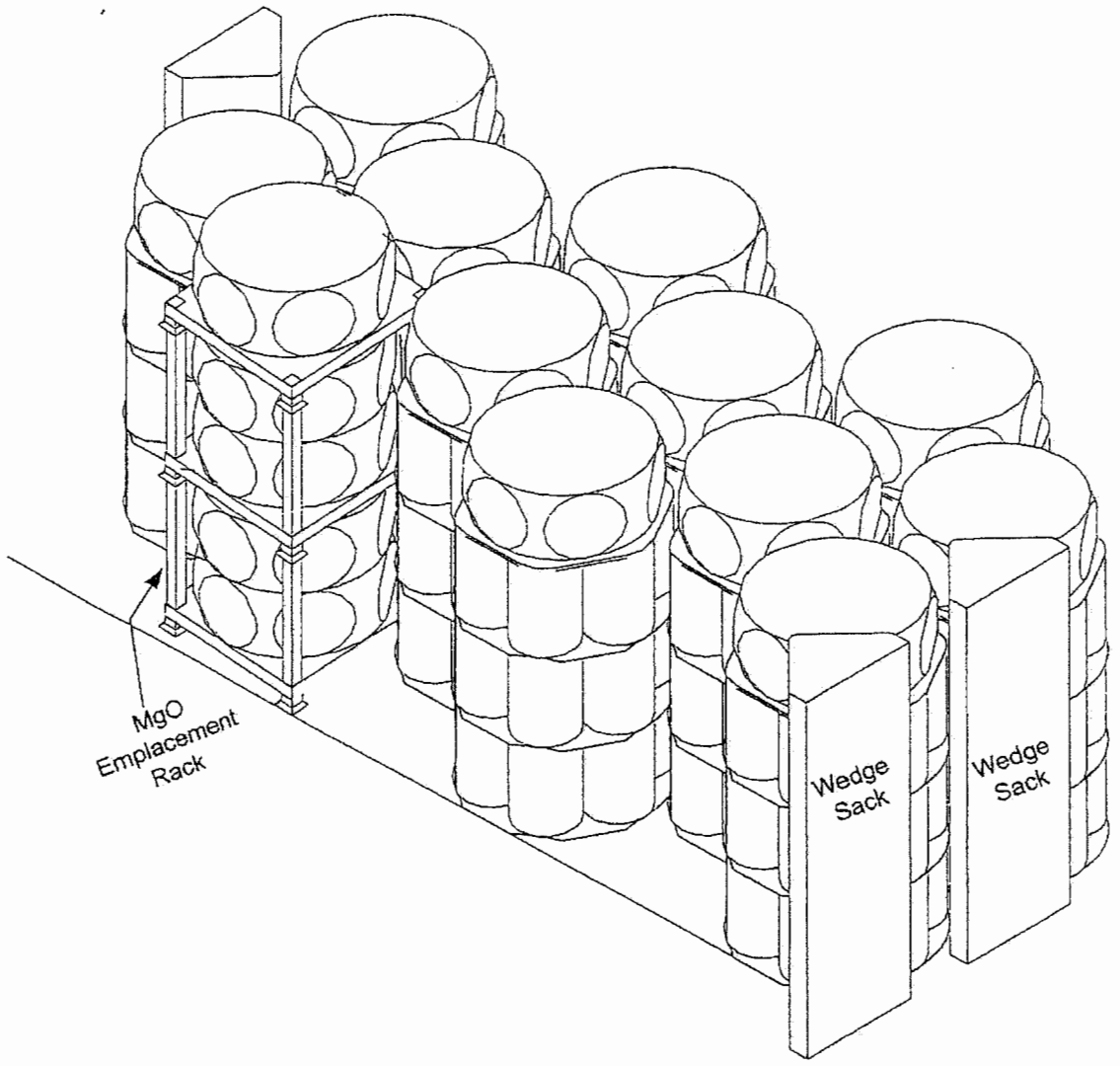

Figure A2-5a
Potential MgO Emplacement Configurations

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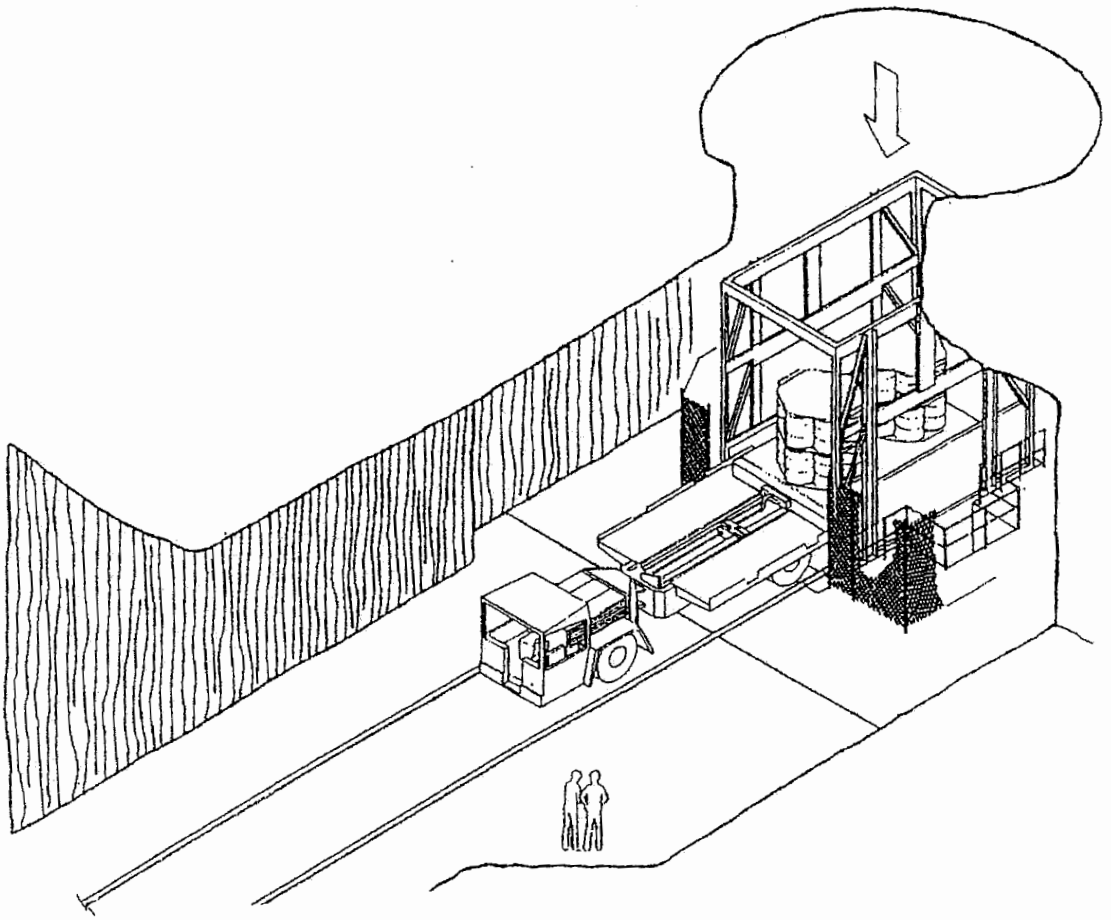

Figure A2-6
Waste Transfer Cage to Transporter

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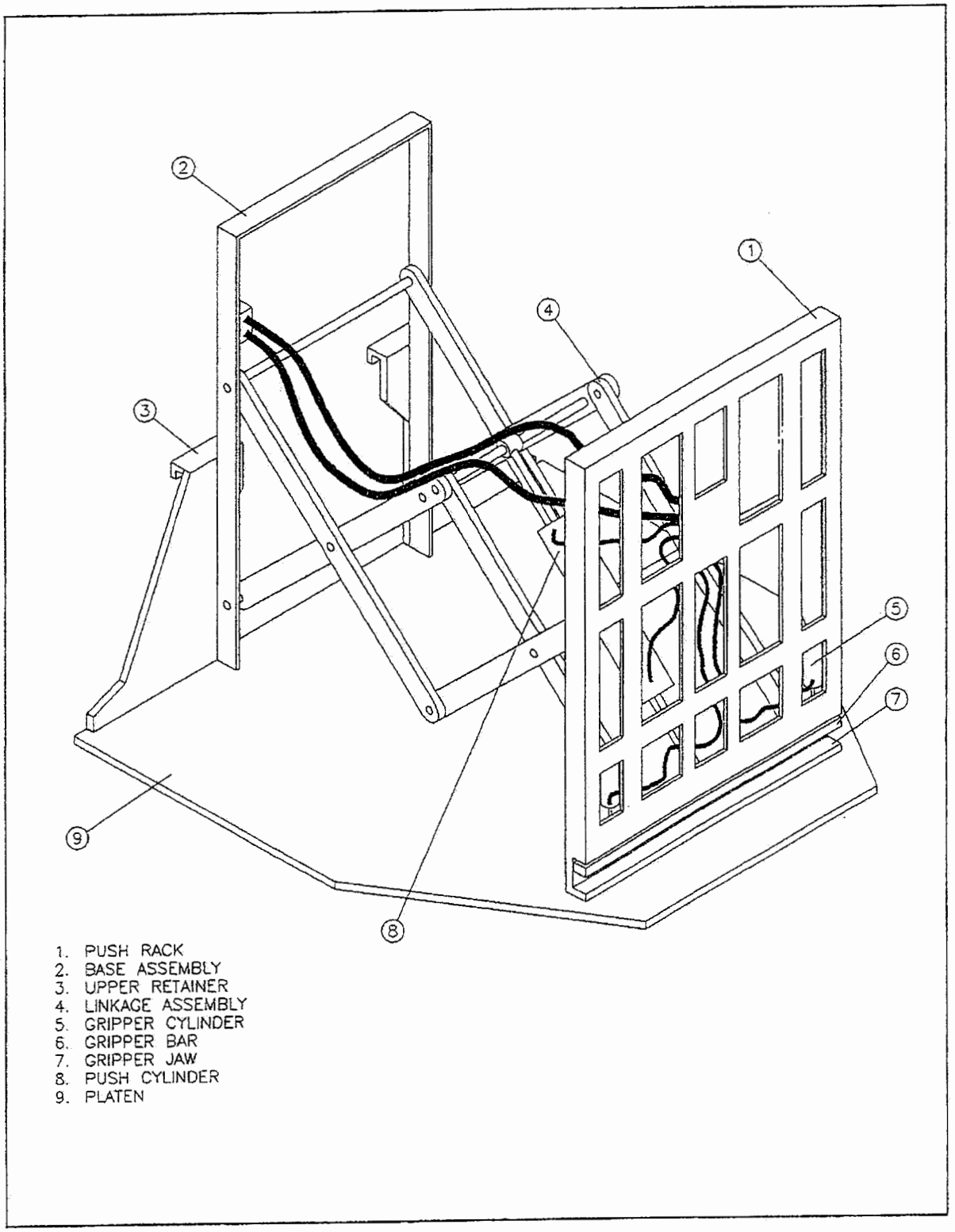

Figure A2-7
Push-Pull Attachment to Forklift to Allow Handling of Waste Containers

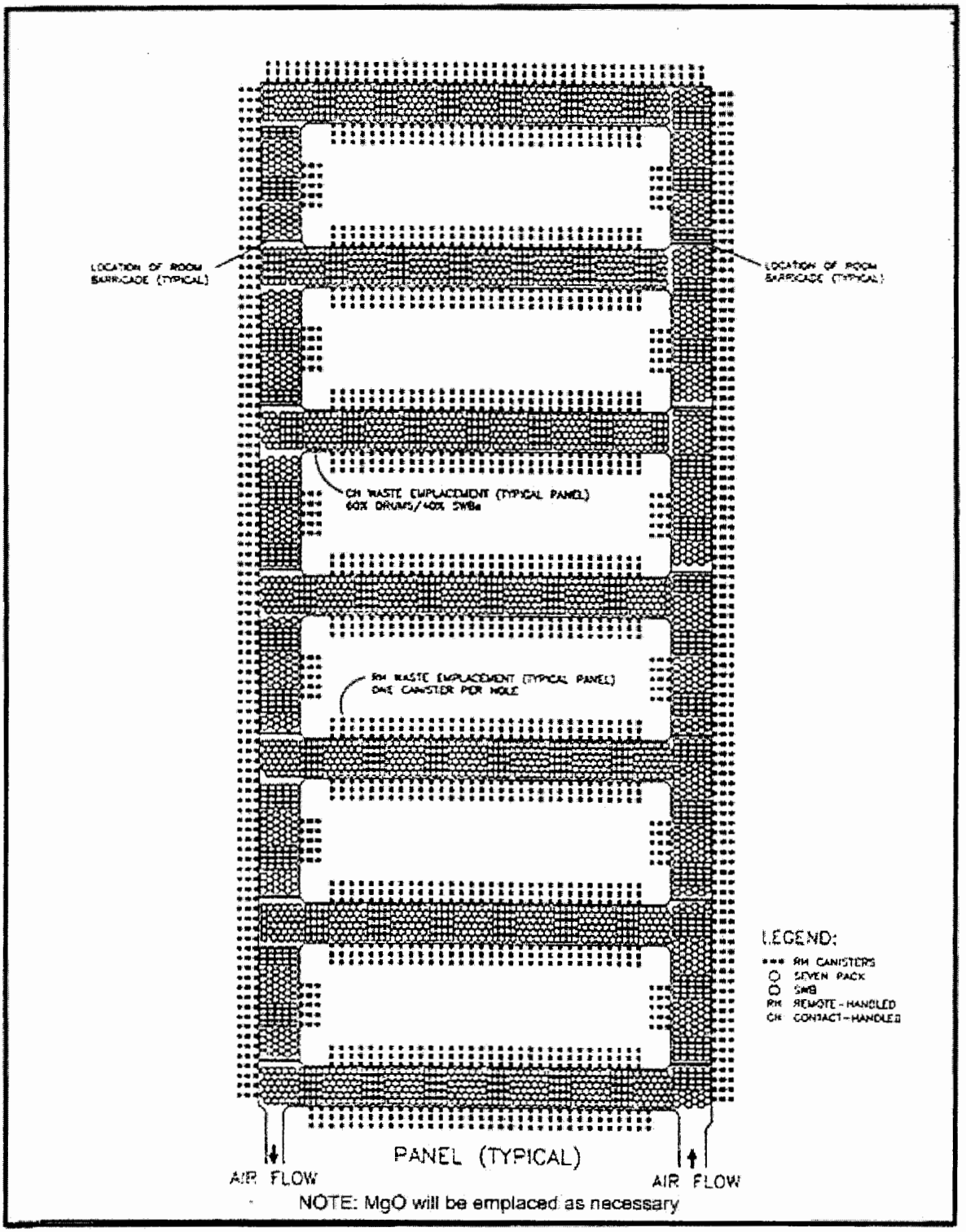

Figure A2-8
Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration

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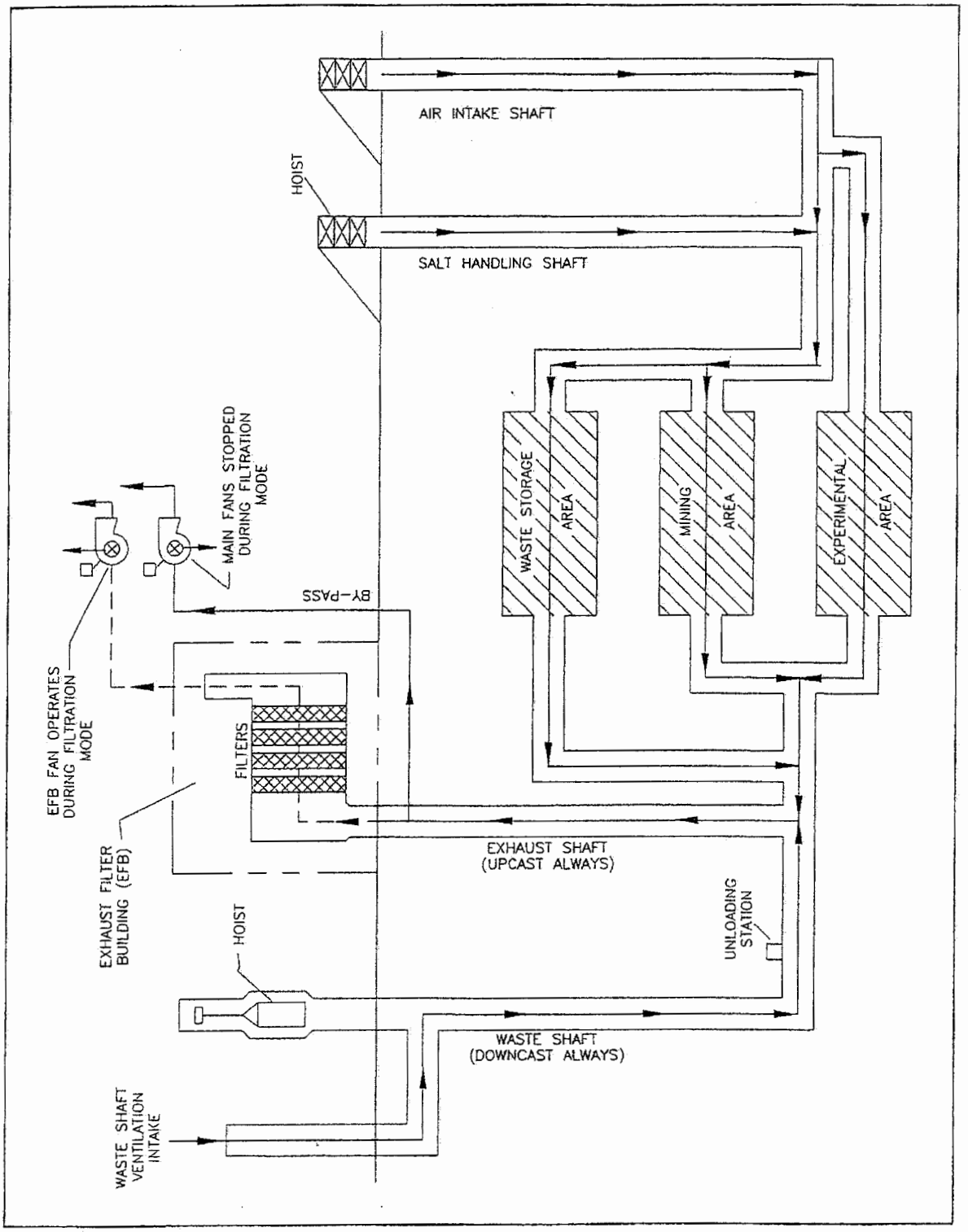

Figure A2-9
Underground Ventilation System Airflow

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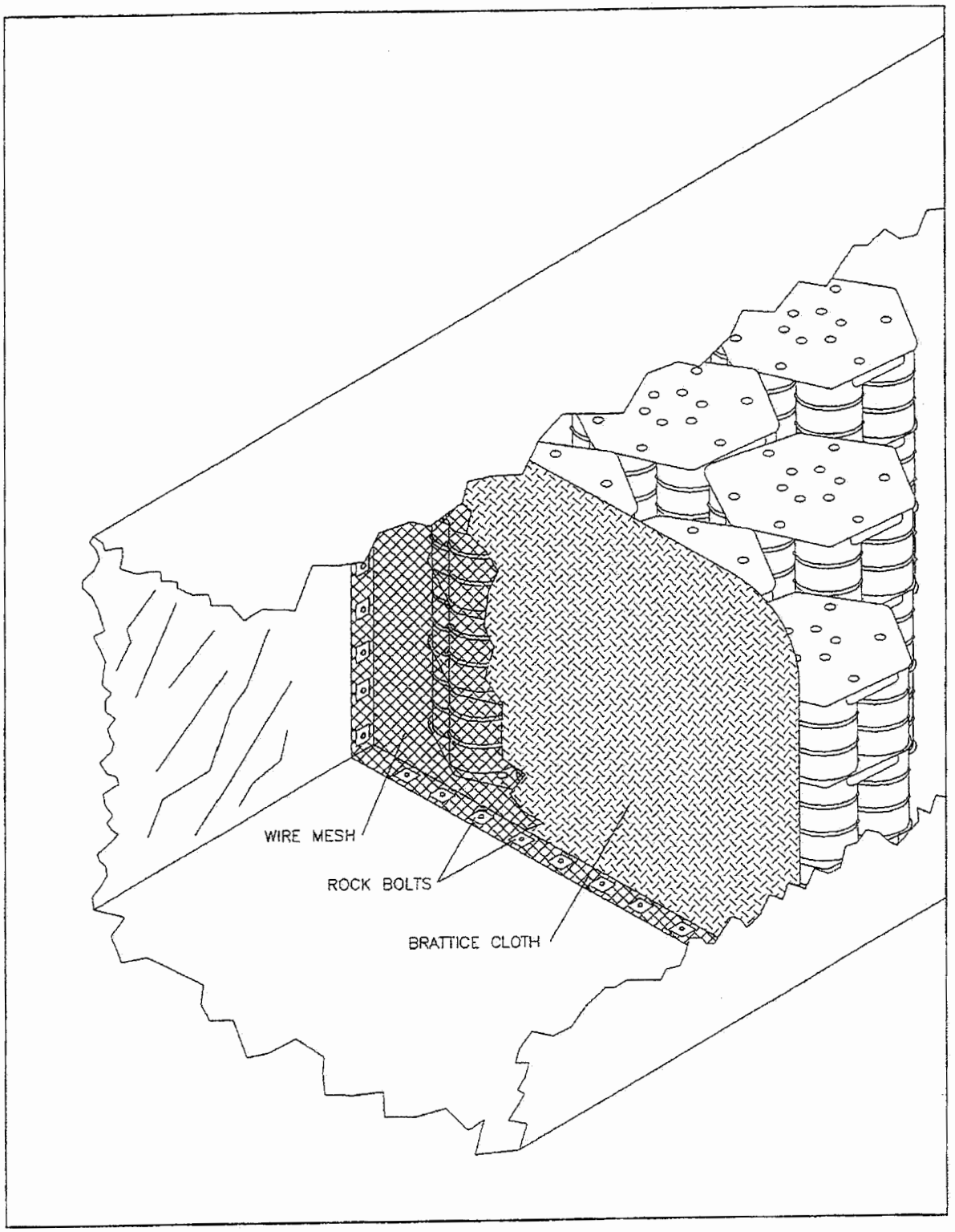

Figure A2-11
Typical Room Barricade

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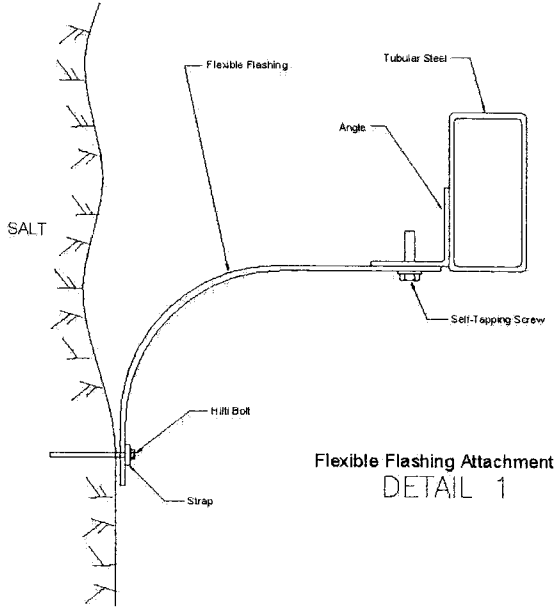

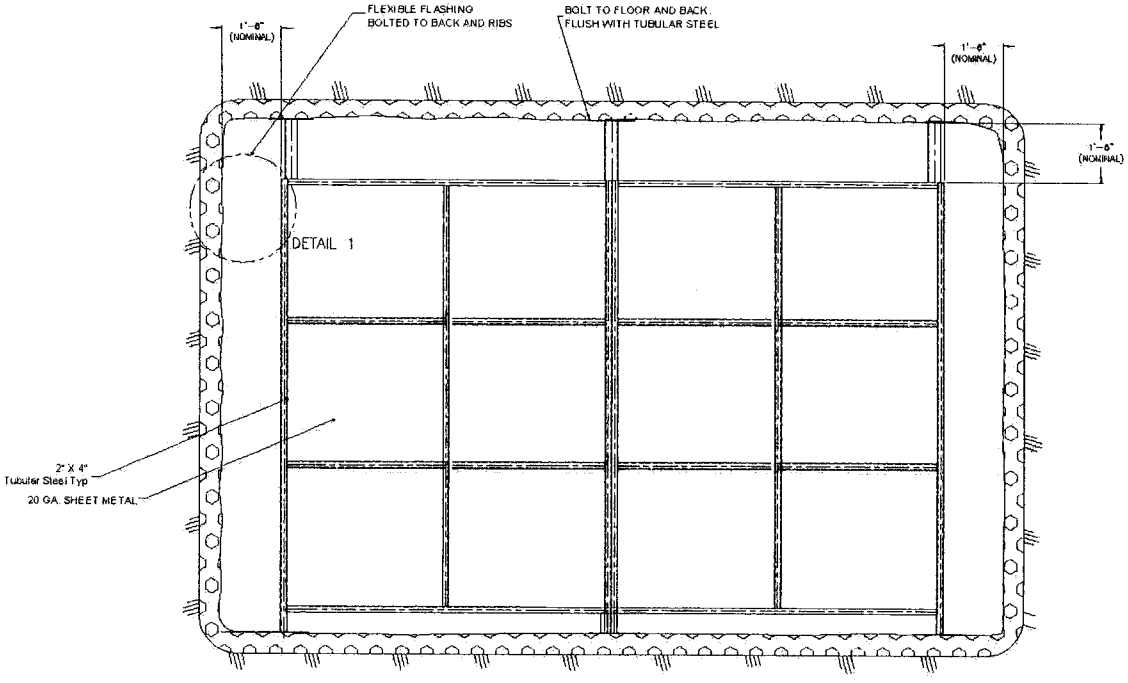

Not to Scale. All dimensions are nominal.

Figure A2-11a
Typical Bulkhead

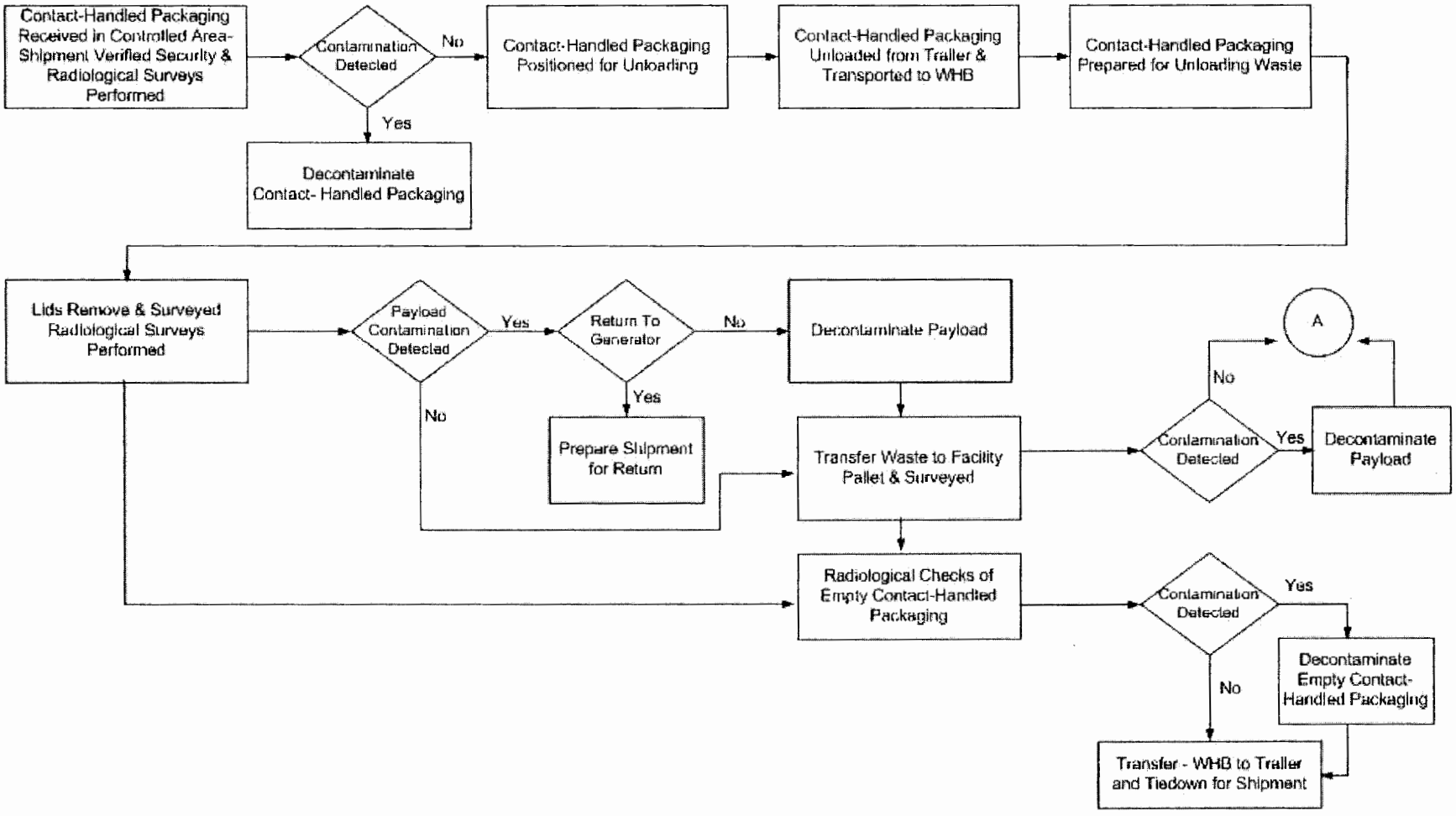

Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

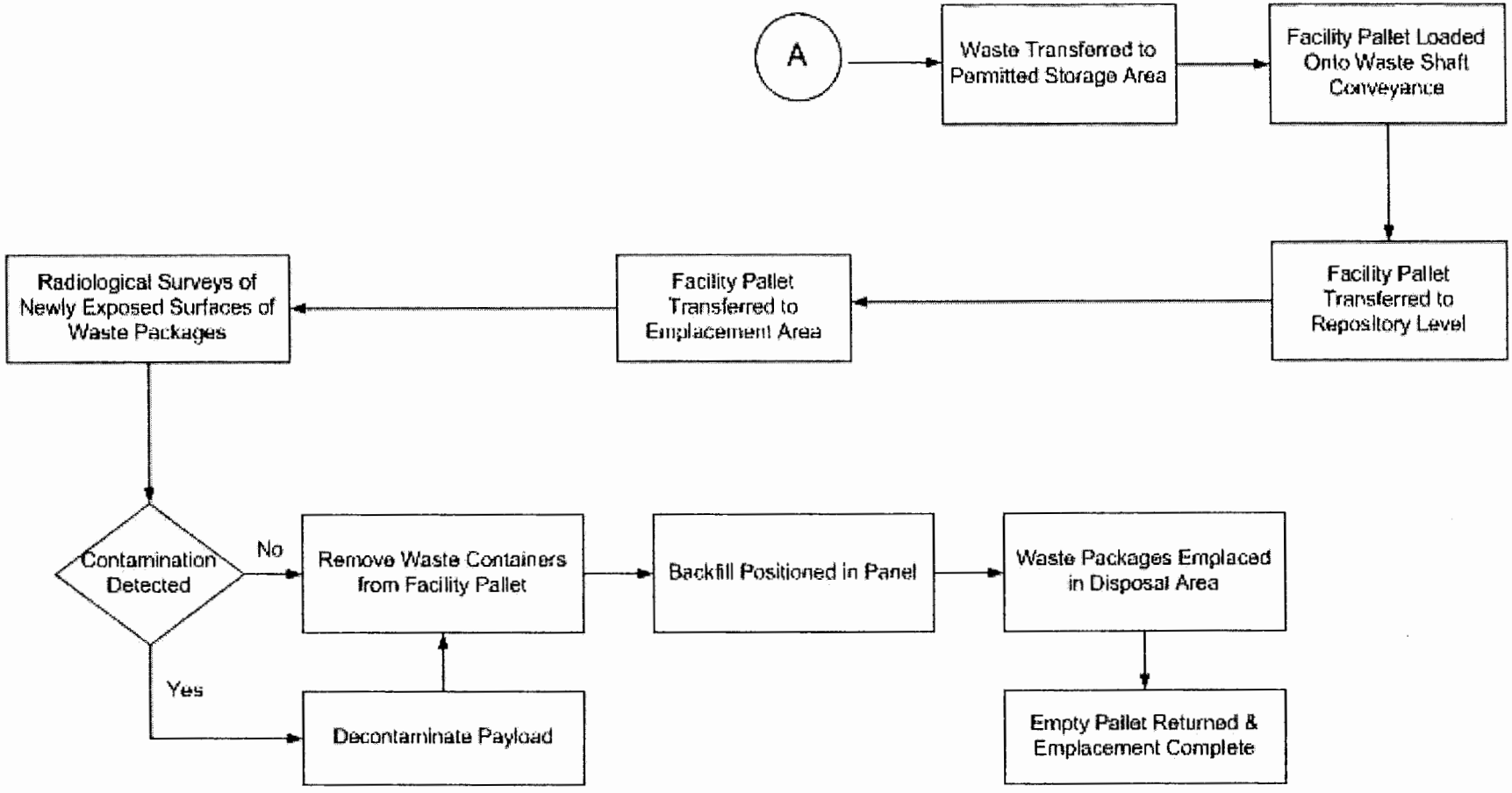

Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

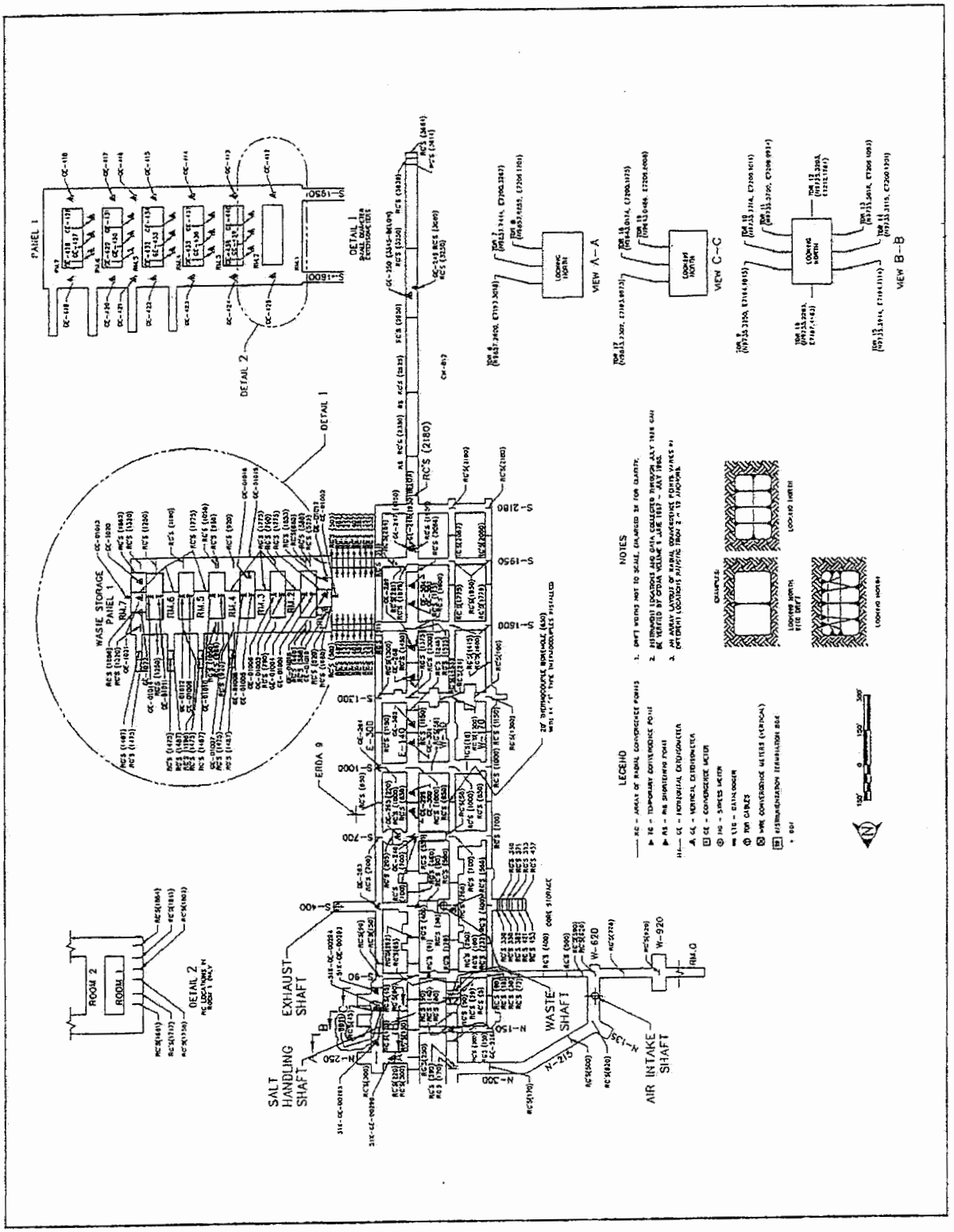

Figure A2-13
Layout and Instrumentation - As of 1/96

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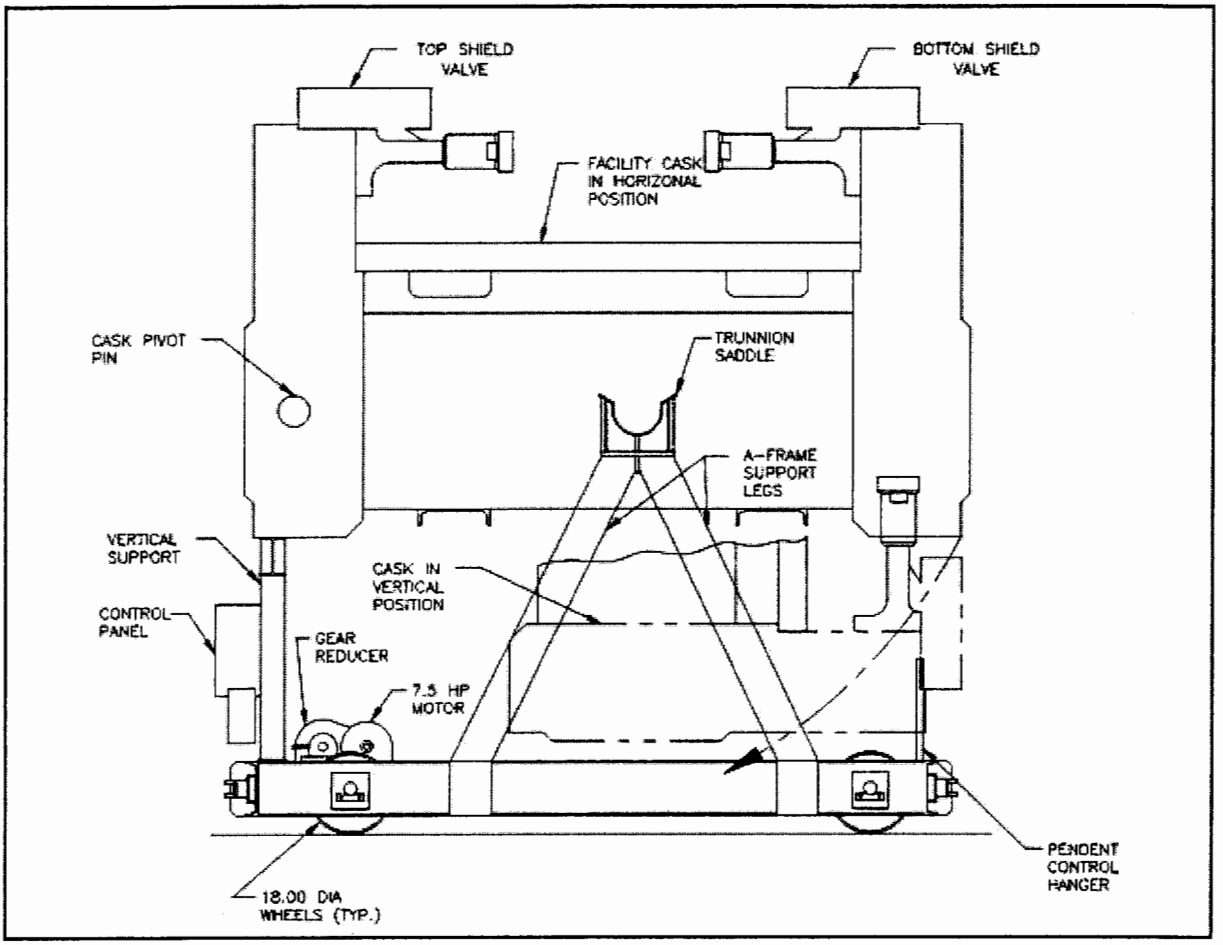

Figure A2-14
Facility Cask Transfer Car (Side View)

02239

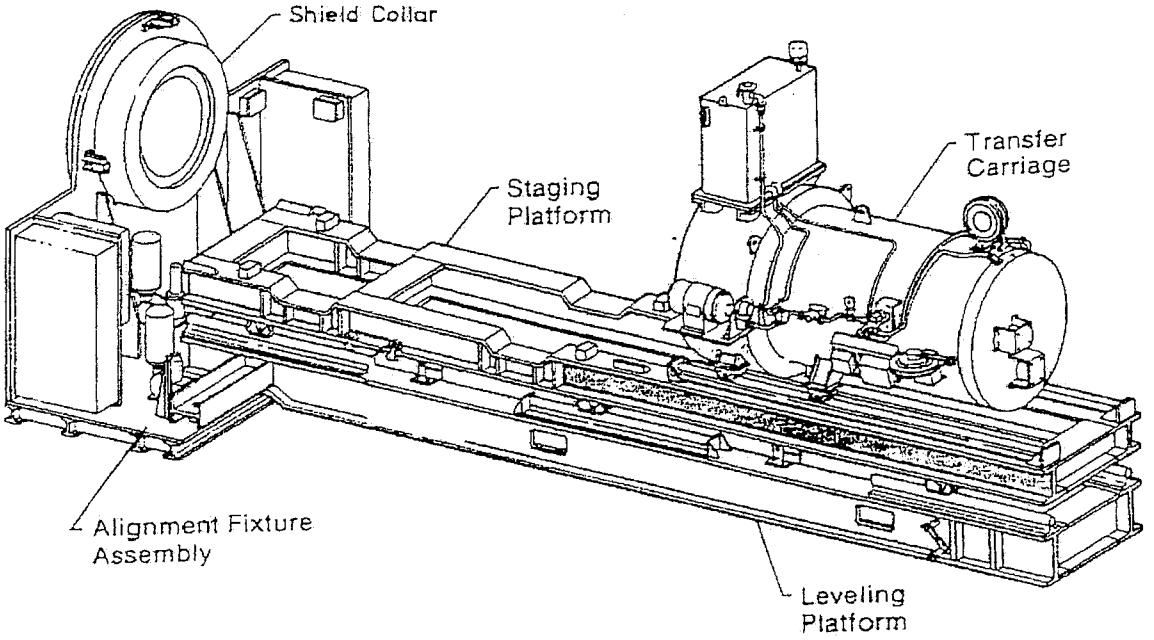

Figure A2-15
Typical Emplacement Equipment

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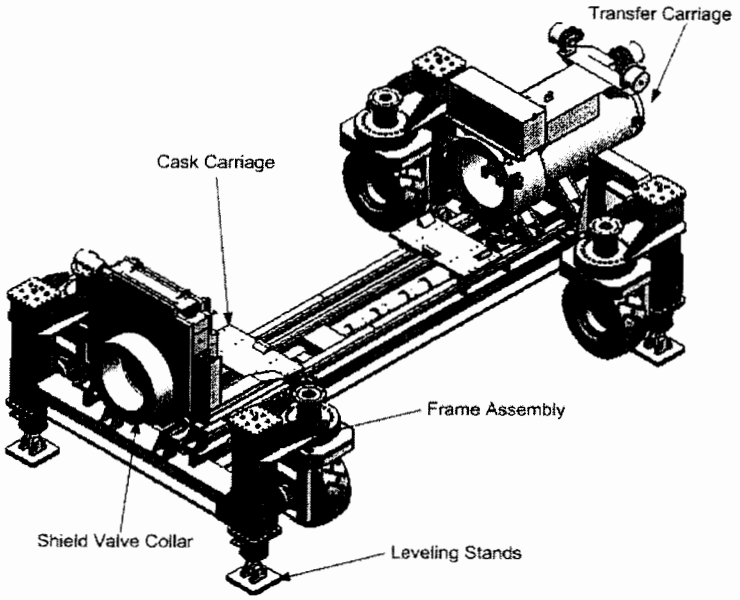

Figure A2-15a
Typical Emplacement Equipment

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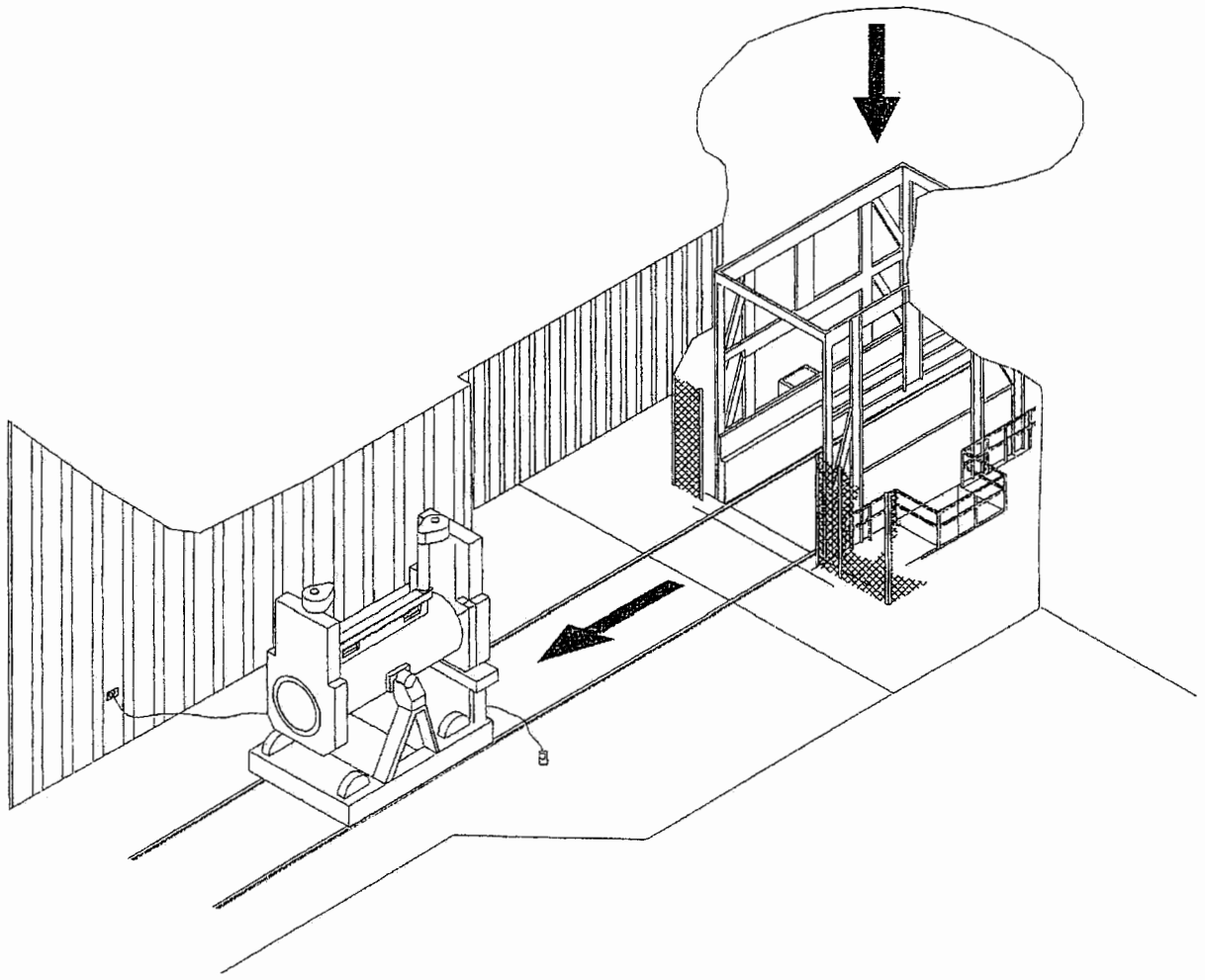

Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

02242

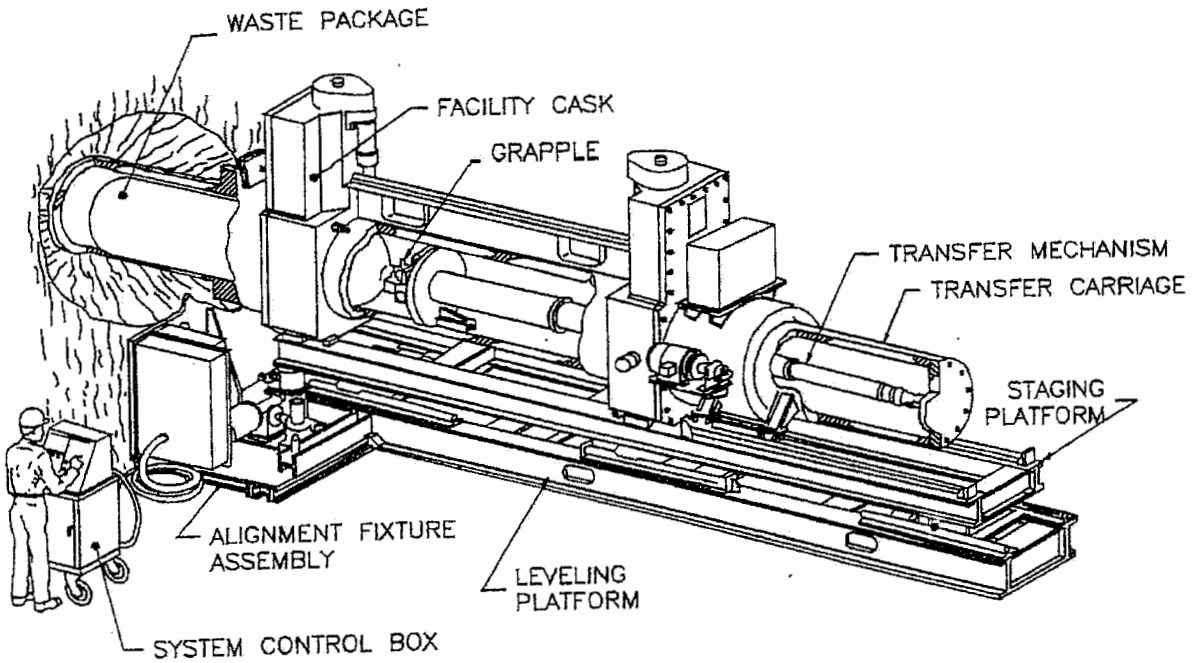

Figure A2-17
Facility Cask Installed on the Typical Emplacement Equipment

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FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

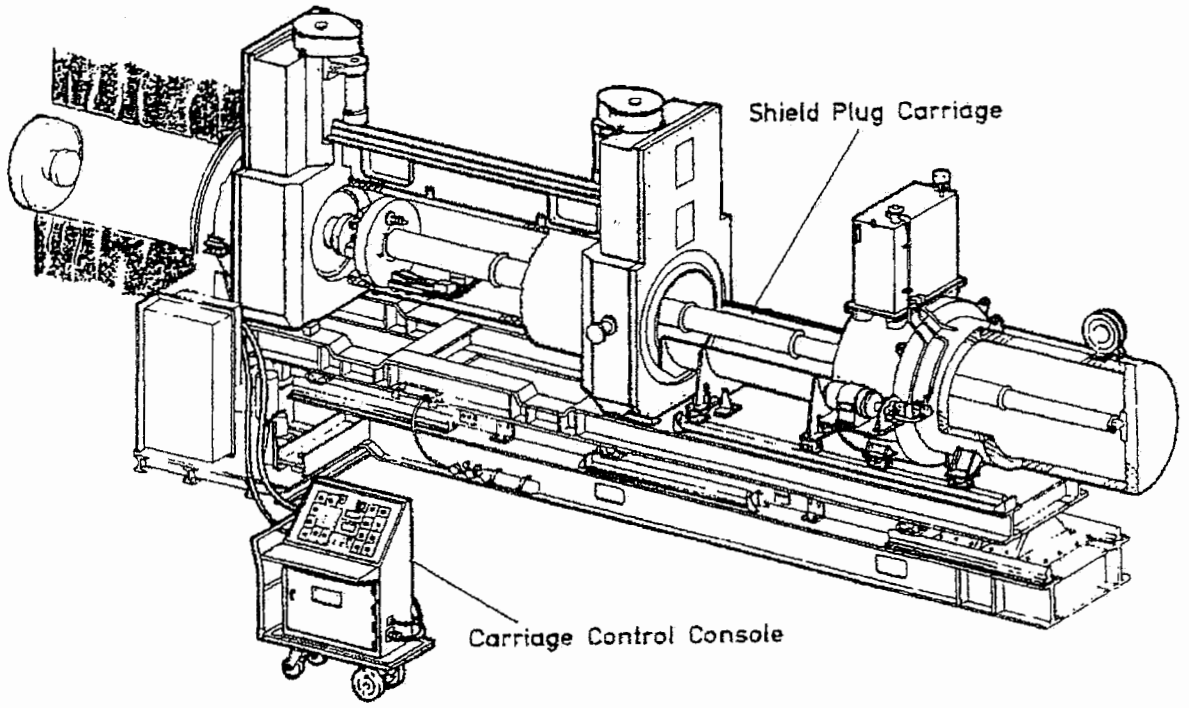


Figure A2-18
Installing Shield Plug

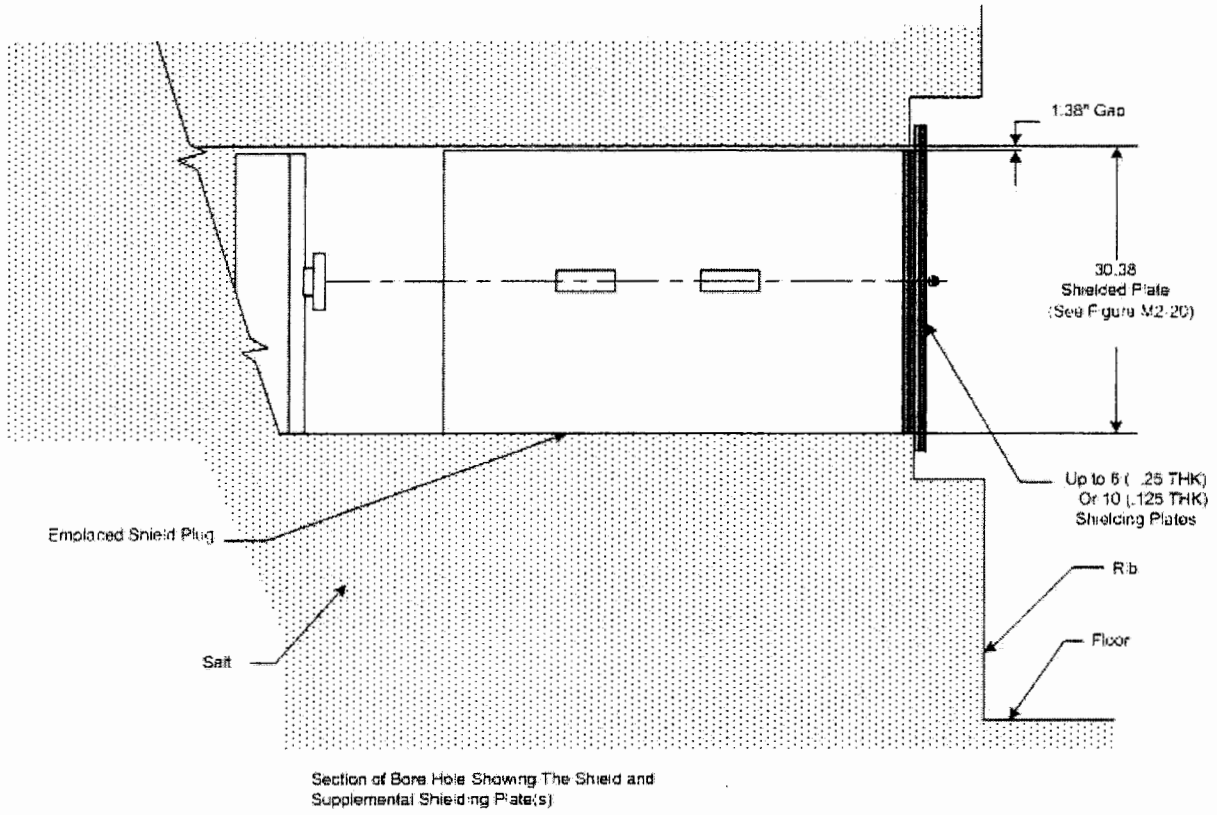


Figure A2-19
Shield Plug Supplemental Shielding Plate(s)

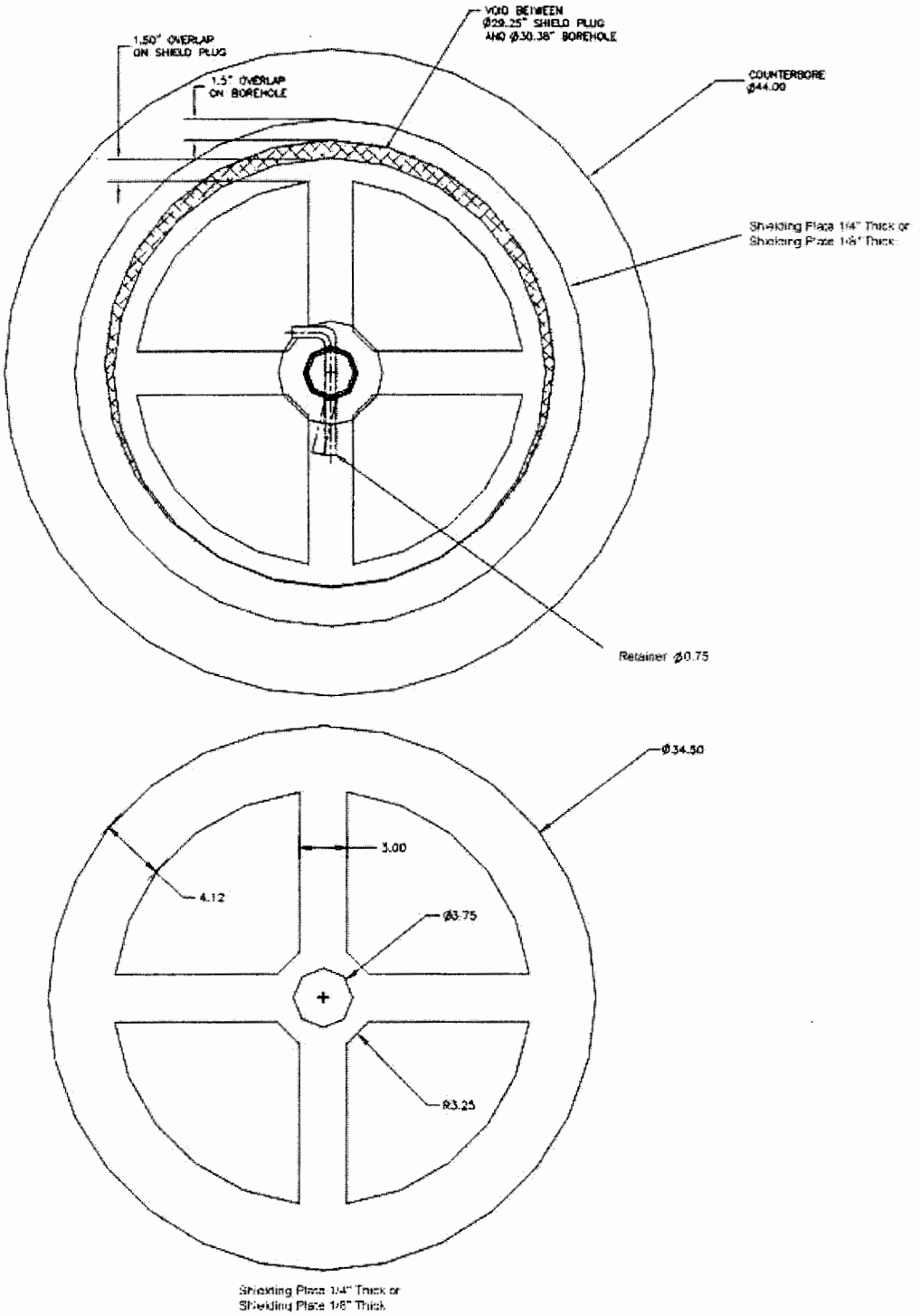
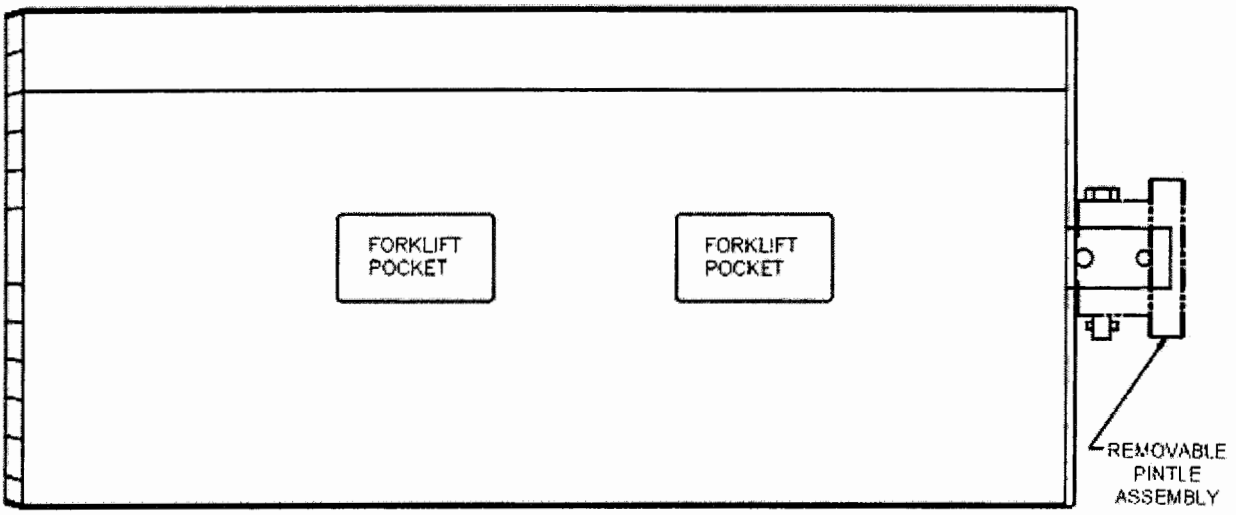


Figure A2-20
Shielding Layers to Supplement RH Borehole Shield Plugs

02246



TYPICAL DIMENSION: APPROXIMATELY 29 INCHES DIAMETER X 61 INCHES SHIELDING LENGTH

Composition: Cylindrical steel shell filled with concrete
Weight: Approximately 3750 pounds

Figure A2-21
Shield Plug Configuration

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

A2-1 Description of the Geologic Repository

Management, storage, and disposal of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) geologic repository is subject to regulation under 20.4.1.500 NMAC. The WIPP is a geologic repository mined within a bedded salt formation, which is defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10) as a miscellaneous unit. As such, HWMUs within the repository are eligible for permitting according to 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and are regulated under 20.4.1.500 NMAC, Miscellaneous Units.

As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the Underground Hazardous Waste Disposal Units (**HWDUs**) in the geologic repository, will be met.

The Disposal Phase will consist of receiving contact-handled (**CH**) and remote-handled (**RH**) TRU mixed waste shipping containers, unloading and transporting the waste containers to the Underground HWDUs, emplacing the waste in the Underground HWDUs, and subsequently achieving closure of the Underground HWDUs in compliance with applicable State and Federal regulations.

The WIPP geologic repository is mined within a 2,000-feet (ft) (610-meters (m))-thick bedded-salt formation called the Salado Formation. The Underground HWDUs (miscellaneous units) are located 2,150 ft (655 m) beneath the ground surface. TRU mixed waste management activities underground will be confined to the southern portion of the 120-acre (48.6 hectares) mined area during the Disposal Phase. During the term of this Permit, disposal of TRU mixed waste will occur only in the HWDUs designated as Panels 5 through 8 and in any currently active panel (See Figure A2-1). RH TRU mixed waste disposal began in Panel 4. The Permittees may also request in the future a Permit to allow disposal of containers of TRU mixed waste in the areas designated as Panels 9 and 10 in Figure A2-1. This Permit, during its 10-year term, authorizes the excavation of Panels 6 through 10 and the disposal of waste in Panels 1 through 8.

Panels 1 through 8 will consist of seven rooms and two access drifts each. Panels 9 and 10 have yet to be designed. Access drifts connect the rooms and have the same cross section (see Section A2-2a(3)). The closure system installed in each HWDU after it is filled will prevent anyone from entering the HWDU and will restrict ventilation airflow. The point of compliance for air emissions from the Underground is Sampling Station VOC-A, as defined in Permit Attachment N (Volatile Organic Compound Monitoring Plan). Sampling Station VOC-A is the location where the concentration of volatile organic compounds (VOCs) in the air emissions from the Underground HWDUs will be measured and then compared to the VOC concentration of concern as required by Permit Part 4.

Four shafts connect the underground area with the surface. The Waste Shaft Conveyance headframe and hoist are located within the Waste Handling Building (**WHB**) and will be used to transport containers of TRU mixed waste, equipment, and materials to the repository horizon. The waste hoist can also be used to transport personnel. The Air Intake Shaft and the Salt Handling Shaft provide ventilation to all areas of the mine except for the Waste Shaft Station.

This area is ventilated by the Waste Shaft itself. The Salt Handling Shaft is also used to hoist mined salt to the surface and serves as the principal personnel transport shaft. The Exhaust Shaft serves as a common exhaust air duct for all areas of the mine. The relationship between the WIPP surface facility, the four shafts, and the geologic repository horizon is shown on Figure A2-2.

The HWDUs identified as Panels 1 through 8 (Figure A2-1) provide room for up to 5,244,900 cubic feet (ft^3) (148,500 cubic meters (m^3)) of CH TRU mixed waste. The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Panels 4 through 8 provide room for up to 93,050 ft^3 (2,635 m^3) of RH TRU mixed waste. RH TRU mixed waste may be disposed of in up to 730 boreholes per panel, subject to the limitations in Permit Part 4, Section 4.1.1.2.ii. These boreholes shall be drilled on nominal eight-foot centers, horizontally, about mid-height in the ribs of a disposal room. The thermal loading from RH TRU mixed waste shall not exceed 10 kilowatts per acre when averaged over the area of a panel, as shown in Permit Attachment A3, plus 100 feet of each of a Panel's adjoining barrier pillars.

The WIPP facility is located in a sparsely populated area with site conditions favorable to isolation of TRU mixed waste from the biosphere. Geologic and hydrologic characteristics of the site related to its TRU mixed waste isolation capabilities are discussed in Addendum L1 of the WIPP Hazardous Waste Facility Permit Amended Renewal Application (DOE, 2009). Hazard prevention programs are described in this Permit Attachment. Contingency and emergency response actions to minimize impacts of unanticipated events, such as spills, are described in Permit Attachment D. The closure plan for the WIPP facility is described in Permit Attachment G.

A2-2 Geologic Repository Design and Process Description

A2-2a Geologic Repository Design and Construction

The WIPP facility, when operated in compliance with the Permit, will ensure safe operations and be protective of human health and the environment.

As a part of the design validation process, geomechanical tests were conducted in SPDV test rooms. During the tests, salt creep rates were measured. Separation of bedding planes and fracturing were also observed. Consequently, a ground-control strategy was implemented. The ground-control program at the WIPP facility mitigates the potential for roof or rib falls and maintains normal excavation dimensions, as long as access to the excavation is possible.

A2-2a(1) CH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage CH TRU waste in the geologic repository. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A2-1.

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2

(**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, ~~or~~ four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Backfill

Magnesium oxide (**MgO**) will be used as a backfill in order to provide chemical control over the solubility of radionuclides in order to comply with the requirements of 40 CFR §191.13. The MgO backfill will be purchased prepackaged in the proper containers for emplacement in the underground. Purchasing prepackaged backfill eliminates handling and placement problems associated with bulk materials, such as dust creation. In addition, prepackaged materials will be easier to emplace, thus reducing potential worker exposure to radiation. Should a backfill container be breached, MgO is benign and cleanup is simple. No hazardous waste would result from a spill of backfill.

The MgO backfill will be managed in accordance with Specification D-0101 (MgO Backfill Specification) and WP05-WH1025 (CH Waste Downloading and Emplacement). These documents are kept on file at the WIPP facility by the Permittees.

Backfill will be handled in accordance with standard operating procedures. Typical emplacement configurations are shown in Figures A2-5 and A2-5a. Some emplacement configurations may include the use of MgO emplacement racks, as shown in Figure A2-5a.

Quality control will be provided within standard operating procedures to record that the correct number of sacks are placed and that the condition of the sacks is acceptable.

Backfill placed in this manner is protected until exposed when sacks are broken during creep closure of the room and compaction of the backfill and waste. Backfill in sacks utilizes existing techniques and equipment and eliminates operational problems such as dust creation and introducing additional equipment and operations into waste handling areas. There are no mine operational considerations (e.g. ventilation flow and control) when backfill is placed in this manner.

The Waste Shaft Conveyance

The hoist systems in the shafts and all shaft furnishings are designed to resist the dynamic forces of the hoisting system and to withstand a design-basis earthquake of 0.1 g. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided engineering design-basis earthquake report which provides the basis for seismic design of WIPP facility structures. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system (such as overtravel, overspeed, power loss, circuitry failure, or starting in a wrong direction) and will trigger an alarm that automatically shuts down the hoist.

The waste hoist moves the Waste Shaft Conveyance and is a multirope, friction-type hoist. A counterweight is used to balance the waste shaft conveyance. The waste shaft conveyance (outside dimensions) is 30 ft (9 m) high by 10 ft (3 m) wide by 15 ft (4.5 m) deep and can carry a payload of 45 tons (40,824 kg). During loading and unloading operations, it is steadied by fixed guides. The hoist's maximum rope speed is 500 ft (152.4 m) per min.

The Waste Shaft hoist system has two sets of brakes, with two units per set, plus a motor that is normally used to stop the hoist. The brakes are designed so that either set, acting alone, can stop a fully loaded conveyance under all emergency conditions.

The Underground Waste Transporter

The underground waste transporter is a commercially available diesel-powered tractor. The trailer was designed specifically for the WIPP for transporting facility pallets from the waste shaft conveyance to the Underground HWDU in use. This transporter is shown in Figure A2-6.

Underground Forklifts

CH TRU mixed waste containers loaded on slipsheets will be removed from the facility pallets using forklifts with a push-pull attachment (Figure A2-7) attached to the forklift-truck front carriage. The push-pull attachment grips the edge of the slipsheet (on which the waste containers sit) to pull the containers onto the platen. After the forklift moves the waste containers to the emplacement location, the push-pull attachment pushes the containers into position. The use of the push-pull attachment prevents direct contact between waste containers and forklift tines. SWBs and TDOPs may also be removed from the facility pallet by using forklifts equipped with special adapters for these containers. These special adapters will prevent direct contact between SWBs or TDOPs and forklift tines. In addition, the low clearance forklift that is used to emplace MgO may be used to emplace waste if necessary.

A forklift will be used to offload the SLB2 from the underground transporter and emplace the waste container in the waste stack.

A2-2a(2) Shafts

The WIPP facility uses four shafts: the Waste Shaft, the Salt Handling Shaft, the Air Intake Shaft, and the Exhaust Shaft. These shafts are vertical openings that extend from the surface to the repository level.

The Waste Shaft is located beneath the WHB and is 19 to 20 ft (5.8 to 6.1 m) in diameter. The Salt Handling Shaft, located north of the Waste Shaft beneath the salt handling headframe, is 10 to 12 ft (3 to 3.6 m) in diameter. Salt mined from the repository horizon is removed through the Salt Handling Shaft. The Salt Handling Shaft is the main personnel and materials hoist and also serves as a secondary-supply air duct for the underground areas. The Air Intake Shaft, northwest of the WHB, varies in diameter from 16 ft 7 in. (4.51 m) to 20 ft 3 in. (6.19 m) and is the primary source of fresh air underground. The Exhaust Shaft, east of the WHB, is 14 to 15 ft (4.3 to 4.6 m) in diameter and serves as the exhaust duct for the underground air.

Openings excavated in salt experience closure because of salt creep (or time-dependent deformation at constant load). The closure affects the design of all of the openings discussed in this section. Underground excavation dimensions, therefore, are nominal, because they change

with time. The unlined portions of the shafts have larger diameters than the lined portions, which allows for closure caused by salt creep. Each shaft includes a shaft collar, a shaft lining, and a shaft key section. The Final Design Validation Report in Appendix D1 of the WIPP RCRA Part B Permit Application (DOE, 1997) discusses the shafts and shaft components in greater detail.

The reinforced-concrete shaft collars extend from the surface to the top of the underlying consolidated sediments. Each collar serves to retain adjacent unconsolidated sands and soils and to prevent surface runoff from entering the shafts. The shaft linings extend from the base of the collar to the top of the salt beds approximately 850 ft (259 m) below the surface. Grout injected behind the shaft lining retards water seeping into the shafts from water-bearing formations, and the liner is designed to withstand the natural water pressure associated with these formations. The shaft liners are concrete, except in the Salt Handling Shaft, where a steel shaft liner has been grouted in place.

The shaft key is a circular reinforced concrete section emplaced in each shaft below the liner in the base of the Rustler and extending about 50 ft (15 m) into the Salado. The key functions to resist lateral pressures and assures that the liner will not separate from the host rocks or fail under tension. This design feature also aids in preventing the shaft from becoming a route for groundwater flow into the underground facility.

On the inside surface of each shaft, excluding the Salt Handling Shaft, there are three water-collection rings: one just below the Magenta, one just below the Culebra, and one at the lowermost part of the key section. These collection rings will collect water that may seep into the shaft through the liner. The Salt Handling Shaft has a single water collection ring in the lower part of the key section. Water collection rings are drained by tubes to the base of the shafts where the water is accumulated.

WIPP shafts and other underground facilities are, for all practical purposes, dry. Minor quantities of water (which accumulate in some shaft sumps) are insufficient to affect the waste disposal area. This water is collected, brought to the surface, and disposed of in accordance with current standards and regulations.

The Waste Shaft is protected from precipitation by the roof of the waste shaft conveyance headframe tower. The Exhaust Shaft is configured at the top with a 14 ft- (4.3 m-) diameter duct that diverts air into the exhaust filtration system or to the atmosphere, as appropriate. The Salt Handling and Air Intake Shaft collars are open except for the headframes. Rainfall into the shafts is evaporated by ventilation air.

The waste hoist system in the Waste Shaft and all Waste Shaft furnishings are designed to resist the dynamic forces of the hoisting system, which are greater than the seismic forces on the underground facilities. In addition the Waste Shaft conveyance headframe is designed to withstand the design-basis earthquake (**DBE**). Maximum operating speed of the hoist is 500 ft (152.4 m) per minute. During loading and unloading operations, the waste hoist is steadied by fixed guides. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system, such as overtravel, overspeed, power loss, or circuitry failure. The control response is to annunciate the condition and shut the hoist down. Operator response is required to recover from the automatic shutdown. Waste hoist operation is continuously monitored by the CMS. A battery powered FM transmitter/receiver allows communication between the hoist conveyance and the hoist house.

The waste hoist has two pairs of brake calipers acting on independent brake paths. The hoist motor is normally used for braking action of the hoist. The brakes are used to hold the hoist in position during normal operations and to stop the hoist under emergency conditions. Each pair of brake calipers is capable of holding the hoist in position during normal operating conditions and stopping the hoist under emergency conditions. In the event of power failure, the brakes will set automatically.

The waste hoist is protected by a fixed automatic fire suppression system. Portable fire extinguishers are also provided on the hoist floor and in equipment areas.

A2-2a(3) Subsurface Structures

The subsurface structures in the repository, located at 2,150 ft (655 m) below the surface, include the HWDUs, the northern experimental areas, and the support areas. Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided details of the underground layout. Figure A2-8 shows the proposed waste emplacement configuration for the HWDUs.

The status of important underground equipment, including fixed fire-protection systems, the ventilation system, and contamination detection systems, will be monitored by a central monitoring system, located in the Support Building adjacent to the WHB. Backup power will be provided as discussed below. The subsurface support areas are constructed and maintained to conform to Federal mine safety codes.

Underground Hazardous Waste Disposal Units (HWDUs)

During the terms of this and the preceding Permit, the volume of CH TRU mixed waste emplaced in the repository will not exceed 5,244,900 ft^3 (148,500 m^3) and the volume of RH TRU mixed waste shall not exceed 93,050 ft^3 (2,635 m^3). CH TRU mixed waste will be disposed of in Underground HWDUs identified as Panels 1 through 8. RH TRU mixed waste may be disposed of in Panels 4 through 8.

Main entries and cross cuts in the repository provide access and ventilation to the HWDUs. The main entries link the shaft pillar/service area with the TRU mixed waste management area and are separated by pillars. Each of the Underground HWDUs labeled Panels 1 through 8 will have seven rooms. The locations of these HWDUs are shown in Figure A2-1. The rooms will have nominal dimensions of 13 ft (4.0 m) high by 33 ft (10 m) wide by 300 ft (91 m) long and will be supported by 100 ft- (30 m-) wide pillars.

As currently planned, future Permits may allow disposal of TRU mixed waste containers in two additional panels, identified as Panels 9 and 10. Disposal of TRU mixed waste in Panels 9 and 10 is prohibited under this Permit. If waste volumes disposed of in the eight panels fail to reach the stated design capacity, the Permittees may request a Permit to allow disposal of TRU mixed waste in the four main entries and crosscuts adjacent to the waste panels (referred to as the disposal area access drifts). These areas are labeled Panels 9 and 10 in Figure A2-1. A permit modification or future permit would be submitted describing the condition of those drifts and the controls exercised for personnel safety and environmental protection while disposing of waste in these areas. These areas have the following nominal dimensions:

The E-140 waste transport route south of the Waste Shaft Station is mined to be 25 ft wide nominally and its height ranges from about 14 ft to 20 ft.

The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room when waste disposal is taking place and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. Flexible flashing attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. The filled rooms will be isolated from the ventilation system, while the active rooms that are actively being filled will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

Overall, there are six possible modes of exhaust fan operation:

2 main fans in operation
1 main fan in operation
1 filtration fan in filtered operation
1 filtration fan in unfiltered operation
2 filtration fans in unfiltered operation
1 main and 1 filtration fan (unfiltered) in operation

Under some circumstances (such as power outages and maintenance activities, etc.), all mine ventilation may be discontinued for short periods of time.

In the normal mode, two main surface exhaust fans, located near the Exhaust Shaft, will provide continuous ventilation of the underground areas. All underground flows join at the bottom of the Exhaust Shaft before discharge to the atmosphere.

Outside air will be supplied to the mining areas and the waste disposal areas through the Air Intake Shaft, the Salt Handling Shaft, and access entries. A small quantity of outside air will flow down the Waste Shaft to ventilate the Waste Shaft station. The ventilation system is designed to operate with the Air Intake Shaft as the primary source of fresh air. Under these circumstances, sufficient air will be available to simultaneously conduct all underground operations (e.g., waste handling, mining, experimentation, and support). Ventilation may be supplied by operating fans in the configurations listed in the above description of the ventilation modes.

If the nominal flow of 425,000 cfm (12,028 m^3/min) is not available (i.e., only one of the main ventilation fans is available) underground operations may proceed, but the number of activities that can be performed in parallel may be limited depending on the quantity of air available. Ventilation may be supplied by operating one or two of the filtration exhaust fans. To accomplish this, the isolation dampers will be opened, which will permit air to flow from the main exhaust duct to the filter outlet plenum. The filtration fans may also be operated to bypass the HEPA plenum. The isolation dampers of the filtration exhaust fan(s) to be employed will be opened, and the selected fan(s) will be switched on. In this mode, underground operations will be limited, because filtration exhaust fans cannot provide sufficient airflow to support the use of diesel equipment.

In the filtration mode, the exhaust air will pass through two identical filter assemblies, with only one of the three Exhaust Filter Building filtration fans operating (all other fans are stopped). This system provides a means for removing the airborne particulates that may contain radioactive and hazardous waste contaminants in the reduced exhaust flow before they are discharged through the exhaust stack to the atmosphere. The filtration mode is activated manually or automatically if the radiation monitoring system detects abnormally high concentrations of airborne radioactive particulates (an alarm is received from the continuous air monitor in the exhaust drift of the active waste panel) or a waste handling incident with the potential for a waste container breach is observed. The filtration mode is not initiated by the release of gases such as VOCs.

If utility power fails, the exhaust filter system goes into the fail-safe position, and the system high-efficiency particulate-air filter dampers are placed into filtration position. When power is restored by the diesel generators, a decision is made whether to remain in filtration mode and energize a filtration fan or to realign the dampers into the minimum exhaust mode. Without any indication of a radiological release, the decision is usually the latter. TRU mixed waste handling and related operations cease upon loss of utility power and are not resumed until normal utility

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power is returned. As specified in Part 2, all waste handling equipment will "fail safe," meaning that it will retain its load during a power outage.

Underground Ventilation Normal Mode Redundancy

The underground ventilation system has been provided redundancy in normal ventilation mode by the addition of a third main fan. Ductwork leading to that new fan ties into the existing main exhaust duct.

Electrical System

The WIPP facility uses electrical power (utility power) supplied by the regional electric utility company. If there is a loss of utility power, TRU mixed waste handling and related operations will cease.

Backup, alternating current power will be provided on site by two 1,100-kilowatt diesel generators. These units provide 480-volt power with a high degree of reliability. Each of the diesel generators can carry predetermined equipment loads while maintaining additional power reserves. Predetermined loads include lighting and ventilation for underground facilities, lighting and ventilation for the TRU mixed waste handling areas, and the Air Intake Shaft hoist. The diesel generator can be brought on line within 30 minutes either manually or from the control panel in the Central Monitoring Room (CMR).

Uninterruptible power supply (**UPS**) units are also on line providing power to predetermined monitoring systems. These systems ensure that the power to the radiation detection system for airborne contamination, the local processing units, the computer room, and the CMR will always be available, even during the interval between the loss of off-site power and initiation of backup diesel generator power.

A2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table A2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure A2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the Facility Cask is loaded, the Facility Cask Transfer Car moves onto the waste shaft conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste shaft conveyance to provide forklift access to the Facility Cask.

Horizontal Emplacement and Retrieval Equipment or Functionally Equivalent Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) or functionally equivalent equipment (Figure A2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

A2-2b Geologic Repository Process Description

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste shaft conveyance and is lowered to the waste shaft station underground. At the waste shaft station underground, the Facility Cask is moved from the waste shaft conveyance by the Facility Cask Transfer Car (Figure A2-16). A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU. There, the Facility Cask is placed on the HERE (Figure A2-17). The HERE is used to emplace the RH TRU mixed waste canister into the borehole. The borehole will be visually inspected for obstructions prior to aligning the HERE and emplacement of the RH TRU mixed waste canister. The Facility Cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear Facility Cask shield valve. The shield valves on the Facility Cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the Facility Cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the Facility Cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure A2-18). The transfer mechanism is retracted, the shield valves close on the Facility Cask, and the Facility Cask is removed from the HERE.

A shield plug is a concrete filled cylindrical steel shell (Figure A2-21) approximately 61 in. long and 29 in. in diameter, made of concrete shielding material inside a 0.24 in. thick steel shell with a removable pintle at one end. Each shield plug has integral forklift pockets and weighs approximately 3,750 lbs. The shield plug is inserted with the pintle end closest to the HERE to provide the necessary shielding , limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr . Additional shielding is provided at the direction of the Radiological Control Technician based on dose rate surveys following shield plug emplacement. This additional shielding is provided by the manual emplacement of one or more shield plug supplemental shielding plates and a retainer (Figures A2-19 and A2-20).

The amount of RH TRU mixed waste disposal in each panel is limited based on thermal and geomechanical considerations and shall not exceed 10 kilowatts per acre as described in Permit Attachment A2-1. RH TRU mixed waste emplacement boreholes shall be drilled in the ribs of the panels at a nominal spacing of 8 ft (2.4 m) center-to-center, horizontally.

Figures A1-26 and A1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and CNS 10-160B casks, respectively.

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers ~~(e.g., TRUPACT-IIs or HalfPACTs)~~, at which time they will undergo security and radiological checks and shipping documentation reviews. The

trailers carrying the shipping containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one three-pack of shielded containers or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste shaft conveyance, and the facility pallet will be transferred from the waste shaft conveyance onto the transporter (see Figure A2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement. The underground waste transporter is equipped with a fire suppression system, rupture-resistant diesel fuel tanks, and reinforced fuel lines to minimize the potential for a fire involving the fuel system.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment or, in the case of an SLB2, the SLB2 will be lifted from the facility pallet and placed directly on the floor of the emplacement room. The waste will be emplaced room by room in Panels 1 through 8. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade and, if necessary, bulkheads will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

The emplacement of CH TRU mixed waste into the HWDUs will typically be in the order received and unloaded from the Contact Handled Packaging. There is no specification for the amount of space to be maintained between the waste containers themselves, or between the waste containers and the walls. Containers will be stacked in the best manner to provide stability for the stack (which is up to three containers high) and to make best use of available space. It is anticipated that the space between the wall and the container could be from 8 to 18 in. (20 to 46 cm). This space is a function of disposal room wall irregularities, container type, and sequence of emplacement. Bags of backfill will occupy some of this space. Space is required over the stacks of containers to assure adequate ventilation for waste handling operations. A minimum of 16 in. (41 cm) was specified in the Final Design Validation Report (Appendix D1, Chapter 12 of the WIPP RCRA Part B Permit Application (DOE, 1997)) to maintain air flow. Typically, the space above a stack of containers will be 36 to 48 in. (90 to 122 cm). However 18 in. (0.45 m) will contain backfill material consisting of bags of Magnesium Oxide (MgO). Figure A2-8 shows a typical container configuration, although this figure does not mix containers on any row. Such mixing, while inefficient, will be allowed to assure timely movement of waste into the underground. No aisle space will be maintained for personnel access to emplaced waste containers. No roof maintenance behind stacks of waste is planned.

The anticipated schedule for the filling of each of the Underground HWDUs known as Panels 1 through 8 is shown in Permit Attachment G, Table G-1. Panel closure in accordance with the Closure Plan in Permit Attachment G and Permit Attachment G1 is estimated to require an additional 150 days.

Figure A2-12 is a flow diagram of the CH TRU mixed waste handling process.

A2-3 Waste Characterization

TRU mixed waste characterization is described in Permit Attachment C.

A2-4 Treatment Effectiveness

TRU mixed waste treatment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), for which a permit is required, will not be performed at the WIPP facility.

A2-5 Maintenance, Monitoring, and Inspection

A2-5a Maintenance

A2-5a(1) Ground-Control Program

The ground-control program at the WIPP facility will ensure that any room in an HWDU in which waste will be placed will be sufficiently supported to assure compliance with the applicable portions of the Land Withdrawal Act (**LWA**), which requires a regular review of roof-support plans and practices by the Mine Safety and Health Administration (**MSHA**). Support is installed to the requirements of 30 CFR §57, Subpart B.

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A2-5b Monitoring

A2-5b(1) Groundwater Monitoring

Groundwater monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 5 and Permit Attachment L of this permit.

A2-5b(2) Geomechanical Monitoring

The geomechanical monitoring program at the WIPP facility is an integral part of the ground-control program (See Figure A2-13). HWDUs, drifts, and geomechanical test rooms will be monitored to provide confirmation of structural integrity. Geomechanical data on the performance of the repository shafts and excavated areas will be collected as part of the geotechnical field-monitoring program. The results of the geotechnical investigations will be reported annually. The report will describe monitoring programs and geomechanical data collected during the previous year.

A2-5b(2)(a) Description of the Geomechanical Monitoring System

The Geomechanical Monitoring System (**GMS**) provides in situ data to support the continuous assessment of the design for underground facilities. Specifically, the GMS provides for:

- Early detection of conditions that could affect operational safety
- Evaluation of disposal room closure that ensures adequate access
- Guidance for design modifications and remedial actions
- Data for interpreting the behavior of underground openings, in comparison with established design criteria

The instrumentation in Table A2-2 is available for use in support of the geomechanical program.

The minimum instrumentation for each of the eight panels will be one borehole extensometer installed in the roof at the center of each disposal room. The roof extensometers will monitor the dilation of the immediate salt roof beam and possible bed separations along clay seams. Additional instrumentation will be installed as conditions warrant.

Remote polling of the geomechanical instrumentation will be performed at least once every month. This frequency may be increased to accommodate any changes that may develop.

The results from the remotely read instrumentation will be evaluated after each scheduled polling. Documentation of the results will be provided annually in the Geotechnical Analysis Report.

Data from remotely read instrumentation will be maintained as part of a geotechnical instrumentation system. The instrumentation system provides for data maintenance, retrieval, and presentation. The Permittees will retrieve the data from the instrumentation system and verify data accuracy by confirming the measurements were taken in accordance with applicable instructions and equipment calibration is known. Next, the Permittees will review the data after

each polling to assess the performance of the instrument and of the excavation. Anomalous data will be investigated to determine the cause (instrumentation problem, error in recording, changing rock conditions). The Permittees will calculate various parameters such as the change between successive readings and deformation rates. This assessment will be reported to the Permittees' cognizant ground control engineer and operations personnel. The Permittees will investigate unexpected deformation to determine if remediation is needed.

The stability of an open panel excavation is generally determined by the rock deformation rate. The excavation may be unstable when there is a continuous increase in the deformation rate that cannot be controlled by the installed support system. The Permittees will evaluate the performance of the excavation. These evaluations assess the effectiveness of the roof support system and estimate the stand-up time of the excavation. If an open panel shows the trend is toward adverse (unstable) conditions, the results will be reported to determine if it is necessary to terminate waste disposal activities in the open panel. This report of the trend toward adverse conditions in an open HWDU will also be provided to the Secretary of the NMED within seven (7) calendar days of issuance of the report.

A2-5b(2)(b) System Experience

Much experience in the use of geomechanical instrumentation was gained as the result of performance monitoring of Panel 1, which began at the time of completion of the panel excavation in 1988. The monitoring system installed at that time involved simple measurements and observations (e.g., vertical and horizontal convergence rates, and visual inspections). Minimal maintenance of instrumentation is required, and the instrumentation is easily replaced if it malfunctions. Conditions throughout Panel 1 are well known. The monitoring program continues to provide data to compare the performance of Panel 1 with that established elsewhere in the underground. Panel 1 performance is characterized by the following:

- The development of bed separations and lateral shifts at the interfaces of the salt and the clays underlying the anhydrites "a" and "b."
- Room closures. A closure due only to the roof movement will be separated from the total closure.
- The behavior of the pillars.
- Fracture development in the roof and floor.
- Distribution of load on the support system.

Roof conditions are assessed from observation boreholes and extensometer measurements. Measurements of room closure, rock displacements, and observations of fracture development in the immediate roof beam are made and used to evaluate the performance of a panel. A description of the Panel 1 monitoring program was presented to the members of the Geotechnical Experts Panel (in 1991) who concurred that it was adequate to determine deterioration within the rooms and that it will provide early warning of deteriorating conditions.

The assessment and evaluation of the condition of WIPP excavations is an interactive, continuous process using the data from the monitoring programs. Criteria for corrective action are continually reevaluated and reassessed based on total performance to date. Actions taken

are based on these analyses and planned utilization of the excavation. Because WIPP excavations are in a natural geologic medium, there is inherent variability from point to point. The principle adopted is to anticipate potential ground control requirements and implement them in a timely manner rather than to wait until a need arises.

A2-5b(3) Volatile Organic Compound Monitoring

The volatile organic compound monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 4 and Permit Attachment N of this permit.

A2-5c Inspection

The inspection of the WIPP Underground HWDUs will be conducted in accordance with Part 2 and Permit Attachment E of this permit.

References

DOE, 1997. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Revision 6.5, 1997.

DOE, 2009. WIPP Hazardous Waste Facility Permit Amended Renewal Application, Carlsbad, New Mexico, September 2009.

TABLES

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

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Table A2-2
Instrumentation Used in Support of the Geomechanical Monitoring System

Instrument Type	Features	Parameter Measured	Range
Borehole Extensometer	The extensometer provides for monitoring the deformation parallel to the borehole axis. Units suitable for up to 5 measurements anchors in addition to the reference head. Maximum borehole depths shall be 50 feet.	Cumulative Deformation	0-2 inches
Borehole Television Camera	Closed circuit television may be used for monitoring areas otherwise inaccessible, such as boreholes or shafts.	Video Image	N/A
Convergence Points and Tape Extensometers	Mechanically anchored eyebolts to which a portable tape extensometer is attached.	Cumulative Deformation	2-50 feet
Convergence Meters	Includes wire and sonic meters. Mounted on rigid plates anchored to the rock surface.	Cumulative Deformation	2-50 feet
Inclinometers	Both vertical and horizontal inclinometers are used. Traversing type of system in which a probe is moved periodically through casing located in the borehole whose inclination is being measured.	Cumulative Deformation	0-30 degrees
Rock Bolt Load Cells	Spool type units suitable for use with rock bolts. Tensile stress is inferred from strain gauges mounted on the surface of the spool.	Load	0-300 kips
Earth Pressure Cells	Installed between concrete keys and rock. Preferred type is a hydraulic pressure plate connected to a vibrating wire transmitter.	Lithostatic Pressure	0-1000 psi
Piezometer Pressure Transducers	Located in shafts and of robust design and construction. Periodic checks on operability required.	Fluid Pressure	0-500 psi
Strain Gauges	Installed within the concrete shaft key. Suitably sealed for the environment. Two types used--surface mounted and embedded.	Cumulative Deformation	0-3000 µin/in (embedded) 0-2500 µin/in (surface)

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Table A2-3
RH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
41-Ton Forklift	82,000 lbs
Maximum Gross Weights of RH TRU Containers	
RH TRU Facility Canister	10,000 lbs
55-Gallon Drum	1,000 lbs
RH TRU Canister	8,000 lbs
Maximum Net Empty Weights of Equipment	
Facility Cask	67,700 lbs

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FIGURES

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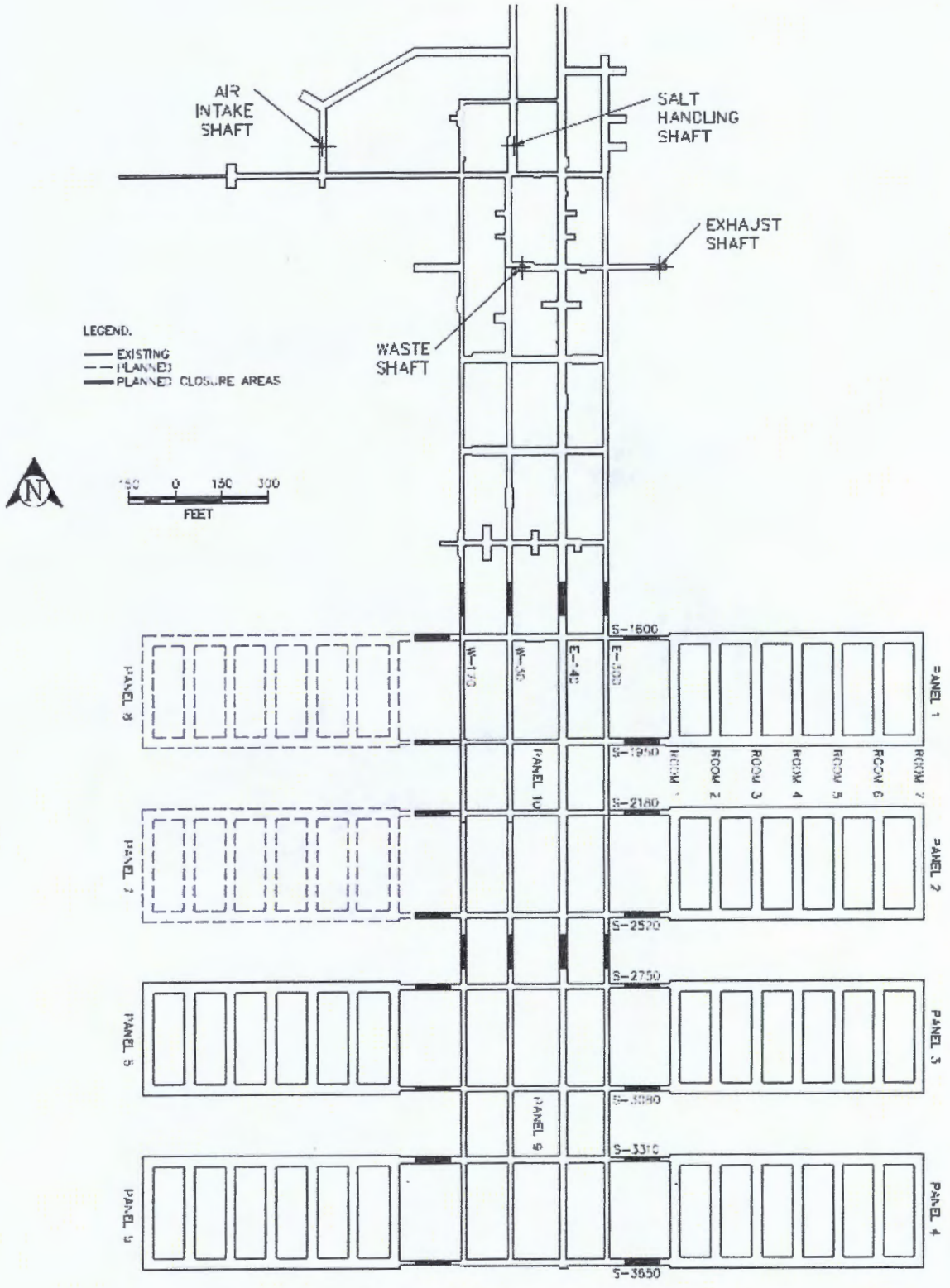

Figure A2-1
Repository Horizon

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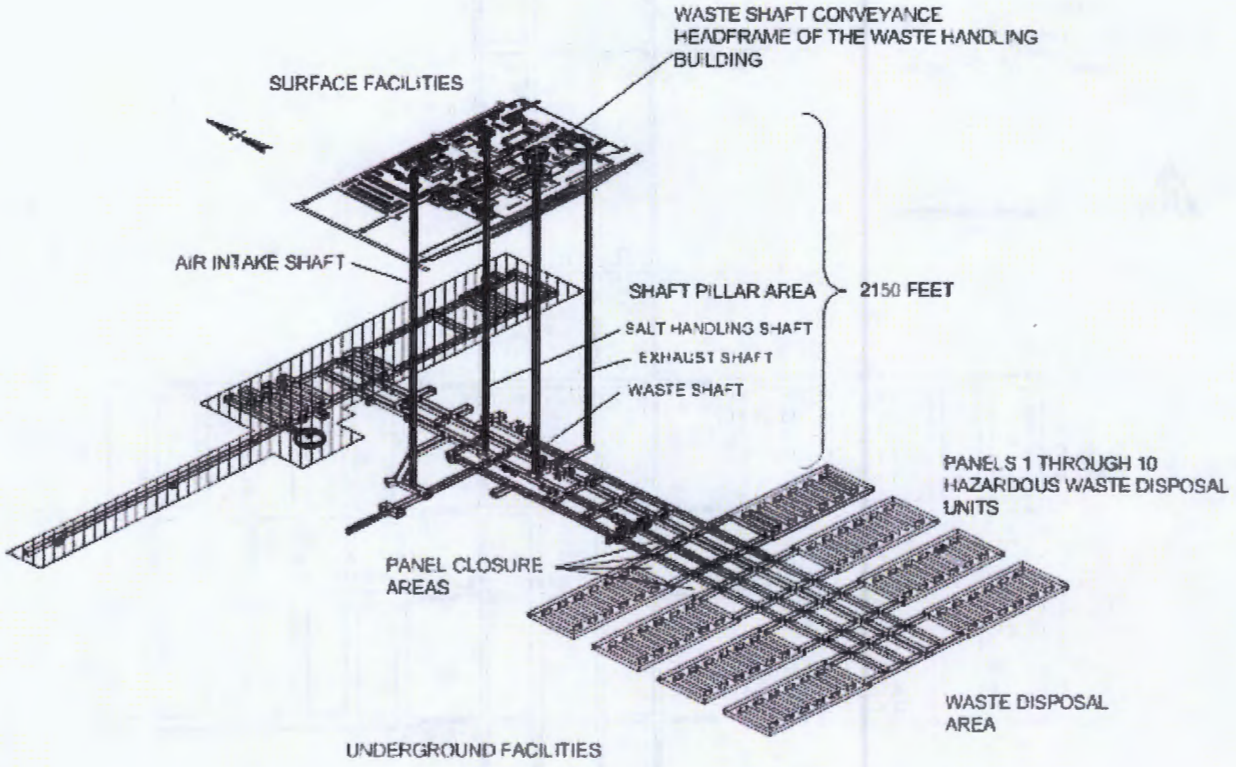

Figure A2-2
Spatial View of the Miscellaneous Unit and Waste Handling Facility

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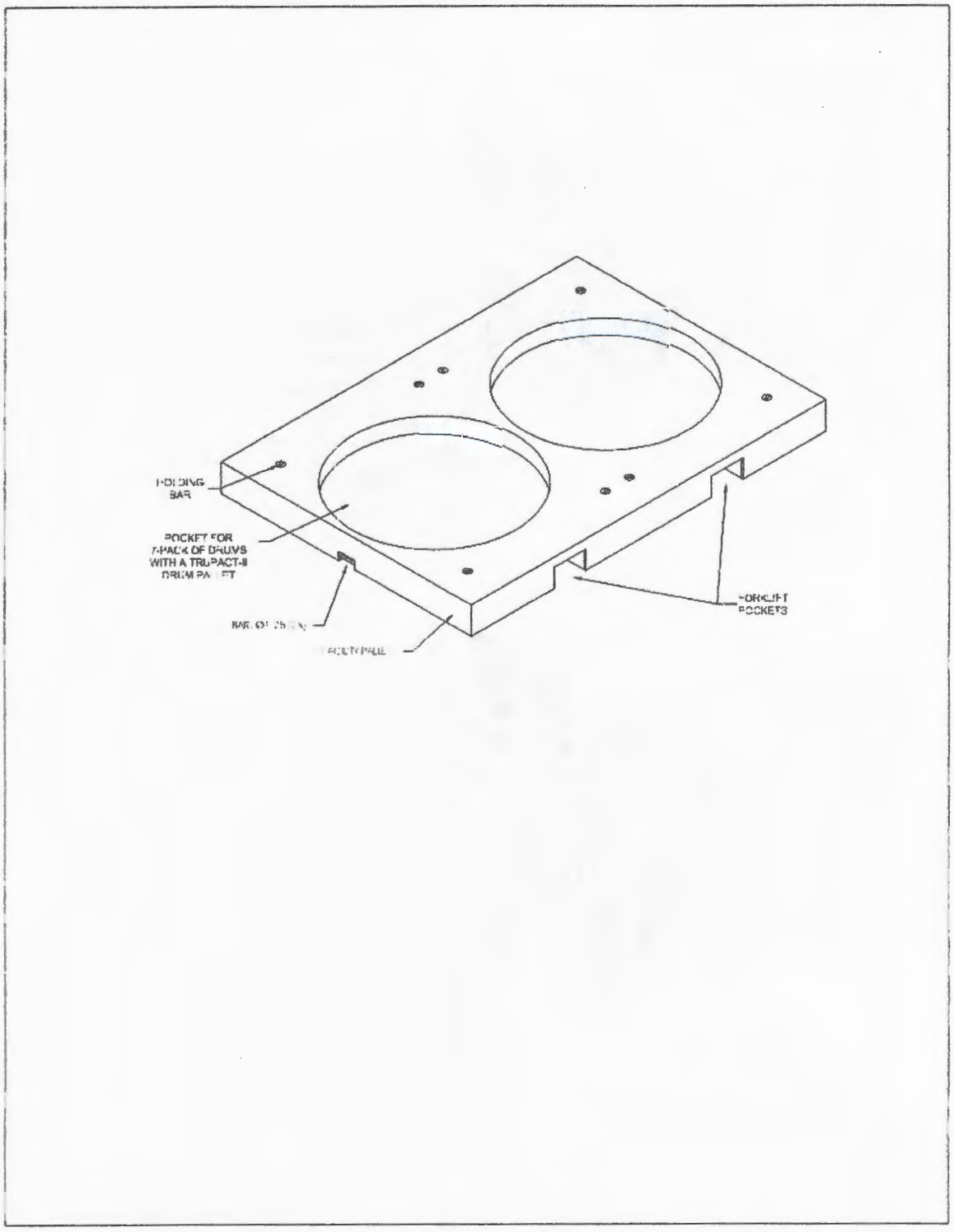

Figure A2-3
Facility Pallet for Seven-Pack of Drums

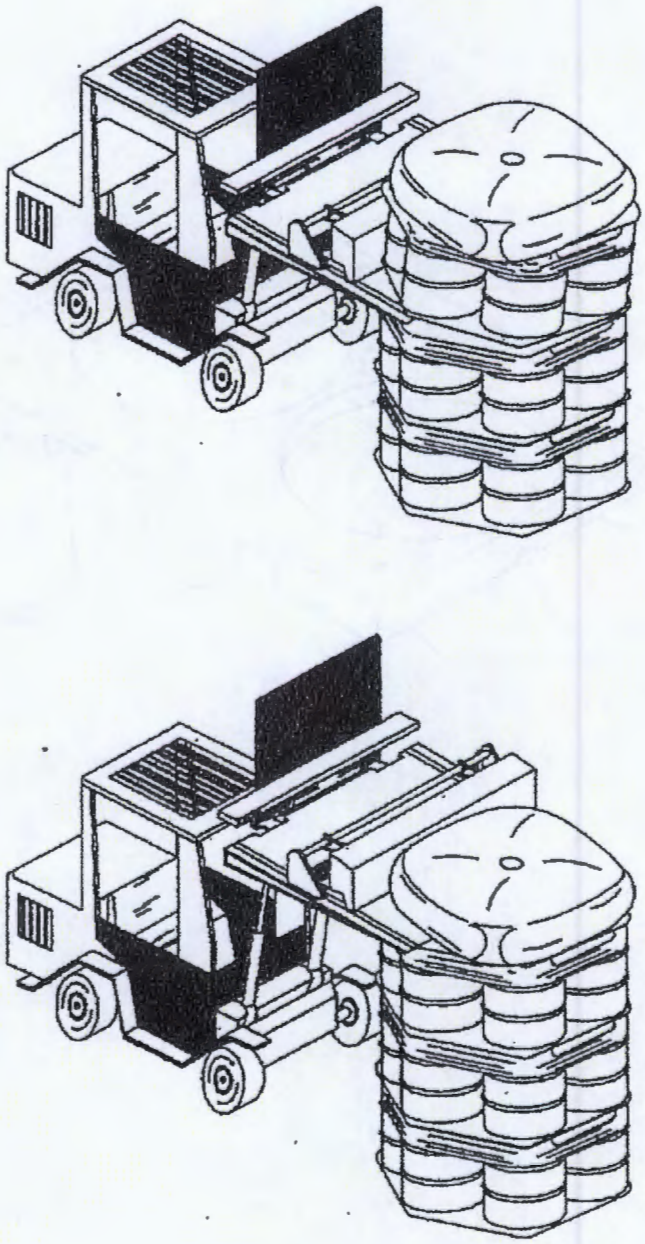

Figure A2-5
Typical Backfill Sacks Emplaced on Drum Stacks

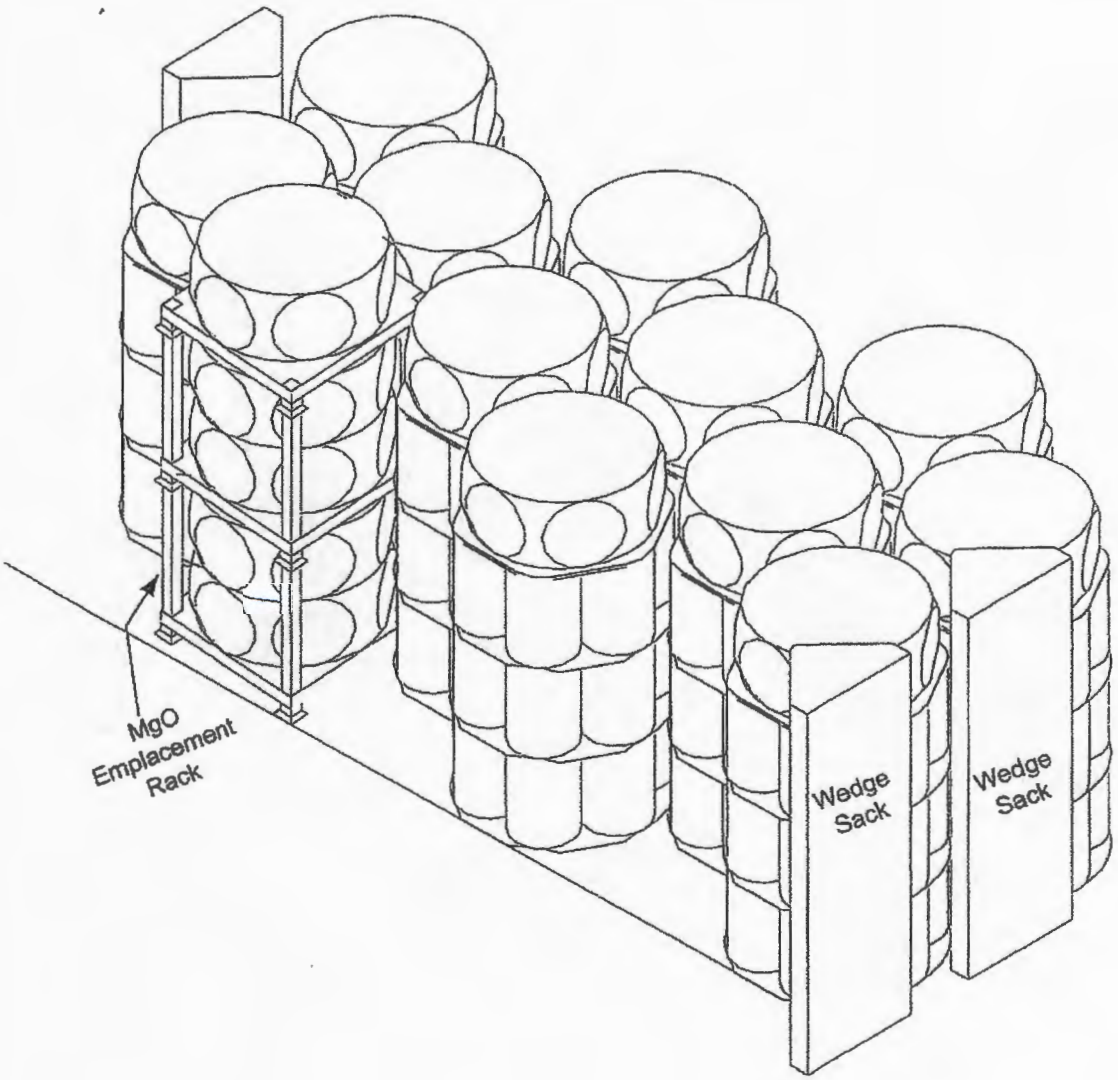

Figure A2-5a
Potential MgO Emplacement Configurations

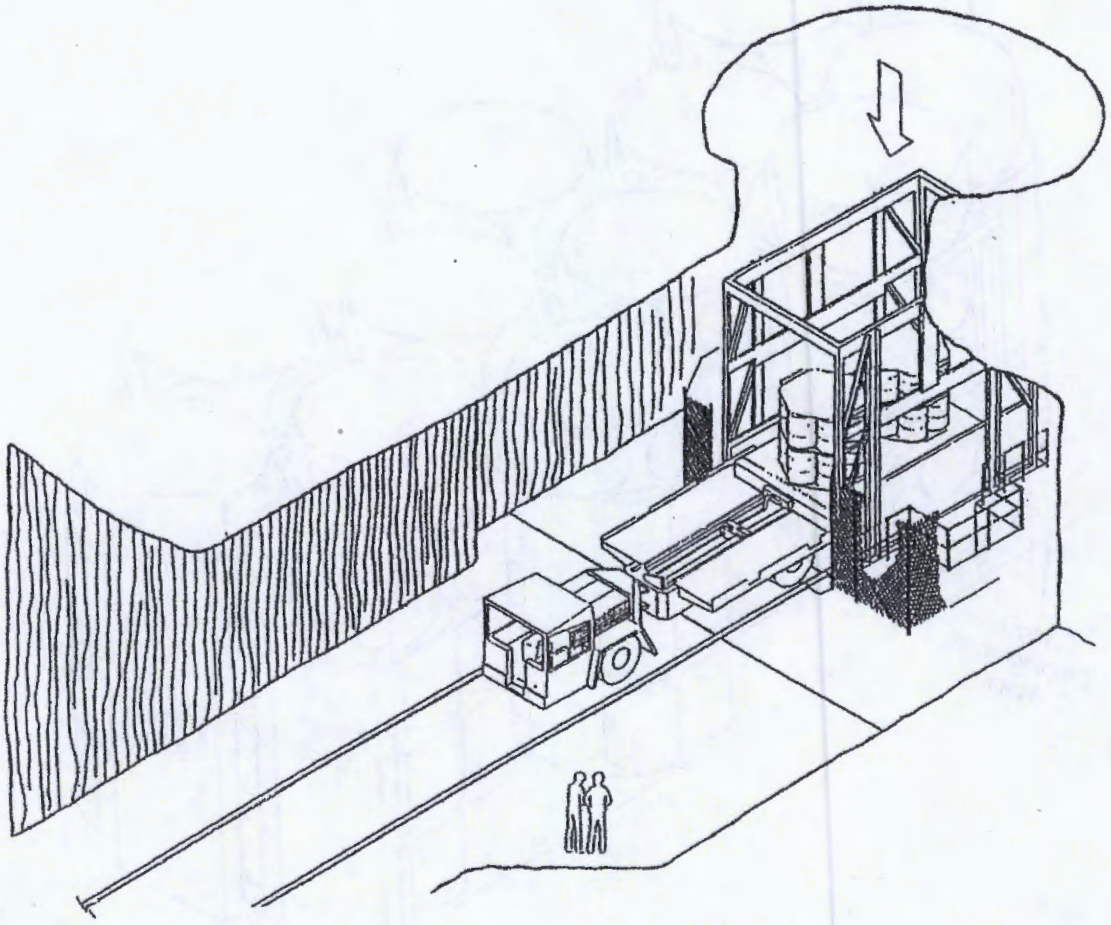

Figure A2-6
Waste Transfer Cage to Transporter

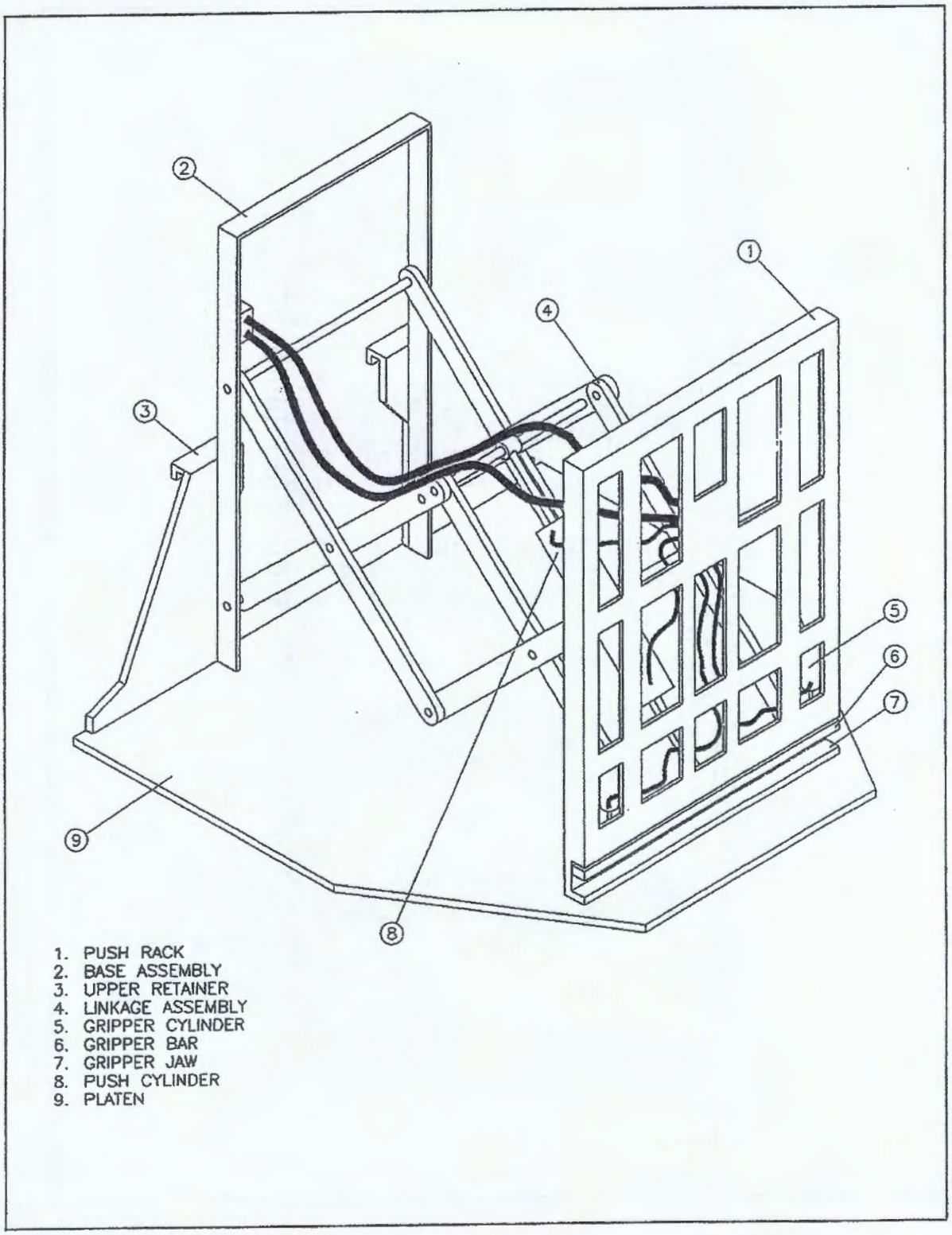

Figure A2-7
Push-Pull Attachment to Forklift to Allow Handling of Waste Containers

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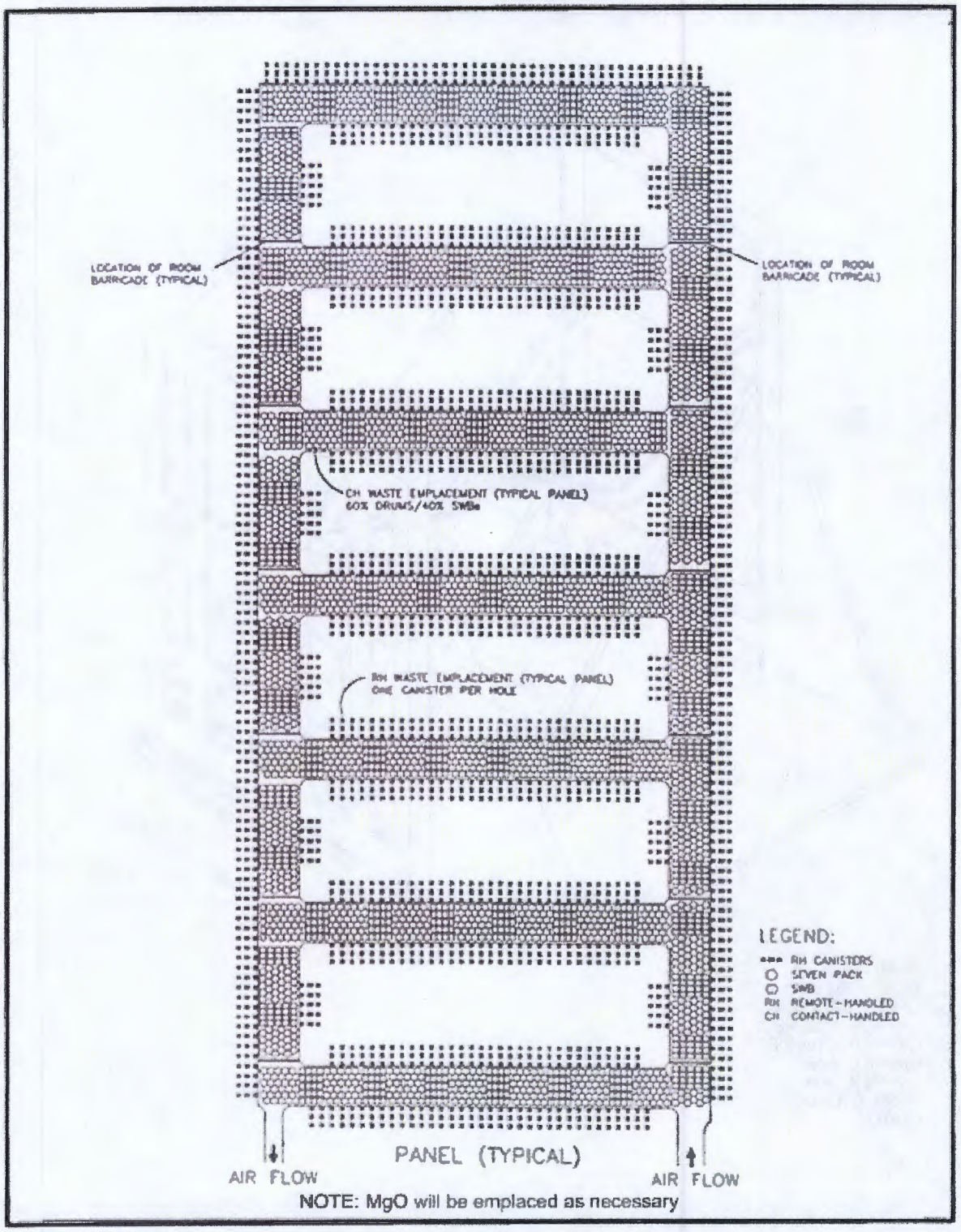

Figure A2-8
Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration

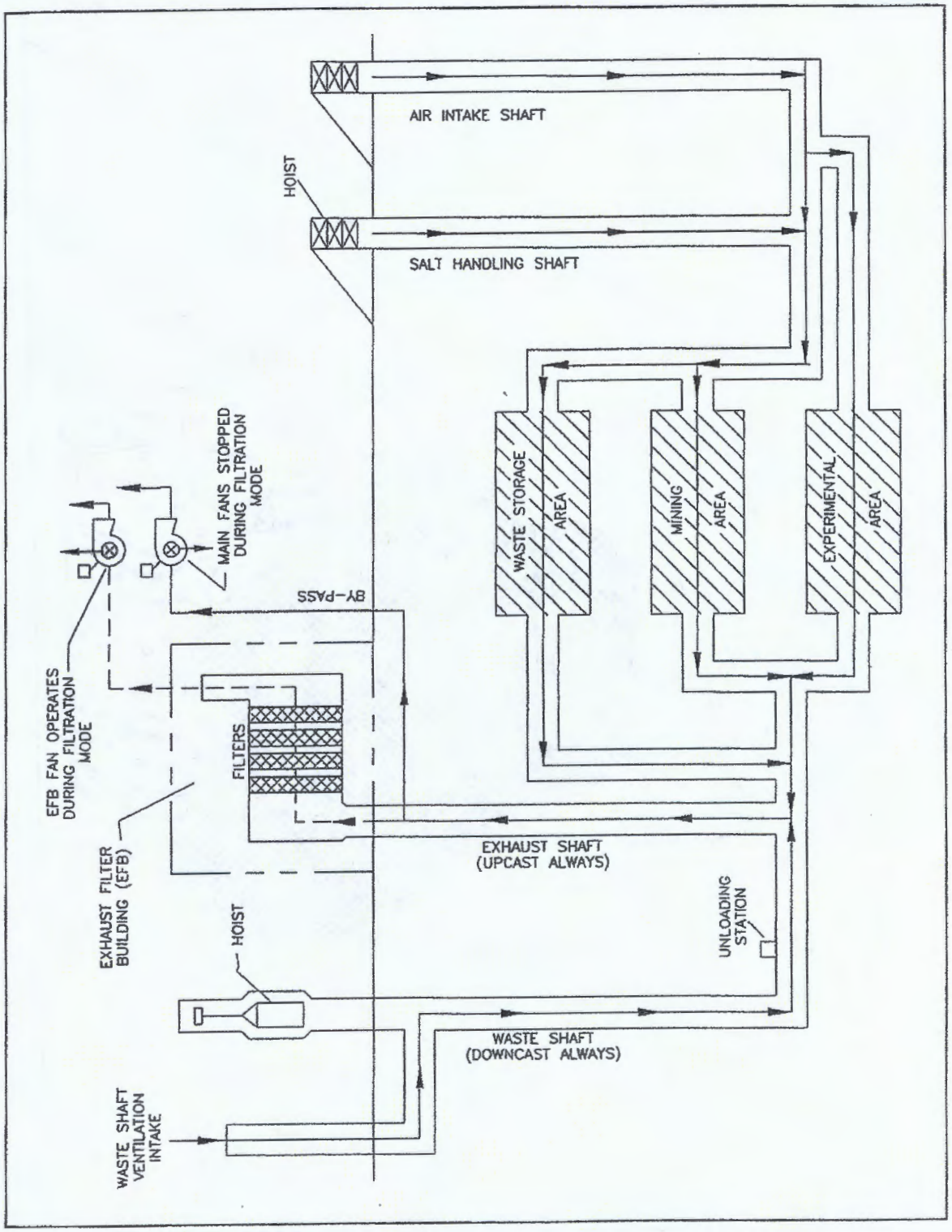

Figure A2-9
Underground Ventilation System Airflow

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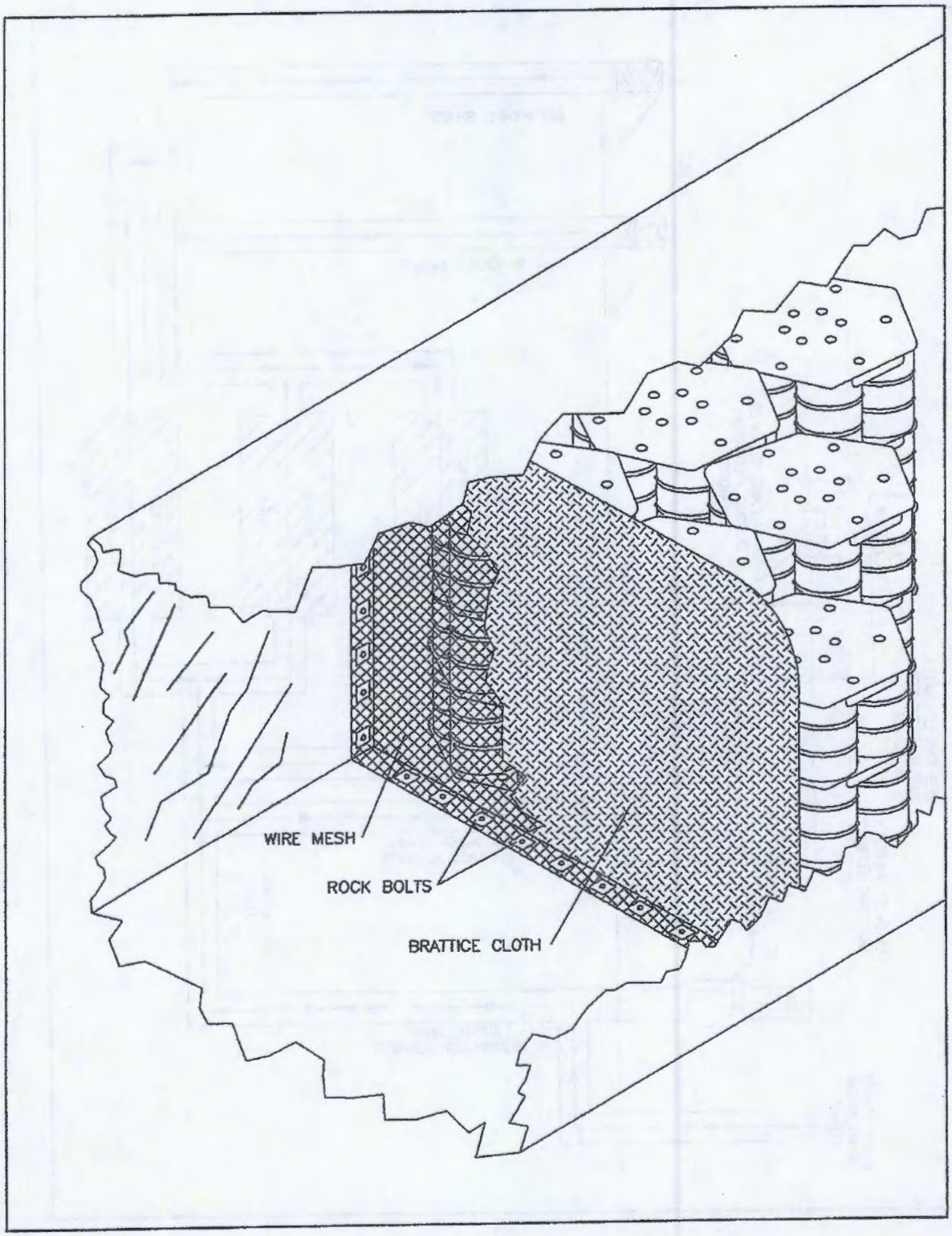
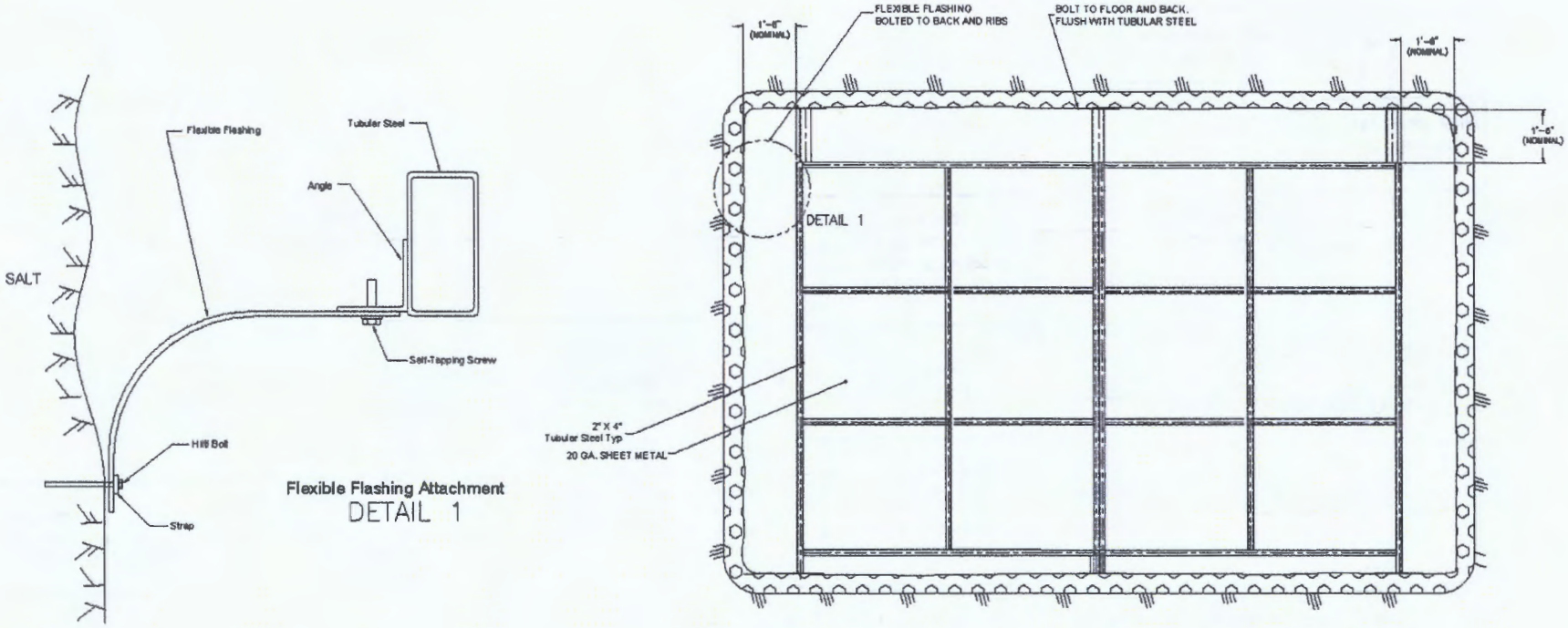


Figure A2-11
Typical Room Barricade



Not to Scale. All dimensions are nominal.

Figure A2-11a
Typical Bulkhead

02286

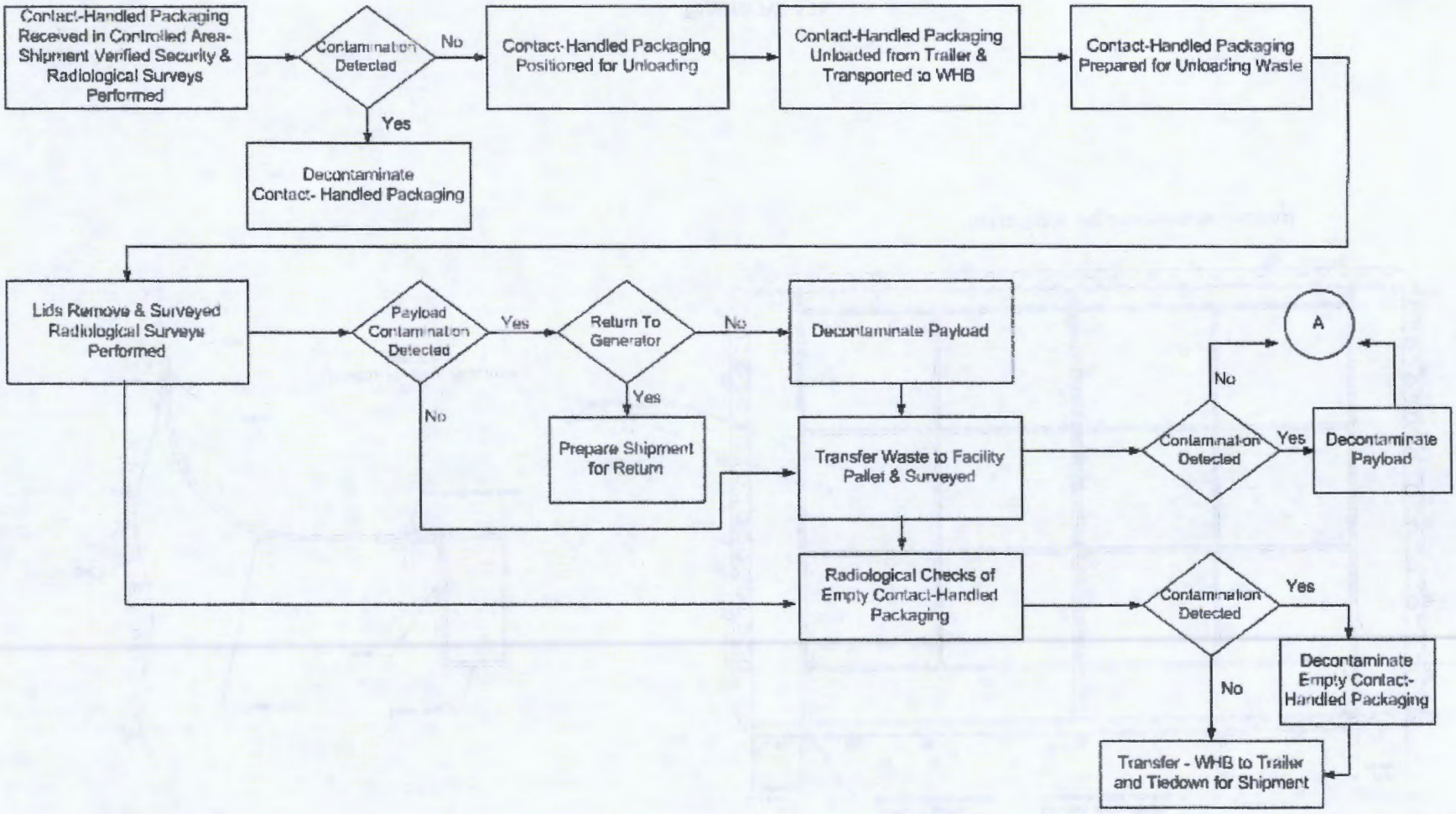


Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

02287

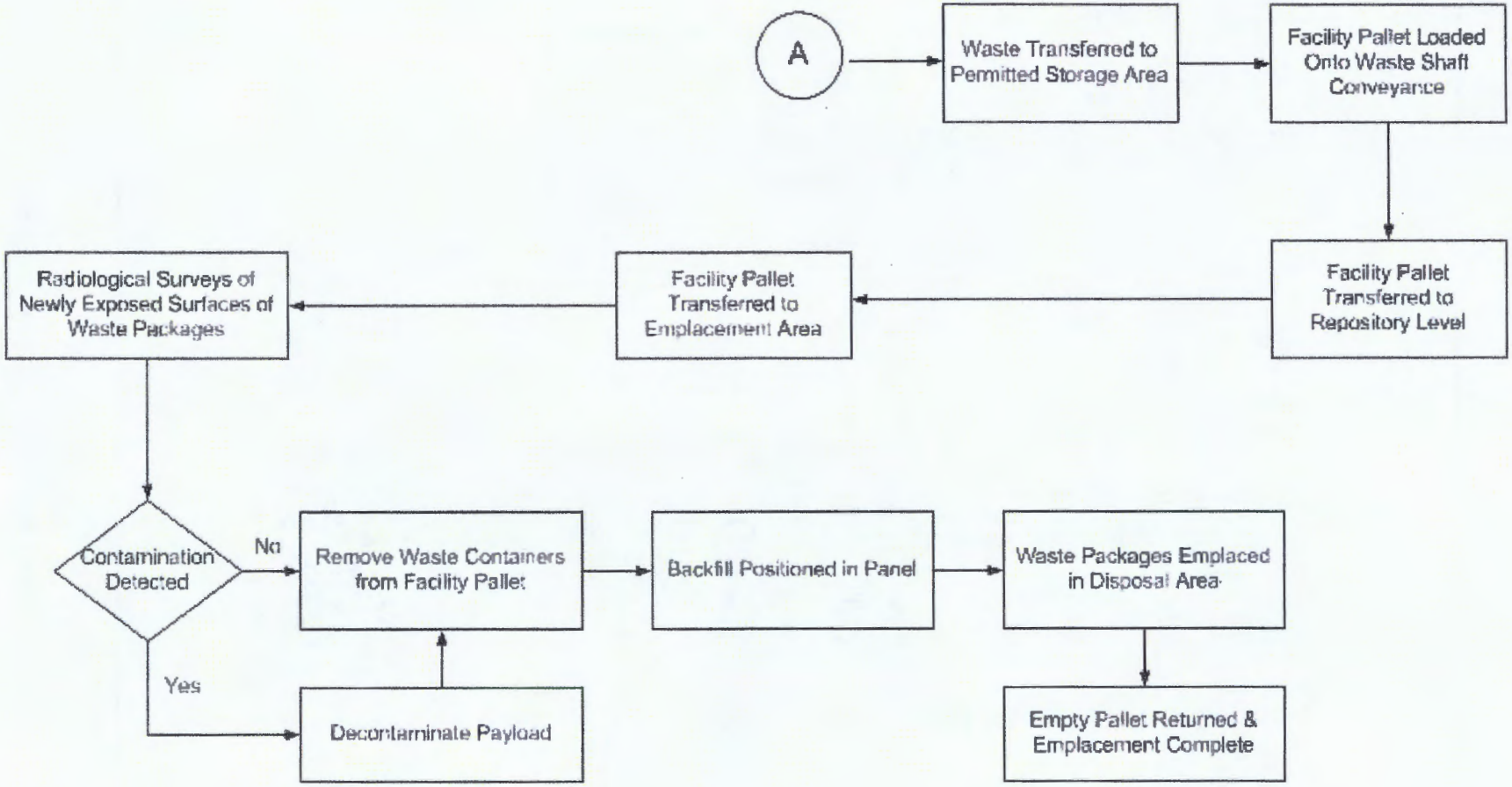


Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

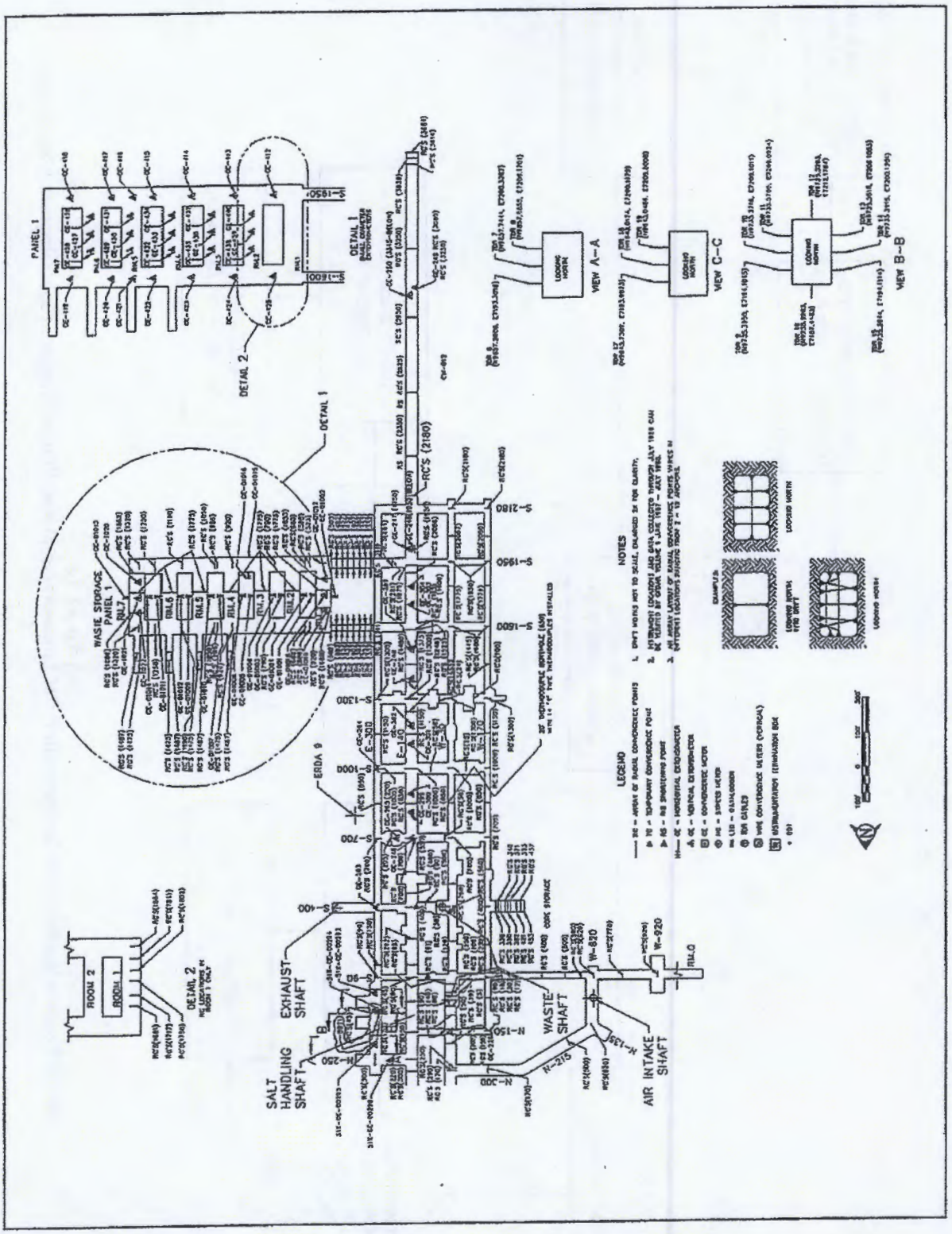


Figure A2-13
Layout and Instrumentation - As of 1/96

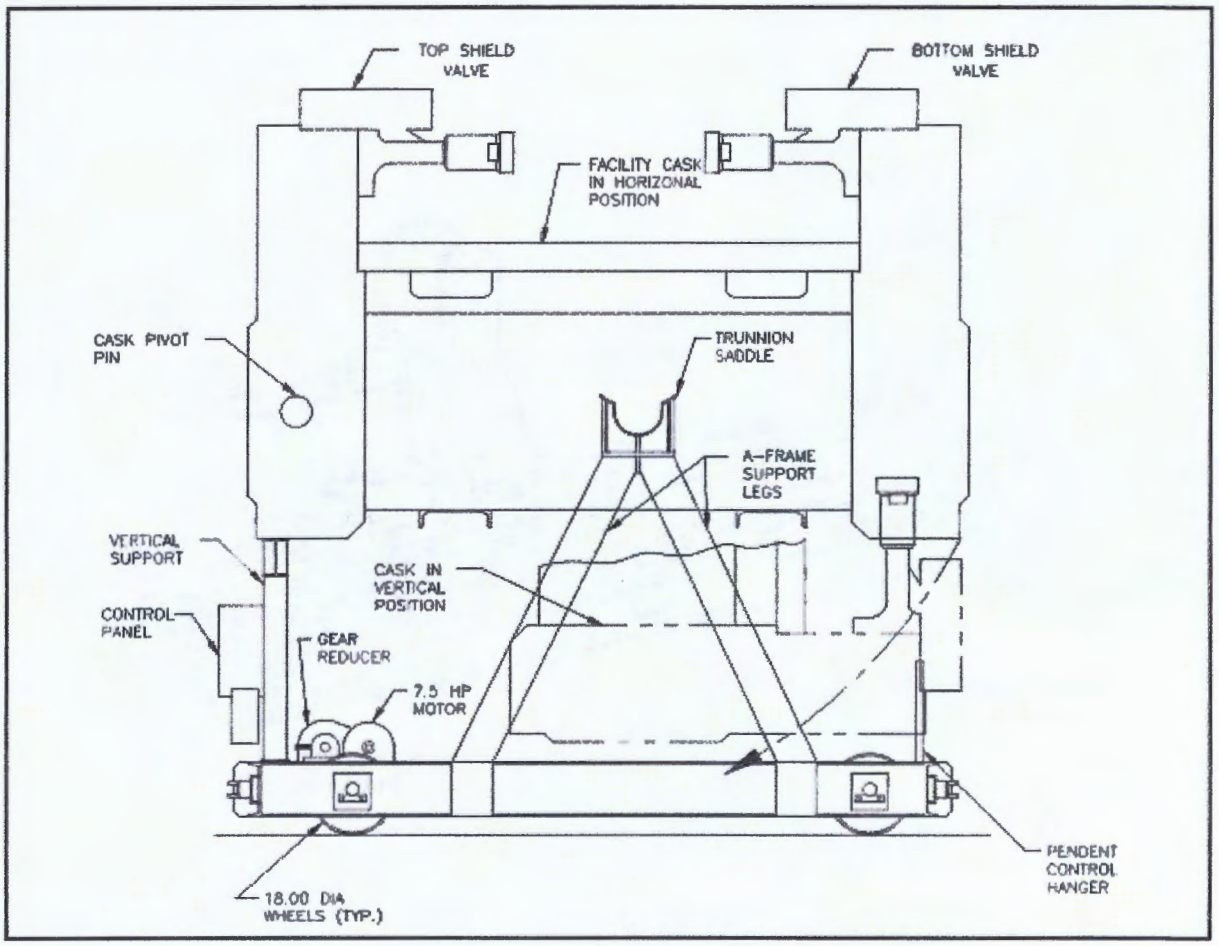


Figure A2-14
Facility Cask Transfer Car (Side View)

02290

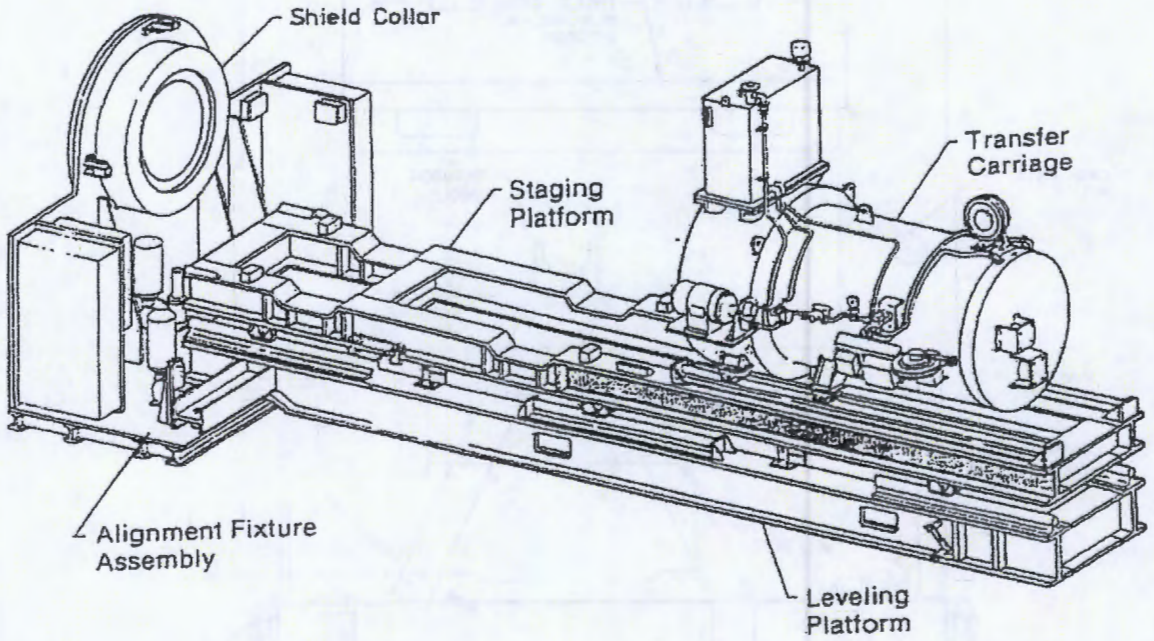


Figure A2-15
Typical Emplacement Equipment

1

02291

1

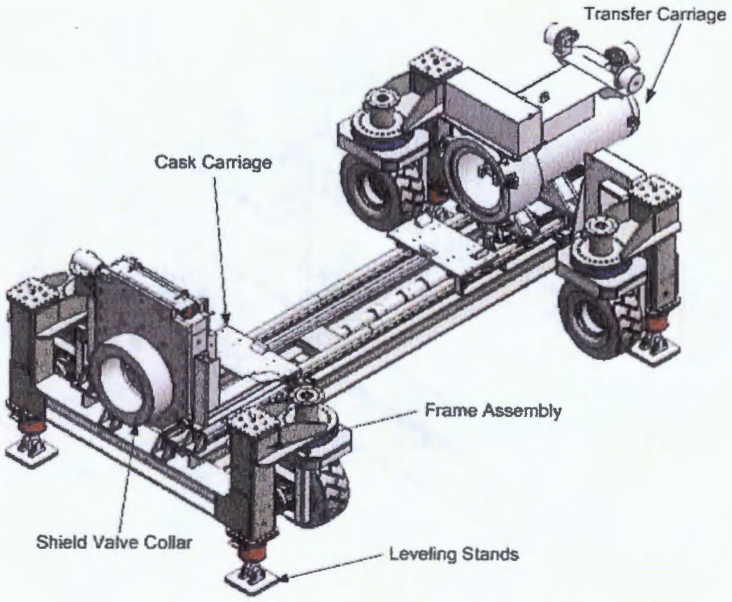


Figure A2-15a
Typical Emplacement Equipment

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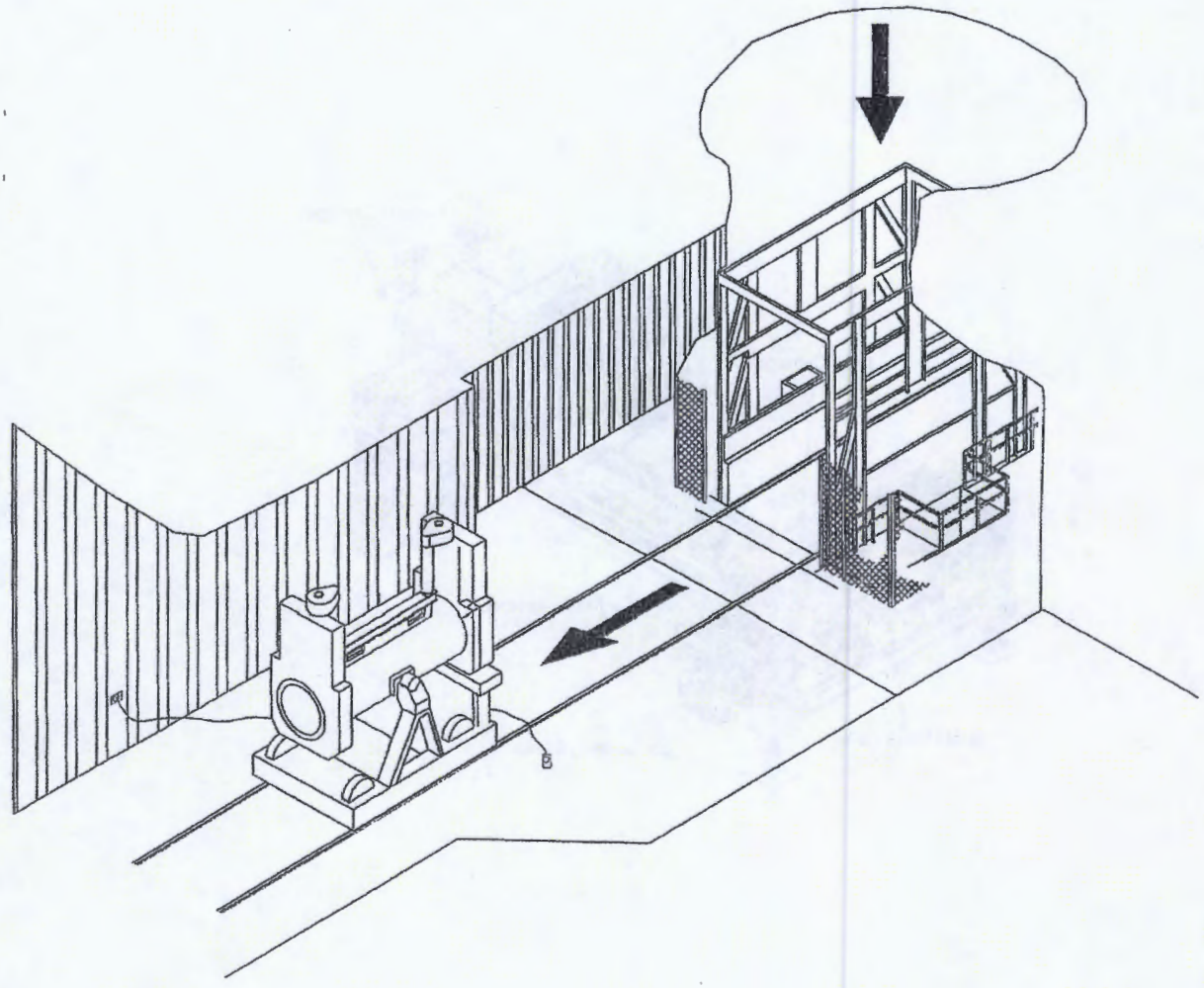


Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

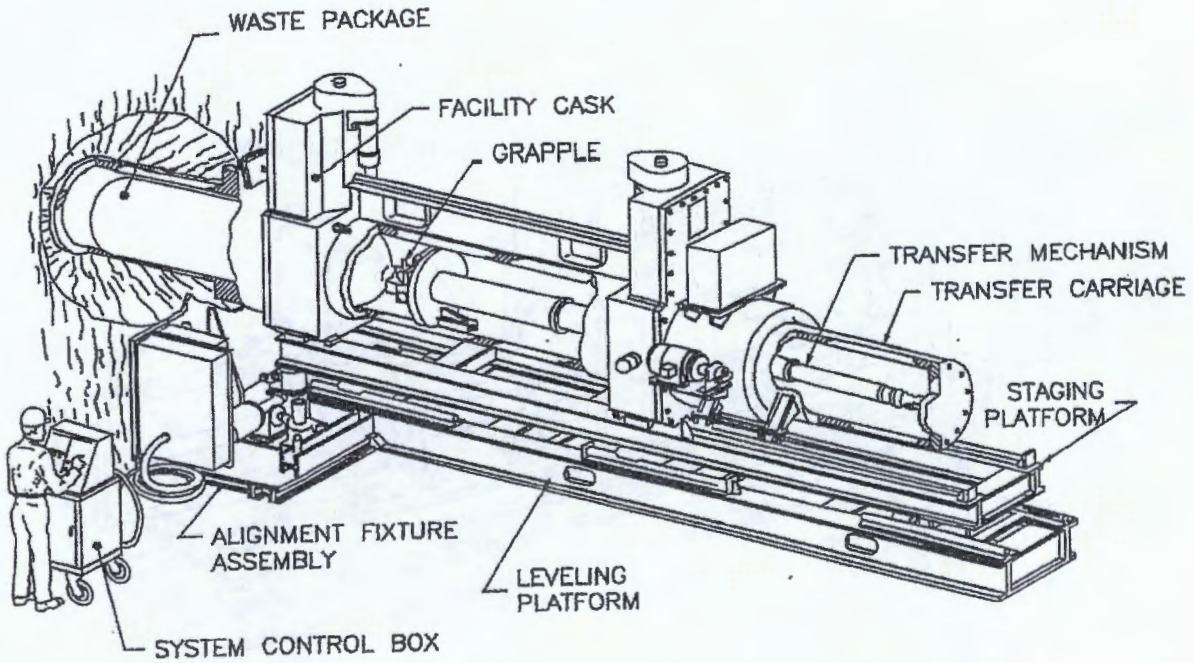


Figure A2-17
Facility Cask Installed on the Typical Emplacement Equipment

02294

FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

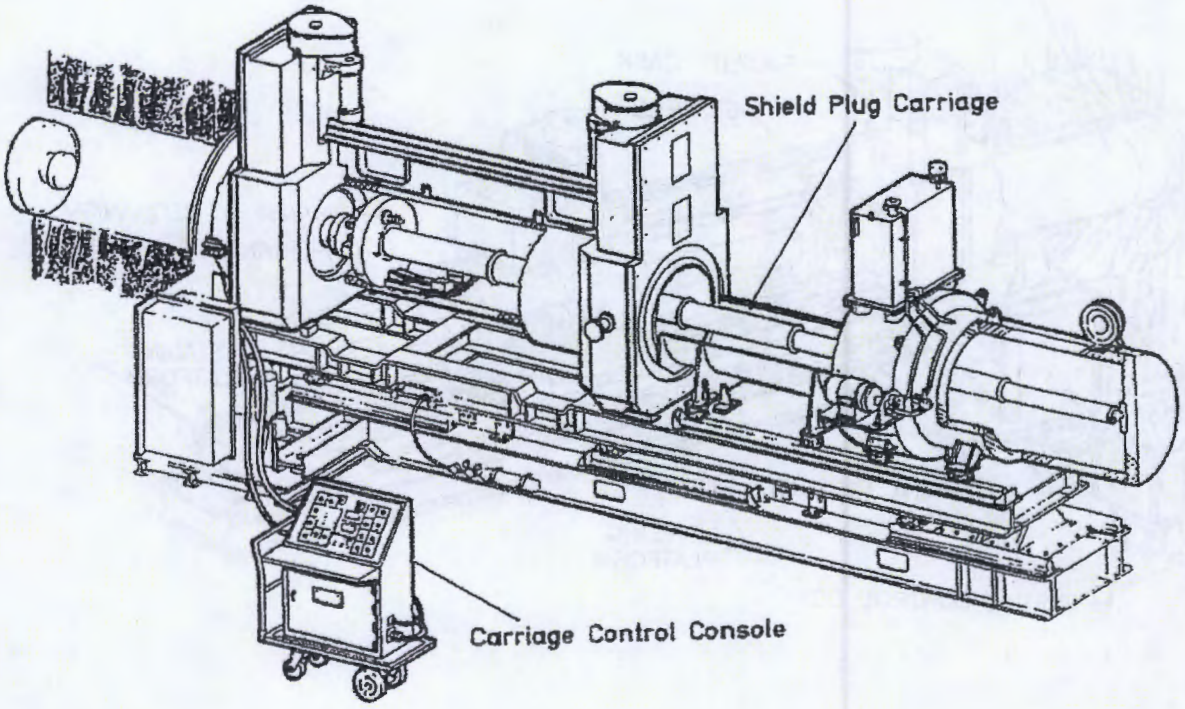
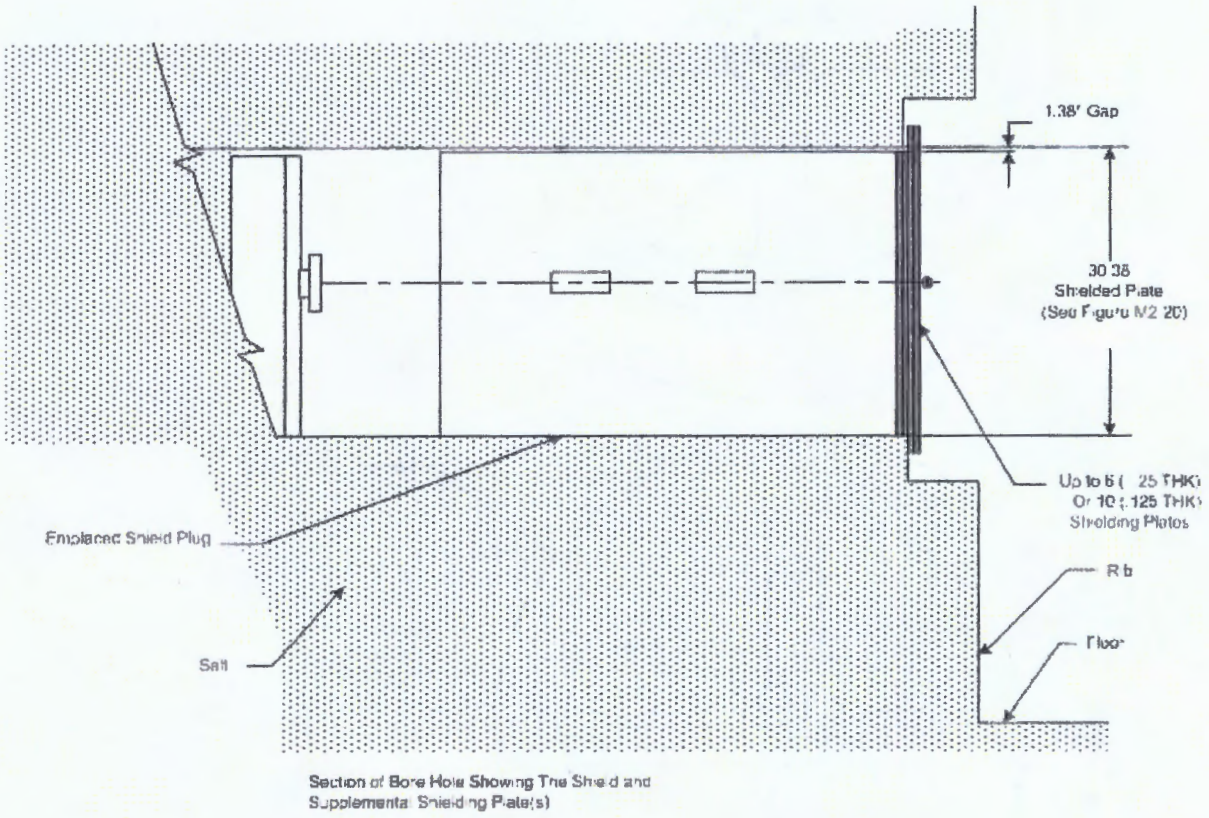


Figure A2-18
Installing Shield Plug



Section of Bore Hole Showing The Shield and Supplemental Shielding Plate(s)

Figure A2-19
Shield Plug Supplemental Shielding Plate(s)

02296

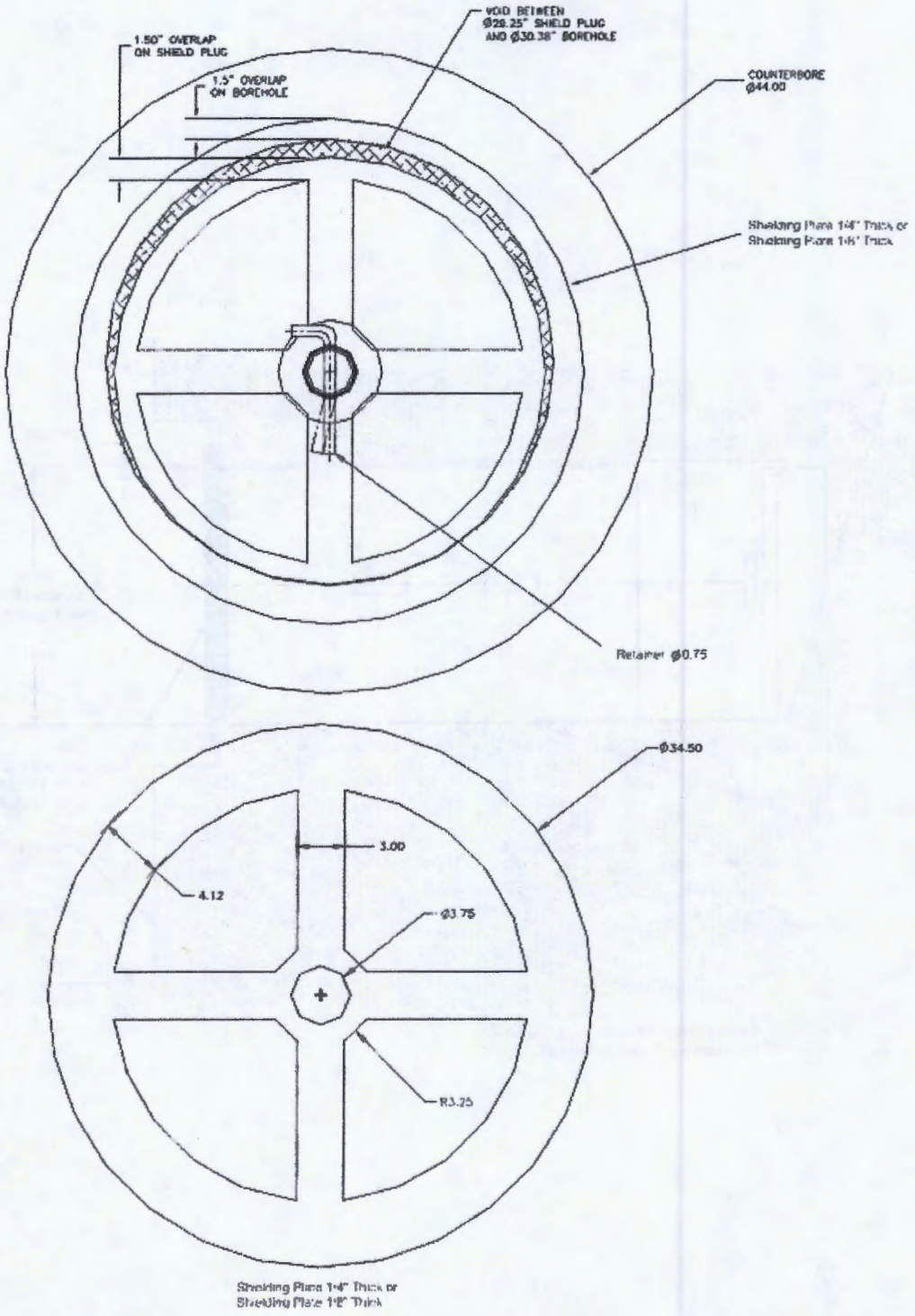
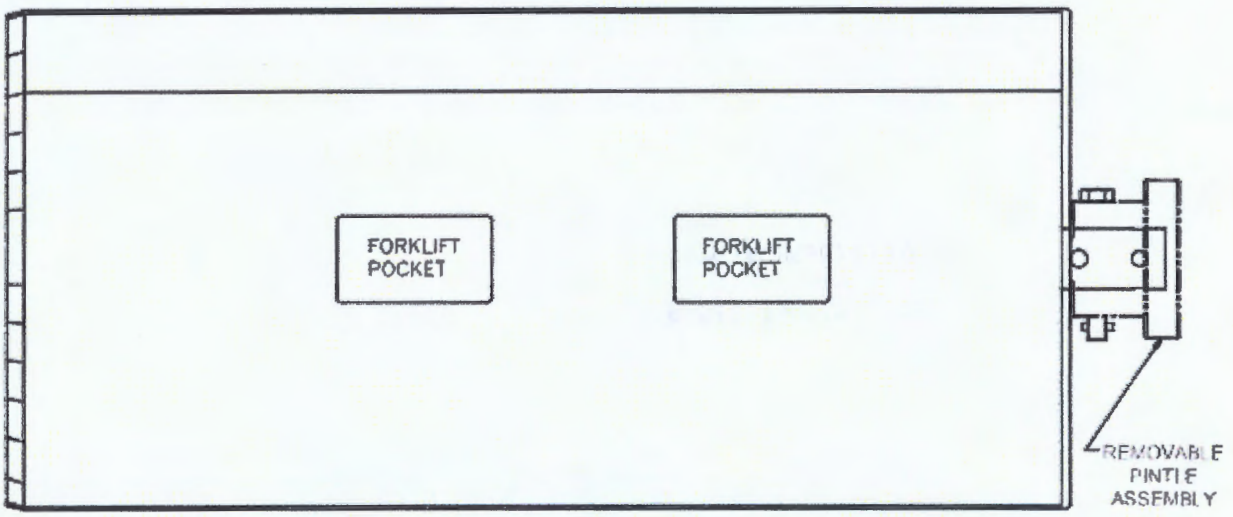


Figure A2-20
Shielding Layers to Supplement RH Borehole Shield Plugs



TYPICAL DIMENSION. APPROXIMATELY 29 INCHES DIAMETER X 61 INCHES SHIELDING LENGTH

Composition: Cylindrical steel shell filled with concrete
Weight: Approximately 3750 pounds

Figure A2-21
Shield Plug Configuration

1

: 02298

Field Code Changed

ATTACHMENT A4

TRAFFIC PATTERNS

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ATTACHMENT A4

TRAFFIC PATTERNS

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ATTACHMENT A4

TRAFFIC PATTERN

A4-1 Traffic Information and Traffic Patterns

Access to the WIPP facility is provided by two access roads that connect with U.S. Highway 62/180, 13 mi (21 km) to the north, and NM Highway 128 (Jal Highway), 4 mi (6.4 km) to the south (Figure A4-1). These access roads were built for the Permittees to transport TRU mixed waste to the site. Both access roads are owned and maintained by the Department of Energy (**DOE**). Signs and pavement markings are located in accordance with the Uniform Traffic Control Devices Manual. Access-road design designation parameters, such as traffic volume, are presented in Table A4-1.

A4-2 Facility Access and Traffic

Access to the facility for personnel, visitors, and trucks carrying supplies and TRU mixed waste is provided through a security checkpoint (vehicle trap). After passing through the security checkpoint, TRU mixed waste transport trucks will normally turn right (south) before reaching the Support Building and then left (east) to park in the parking area HWMU just east of the air locks (Figure A4-2). Outgoing trucks depart the same way they arrived, normally out of the west end of the parking area, north through the fence gate and out through the vehicle trap. An alternate inbound route is to continue straight ahead from the security checkpoint to the second road and to turn south to enter the truck parking area. The alternate outbound route is also the reverse of this route. Salt transport trucks, which remove mined salt from the Salt Handling Shaft area, will not cross paths with TRU mixed waste transporters; instead, they will proceed from the Salt Handling Shaft northward to the salt pile. Figure A4-2 shows surface traffic flow at the WIPP facility.

The site speed limit for motor vehicles is 10 mph (16 kph) and 5 mph (8 kph) for rail movements. Speed limits are clearly posted at the entrance to the site and enforced by security officers. There are no traffic signals. Stop signs are located at the major intersections of roadways with the main east-west road. Safety requirements are communicated to all site personnel via General Employee Training within 30 days of their employment. Employee access to on-site facilities requires an annual refresher course to reinforce the safety requirements. Security officers monitor vehicular traffic for compliance with site restrictions, and provide instructions to off-site delivery shipments. Vehicular traffic other than the waste transporters use the same roads, but there will be no interference because there are two lanes available on the primary and alternate routes for waste shipments. Pedestrian traffic is limited to the sidewalks and prominently marked crosswalks. Site traffic is composed mostly of pickup trucks and electric carts with a frequency of perhaps 10 per hour at peak periods. Emergency vehicles are exercised periodically for maintenance and personnel training, with an average frequency of one each per day. They are used for their intended purpose on an as-required basis.

The traffic circulation system is designed in accordance with American Association of State Highway and Transportation Officials (**AASHTO**) Site Planning Guides for lane widths, lateral clearance to fixed objects, minimum pavement edge radii, and other geometric features. Objects in or near the roadway are prominently marked.

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On-site roads, sidewalks, and paved areas are used for the distribution and storage of vehicles and personnel and are designed to handle all traffic generated by employees, visitors, TRU mixed waste shipments, and movements of operational and maintenance vehicles. The facility entrance and TRU mixed waste haul roads are designed for AASHTO H20-S16 wheel loading. Service roads are designed for AASHTO H10 wheel loading. Access and on-site paved roads are designed to bear the anticipated maximum load of115,000 lbs (52,163.1 kg), the maximum allowable weight of a truck/trailer carrying loaded Contact-Handled or Remote-Handled Packages. The facility is designed to handle approximately eight truck trailers per day, each carrying one or more Contact-Handled or Remote-Handled Packages. This is equivalent to 3,640 TRU mixed waste-carrying vehicles per year.

The calculations to support the anticipated maximum load of 115,000 lbs. are shown below:

Soil Resistance R (psi) - is taken directly from the WIPP Soil Report and Bechtel calculation because there is no change.

A. Pavement Thickness

The traffic frequency increase from 10 shipments per day to 10.15 shipments per day has only minimal impact on the Total Expanded Average Load (**EAL**) and the traffic index (**TI**) as shown below, both important parameters in pavement design.

Total EAL (TEAL):
13,780 ~ constant for 5 or more axles over 20 years, taken from Table 7-651.2A - Highway Design Manual (HDM).
TEAL = 13,780 × 25yr./20yr. = 17,225
Using 10.15 shipments per day ~ 17,225 × 10.15 = 174,834

Conversion of EAL to Traffic Index (TI).
For TEAL of 174,834 ~ TI = 7.5 - (from HDM, Table 7-651.2B)

Asphalt Concrete Thickness TAC:
GE = 0.0032 × TI × (100 -R)....R = 80
GE - Gravel Equivalent (Ft).
GE = 0.0032 × 7.5 × 20 = 0.48' ...GfAC = 2.01⇒ TAC = 0.48/2.01 = 0.24' ⇒ use 2½" AC Surface Course.
(Actually used: 3")
Gf - Gravel Equivalent Factor (constant from Table 7-651.2C from HDM).

B. Bituminous Treated Base

GE = 0.0032 × TI × (100 -R) .... R = 55 ~ caliche subbase ⇒ GE = 1.08' GEBTB = 1.08 - 2.01 × 0.21 = 0.66'
TBTB = GEBTB/GfBTB = 0.66/1.2 = 0.55' ⇒ Use 4" BTB
GfBTB ~ taken from table 7-651.2C

C. Caliche Subbase ~ TCSB

GE = 0.0032 × TI × (100 -R) .....R = 50 - prepared subgrade
GE = 1.2

GECSB = 1.2 - (0.21× 2.07) - (0.33 × 1.2) ⇒ 0.37'
TCBS = 0.37/1.0 = 0.37' ~ 4½"

Based on the results of the above calculation, the site paved roads designated for waste transportation are safe to be used by the heavier truckloads carrying shipping casks used in RH TRU mixed waste transportation to the WIPP.

A4-3 Waste Handling Building Traffic

CH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed Contact Handled Packages. Upon receipt, security checks, radiological surveys, and shipping documentation reviews will be performed. A forklift or Yard Transfer Vehicle will remove the Contact Handled Packages and transport them a short distance through an air lock that is designed to maintain differential pressure in the WHB. The forklift or Yard Transfer Vehicle will place the shipping containers at one of the two TRUPACT-II unloading docks (**TRUDOCK**) inside the WHB or, in the case of the TRUPACT-III, at the payload transfer station in Room 108.

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one shielded container 3-pack, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two shielded container 3-packs, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

RH TRU mixed waste will arrive at the WIPP facility in a payload container contained in a shielded cask loaded on a tractor-trailer. Upon arrival, radiological surveys, security checks, and shipping documentation reviews will be performed, and the trailer carrying the cask will be moved into the Parking Area or directly into the RH Bay of the Waste Handling Building Unit.

The cask is unloaded from the trailer in the RH Bay and is placed on the Cask Transfer Car. The Cask Transfer Car is used to move the cask to the Cask Unloading Room. At this point, a crane moves the waste to the Hot Cell or the Transfer Cell. Some RH TRU mixed waste may be moved to the Hot Cell for overpacking before being moved to the Transfer Cell. Once in the Transfer Cell, the Transfer Cell Shuttle Car moves the waste beneath the facility cask. A crane is used to move the waste from the Transfer Cell Shuttle Car into the facility cask. The Facility Cask Transfer Car then moves the facility cask to the underground. A more detailed description of waste handling in the WHB is included in Attachment M1. Figures A4-5, A4-6 and A4-7 show RH TRU mixed waste transport routes.

A4-4 Underground Traffic

The Permittees shall designate the traffic routes of TRU mixed waste handling equipment and construction equipment and record this designation on a map that is posted in a location where it can be examined by personnel entering the underground. The map will be updated whenever the routes are changed. Maps will be available in facility files until facility closure. The ventilation and traffic flow path in the TRU mixed waste handling areas underground are restricted and separate from those used for mining and haulage (construction) equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600 (Figures A4-4 and A4-4a). In general, the Permittees restrict waste traffic to the intake ventilation drift to maximize isolation of this activity from personnel. The exhaust drift in the waste disposal area will normally not be used for personnel access. Non-waste and non-construction traffic is generally comprised of escorted visitors only and is minimized during each of the respective operations.

Adequate clearances that exceed the mining regulations of 30 CFR §57 exist underground for safe passage of vehicles and pedestrians. Pedestrians/personnel are required to yield to vehicles in the WIPP underground facility. This condition is reinforced through the WIPP equipment operating procedures, the WIPP Safety Manual, the WIPP safety briefing required for all underground visitors, the General Employee Training annual refresher course, and the Underground annual refresher course that are mandated by 30 CFR §57, the New Mexico Mine Code, and DOE Order 5480.20A.

In addition, other physical means are utilized to safeguard pedestrians/personnel when underground such as:

- All equipment operators are required to sound the vehicle horn when approaching intersections.
- All airlock and bulkhead vehicle doors are equipped with warning bells or strobe lights to alert personnel when door opening is imminent.
- Hemispherical mirrors are used at blind intersections so that persons can see around corners.
- All heavy equipment is required to have operational back-up alarms.
- Heavily used intersections are well lighted.

Typically, the traffic routes during waste disposal in all Panels will use the same main access drifts.

All traffic safety is regulated and enforced by the Federal and State mine codes of regulations (30 CFR §57 and New Mexico State Mine Code). The agencies that administer these codes make regular inspection tours of the WIPP underground facilities for the purpose of enforcement.

All underground equipment is designed for off-road use since all driving surfaces are excavated in salt. No loads on the underground roadways will exceed the bearing strength of in situ halite.

TABLES

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Table A4-1
Waste Isolation Pilot Plant Site Design Designation Traffic Parameters [a]

Traffic Parameter	North Access Road (No. of Vehicles, unless otherwise stated)	South Access Road (No. of Vehicles, unless otherwise stated)	On-Site Waste Haul Roads Contact-Handled and Remote-Handled Package Traffic)
Average Daily Traffic (ADT)[b]	800	800	8
Design Hourly Volume (DHV)[c]	144	144	NA [g]
Hourly Volume (Max. at Shift Change)	250	250	NA
Distribution (D)[d]	67%	67%	NA
Trucks (T)[e]	2%	2%	100%
Design Speed [h,i]	70 mph (113 kph)	60 mph (97 kph)	25 mph (40 kph)
Control of Access [f]	None	None	Full

[a] For WIPP personnel and TRU mixed waste shipments only.

[b] ADT—Estimated number of vehicles traveling in both directions per day.

[c] DHV—A two-way traffic count with directional distribution.

[d] D—The percentage of DHV in the predominant direction of travel.

[e] T—The percentage of ADT comprised of trucks (excluding light delivery trucks).

[f] Control of Access—The extent of roadside interference or restriction of movement.

[g] NA—Not applicable.

[h] mph—miles per hour.

[i] kph—kilometers per hour.

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FIGURES

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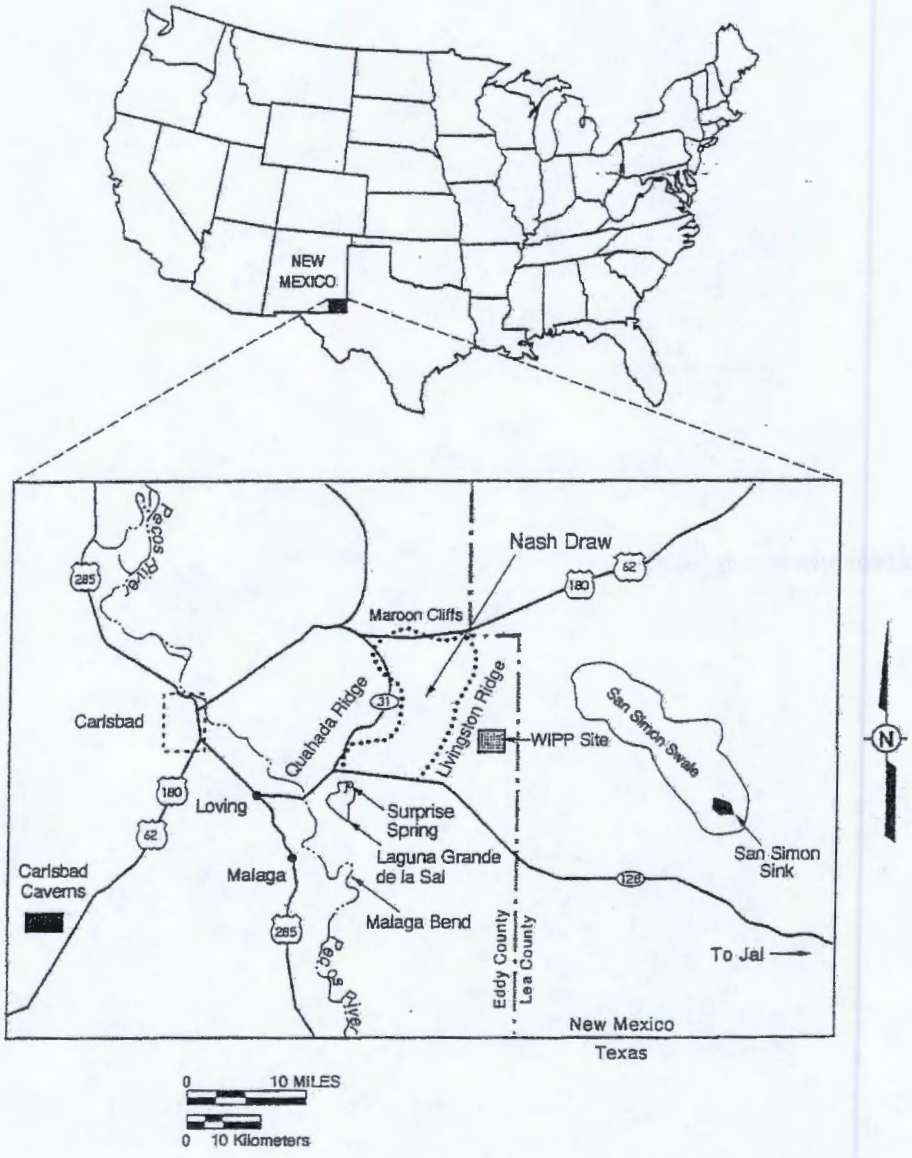

Figure A4-1
General Location of the WIPP Facility

02313

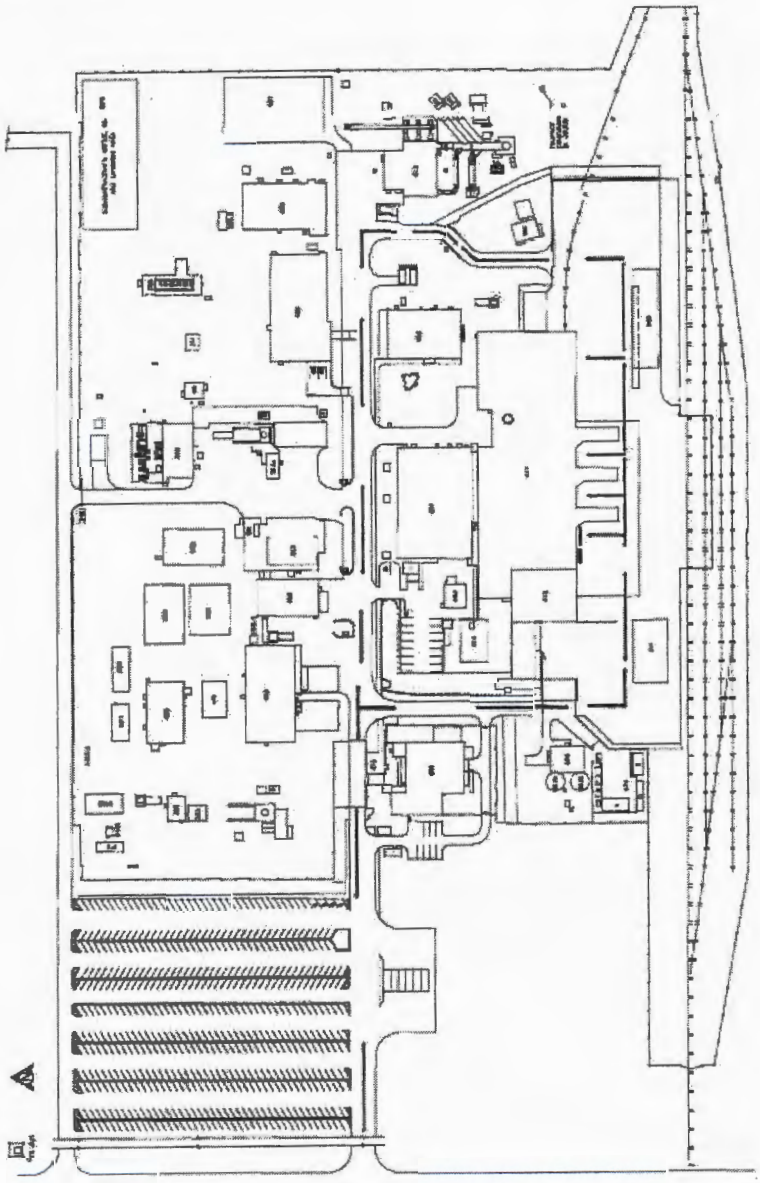

Figure A4-2
WIPP Traffic Flow Diagram

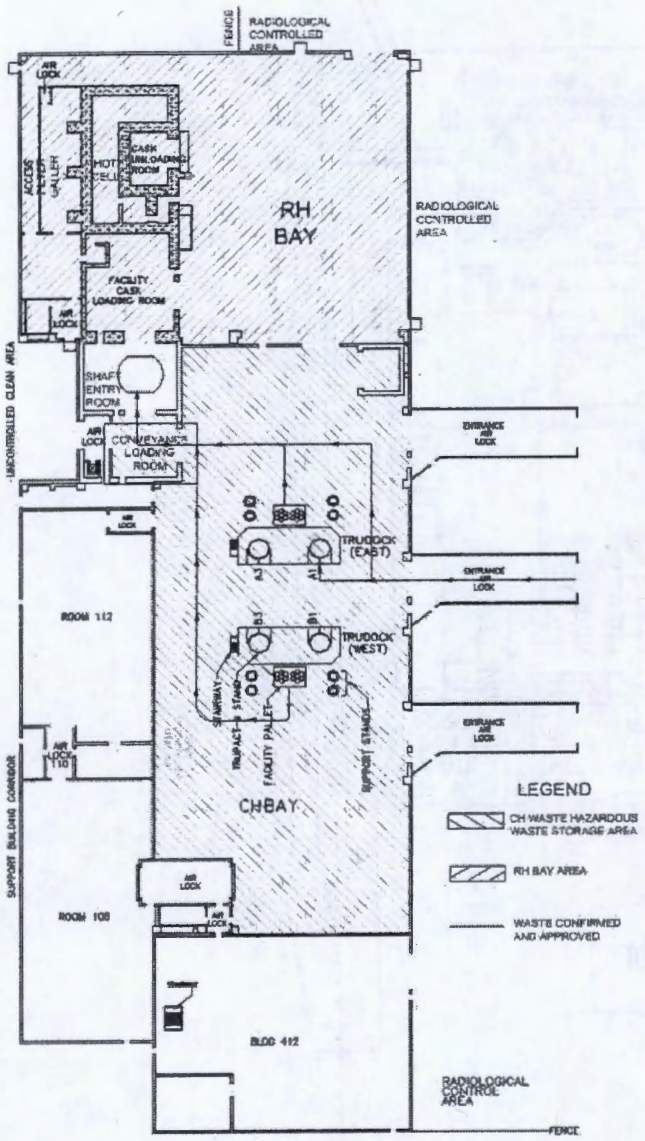

Figure A4-3
Waste Transport Routes in Waste Handling Building - Container Storage Unit

: 02315

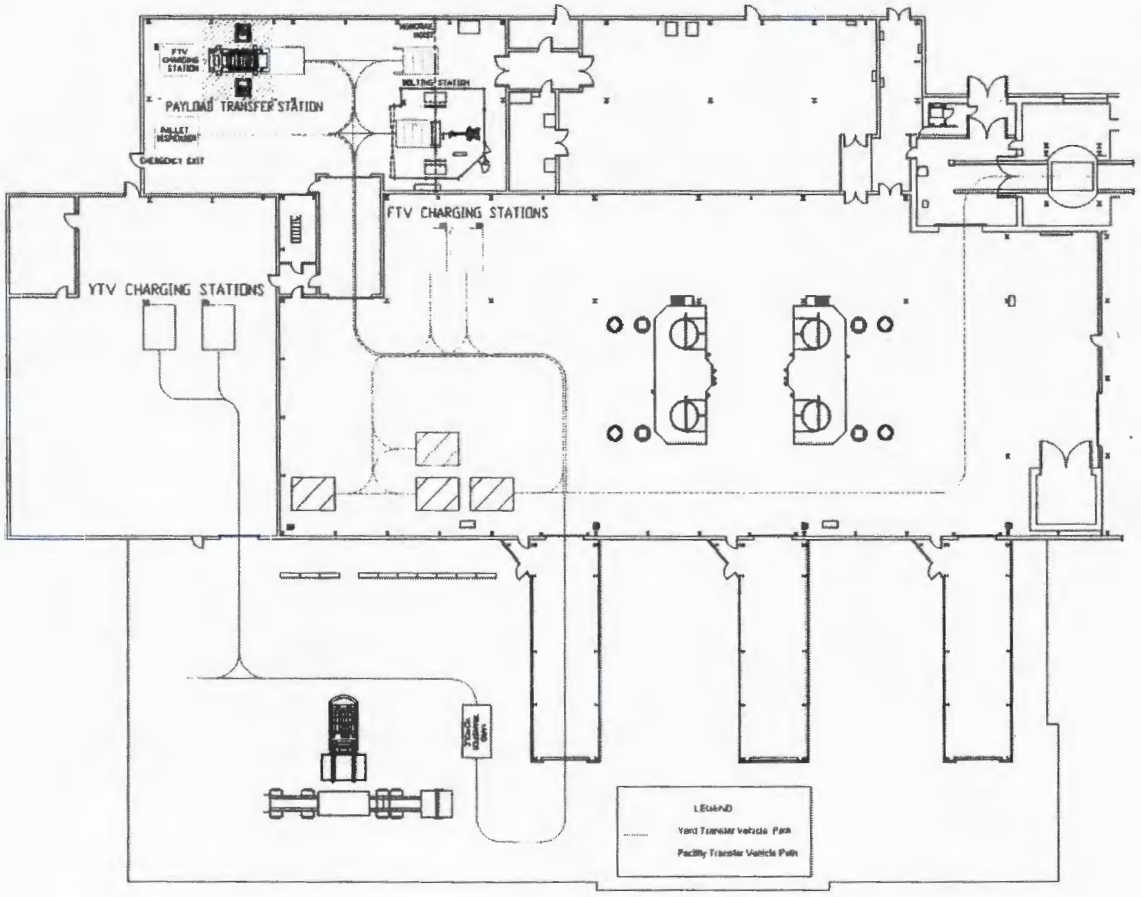

Figure A4-3a
Typical Transport Route for TRUPACT-III and Standard Large Box 2

92316

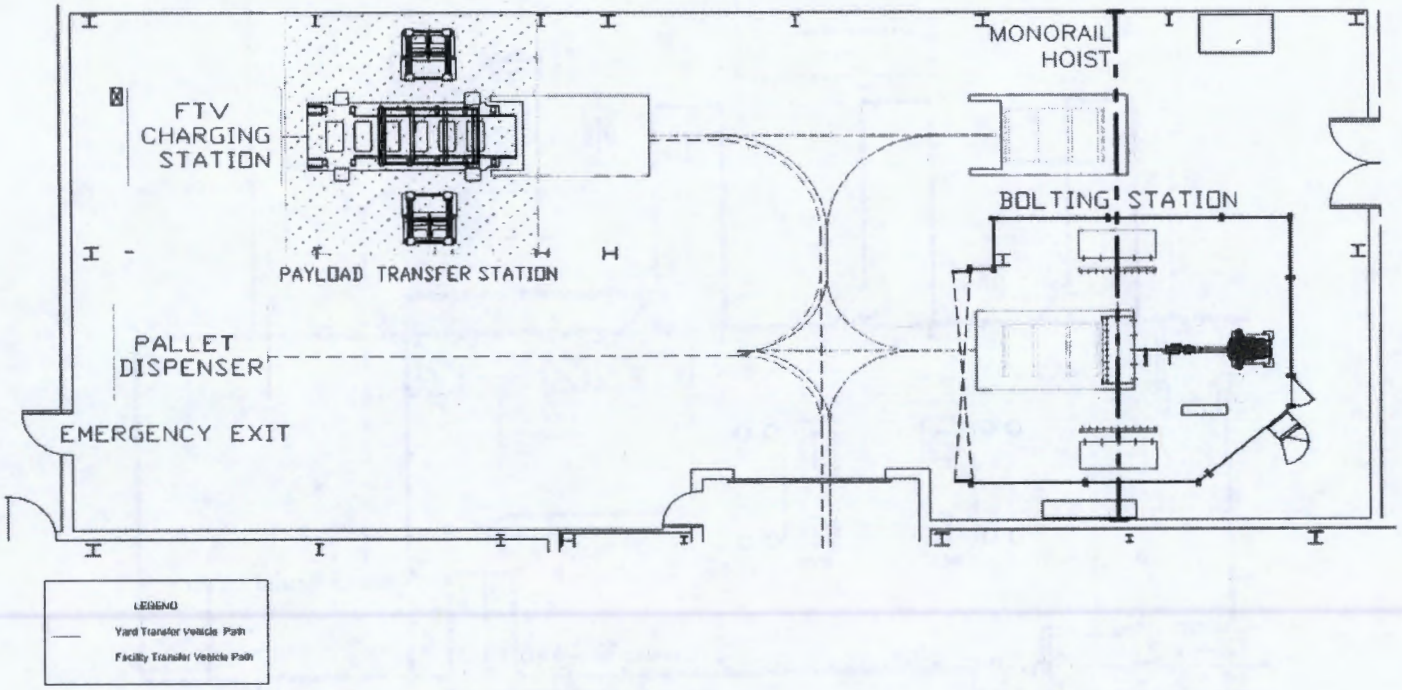

Figure A4-3b
Typical Transport Route for TRUPACT-III and Standard Large Box 2 in Room 108

023117

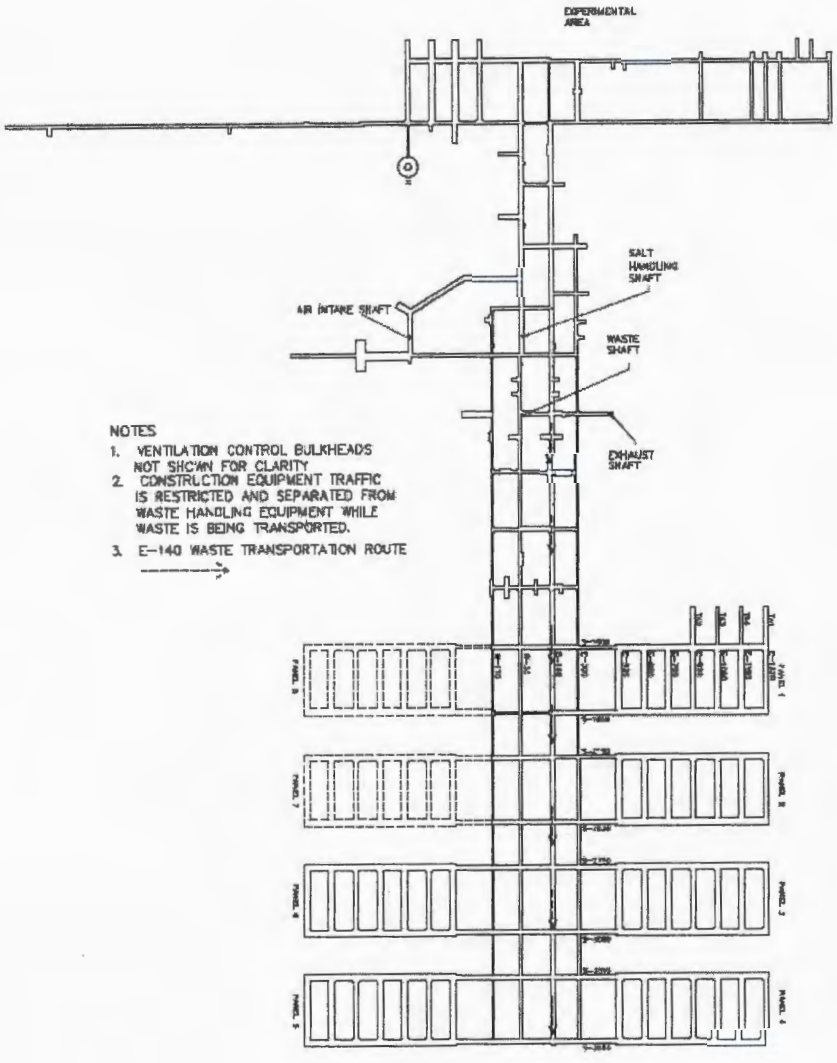

Figure A4-4
Typical Underground Transport Route Using E-140

02318

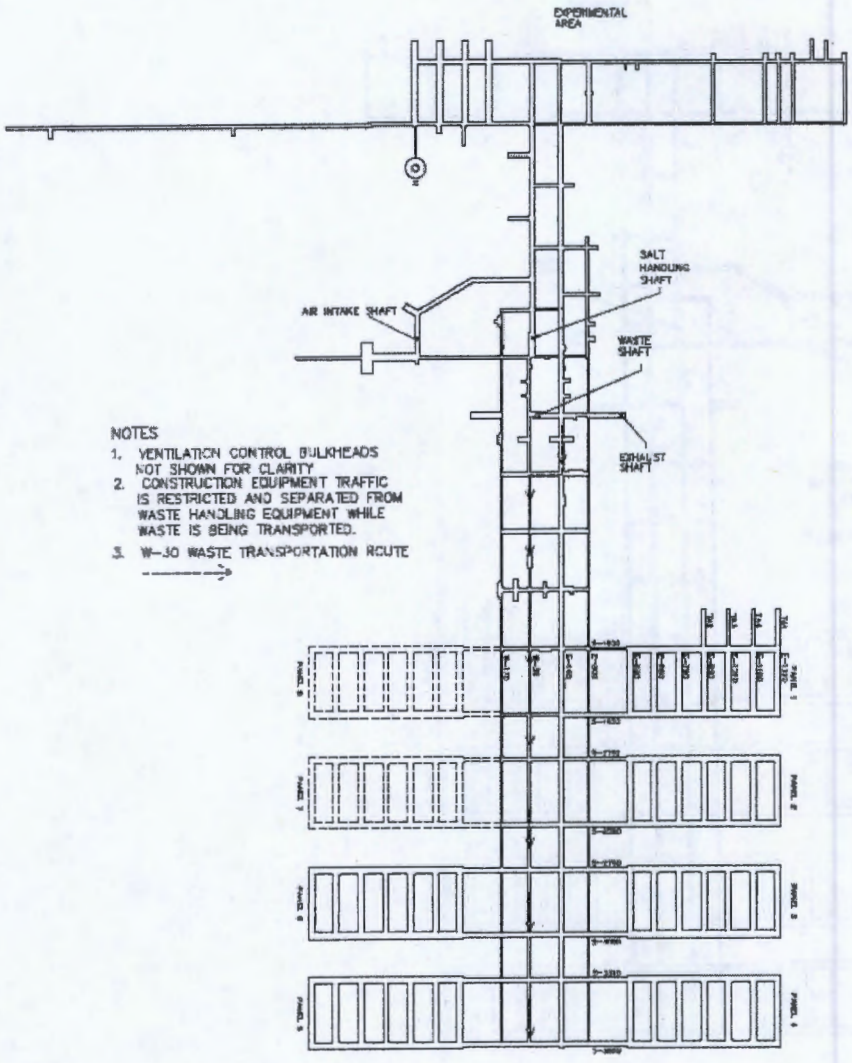

Figure A4-4a
Typical Underground Transport Route Using W-30

02319

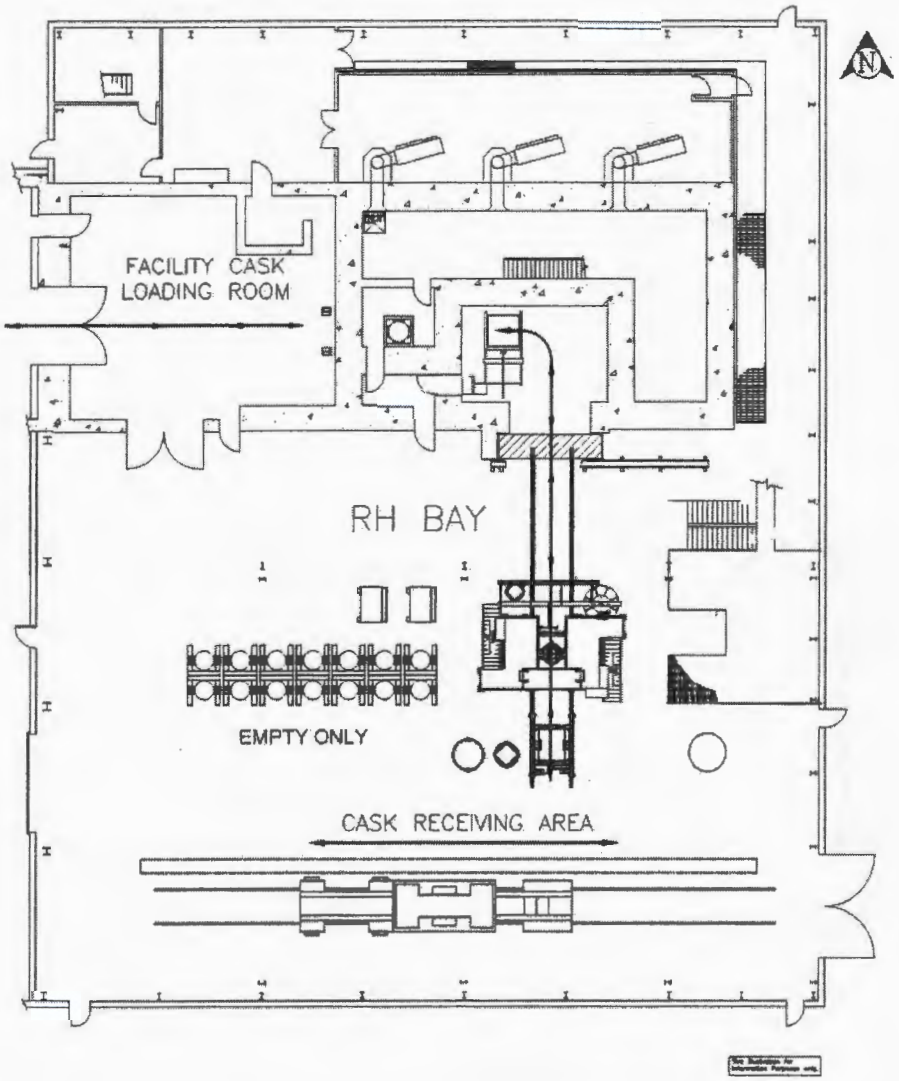

Figure A4-5
RH Bay Waste Transport Routes

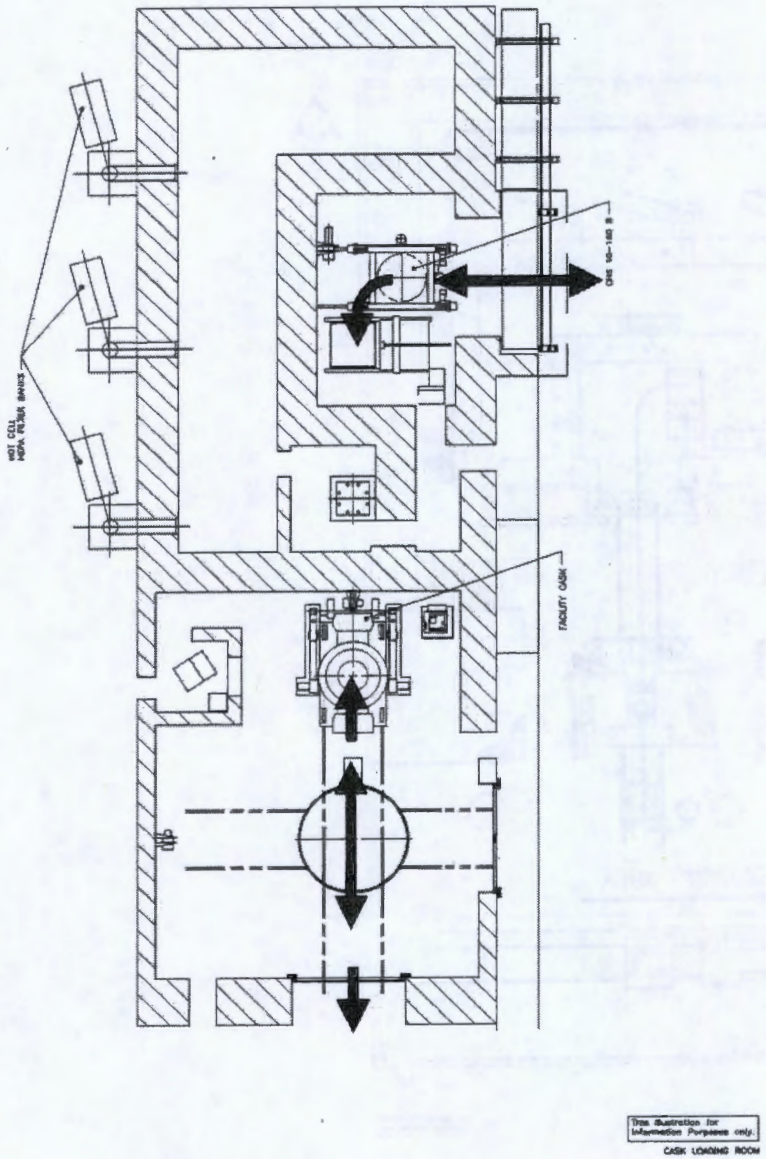

Figure A4-6
RH Bay Cask Loading Room Waste Transport Route

02321

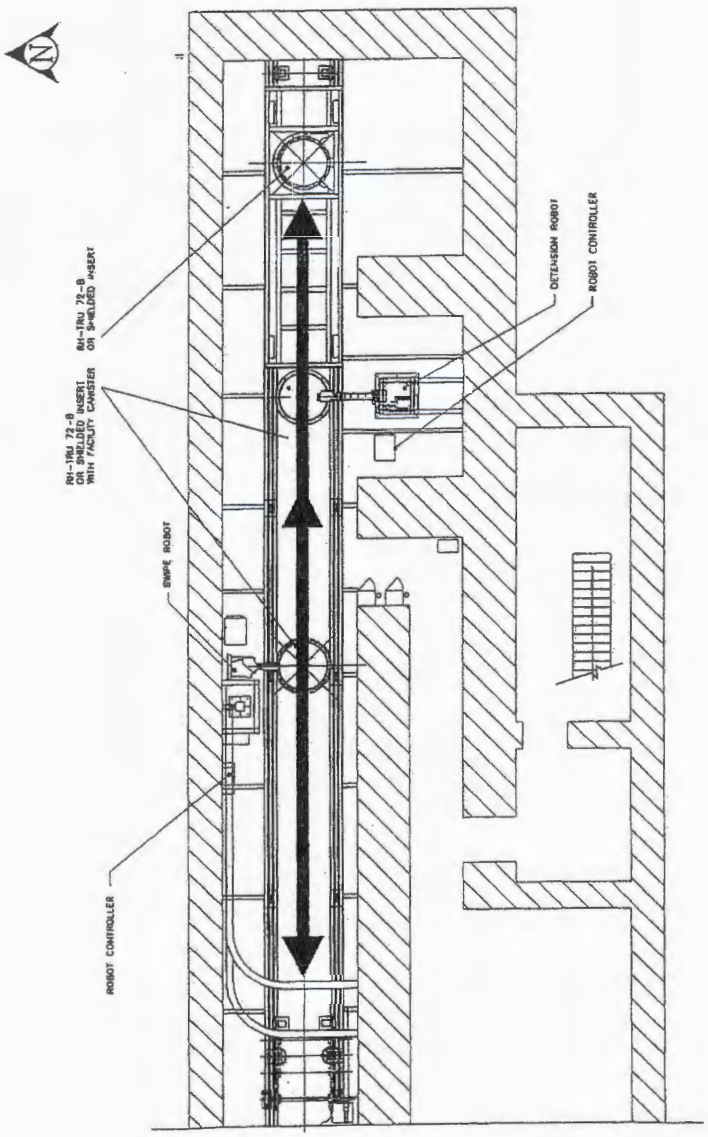

Figure A4-7
RH Bay Canister Transfer Cell Waste Transport Route

1

Field Code Changed

Field Code Changed

ATTACHMENT A4

TRAFFIC PATTERNS

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ATTACHMENT A4

TRAFFIC PATTERNS

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Figure A4-6	RH Bay Cask Loading Room Waste Transport Route
Figure A4-7	RH Bay Canister Transfer Cell Waste Transport Route

ATTACHMENT A4

TRAFFIC PATTERN

A4-1 Traffic Information and Traffic Patterns

Access to the WIPP facility is provided by two access roads that connect with U.S. Highway 62/180, 13 mi (21 km) to the north, and NM Highway 128 (Jal Highway), 4 mi (6.4 km) to the south (Figure A4-1). These access roads were built for the Permittees to transport TRU mixed waste to the site. Both access roads are owned and maintained by the Department of Energy (**DOE**). Signs and pavement markings are located in accordance with the Uniform Traffic Control Devices Manual. Access-road design designation parameters, such as traffic volume, are presented in Table A4-1.

A4-2 Facility Access and Traffic

Access to the facility for personnel, visitors, and trucks carrying supplies and TRU mixed waste is provided through a security checkpoint (vehicle trap). After passing through the security checkpoint, TRU mixed waste transport trucks will normally turn right (south) before reaching the Support Building and then left (east) to park in the parking area HWMU just east of the air locks (Figure A4-2). Outgoing trucks depart the same way they arrived, normally out of the west end of the parking area, north through the fence gate and out through the vehicle trap. An alternate inbound route is to continue straight ahead from the security checkpoint to the second road and to turn south to enter the truck parking area. The alternate outbound route is also the reverse of this route. Salt transport trucks, which remove mined salt from the Salt Handling Shaft area, will not cross paths with TRU mixed waste transporters; instead, they will proceed from the Salt Handling Shaft northward to the salt pile. Figure A4-2 shows surface traffic flow at the WIPP facility.

The site speed limit for motor vehicles is 10 mph (16 kph) and 5 mph (8 kph) for rail movements. Speed limits are clearly posted at the entrance to the site and enforced by security officers. There are no traffic signals. Stop signs are located at the major intersections of roadways with the main east-west road. Safety requirements are communicated to all site personnel via General Employee Training within 30 days of their employment. Employee access to on-site facilities requires an annual refresher course to reinforce the safety requirements. Security officers monitor vehicular traffic for compliance with site restrictions, and provide instructions to off-site delivery shipments. Vehicular traffic other than the waste transporters use the same roads, but there will be no interference because there are two lanes available on the primary and alternate routes for waste shipments. Pedestrian traffic is limited to the sidewalks and prominently marked crosswalks. Site traffic is composed mostly of pickup trucks and electric carts with a frequency of perhaps 10 per hour at peak periods. Emergency vehicles are exercised periodically for maintenance and personnel training, with an average frequency of one each per day. They are used for their intended purpose on an as-required basis.

The traffic circulation system is designed in accordance with American Association of State Highway and Transportation Officials (**AASHTO**) Site Planning Guides for lane widths, lateral clearance to fixed objects, minimum pavement edge radii, and other geometric features. Objects in or near the roadway are prominently marked.

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On-site roads, sidewalks, and paved areas are used for the distribution and storage of vehicles and personnel and are designed to handle all traffic generated by employees, visitors, TRU mixed waste shipments, and movements of operational and maintenance vehicles. The facility entrance and TRU mixed waste haul roads are designed for AASHTO H20-S16 wheel loading. Service roads are designed for AASHTO H10 wheel loading. Access and on-site paved roads are designed to bear the anticipated maximum load of115,000 lbs (52,163.1 kg), the maximum allowable weight of a truck/trailer carrying loaded Contact-Handled or Remote-Handled Packages. The facility is designed to handle approximately eight truck trailers per day, each carrying one or more Contact-Handled or Remote-Handled Packages. This is equivalent to 3,640 TRU mixed waste-carrying vehicles per year.

The calculations to support the anticipated maximum load of 115,000 lbs. are shown below:

Soil Resistance R (psi) - is taken directly from the WIPP Soil Report and Bechtel calculation because there is no change.

A. Pavement Thickness

The traffic frequency increase from 10 shipments per day to 10.15 shipments per day has only minimal impact on the Total Expanded Average Load (**EAL**) and the traffic index (**TI**) as shown below, both important parameters in pavement design.

Total EAL (TEAL):
13,780 ~ constant for 5 or more axles over 20 years, taken from Table 7-651.2A - Highway Design Manual (HDM).
TEAL = 13,780 × 25yr./20yr. = 17,225
Using 10.15 shipments per day ~ 17,225 × 10.15 = 174,834

Conversion of EAL to Traffic Index (TI).
For TEAL of 174,834 ~ TI = 7.5 - (from HDM, Table 7-651.2B)

Asphalt Concrete Thickness TAC:
GE = 0.0032 × TI × (100 -R)....R = 80
GE - Gravel Equivalent (Ft).
GE = 0.0032 × 7.5 × 20 = 0.48' ...GfAC = 2.01⇒ TAC = 0.48/2.01 = 0.24' ⇒ use 2½" AC Surface Course.
(Actually used: 3")
Gf - Gravel Equivalent Factor (constant from Table 7-651.2C from HDM).

B. Bituminous Treated Base

GE = 0.0032 × TI × (100 -R) .... R = 55 ~ caliche subbase ⇒ GE = 1.08' GEBTB = 1.08 - 2.01 × 0.21 = 0.66'
TBTB = GEBTB/GfBTB = 0.66/1.2 = 0.55' ⇒ Use 4" BTB
GfBTB ~ taken from table 7-651.2C

C. Caliche Subbase ~ TCSB

GE = 0.0032 × TI × (100 -R) .....R = 50 - prepared subgrade
GE = 1.2

GECSB = 1.2 - (0.21× 2.07) - (0.33 × 1.2) ⇒ 0.37'
TCBS = 0.37/1.0 = 0.37' ~ 4½"

Based on the results of the above calculation, the site paved roads designated for waste transportation are safe to be used by the heavier truckloads carrying shipping casks used in RH TRU mixed waste transportation to the WIPP.

A4-3 Waste Handling Building Traffic

CH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed Contact Handled Packages. Upon receipt, security checks, radiological surveys, and shipping documentation reviews will be performed. A forklift or Yard Transfer Vehicle will remove the Contact Handled Packages and transport them a short distance through an air lock that is designed to maintain differential pressure in the WHB. The forklift or Yard Transfer Vehicle will place the shipping containers at one of the two TRUPACT-II unloading docks (**TRUDOCK**) inside the WHB or, in the case of the TRUPACT-III, at the payload transfer station in Room 108.

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one shielded container 3-pack, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two shielded container 3-packs, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

RH TRU mixed waste will arrive at the WIPP facility in a payload container contained in a shielded cask loaded on a tractor-trailer. Upon arrival, radiological surveys, security checks, and shipping documentation reviews will be performed, and the trailer carrying the cask will be moved into the Parking Area or directly into the RH Bay of the Waste Handling Building Unit.

The cask is unloaded from the trailer in the RH Bay and is placed on the Cask Transfer Car. The Cask Transfer Car is used to move the cask to the Cask Unloading Room. At this point, a crane moves the waste to the Hot Cell or the Transfer Cell. Some RH TRU mixed waste may be moved to the Hot Cell for overpacking before being moved to the Transfer Cell. Once in the Transfer Cell, the Transfer Cell Shuttle Car moves the waste beneath the facility cask. A crane is used to move the waste from the Transfer Cell Shuttle Car into the facility cask. The Facility Cask Transfer Car then moves the facility cask to the underground. A more detailed description of waste handling in the WHB is included in Attachment M1. Figures A4-5, A4-6 and A4-7 show RH TRU mixed waste transport routes.

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A4-4 Underground Traffic

The Permittees shall designate the traffic routes of TRU mixed waste handling equipment and construction equipment and record this designation on a map that is posted in a location where it can be examined by personnel entering the underground. The map will be updated whenever the routes are changed. Maps will be available in facility files until facility closure. The ventilation and traffic flow path in the TRU mixed waste handling areas underground are restricted and separate from those used for mining and haulage (construction) equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600 (Figures A4-4 and A4-4a). In general, the Permittees restrict waste traffic to the intake ventilation drift to maximize isolation of this activity from personnel. The exhaust drift in the waste disposal area will normally not be used for personnel access. Non-waste and non-construction traffic is generally comprised of escorted visitors only and is minimized during each of the respective operations.

Adequate clearances that exceed the mining regulations of 30 CFR §57 exist underground for safe passage of vehicles and pedestrians. Pedestrians/personnel are required to yield to vehicles in the WIPP underground facility. This condition is reinforced through the WIPP equipment operating procedures, the WIPP Safety Manual, the WIPP safety briefing required for all underground visitors, the General Employee Training annual refresher course, and the Underground annual refresher course that are mandated by 30 CFR §57, the New Mexico Mine Code, and DOE Order 5480.20A.

In addition, other physical means are utilized to safeguard pedestrians/personnel when underground such as:

- All equipment operators are required to sound the vehicle horn when approaching intersections.
- All airlock and bulkhead vehicle doors are equipped with warning bells or strobe lights to alert personnel when door opening is imminent.
- Hemispherical mirrors are used at blind intersections so that persons can see around corners.
- All heavy equipment is required to have operational back-up alarms.
- Heavily used intersections are well lighted.

Typically, the traffic routes during waste disposal in all Panels will use the same main access drifts.

All traffic safety is regulated and enforced by the Federal and State mine codes of regulations (30 CFR §57 and New Mexico State Mine Code). The agencies that administer these codes make regular inspection tours of the WIPP underground facilities for the purpose of enforcement.

All underground equipment is designed for off-road use since all driving surfaces are excavated in salt. No loads on the underground roadways will exceed the bearing strength of in situ halite.

TABLES

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Table A4-1
Waste Isolation Pilot Plant Site Design Designation Traffic Parameters [a]

Traffic Parameter	North Access Road (No. of Vehicles, unless otherwise stated)	South Access Road (No. of Vehicles, unless otherwise stated)	On-Site Waste Haul Roads Contact-Handled and Remote-Handled Package Traffic)
Average Daily Traffic (ADT)[b]	800	800	8
Design Hourly Volume (DHV)[c]	144	144	NA [g]
Hourly Volume (Max. at Shift Change)	250	250	NA
Distribution (D)[d]	67%	67%	NA
Trucks (T)[e]	2%	2%	100%
Design Speed [h,i]	70 mph (113 kph)	60 mph (97 kph)	25 mph (40 kph)
Control of Access [f]	None	None	Full

[a] For WIPP personnel and TRU mixed waste shipments only.

[b] ADT—Estimated number of vehicles traveling in both directions per day.

[c] DHV—A two-way traffic count with directional distribution.

[d] D—The percentage of DHV in the predominant direction of travel.

[e] T—The percentage of ADT comprised of trucks (excluding light delivery trucks).

[f] Control of Access—The extent of roadside interference or restriction of movement.

[g] NA—Not applicable.

[h] mph—miles per hour.

[i] kph—kilometers per hour.

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FIGURES

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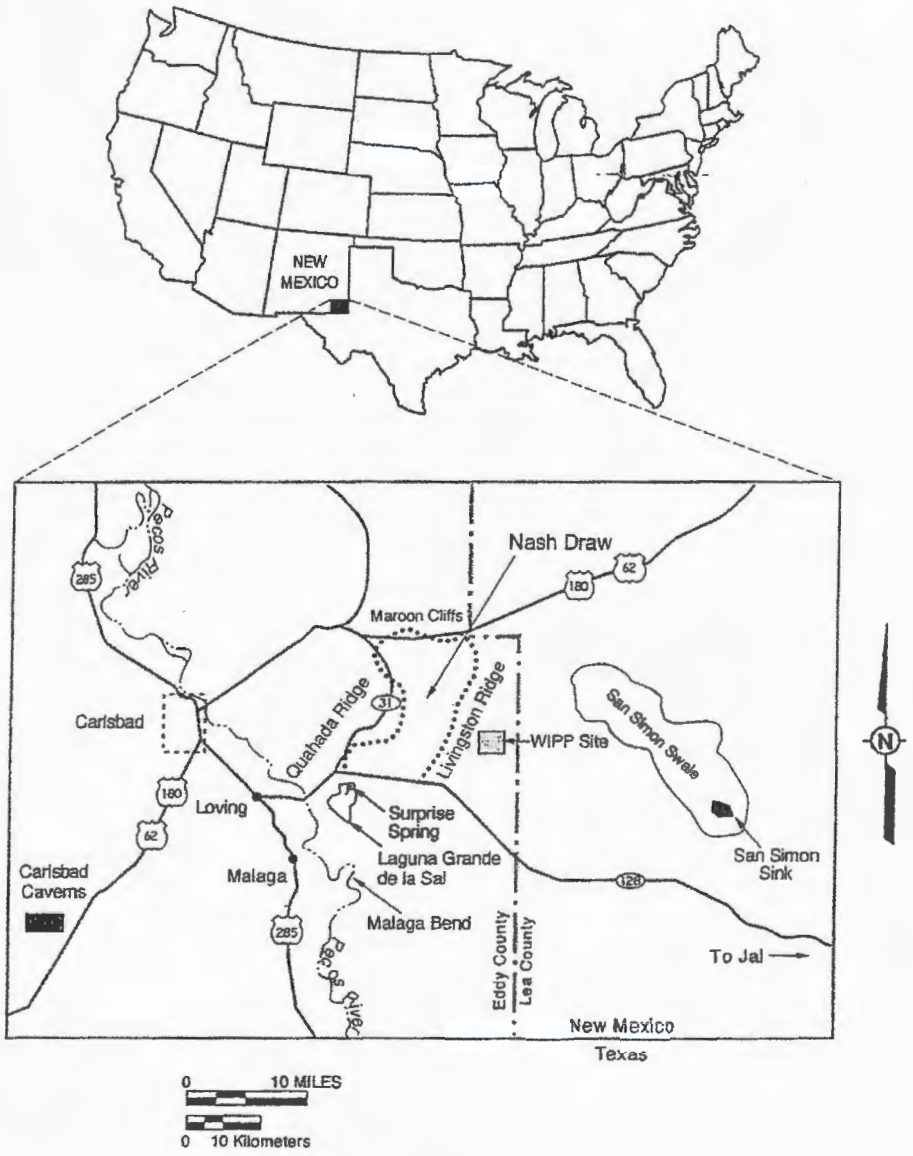

Figure A4-1
General Location of the WIPP Facility

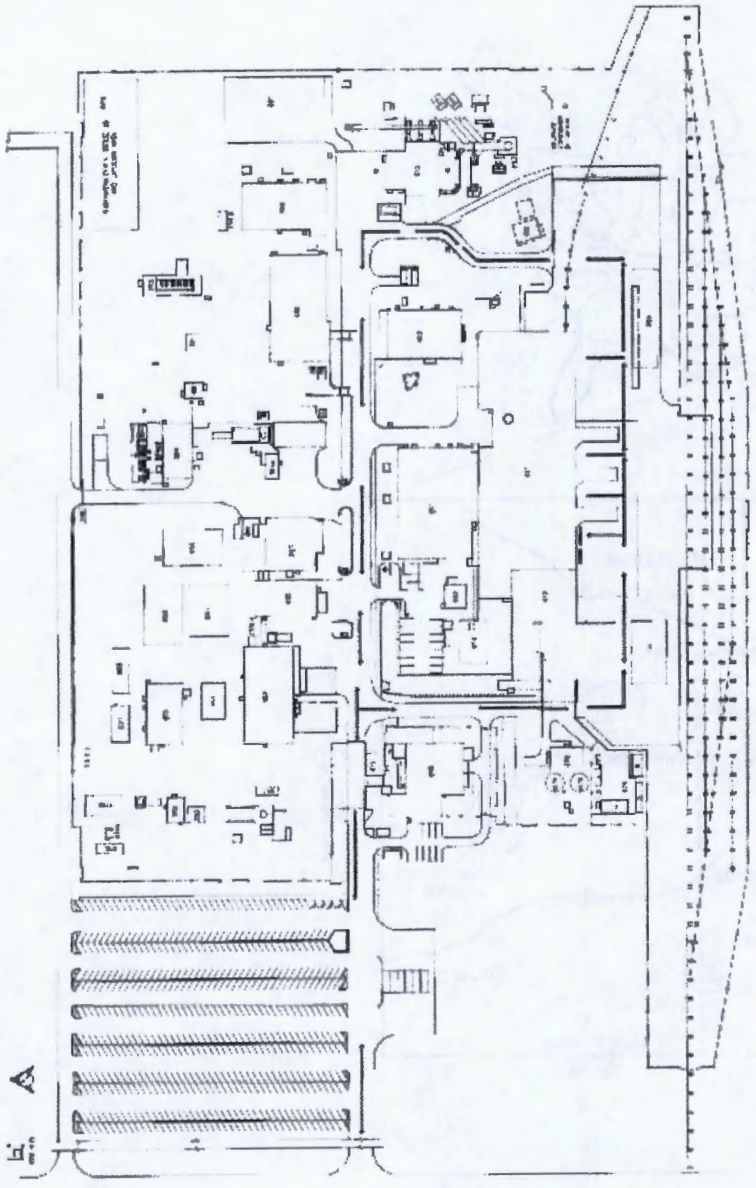

Figure A4-2
WIPP Traffic Flow Diagram

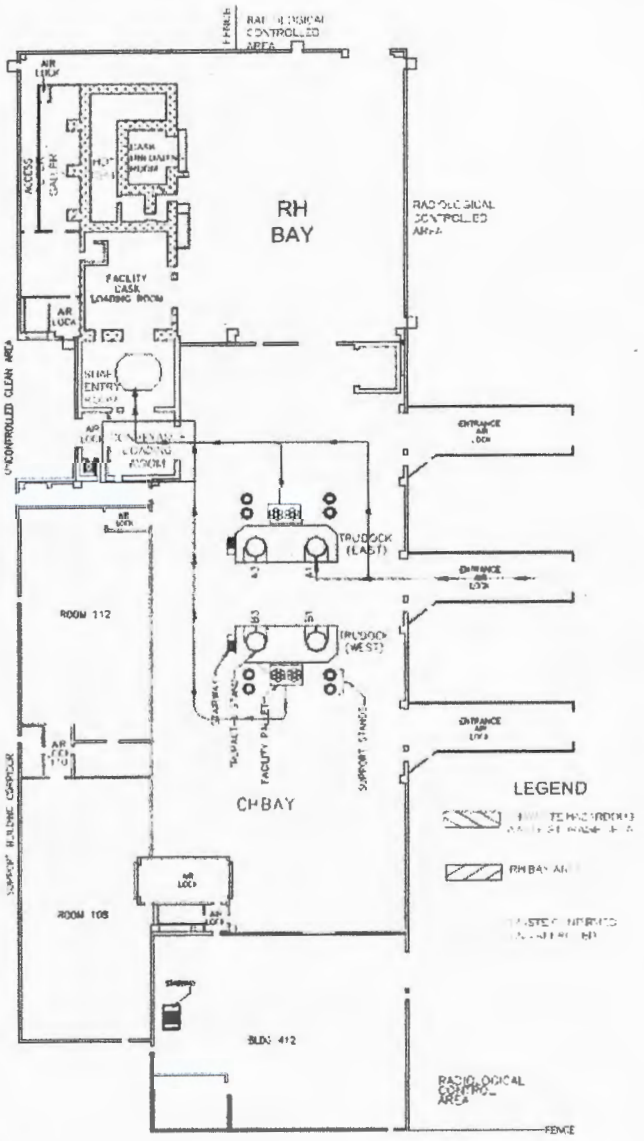

Figure A4-3
Waste Transport Routes in Waste Handling Building - Container Storage Unit

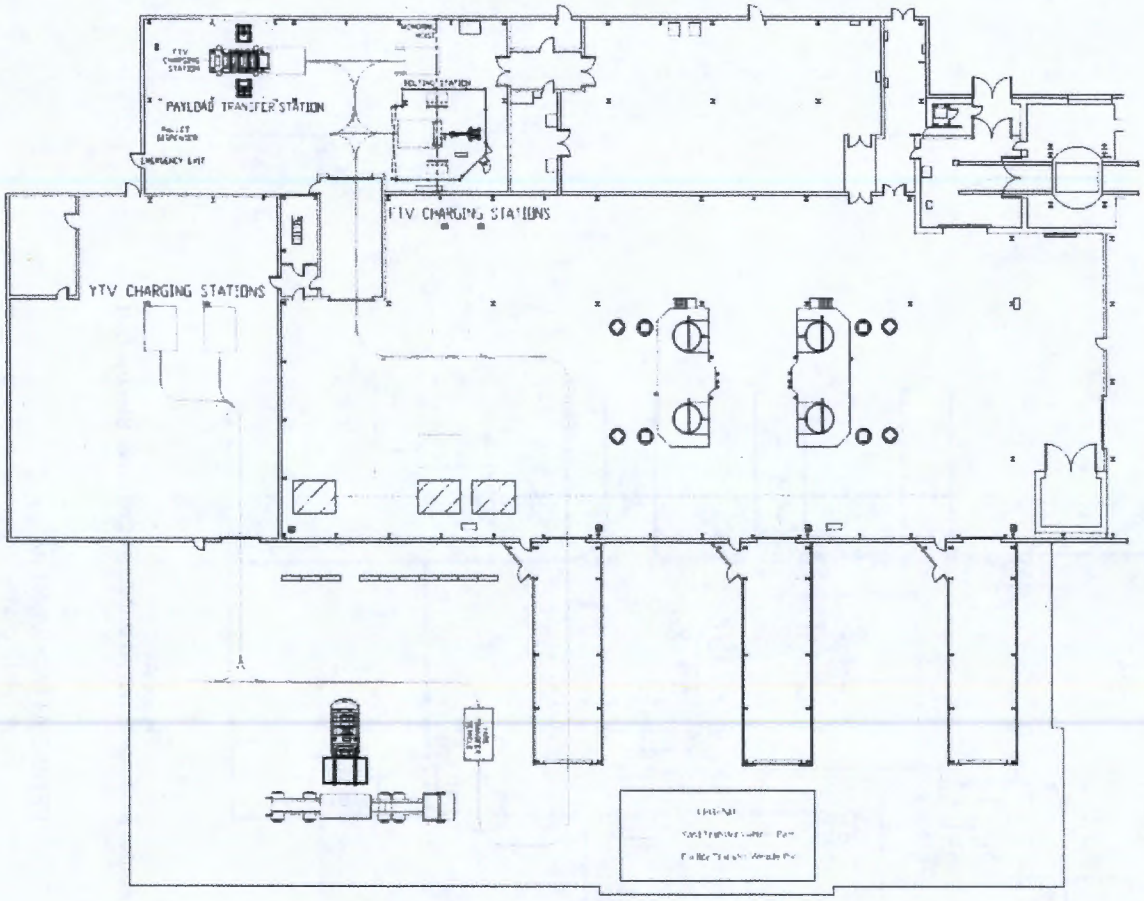

Figure A4-3a
Typical Transport Route for TRUPACT-III and Standard Large Box 2

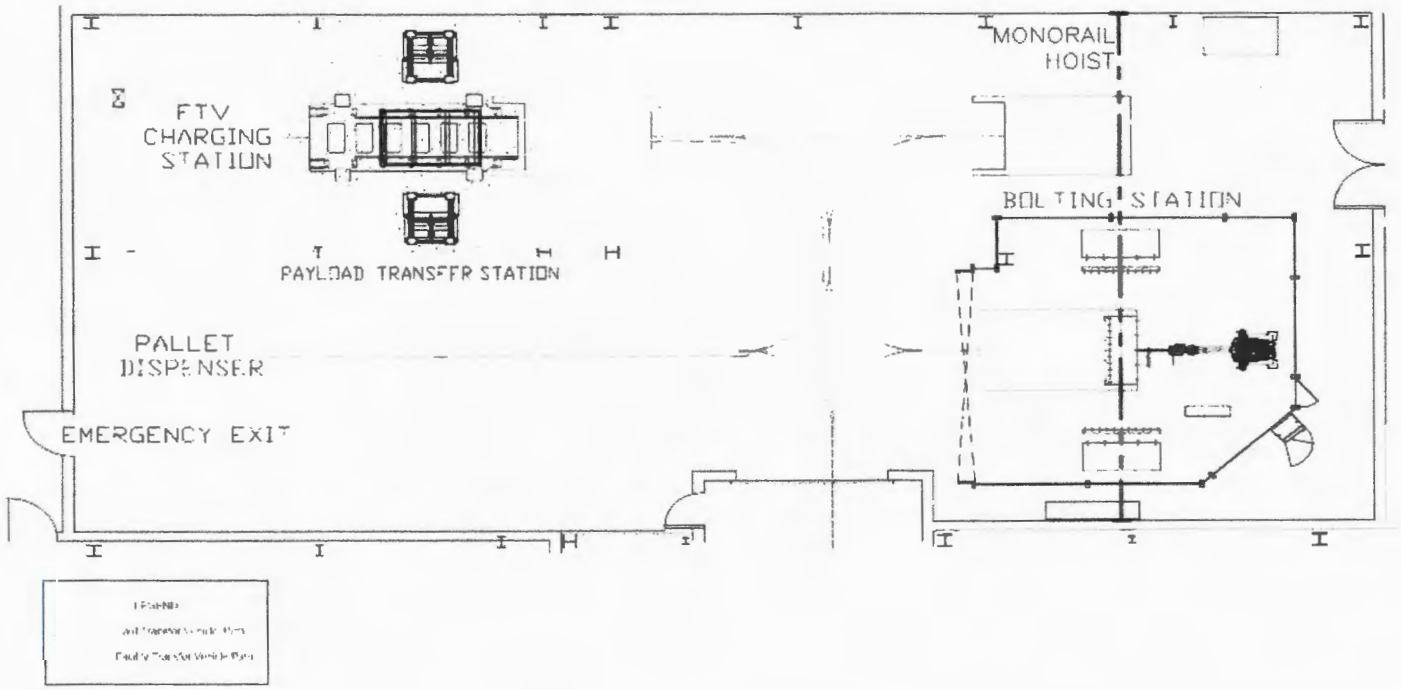

Figure A4-3b
Typical Transport Route for TRUPACT-III and Standard Large Box 2 in Room 108

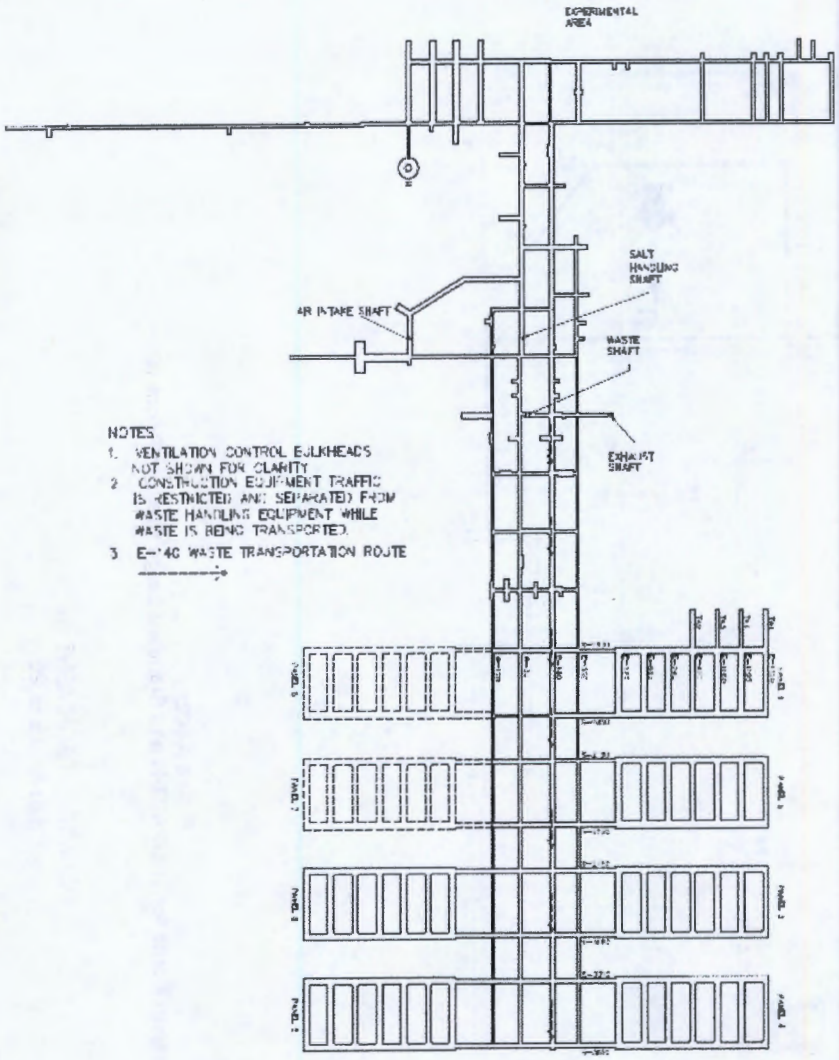

Figure A4-4
Typical Underground Transport Route Using E-140

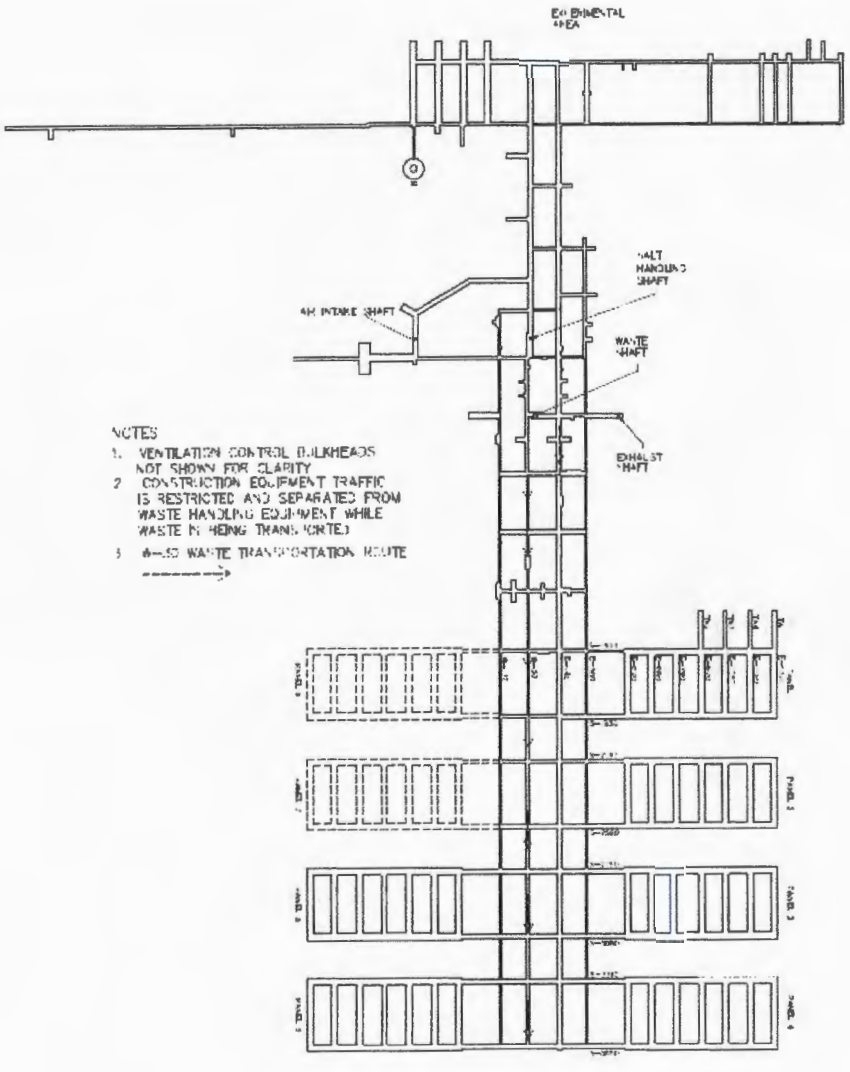

Figure A4-4a
Typical Underground Transport Route Using W-30

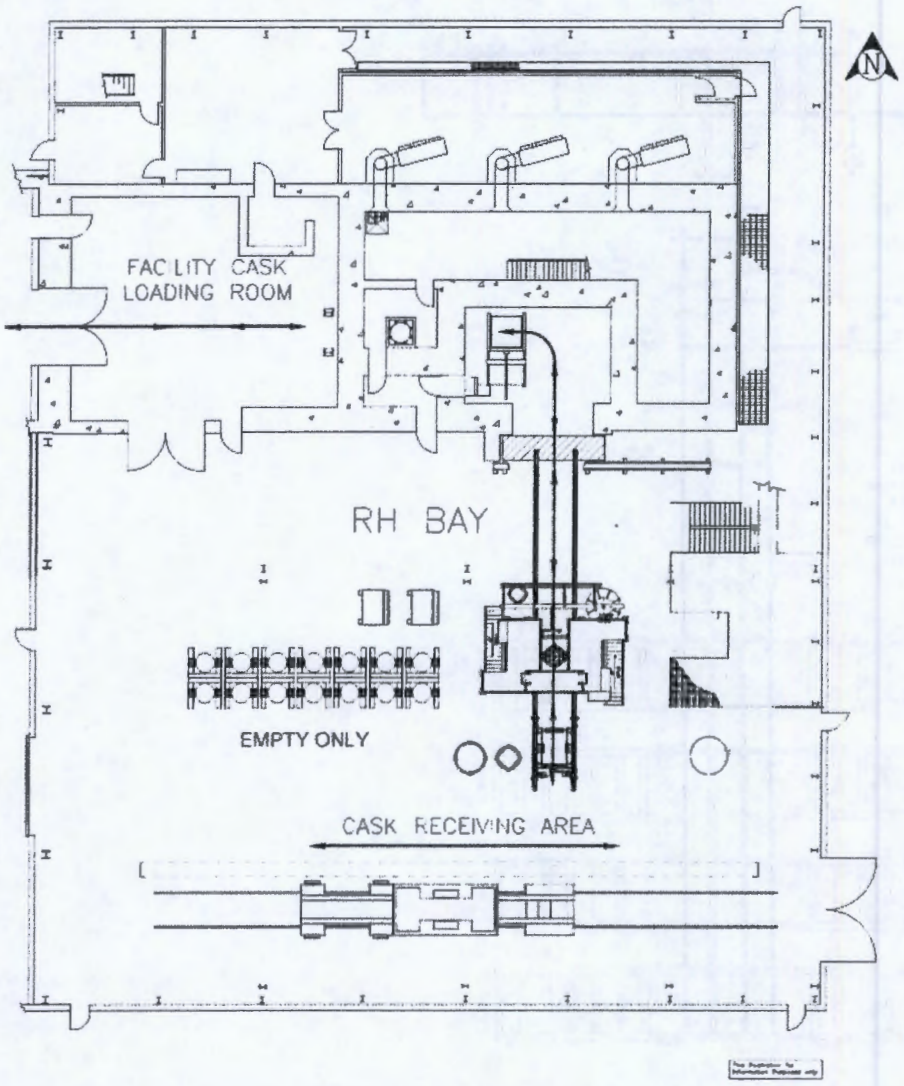

Figure A4-5
RH Bay Waste Transport Routes

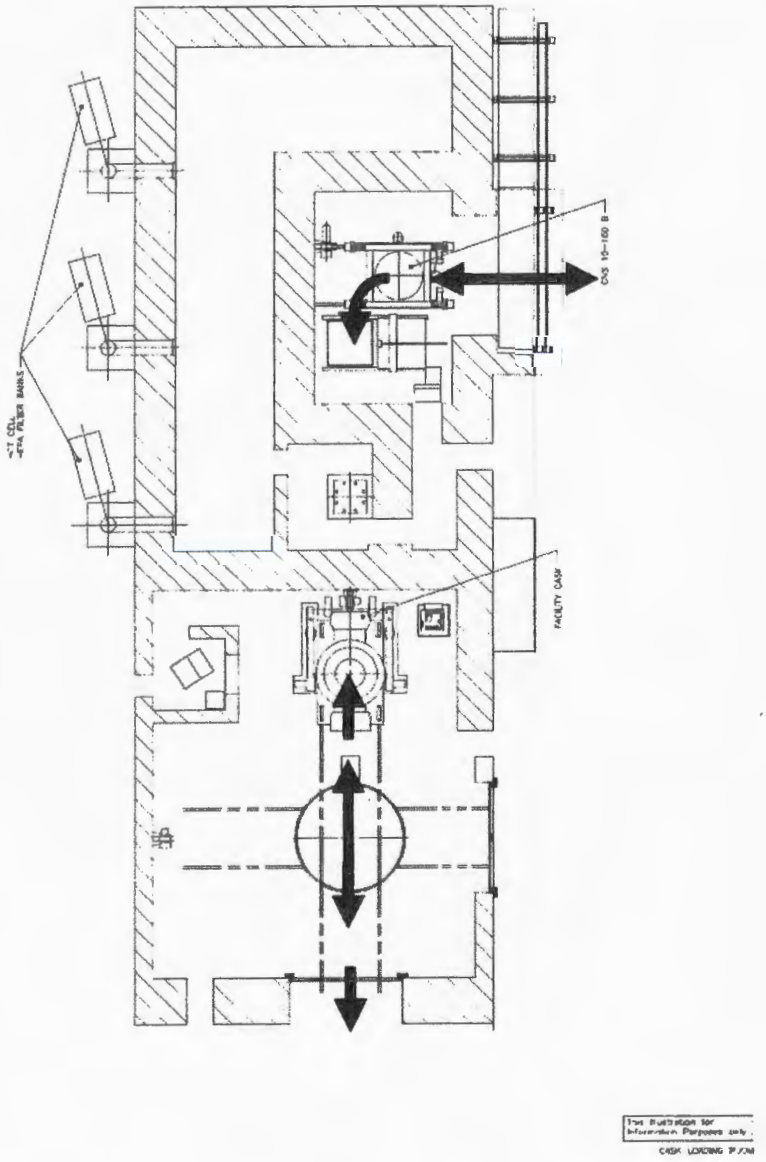

Figure A4-6
RH Bay Cask Loading Room Waste Transport Route

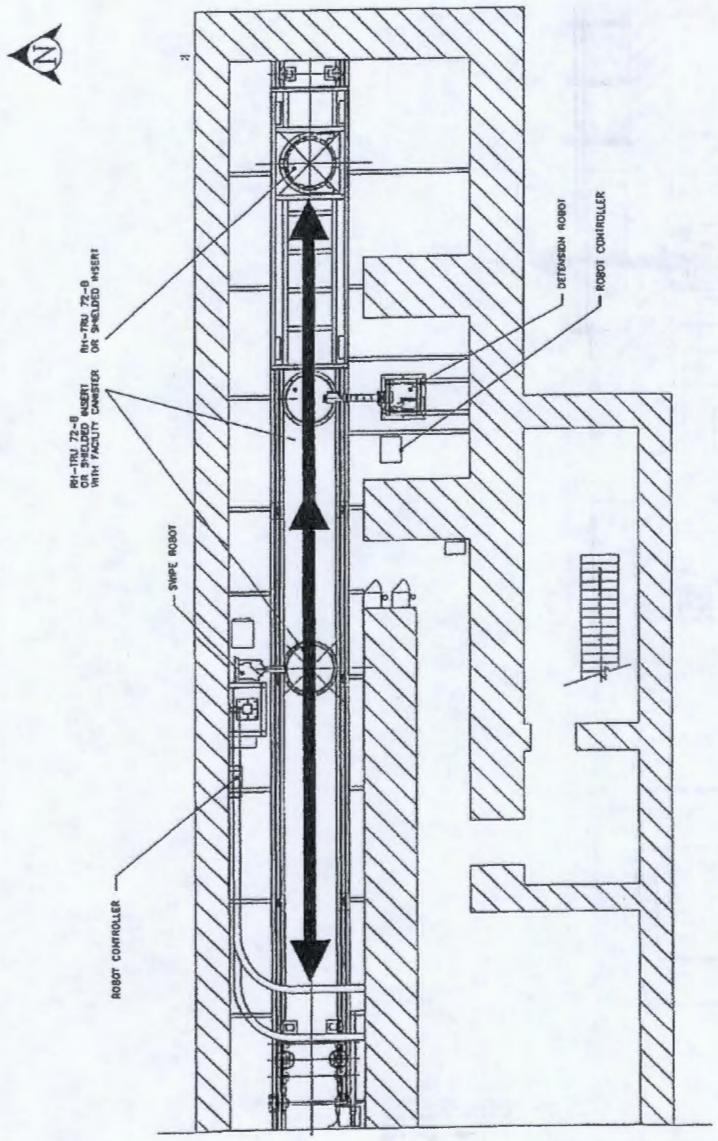

Figure A4-7
RH Bay Canister Transfer Cell Waste Transport Route

1 **Field Code Changed**

Field Code Changed

ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

Introduction

The Permittees will require generator/storage sites (**sites**) to use the following methods, as applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at WIPP. These methods include requirements for headspace-gas sampling, sampling of homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this Attachment provides quality control, sample custody, and sample packing and shipping requirements.

C1-1 Sampling of Debris Waste (Summary Category S5000)

Headspace gas sampling and analysis shall be used to resolve the assignment of Environmental Protection Agency (**EPA**) hazardous waste numbers to debris waste streams.

C1-1a Method Requirements

The Permittees shall require all headspace-gas sampling be performed in an appropriate radiation containment area on waste containers that are in compliance with the container equilibrium requirements (i.e., 72 hours at 18° C or higher).

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using

the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

The determination of packaging configuration consists of identifying the number of confinement layers and the identification of rigid poly liners when present. Generator/storage sites shall use either the default conditions specified in Tables C1-7 through C1-9 for retrievably stored waste or the data documented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) for determining the appropriate DAC for each container from which a headspace gas sample is collected. These drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling documents for each container from which a headspace gas sample is collected:

- sampling scenario from Table C1-5 and associated information from Tables C1-6 and/or Table C1-7;
- the packaging configuration from Table C1-8 and associated information from Table C1-9, including the diameter of the rigid liner vent hole, the number of inner bags, the number of liner bags, the presence/absence of drum liner, and the filter hydrogen diffusivity,
- the permit-required equilibrium time,
- the drum age,
- for supercompacted waste, both
  - the absence of rigid liners in the compacted 55-gallon drums which have not been headspace gas sampled in accordance with this permit prior to compaction, and
  - the absence of layers of confinement must be documented in the WWIS if Packaging Configuration Group 7 is used.

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and

100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly liners) shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a representative sample is collected (using a sampling needle connected to the sampling head to pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies this requirement). The configuration of the containment area and remote-handling equipment at each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the analytes listed in Table C3-2 of Permit Attachment C3. If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000). Consistent with footnote "a" in Table C1-8, any waste container selected for headspace gas sampling that cannot be assigned a packaging configuration specified in Table C1-8 shall be assigned a conservative default packaging configuration..

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, SLB2s, and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

The Permittees shall require site personnel to collect samples in SUMMA® or equivalent canisters using standard headspace-gas sampling methods that meet the general guidelines established by the EPA in the Compendium Method TO-14A or TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by using on-line integrated sampling/analysis systems. Samples will be directed to an analytical instrument instead of being collected in SUMMA® or equivalent canisters if a single-sample on-line integrated sampling/analysis system is used. If a multi-sample on-line integrated sampling/analysis system is used, samples will be directed to an integrated holding area that meets the cleaning requirements of Section C1-1c(1). The leak proof and inert nature of the integrated holding area interior surface must be demonstrated and documented. Samples are not transported to another location when using on-line integrated sampling/analysis systems; therefore, the sample custody requirements of Section C1-4 and C1-5 do not apply. The same sampling manifold and sampling heads are used with on-line integrated sampling/analysis systems and all of the requirements associated with sampling manifolds and sampling heads must be met. However, when using an on-line integrated sampling/analysis system, the sampling batch and analytical batch quality control (**QC**) samples are combined as on-line batch QC samples as outlined in Section C1-1b.

C1-1a(2) Manifold Headspace Gas Sampling

This headspace-gas sampling protocol employs a multiport manifold capable of collecting multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be used to collect samples in SUMMA® or equivalent canisters or as part of an on-line integrated sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to first use and as needed thereafter. The manifold and sample canisters will be evacuated to 0.0039 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet valve is opened. The manifold inlet valve will be attached to a changeable filter connected to either a side port needle sampling head capable of forming an airtight seal (for penetrating a

filter or rigid poly liner when necessary), a drum punch sampling head capable of forming an airtight seal (capable of punching through the metal lid of a drum for sampling through the drum lid), or a sampling head with an airtight fitting for sampling through a pipe overpack container filter vent hole. Refer to Section C1-1a(4) for descriptions of these sampling heads.

The manifold shall also be equipped with a purge assembly that allows applicable QC samples to be collected through all sampling components that may affect compliance with the quality assurance objectives (**QAOs**). The Permittees shall require the sites to demonstrate and document the effectiveness of the sampling equipment design in meeting the QAOs. Field blanks shall be samples of room air collected in the sampling area in the immediate vicinity of the waste container to be sampled. If using SUMMA® or equivalent canisters, field blanks shall be collected directly into the canister, without the use of the manifold.

The manifold, the associated sampling heads, and the headspace-gas sample volume requirements shall be designed to ensure that a representative sample is collected. The manifold internal volume must be calculated and documented in a field logbook dedicated to headspace-gas sample collection. The total volume of headspace gases collected during each sampling operation will be determined by adding the combined volume of the canisters attached to the manifold and the internal volume of the manifold. The sample volume should remain small in comparison to the volume of the waste container. When an estimate of the available headspace gas volume in the drum can be made, less than 10 percent of that volume should be withdrawn.

As illustrated in Figure C1-2, the sampling manifold must consist of a sample side and a standard side. The dotted line in Figure C1-2 indicates how the sample side shall be connected to the standard side for cleaning and collecting equipment blanks and field reference standards. The sample side of the sampling manifold shall consist of the following major components:

- An applicable sampling head that forms a leak-tight connection with the headspace sampling manifold.
- A flexible hose that allows movement of the sampling head from the purge assembly (standard side) to the waste container.
- A pressure sensor(s) that must be pneumatically connected to the manifold. This manifold pressure sensor(s) must be able to measure absolute pressure in the range from 0.002 in. (0.05 mm) Hg to 39.3 in. (1,000 mm) Hg. Resolution for the manifold pressure sensors must be ±0.0004 in. (0.01 mm) Hg at 0.002 in. (0.05 mm) of Hg. The manifold pressure sensor(s) must have an operating range from approximately 59°F (15°C) to 104°F (40°C).
- Available ports for attaching sample canisters. If using canister-based sampling methods, a sufficient number of ports shall be available to allow simultaneous collection of headspace-gas samples and duplicates for VOC analyses. If using an on-line integrated sampling/analysis system, only one port is necessary for the collection of comparison samples. Ports not occupied with sample canisters during cleaning or headspace-gas sampling activities require a plug to prevent ambient air from entering the system. In place of using plugs, sites may choose to install valves that can be closed to prevent intrusion of ambient air into the manifold. Ports shall have VCR®

fittings for connection to the sample canister(s) to prevent degradation of the fittings on the canisters and manifold.

- Sample canisters, as illustrated in Figure C1-3, are leak-free, stainless steel pressure vessels, with a chromium-nickel oxide (**Cr-NiO**) SUMMA®-passivated interior surface, bellows valve, and a pressure/vacuum gauge. Equivalent designs, such as Silco Steel canisters, may be used so long as the leak proof and inert nature of the canister interior surface is demonstrated and documented. All sample canisters must have VCR® fittings for connection to sampling and analytical equipment. The pressure/vacuum gauge must be mounted on each manifold. The canister must be helium-leak tested to 1.5×10^{-7} standard cubic centimeters per second (cc/s), have all stainless steel construction, and be capable of tolerating temperatures to 125°C. The gauge range shall be capable of operating in the leak test range as well as the sample collection range.

- A dry vacuum pump with the ability to reduce the pressure in the manifold to 0.05 mm Hg. A vacuum pump that requires oil may be used, but precautions must be taken to prevent diffusion of oil vapors back to the manifold. Precautions may include the use of a molecular sieve and a cryogenic trap in series between the headspace sampling ports and the pump.

- A minimum distance, based upon the design of the manifold system, between the tip of the needle and the valve that isolates the pump from the manifold in order to minimize the dead volume in the manifold.

- If real-time equipment blanks are not available, the manifold must be equipped with an organic vapor analyzer (**OVA**) that is capable of detecting all analytes listed in Table C3-2 of Permit Attachment C3. The OVA shall be capable of measuring total VOC concentrations below the lowest headspace gas PRQL. Detection of 1,1,2-trichloro-1,2,2-trifluoroethane may not be possible if a photoionization detector is used. The OVA measurement shall be verified by the collection of equipment blanks at the frequency specified in Section C1-1 to check for manifold cleanliness.

The standard side must consist of the following major elements:

- A cylinder of compressed zero air, helium, argon, or nitrogen gas that is hydrocarbon and carbon dioxide (**CO_2**)-free (only hydrocarbon and CO_2-free gases required for Fourier Transform Infrared System [**FTIRS**]) to clean the manifold between samples and to provide gas for the collection of equipment blanks or on-line blanks. These high-purity gases shall be certified by the manufacturer to contain less than one ppm total VOCs. The gases must be metered into the standard side of the manifold using devices that are corrosion proof and that do not allow for the introduction of manifold gas into the purge gas cylinders or generator. Alternatively, a zero air or nitrogen generator may be used, provided a sample of the zero air or nitrogen is collected and demonstrated to contain less than one ppm total VOCs. Zero air or nitrogen from a generator shall be humidified (except for use with FTIRS).

- Cylinders of field-reference standard gases or on-line control sample gases. These cylinders provide gases for evaluating the accuracy of the headspace-gas sampling

process. Each cylinder of field-reference gas or on-line control sample gas shall have a flow-regulating device. The field-reference standard gases or on-line control sample gas shall be certified by the manufacturer to contain analytes from Table C3-2 of Permit Attachment C3 at known concentrations.

- If using an analytical method other than FTIRS a humidifier filled with American Society for Testing and Materials (**ASTM**) Type I or II water, connected, and opened to the standard side of the manifold between the compressed gas cylinders and the purge assembly shall be used. Dry gases flowing to the purge assembly will pick up moisture from the humidifier. Moisture is added to the dry gases to condition the equipment blanks and field-reference standards and to assist with system cleaning between headspace-gas sample collection. If using FTIRS for analysis, the sample and sampling system shall be kept dry.

  NOTE: Caution should be exercised to isolate the humidifier during the evacuation of the system to prevent flooding the manifold. In lieu of the humidifier, the compressed gas cylinders (e.g., zero air and field-reference standard gas) may contain water vapor in the concentration range of 1,000 to 10,000 parts per million by volume (**ppmv**).

- A purge assembly that allows the sampling head (sample side) to be connected to the standard side of the manifold. The ability to make this connection is required to transfer gases from the compressed gas cylinders to the canisters or on-line analytical instrument. This connection is also required for system cleaning.

- A flow-indicating device or a pressure regulator that is connected to the purge assembly to monitor the flow rate of gases through the purge assembly. The flow rate or pressure through the purge assembly shall be monitored to assure that excess flow exists during cleaning activities and during QC sample collection. Maintaining excess flow will prevent ambient air from contaminating the QC samples and allow samples of gas from the compressed gas cylinders to be collected near ambient pressure.

In addition to a manifold consisting of a sample side and a standard side, the area in which the manifold is operated shall contain sensors for measuring ambient pressure and ambient temperature, as follows:

- The ambient-pressure sensor must have a sufficient measurement range for the ambient barometric pressures expected at the sampling location. It must be kept in the sampling area during sampling operations. Its resolution shall be 0.039 in. (1.0 mm) Hg or less, and calibration performed by the manufacturer shall be based on National Institute of Standards and Technology (**NIST**), or equivalent, standards.

- The temperature sensor shall have a sufficient measurement range for the ambient temperatures expected at the sampling location. The measurement range of the temperature sensor must be from 18°C to 50°C. The temperature sensor calibration shall be traceable to NIST, or equivalent, standards.

C1-1a(3) Direct Canister Headspace Gas Sampling

This headspace-gas sampling protocol employs a canister-sampling system to collect headspace-gas samples for analysis and QC purposes without the use of the manifold

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described above. Rather than attaching sampling heads to a manifold, in this method the sampling heads are attached directly to an evacuated sample canister as shown in Figure C1-4.

Canisters shall be evacuated to 0.0039 in. (0.10 mm) Hg prior to use and attached to a changeable filter connected to the appropriate sampling head. The sampling head(s) must be capable of either punching through the metal lid of the drums (and/or the rigid poly liner when necessary) while maintaining an airtight seal when sampling through the drum lid, penetrating a filter or the septum in the orifice of the self-tapping screw, or maintaining an airtight seal for sampling through a pipe overpack container filter vent hole to obtain the drum headspace samples. Field duplicates must be collected at the same time, in the same manner, and using the same type of sampling apparatus as used for headspace-gas sample collection. Field blanks shall be samples of room air collected in the immediate vicinity of the waste-drum sampling area prior to removal of the drum lid. Equipment blanks and field-reference standards must be collected using a purge assembly equivalent to the standard side of the manifold described above. These samples shall be collected from the needle tip through the same components (e.g., needle and filter) that the headspace-gas samples pass through.

The sample canisters, associated sampling heads, and the headspace-sample volume requirements ensure that a representative sample is collected. When an estimate of the available headspace-gas volume of the waste container can be made, less than 10 percent of that volume should be withdrawn. A determination of the sampling head internal volume shall be made and documented. The total volume of headspace gases collected during each headspace gas sampling operation can be determined by adding the volume of the sample canister(s) attached to the sampling head to the internal volume of the sampling head. Every effort shall be made to minimize the internal volume of sampling heads.

Each sample canister used with the direct canister method shall have a pressure/vacuum gauge capable of indicating leaks and sample collection volumes. Canister gauges are intended to be gross leak-detection devices not vacuum-certification devices. If a canister pressure/vacuum gauge indicates an unexpected pressure change, determination of whether the change is a result of ambient temperature and pressure differences or a canister leak shall be made. This gauge shall be helium-leak tested to 1.5×10^{-7} standard cc/s, have all stainless steel construction, and be capable of tolerating temperatures to 125°C.

The SUMMA® or equivalent sample canisters as specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) shall be used when sampling each drum. These heads shall form a leak-tight connection with the canister and allow sampling through the drum-lid filter, through the drum lid itself and/or rigid poly liner when necessary (by use of a punch or self-tapping screw), using an airtight fitting to collect the sample through the filter vent hole of a pipe overpack container, or using a hollow side port needle. Figure C1-4 illustrates the direct canister-sampling equipment.

C1-1a(4) Sampling Heads

A sample of the headspace gas directly under the container lid, pipe overpack filter vent hole, or rigid poly liner shall be collected. Several methods have been developed for collecting a representative sample: sampling through the filter, sampling through the drum lid by drum punching, sampling through a pipe overpack container filter vent hole, and sampling through the rigid poly liner. The chosen sampling method shall preserve the integrity of the drum to contain

radionuclides (e.g., replace the damaged filter, replace set screw in filter housing, seal the punched drum lid).

C1-1a(4)(i) Sampling Through the Filter

To sample the drum-headspace gas through the drum's filter, a side-port needle (e.g., a hollow needle sealed at the tip with a small opening on its side close to the tip) shall be pressed through the filter and into the headspace beneath the drum lid. This permits the gas to be drawn into the manifold or directly into the canister(s). To assure that the sample collected is representative, all of the general method requirements, sampling apparatus requirements, and QC requirements described in this section shall be met in addition to the following requirements that are pertinent to drum headspace-gas sampling through the filter:

- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If the sample is collected by removing the drum lid, the sampling device shall form an airtight seal with the rigid poly liner to prevent the intrusion of outside air into the sample (using a sampling needle connected to the sampling head to pierce the rigid poly liner satisfies this requirement). If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.

- For sample collection, the drum's filter shall be sealed to prevent outside air from entering the drum and diluting and/or contaminating the sample.

The sampling head for collecting drum headspace by penetrating the filter shall consist of a side-port needle, a filter to prevent particles from contaminating the gas sample, and an adapter to connect the side-port needle to the filter. To prevent cross contamination, the sampling head shall be cleaned or replaced after sample collection, after field-reference standard collection, and after field-blank collection. The following requirements shall also be met:

- The housing of the filter shall allow insertion of the sampling needle through the filter element or a sampling port with septum that bypasses the filter element into the drum headspace.

- The side-port needle shall be used to reduce the potential for plugging.

- The purge assembly shall be modified for compatibility with the side-port needle.

C1-1a(4)(ii) Sampling Through the Drum Lid By Drum Lid Punching

Sampling through the drum lid at the time of drum punching or thereafter may be performed as an alternative to sampling through the drum's filter if an airtight seal can be maintained. To sample the drum headspace-gas through the drum lid at the time of drum punching or thereafter, the lid shall be breached using an appropriate punch. The punch shall form an airtight seal between the drum lid and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method requirements,

sampling apparatus requirements, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the drum lid and sampling head shall be designed to minimize intrusion of ambient air.
- All components of the sampling system that come into contact with sample gases shall be purged with humidified zero air, nitrogen, or helium prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the punch that contact the headspace-gas sample.
- Pressure shall be applied to the punch until the drum lid has been breached.
- Provisions shall be made to relieve excessive drum pressure increases during drum-punch operations; potential pressure increases may occur during sealing of the drum punch to the drum lid.
- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.
- During sampling, the drum's filter, if present, shall be sealed to prevent outside air from entering the drum.
- While sampling through the drum lid using manifold sampling, a flow-indicating device or pressure regulator to verify flow of gases shall be pneumatically connected to the drum punch and operated in the same manner as the flow-indicating device described above in Section C1-1a(2).
- Equipment shall be used to adequately secure the drum-punch sampling system to the drum lid.
- If the headspace gas sample is not taken at the time of drum punching, the presence and diameter of the rigid liner vent hole shall be documented during the punching operation for use in determining an appropriate Scenario 2 DAC.

C1-1a(4)(iii) Sampling Through a Pipe Overpack Container Filter Vent Hole

Sampling through an existing filter vent hole in a pipe overpack container (**POC**) may be performed as an alternative to sampling through the POC's filter if an airtight seal can be maintained. To sample the container headspace-gas through a POC filter vent hole, an appropriate airtight seal shall be used. The sampling apparatus shall form an airtight seal

between the POC surface and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method, sampling apparatus, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the POC surface and sampling apparatus shall be designed to minimize intrusion of ambient air.
- The filter shall be replaced as quickly as is practicable with the airtight sampling apparatus to ensure that a representative sample can be taken. Sites must provide documentation demonstrating that the time between removing the filter and installing the airtight sampling device has been established by testing to assure a representative sample.
- All components of the sampling system that come into contact with sample gases shall be cleaned according to requirements for direct canister sampling or manifold sampling, whichever is appropriate, prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the sampling system that contact the headspace-gas sample.
- During sampling, openings in the POC shall be sealed to prevent outside air from entering the container.
- A flow-indicating device shall be connected to sampling system and operated according to the direct canister or manifold sampling requirements, as appropriate.

C1-1b Quality Control

For manifold and direct canister sampling systems, field QC samples shall be collected on a per sampling batch basis. A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding QC samples), all of which shall be collected within 14 days of the first sample in the batch. For on-line integrated sampling/analysis systems, QC samples shall be collected and analyzed on a per on-line batch basis. Holding temperatures and container requirements for gas sample containers are provided in Table C1-1. An on-line batch is the number of headspace-gas samples collected within a 12-hour period using the same on-line integrated analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system. Table C1-2 provides a summary of field QC sample collection requirements. Table C1-3 provides a summary of QC sample acceptance criteria.

For on-line integrated sampling analysis systems, the on-line batch QC samples serve as combined sampling batch/analytical batch QC samples as follows:

- The on-line blank replaces the equipment blank and laboratory blank
- The on-line control sample replaces the field reference standard and laboratory control sample

- The on-line duplicate replaces the field duplicate and laboratory duplicate

The acceptance criteria for on-line batch QC samples are the same as for the sampling batch and analytical batch QC samples they replace. Acceptance criteria are shown in Table C1-3. A separate field blank shall still be collected and analyzed for each on-line batch. However, if the results of a field blank collected through the sampling manifold meets the acceptance criterion, a separate on-line blank need not be collected and analyzed.

The Permittees shall require the site project manager to monitor and document field QC sample results and fill out a nonconformance report if acceptance or frequency criteria are not met. The Permittees shall require the site project manager to ensure appropriate corrective action is taken if acceptance criteria are not met.

C1-1b(1) Field Blanks

Field blanks shall be collected to evaluate background levels of program-required analytes. Field blanks shall be collected prior to sample collection, and at a frequency of one per sampling batch. The Permittees shall require the site project manager to use the field blank data to assess impacts of ambient contamination, if any, on the sample results. Field blank results determined by gas chromatography/mass spectrometry and gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the method detection limit (**MDL**) listed in Table C3-2 in Permit Attachment C3. Field blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2. A nonconformance report shall be initiated and resolved if the final reported QC sample results do not meet the acceptance criteria.

C1-1b(2) Equipment Blanks

Equipment blanks shall be collected to assess cleanliness prior to first use after cleaning of all sampling equipment. On-line blanks will be used to assess equipment cleanliness as well as analytical contamination. After the initial cleanliness check, equipment blanks collected through the manifold shall be collected at a frequency of one per sampling batch for VOC analysis or one per day, whichever is more frequent. If the direct canister method is used, field blanks may be used in lieu of equipment blanks. The Permittees shall require the site project manager to use the equipment blank data to assess impacts of potentially contaminated sampling equipment on the sample results. Equipment blank results determined by gas chromatography/mass spectrometry or gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the MDL listed in Table C3-2 in Permit Attachment C3. Equipment blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2.

C1-1b(3) Field Reference Standards

Field reference standards shall be used to assess the accuracy with which the sampling equipment collects VOC samples into SUMMA® or equivalent canisters prior to first use of the sampling equipment. The on-line control sample will be used to assess the accuracy with which the sampling equipment collects VOC samples as well as an indicator of analytical accuracy for the on-line sampling system. Field reference standards shall contain a minimum of six of the

analytes listed in Table C3-2 in Permit Attachment C3 at concentrations within a range of 10 to 100 ppmv and greater than the MDL for each compound. Field reference standards shall have a known valid relationship to a nationally recognized standard (e.g., NIST), if available. If NIST traceable standards are not available and commercial gases are used, a Certificate of Analysis from the manufacturer documenting traceability is required. Commercial stock gases shall not be used beyond their manufacturer-specified shelf life. After the initial accuracy check, field reference standards collected through the manifold shall be collected at a frequency of one per sampling batch and submitted as blind samples to the analytical laboratory. For the direct canister method, field reference standard collection may be discontinued if the field reference standard results demonstrate the QAO for accuracy specified in Attachment C3. Field reference standard results shall be acceptable if the accuracy for each tested compound has a recovery of 70 to 130 percent.

C1-1b(4) Field Duplicates

Field duplicate samples shall be collected sequentially and in accordance with Table C1-1 to assess the precision with which the sampling procedure can collect samples into SUMMA® or equivalent canisters. Field duplicates will also serve as a measure of analytical precision for the on-line sampling system. Field duplicate results shall be acceptable if the relative percent difference is less than or equal to 25 for each tested compound found in concentrations greater than the PRQL in both duplicates.

C1-1c Equipment Testing, Inspection and Maintenance

All sampling equipment components that come into contact with headspace sample gases shall be constructed of relatively inert materials such as stainless steel or Teflon®. A passivated interior surface on the stainless steel components is recommended.

To minimize the potential for cross contamination of samples, the headspace sampling manifold and sample canisters shall be properly cleaned and leak-checked prior to each headspace-gas sampling event. Procedures used for cleaning and preparing the manifold and sample canisters shall be equivalent to those provided in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). Cleaning requirements are presented below.

C1-1c(1) Headspace-Gas Sample Canister Cleaning

SUMMA® or equivalent canisters used in these methods shall be subjected to a rigorous cleaning and certification procedures prior to use in the collection of any samples. Guidance for the development of this procedure has been derived from Method TO-14A or TO-15 (EPA 1999). Specific detailed instructions shall be provided in laboratory standard operating procedures (**SOPs**) for the cleaning and certification of canisters.

Canisters shall be cleaned and certified on an equipment cleaning batch basis. An equipment cleaning batch is any number of canisters cleaned together at one time using the same cleaning method. A cleaning system, capable of processing multiple canisters at a time, composed of an oven (optional) and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump shall be used to clean SUMMA® or equivalent canisters. Prior to cleaning, a positive or negative pressure leak test shall be performed on all canisters. The duration of the leak test must be greater than or equal to the time it takes to collect a sample,

but no greater than 24 hours. For a leak test, a canister passes if the pressure does not change by a rate greater than ±2 psig per 24 hours. Any canister that fails shall be checked for leaks, repaired, and reprocessed. One canister per equipment cleaning batch shall be filled with humid zero air or humid high purity nitrogen and analyzed for VOCs. The equipment cleaning batch of canisters shall be considered clean if there are no VOCs above three times the MDLs listed in Table C3-2 of Permit Attachment C3. After the canisters have been certified for leak-tightness and found to be free of background contamination, they shall be evacuated to 0.0039 in. (0.10 mm) Hg or less for storage prior to shipment. The Permittees shall require the laboratory responsible for canister cleaning and certification to maintain canister certification documentation and initiate the canister tags as described in Permit Attachment C3.

C1-1c(2) Sampling Equipment Initial Cleaning and Leak Check

The surfaces of all headspace-gas sampling equipment components that will come into contact with headspace gas shall be thoroughly inspected and cleaned prior to assembly. The manifold and associated sampling heads shall be purged with humidified zero air, nitrogen, or helium, and leak checked after assembly. This cleaning shall be repeated if the manifold and/or associated sampling heads are contaminated to the extent that the routine system cleaning is inadequate.

C1-1c(3) Sampling Equipment Routine Cleaning and Leak Check

The manifold and associated sampling heads which are reused shall be cleaned and checked for leaks in accordance with the cleaning and leak check procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). The procedures shall be conducted after headspace gas and field duplicate collection; after field blank collection, after field blanks are collected through the manifold; and after the additional cleaning required for field reference standard collection has been completed. The protocol for routine manifold cleaning and leak check requires that sample canisters be attached to the canister ports, or that the ports be capped or closed by valves, and requires that the sampling head be attached to the purge assembly.

VOCs shall be removed from the internal surfaces of the headspace sampling manifold to levels that are less than or equal to three times the MDLs of the analytes listed in Table C3-2 of Permit Attachment C3, as determined by analysis of an equipment blank or through use of an OVA. It is recommended that the headspace sampling manifold be heated to 150° Centigrade and periodically evacuated and flushed with humidified zero air, nitrogen, or helium. When not in use, the manifold shall be demonstrated clean before storage with a positive pressure of high purity gas (i.e., zero air, nitrogen, or helium) in both the standard and sample sides.

Sampling shall be suspended and corrective actions shall be taken when the analysis of an equipment blank indicates that the VOC limits have been exceeded or if a leak test fails. The Permittees shall require the site project manager to ensure that corrective action has been taken prior to resumption of sampling.

C1-1c(4) Manifold Cleaning After Field Reference Standard Collection

The sampling system shall be specially cleaned after a field reference standard has been collected, because the field reference standard gases contaminate the standard side of the headspace sampling manifold when they are regulated through the purge assembly. This

cleaning requires the installation of a gas-tight connector in place of the sampling head, between the flexible hose and the purge assembly. This configuration allows both the sample and standard sides of the sampling system to be flushed (evacuated and pressurized) with humidified zero air, nitrogen, or helium which, combined with heating the pneumatic lines, should sweep and adequately clean the system's internal surfaces. After this protocol has been completed and prior to collecting another sample, the routine system cleaning and leak check (see previous section) shall also be performed.

C1-1c(5) Sampling Head Cleaning

To prevent cross contamination, the needle, airtight fitting or airtight seal, adapters, and filter of the sampling heads shall be cleaned in accordance with the cleaning procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). After sample collection, a sampling head shall be disposed of or cleaned in accordance with EPA's Compendium Method TO-14A or TO-15 (EPA1999), prior to reuse. As a further QC measure, the needle, airtight fitting or airtight seal, and filter, after cleaning, should be purged with zero air, nitrogen, or helium and capped for storage to prevent sample contamination by VOCs potentially present in ambient air.

C1-1d Equipment Calibration and Frequency

The manifold pressure sensor shall be certified prior to initial use, then annually, using NIST traceable, or equivalent, standards. If necessary, the pressure indicated by the pressure sensor(s) shall be temperature compensated. The ambient air temperature sensor, if present, shall be certified prior to initial use, then annually, to NIST traceable, or equivalent, temperature standards.

The OVA shall be calibrated once per day, prior to first use, or as necessary according to the manufacturer's specifications. Calibration gases shall be certified to contain known analytes from Table C3-2 of Permit Attachment C3 at known concentrations. The balance of the OVA calibration gas shall be consistent with the manifold purge gas when the OVA is used (i.e., zero air, nitrogen, or helium).

C1-2 Sampling of Homogeneous Solids and Soil/Gravel (Summary Categories S3000/S4000)

For those waste streams without an AK Sufficiency Determination approved by DOE, randomly selected containers of homogeneous solid and/or soil/gravel waste streams (S3000/S4000) shall be sampled and analyzed to resolve the assignment of EPA hazardous waste numbers. For example, analytical results may be useful to resolve uncertainty regarding hazardous constituents used in a process that generated the waste stream when the hazardous constituents are not documented in the acceptable knowledge information for the waste.

C1-2a Method Requirements

The methods used to collect samples of transuranic (**TRU**) mixed waste, classified as homogeneous solids and soil/gravel from waste containers, shall be such that the samples are representative of the waste from which they were taken. To minimize the quantity of investigation-derived waste, laboratories conducting the analytical work may require no more sample than is required for the analysis, based on the analytical methods. However, a sufficient number of samples shall be collected to adequately represent waste being sampled. For those

waste streams defined as Summary Category Groups S3000 or S4000 in Attachment C, debris that may also be present within these wastes need not be sampled.

Samples of retrievably stored waste containers will be collected using appropriate coring equipment or other EPA approved methods to collect a representative sample. Newly generated wastes that are sampled from a process as it is generated may be sampled using EPA approved methods, including scoops and ladles, that are capable of collecting a representative sample. All sampling and core sampling will comply with the QC requirements specified in C1-2b.

C1-2a(1) Core Collection

Coring tools shall be used to collect cores of homogeneous solids and soil/gravel from waste containers, when possible, in a manner that minimizes disturbance to the core. A rotational coring tool (i.e., a tool that is rotated longitudinally), similar to a drill bit, to cut, lift the waste cuttings, and collect a core from the bore hole, shall be used to collect sample cores from waste containers. For homogeneous solids and soil/gravel that are relatively soft, non-rotational coring tools may be used in lieu of a rotational coring tool.

To provide a basis for describing the requirements for core collection, diagrams of a rotational coring tool (i.e., a light weight auger) and a non-rotational coring tool (i.e., a thin-walled sampler) are provided in Figures C1-5 and C1-6, respectively.

The following requirements apply to the use of coring tools:

- Each coring tool shall contain a removable tube (liner) that is constructed of fairly rigid material unlikely to affect the composition and/or concentrations of target analytes in the sample core. Materials that are acceptable for use for coring device sleeves are polycarbonate, teflon, or glass for most samples, and stainless steel or brass if samples are not to be analyzed for metals. The Permittees shall require site quality assurance project plans (**QAPjPs**) to document that analytes of concern are not present in liner material. The Permittees shall also require sites to document that the materials are unlikely to affect sample results through the collection and analysis of an equipment blank prior to first use as specified in the 'Equipment Blanks' section of this appendix. Liner outer diameter is recommended to be no more than 2 in. and no less than one in. Liner wall thickness is recommended to be no greater than 1/16 in. Before use, the liner shall be cleaned in accordance the requirements in Section C1-2b. The liner shall fit flush with the inner wall of the coring tool and shall be of sufficient length to hold a core that is representative of the waste along the entire depth of the waste. The depth of the waste is calculated as the distance from the top of the sludge to the bottom of the drum (based on the thickness of the liner and the rim at the bottom of the drum). The liner material shall have sufficient transparency to allow visual examination of the core after sampling. If sub-sampling is not conducted immediately after core collection and liner extrusion, then end caps constructed of material unlikely to affect the composition and/or concentrations of target analytes in the core (e.g., Teflon®) shall be placed over the ends of the liner. End caps shall fit tightly to the ends of the liner. The Permittees shall require site specific QAPjPs to indicate the acceptable materials for core liners and end caps.

- A spring retainer, similar to that illustrated in Figures C1-5 and C1-6, shall be used with each coring tool when the physical properties of the waste are such that the waste may fall out of the coring tool's liner during sampling activities. The spring retainer shall be constructed of relatively inert material (e.g., stainless steel or Teflon®) and its inner diameter shall not be less than the inner diameter of the liner. Before use, spring retainers shall be cleaned in accordance with the requirements in Section C1-2b.

- Coring tools may have an air-lock mechanism that opens to allow air inside the liners to escape as the tool is pressed into the waste (e.g., ball check valve). If used, this air-lock mechanism shall also close when the core is removed from the waste container.

- After disassembling the coring tool, a device (extruder) to forcefully extrude the liner from the coring tool shall be used if the liner does not slide freely. All surfaces of the extruder that may come into contact with the core shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- Coring tools shall be of sufficient length to hold the liner and shall be constructed to allow placement of the liner leading edge as close as possible to the coring tools leading edge.

- All surfaces of the coring tool that have the potential to contact the sample core or sample media shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- The leading edge of the coring tools may be sharpened and tapered to a diameter equivalent to, or slightly smaller than, the inner diameter of the liner to reduce the drag of the homogeneous solids and soil/gravel against the internal surfaces of the liner, thereby enhancing sample recovery.

- Rotational coring tools shall have a mechanism to minimize the rotation of the liner inside the coring tool during coring activities, thereby minimizing physical disturbance to the core.

- Rotational coring shall be conducted in a manner that minimizes transfer of frictional heat to the core, thereby minimizing potential loss of VOCs.

- Non-rotational coring tools shall be designed such that the tool's kerf width is minimized. Kerf width is defined as one-half of the difference between the outer diameter of the tool and the inner diameter of the tool's inlet.

C1-2a(2) Sample Collection

Sampling of cores shall be conducted in accordance with the following requirements:

- Sampling shall be conducted as soon as possible after core collection. If a substantial delay (i.e., more than 60 minutes) is expected between core collection and sampling, the core shall remain in the liner and the liner shall be capped at each end. If the liner containing the core is not extruded from the coring tool and capped, then two alternatives are permissible: 1) the liner shall be left in the coring tool and the coring

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tool shall be capped at each end, or 2) the coring tool shall remain in the waste container with the air-lock mechanism attached.

- Samples of homogeneous solids and soil/gravel for VOC analyses shall be collected prior to extruding the core from the liner. These samples may be collected by collecting a single sample from the representative subsection of the core, or three sub-samples may be collected from the vertical core to form a single 15-gram composite sample. Smaller sample sizes may be used if method PRQL requirements are met for all analytes. The sampling locations shall be randomly selected. If a single sample is used, the representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). If the three sub-sample method is used, the sampling locations shall be randomly selected within three equal-length subsections of the core along the long axis of the liner and access to the waste shall be gained by making a perpendicular cut through the liner and the core. The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. A sampling device such as the metal coring cylinder described in EPA's SW-846 Manual (1996), or equivalent, shall be immediately used to collect the sample once the core has been exposed to air. Immediately after sample collection, the sample shall be extruded into 40-ml volatile organics analysis (**VOA**) vials (or other containers specified in appropriate SW-846 methods), the top rim of the vial visually inspected and wiped clean of any waste residue, and the vial cap secured. Sample handling requirements are outlined in Table C1-4. Additional guidance for this type of sampling can be found in SW-846 (EPA 1996).

- Samples of the homogeneous solids and soil/gravel for semi-volatile organic compound and metals analyses shall be collected. These samples may be collected from the same sub-sample locations and in the same manner as the sample collected for VOC analysis, or they may be collected by splitting or compositing the representative subsection of the core. The representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. Guidance for splitting and compositing solid materials can be found in SW-846 (EPA 1996). All surfaces of the sampling tools that have the potential to come into contact with the sample shall be constructed of materials unlikely to affect the composition or concentrations of target analytes in the waste (e.g., Teflon®). In addition, all surfaces that have the potential to come into contact with core sample media shall either be disposed or decontaminated according to the procedures found in Section C1-2(b). Sample sizes and handling requirements are outlined in Table C1-4.

Newly generated waste samples may be collected using methods other than coring, as discussed in Section C1-2a. Newly generated wastes samples will be collected as soon as possible after sampling, but the spatial and temporal homogeneity of the waste stream dictate

whether a representative grab sample or composite sample shall be collected. As part of the site audit, DOE shall assess waste sampling to ensure collection of representative samples.

C1-2b Quality Control

QC requirements for sampling of homogeneous solids and soil/gravel include collecting co-located samples from cores or other sample types to determine precision; equipment blanks to verify cleanliness of the sampling and coring tools and sampling equipment; and analysis of reagent blanks to ensure reagents, such as deionized or high pressure liquid chromatography (**HPLC**) water, are of sufficient quality. Coring and sampling of homogeneous solids and soil/gravel shall comply, at minimum, with the following QC requirements.

C1-2b(1) Co-located Samples

In accordance with the requirement to collect field duplicates required by the EPA methods found in SW-846 (EPA 1996), samples shall be collected to determine the combined precision of the coring and sampling procedures. The co-located core methodology is a duplicate sample collection methodology intended to collect samples from a second core placed at approximately the same location within the drum when samples are collected by coring. Waste may not be amenable to coring in some instances. In this case, a co-located sample may be collected from a sample (e.g. scoop) collected from approximately the same location in the waste stream. A sample from each co-located core or waste sample collected by other means shall be collected side by side as close as feasible to one another, handled in the same manner, visually inspected through the transparent liner (if cored), and sampled in the same manner at the same randomly selected sample location(s). If the visual examination detects inconsistencies such as color, texture, or waste type in the waste at the sample location, another sampling location may be randomly selected, or the samples may be invalidated and co-located samples or cores may again be collected. Co-located samples, from either core or other sample type, shall be collected at a frequency of one per sampling batch or once per week, whichever is more frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

C1-2b(2) Equipment Blanks

In accordance with SW-846 (EPA 1996), equipment blanks shall be collected from fully assembled sampling and coring tools (i.e., at least those portions of the sampling equipment that contact the sample) prior to first use after cleaning at a frequency of one per equipment cleaning batch. An equipment cleaning batch is the number of sampling equipment items cleaned together at one time using the same cleaning method. The equipment blank shall be collected from the fully assembled sampling or coring tool, in the area where the sampling or coring tools are cleaned, prior to covering with protective wrapping and storage. The equipment blank shall be collected by pouring clean water (e.g., deionized water, HPLC water) down the inside of the assembled sampling or coring tool. The water shall be collected in a clean sample container placed at the leading edge of the sampling or coring tool and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the analysis indicates no analyte at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 or in the Program Required Detection Limits (**PRDL**) in Table C3-8 of Permit Attachment C3. If analytes

are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling or coring tools shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Equipment blanks for coring tools shall be collected from liners that are cleaned separately from the coring tools. These equipment blanks shall be collected at a frequency of one per equipment cleaning batch. The equipment blanks shall be collected by randomly selecting a liner from the equipment cleaning batch, pouring clean water (e.g., deionized water or HPLC water) across its internal surface, collecting the water in a clean sample container, and analyzing the water for the analytes listed in Tables C3-4, C3-6, and the PRDLs in Table C3-8 of Permit Attachment C3. The results of the equipment blank analysis will be considered acceptable if the results indicate no analyte at a concentration greater than three times the MDLs listed in Tables C3-4, C3-6, or C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of liners shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Sampling equipment (e.g., bowls, spoons, chisel, VOC sub-sampler) shall also be cleaned. Equipment blanks shall be collected for the sampling equipment at a frequency of one per equipment cleaning batch. After the sampling equipment has been cleaned, one item from the equipment cleaning batch is randomly selected, water (e.g., deionized water, HPLC water) is passed over its surface, collected in a clean container, and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the results indicate no analyte present at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 and in the PRDLs in C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank. The above equipment blanks may be performed on a purchased batch basis for sampling equipment purchased sterile and sealed in protective packaging. Equipment blanks need not be performed for equipment purchased in sealed protective packaging accompanied by a certificate certifying cleanliness.

The results of equipment blanks shall be traceable to the items in the equipment cleaning batch that the equipment blank represents. All sampling items should be identified, and the associated equipment cleaning batch should be documented. The method of documenting the connection between equipment and equipment cleaning batches shall be documented. Equipment blank results for the coring tools, liners, and sampling equipment shall be reviewed prior to use. A sufficient quantity of these items should be maintained in storage to prevent disruption of sampling operations.

The Permittees may require a site to use certified clean disposable sampling equipment and discard liners and sampling tools after one use. In this instance, cleaning and equipment blank collection is not required.

C1-2b(3) Coring Tool and Sampling Equipment Cleaning

Coring tools and sampling equipment shall be cleaned in accordance with the following requirements:

- All surfaces of coring tools and sampling equipment that will come into contact with the samples shall be clean prior to use. All sampling equipment shall be cleaned in the same manner. Immediately following cleaning, coring tools and sampling equipment shall be assembled and sealed inside clean protective wrapping.

- Each reusable sampling or coring tool shall have a unique identification number. Each number shall be referenced to the waste container on which it was used. This information shall be recorded in the field records. One sampling or coring tool from each equipment cleaning batch shall be tested for cleanliness in accordance with the requirements specified above. The identification number of the sampling or coring tool from which the equipment blank was collected shall be recorded in the field records. The results of the equipment blank analysis for the equipment cleaning batch in which each sampling or coring tool was cleaned shall be submitted to the sampling facility with the identification numbers of all sampling or coring tools in the equipment cleaning batch. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

- Sample containers shall be cleaned in accordance with SW-846 (EPA 1996).

C1-2c Equipment Testing, Inspection and Maintenance

Prior to initiation of sampling or coring activities, sampling and coring tools shall be tested in accordance with manufacturer specifications to ensure operation within the manufacturer's tolerance limits. Other specifications specific to the sampling operations (e.g., operation of containment structure and safety systems) should also be tested and verified as operating properly prior to initiating coring activities. Coring tools shall be assembled, including liners, and tested. Air-lock mechanisms and rotation mechanisms shall be inspected for free movement of critical parts. Sampling and coring tools found to be malfunctioning shall be repaired or replaced prior to use.

Coring tools and sample collection equipment shall be maintained in accordance with manufacturer's specifications. Clean sampling and coring tools and sampling equipment shall be sealed inside clean protective wrapping and maintained in a clean storage area prior to use. Sampling equipment shall be properly maintained to avoid contamination. A sufficient supply of spare parts should be maintained to prevent delays in sampling activities due to equipment down time. Records of equipment maintenance and repair shall be maintained in the field records in accordance with site SOPs.

Inspection of sampling equipment and work areas shall include the following:

- Sample collection equipment in the immediate area of sample collection shall be inspected daily for cleanliness. Visible contamination on any equipment (e.g., waste on

floor of sampling area, hydraulic fluid from hoses) that has the potential to contaminate a waste core or waste sample shall be thoroughly cleaned upon its discovery.

- The waste coring and sampling work areas shall be maintained in clean condition to minimize the potential for cross contamination between waste (including cores) and samples.

- Expendable equipment (e.g., plastic sheeting, plastic gloves) shall be visually inspected for cleanliness prior to use and properly discarded after each sample.

- Prior to removal of the protective wrapping from a coring tool designated for use, the condition of the protective wrapping shall be visually assessed. Coring tools with torn protective wrapping should be returned for cleaning. Coring tools visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Sampling equipment shall be visually inspected prior to use. All sampling equipment that comes into contact with waste samples shall be stored in protective wrapping until use. Prior to removal of the protective wrapping from sampling equipment, the condition of the protective wrapping shall be visually assessed. Sampling equipment with torn protective wrapping should be discarded or returned for cleaning. Sampling equipment visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Cleaned sampling and coring equipment will be physically segregated from all equipment that has been used for a sampling event and has not been decontaminated.

C1-2d Equipment Calibration and Frequency

The scale used for weighing sub-samples shall be calibrated as necessary to maintain its operation within manufacturer's specification, and after repairs and routine maintenance. Weights used for calibration shall be traceable to a nationally recognized standard. Calibration records shall be maintained in the field records.

C1-3 Radiography

Radiography has been developed by the Permittees specifically to aid in the examination and identification of containerized waste. The Permittees shall require that sites describe all activities required to achieve the radiography objectives in site QAPjPs and SOPs. These SOPs should include instructions specific to the radiography system(s) used at the site. For example, to detect liquids, some systems require the container to be rotated back and forth while other systems require the container to be tilted.

A radiography system (e.g., real time radiography, digital radiography/computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, an audio/video recording system, and an operator control and data acquisition station. Although these six components are required, it is expected there will be some variation within a given component between sites. The radiography system shall have controls or an equivalent process which allow the operator to control image quality. On some radiography systems, it should be possible to vary the voltage, typically

between 150 to 400 kilovolts (**kV**), to provide an optimum degree of penetration through the waste. For example, high-density material should be examined with the X-ray device set on the maximum voltage. This ensures maximum penetration through the waste container. Low-density material should be examined at lower voltage settings to improve contrast and image definition. The imaging system typically utilizes either a fluorescent screen and a low-light television camera or x-ray detectors to generate the image.

To perform radiography, the waste container is scanned while the operator views the television screen. A video and audio recording is made of the waste container scan and is maintained as a non-permanent record. A radiography data form is also used to document the Waste Matrix Code to ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary. Containers whose contents prevent full examination of the remaining contents shall be subject to visual examination unless the site certifies that visual examination would provide no additional relevant information for that container based on the acceptable knowledge information for the waste stream. Such certification shall be documented in the generator/storage site's record.

For containers which contain classified shapes and undergo radiography, the radiography video and audio recording will be considered classified. The radiography data forms will not contain classified information.

The radiography system involves qualitative and semiquantitative evaluations of visual displays. Operator training and experience are the most important considerations for ensuring quality controls in regard to the operation of the radiography system and for interpretation and disposition of radiography results. Only trained personnel shall be allowed to operate radiography equipment.

Standardized training requirements for radiography operators shall be based upon existing industry standard training requirements.

The Permittees shall require each site to develop a training program that provides radiography operators with both formal and on-the-job (**OJT**) training. Radiography operators shall be instructed in the specific waste generating practices, typical packaging configurations, and associated waste material parameters expected to be found in each Waste Matrix Code at the site. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography operator prior to qualification of the training candidate. The training programs will be site-specific due to differences in equipment, waste configurations, and the level of waste characterization efforts. For example, certain sites use digital radiography equipment, which is more sensitive than real-time radiography equipment. In addition, the particular physical forms and packaging configurations at each site will vary; therefore, radiography operators shall be trained on the types of waste that are generated, stored, and/or characterized at that particular site.

Although the Permittees shall require each site to develop its own training program, all of the radiography QC requirements specified in this WAP shall be incorporated into the training programs and radiography operations. In this way data quality and comparability will not be affected.

Radiography training programs will be the subject of the Audit and Surveillance Program (Permit Attachment C6).

One or more training containers with items (including prohibited items) common to the waste streams to be characterized and internal containers of various sizes shall be scanned semiannually by each operator. The audio and video media shall then be reviewed by a supervisor to ensure that operators' interpretations remain consistent and accurate. Imaging system characteristics shall be verified on a routine basis.

Independent replicate scans and replicate observations of the video output of the radiography process shall be performed under uniform conditions and procedures. Independent replicate scans shall be performed on one waste container per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. Independent observations of one scan (not the replicate scan) shall also be made once per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. A testing batch is a suite of waste containers undergoing radiography using the same testing equipment. A testing batch can be up to 20 waste containers without regard to waste matrix.

Oversight functions include periodic audio/video media reviews of accepted waste containers and shall be performed by qualified radiography operators that were not involved in the original scans of the waste containers. The results of this independent verification shall be available to the radiography operators who performed the original scans. The Permittees shall require the site project manager to be responsible for monitoring the quality of the radiography data and calling for corrective action, when necessary.

C1-4 Visual Examination

The waste container contents may be verified directly by visual examination (**VE**) of the waste container contents. Visual examination may be performed by physically examining the contents of waste containers to verify the Waste Matrix Code and to verify that the container is properly included in the appropriate waste stream. Visual examination shall be conducted on a waste container to identify and describe all waste items, packaging materials, and waste material parameters in the waste container. Visual examination activities shall be documented on video/audio media, or by using a second operator to provide additional verification by reviewing the contents of the waste container to ensure correct reporting. When VE is performed using a second operator, each operator performing the VE shall observe for themselves the waste being placed in the waste container or the contents within the examined waste container when waste is not removed. The results of all VE shall be documented on VE data forms, which are used to document the Waste Matrix Code, ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary.

Field Code Changed

Visual examination recorded on video/audio media shall meet the following minimum requirements:

- The video/audio media shall record the waste packaging event for the container such that all waste items placed into the container are recorded in sufficient detail and shall

contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.

- The video/audio media shall capture the waste container identification number.
- The personnel loading the waste container shall be identified on the video/audio media or on packaging records traceable to the loading of the waste container.
- The date of loading of the waste container will be recorded on the video/audio media or on packaging records traceable to the loading of the waste container.

Visual examination performed using two generator site personnel shall meet the following minimum requirements:

- At least two generator site personnel who witnessed the packaging of the waste shall approve the data forms or packaging records attesting to the contents of the waste container.
- The data forms or packaging records shall contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.
- The waste container identification number shall be recorded on the data forms or packaging records.

Visual examination video/audio media of containers which contain classified shapes shall be considered classified information. Visual examination data forms or packaging records will not contain classified information.

Waste container packaging records may be used to meet the VE data quality objectives (**DQOs**) (Permit Attachment C, Section C-4a(1)). These records must meet the minimum requirements listed above for either VE recorded on video/audio media or VE performed by two generator/storage site personnel, and shall be reviewed by operators trained and qualified to the requirements listed below. The operators will prepare data forms based on the visual examination records. Visual examination batch data reports will be prepared, reviewed, and approved as described in Permit Attachment C, Section C-4, and Permit Attachment C3.

Standardized training for VE shall be developed. Visual examination operators shall be instructed in the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code at the site. The training shall be site specific to include the various waste configurations generated/stored at the site. For example, the particular physical forms and packaging configurations at each site will vary so operators shall be trained to examine the types of waste that are generated, stored, and/or characterized at that particular site. Training will include the following regardless of Summary Category Group:

- Identifying and describing the contents of a waste container by examining all items in waste containers of previously packaged waste
- Identifying when VE cannot be used to meet the DQOs

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Visual examination personnel shall be requalified once every two years.

Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste generating processes that have taken place at that site and also be familiar with all of the types of waste being characterized at that site. The VE expert shall be responsible for the overall direction and implementation of the VE at that facility. The Permittees shall require site QAPjPs to specify the selection, qualification, and training requirements of the VE expert.

C1-5 Custody of Samples

Chain-of-Custody on field samples (including field QC samples) will be initiated immediately after sample collection or preparation. Sample custody will be maintained by ensuring that samples are custody sealed during shipment to the laboratory. After samples are accepted by the analytical laboratory, custody is maintained by assuring the samples are in the possession of an authorized individual, in that individual's view, in a sealed or locked container controlled by that individual, or in a secure controlled access location. Sample custody will be maintained until the sample is released by the site project manager or until the sample is expended. The Permittees shall require that site QAPjPs or site-specific procedures include a copy of the sample chain-of-custody form and instructions for completing sample chain-of-custody forms in a legally defensible manner. This form will include provisions for each of the following:

- Signature of individual initiating custody control, along with the date and time.
- Documentation of sample numbers for each sample under custody. Sample numbers will be referenced to a specific sampling event description that will identify the sampler(s) through signature, the date and time of sample collection, type/number containers for each sample, sample matrix, preservatives (if applicable), requested methods of analysis, place/address of sample collection and the waste container number.
- For off-site shipping, method of shipping transfer, responsible shipping organization or corporation, and associated air bill or lading number.
- Signatures of custodians relinquishing and receiving custody, along with date and time of the transfer.
- Description of final sample container disposition, along with signature of individual removing sample container from custody.
- Comment section.
- Documentation of discrepancies, breakage or tampering.

All samples and sampling equipment will be identified with unique identification numbers. Sampling Coring tools and equipment will be identified with unique equipment numbers to ensure that all sampling equipment, coring tools, and sampling canisters are traceable to equipment cleaning batches.

All samples will be uniquely identified to ensure the integrity of the sample and can be used to identify the generator/storage site and date of collection. Sample tags or labels will be affixed to all samples and will identify at a minimum:

- Sample ID number
- Sampler initials and organization
- Ambient temperature and pressure (for gas samples only)
- Sample description
- Requested analyses
- Data and time of collection
- QC designation (if applicable)

C1-6 Sample Packing and Shipping

In the event that the analytical facilities are not at the generator/storage site, the samples shall be packaged and shipped to an off-site laboratory. Sample containers shall be packed to prevent any damage to the sampling container and maintain the preservation temperature, if necessary. Department of Transportation (**DOT**) regulations shall be adhered to for shipment of the package.

When preparing SUMMA® or equivalent canisters for shipment, special care shall be taken with the pressure gauge and the associated connections. Metal boxes which have separate compartments, or cardboard boxes with foam inserts are standard shipping containers. The chosen shipping container shall meet selected DOT regulations. If temperatures shall be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package.

Glass jars are wrapped in bubble wrap or another type of protection. The wrapped jar should be placed in a plastic bag inside of the shipping container, so that if the jar breaks, the inside of the shipping container and the other samples will not be contaminated. The plastic bag will enable the receiving analytical lab to prevent contamination of their shipping and receiving area. Plastic jars do not present a problem for shipping purposes. All shipping containers will contain appropriate blank samples to detect any VOC cross-contamination. A DOT approved cooler, or similar package may be used as the shipping container. If temperatures must be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package. If fill material is needed, compatibility between the samples and the fill should be evaluated prior to use.

All sample containers should be affixed with signed tamper-proof seals or devices so that it is apparent if the sample integrity has been compromised and that the identity of the seal or device is traceable to the individual who affixed the seal. A seal should also be placed on the outside of the shipping container for the same reason. Sample custody documentation shall be placed inside the sealed or locked shipping container, with the current custodian signing to release custody. Transfer of custody is completed when the receiving custodian opens the shipping container and signs the custody documentation. The shipping documentation will serve to track the physical transfer of samples between the two custodians.

A Uniform Hazardous Waste Manifest is not required, since samples are exempted from the definition of hazardous waste under RCRA. All other shipping documentation specified in the

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site specific SOP for sample shipment (i.e., bill of lading, site-specific shipping documentation) is required.

C1-7 List of References

Bechtel BWXT Idaho, LLC (BWXT), 2000, Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations, INEEL/EXT-2000-01207, October 2000, Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

Lockheed Idaho Technologies Company, 1995, Position for Determining Gas Phase Volatile Organic Compound Concentrations in Transuranic Waste Containers, INEL-95/0109/Revision 1, M.J. Connolly, et. al.

U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/10b, January 1999).

U.S. Environmental Protection Agency (EPA), 1996. Test Methods for Evaluating Solid Waste, "Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. EPA, OSW and ER, Washington D.C.

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TABLES

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Table C1-1
Gas Sample Requirements

Parameter	Container [a]	Minimum Drum Headspace Sample Volume [b]	Holding Temperatures
VOCs	SUMMA® Canister	250 ml	0-40 °C

[a] Alternately, canisters that meet QAOs may be used.

[b] Alternatively, if available headspace is limited, a single 100 ml sample may be collected for determination of VOCs.

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Table C1-2
Summary of Drum Field QC Headspace Sample Frequencies

QC Samples	Manifold	Direct Canister	On-Line Systems
Field blanks [a]	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]
Equipment blanks [b]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field reference standards [c]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field duplicates	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]

[a] Analysis of field blanks for VOCs (Table C3-2 of Attachment C3), only, is required. For on-line integrated sampling/analysis systems, if field blank results meet the acceptance criterion, a separate on-line blank is not required.

[b] One equipment blank or on-line sample shall be collected, analyzed for VOCs (Table C3-2), and demonstrated clean prior to first use of the headspace gas sampling equipment with each of the sampling heads, then at the specified frequency, for VOCs only thereafter. Daily, prior to work, the sampling manifold, if in use, shall be verified clean using an OVA.

[c] One field reference standard or on-line control sample shall be collected, analyzed, and demonstrated to meet the QAOs specified in Permit Attachment C3 prior to first use, then at the specified frequency thereafter.

[d] A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

[e] One equipment blank and field reference standard shall be collected after equipment purchase, cleaning, and assembly.

[f] An on-line batch is the number of samples collected within a 12-hour period using the same on-line integrated sampling/analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system.

Table C1-3
Summary of Sampling Quality Control Sample Acceptance Criteria

QC Sample	Acceptance Criteria	Corrective Action [a]
Field blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any VOC amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Equipment blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 of for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any analyte amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Field reference standards or on-line control sample	70 - 130 %R	Nonconformance if %R < 70 or > 130
Field duplicates or on-line duplicate	RPD ≤ 25	Nonconformance if RPD > 25

[a] Corrective action is only required if the final reported QC sample results do not meet the acceptance criteria.

MDL = Method detection limit

%R = Percent recovery

RPD = Relative percent difference

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Table C1-4
Sample Handling Requirements for Homogeneous Solids and Soil/Gravel

Parameter	Suggested Quantity [a]	Required Preservative	Suggested Container	Maximum Holding Time [b]
VOCs	15 grams	Cool to 4°C	Glass Vial [c]	14 Days Prep/ 40 Days Analyze [d]
SVOCs	50 grams	Cool to 4°C	Glass Jar [e]	14 Days Prep/ 40 Days Analyze [d]
Metals	10 grams	Cool to 4°C	Plastic Jar [f]	180 Days [g]

[a] Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.

[b] Holding time begins at sample collection (holding times are consistent with SW-846 requirements).

[c] 40-ml VOA vial or other appropriate containers shall have an airtight cap.

[d] 40-day holding time allowable only for methanol extract - 14-day holding time for non-extracted VOCs.

[e] Appropriate containers should be used and should have Teflon® lined caps.

[f] Polyethylene or polypropylene preferred, glass jar is allowable.

[g] Holding time for mercury analysis is 28 days.

Note: Preservation requirements in the most recent version of SW-846 may be used if appropriate.

Table C1-5
Headspace Gas Drum Age Criteria Sampling Scenarios

Scenario	Description
1	A. Unvented 55-gallon drums without rigid poly liners are sampled through the drum lid at the time of venting. B1. Unvented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. B2. Vented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. C. Unvented 55-gallon drums with vented rigid poly liners are sampled through the drum lid at the time of venting.
2	55-gallon drums that have met the criteria for Scenario 1 and then are vented, but not sampled at the time of venting. [a]
3	Containers (i.e., 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, SLB2s and pipe components) that are initially packaged in a vented condition and sampled in the container headspace and containers that are not sampled under Scenario 1 or 2.

[a] Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. This requires the additional information required of each container in Scenario 3 (i.e., determination of packaging configuration), and such containers can only be sampled after meeting the appropriate Scenario 3 DAC.

Table C1-6
Scenario 1 Drum Age Criteria (in days) Matrix

Summary Category Group	DAC (Days)
S5000	53

Note: Containers that are sampled using the Scenario 1 DAC do not require information on the packaging configuration because the Scenario 1 DAC are based on a bounding packaging configuration. In addition, information on the rigid liner vent hole presence and diameter do not apply to containers that are sampled using the Scenario 1 DAC because they are unvented prior to sampling.

Table C1-7
Scenario 2 Drum Age Criteria (in days) Matrix

	Summary Category Group S5000			
Filter H_2 Diffusivity [a]	Rigid Liner Vent Hole Diameter (in) [b]			
(mol/s/mod fraction)	0.30	0.375	0.75	1.0
1.9×10^{-6}	29	22	13	12
3.7×10^{-6}	25	20	12	11
3.7×10^{-5}	7	6	6	4

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging (Attachment C, Section C-3d(1)), repackaging (Attachment C, Section C-3d(1)), and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

Note: Containers that are sampled using the Scenario 2 DAC do not require information on the packaging configuration because the Scenario 2 DAC are based on a bounding packaging configuration.

Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

1

Table C1-9
Scenario 3 Drum Age Criteria (In Days) Matrix for S5000 Waste by Packaging Configuration Group

Packaging Configuration Group 1						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	131	95	37	24	4	4
3.7×10^{-6}	111	85	36	24	4	4
3.7×10^{-5}	28	28	23	19	4	4

Packaging Configuration Group 2						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-5}	175	138	75	60	30	11
3.7×10^{-6}	152	126	73	59	30	11
3.7×10^{-5}	58	57	52	47	28	8

Packaging Configuration Group 3						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-5}	199	161	96	80	46	16
3.7×10^{-6}	175	148	93	79	46	16
3.7×10^{-5}	72	72	67	62	42	10

Packaging Configuration Group 4	
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Headspace Sample Taken Inside Pipe Component
$> 1.9 \times 10^{-5}$	152

Packaging Configuration Group 5	
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP/SLB2
$> 7.4 \times 10^{-7}$ (SWB)	15
3.33×10^{-7} (TDOP)	15
6.60×10^{-8} (SLB2)	21

Packaging Configuration Group 6			
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP/SLB2		
> 7.4 × 10^{-3} (SWB)	56		
3.33 × 10^{-4} (TDOP)	56		
6.60 × 10^{-4} (SLB2)	56		
Packaging Configuration Group 7 [d]			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction) [a]		
	7.4 × 10^{-6}	1.85 × 10^{-5}	9.25 × 10^{-5} [e]
3.7 × 10^{-6}	13	7	2
7.4 × 10^{-6}	10	6	2
1.85 × 10^{-5}	6	4	2
Packaging Configuration Group 8			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction)		
	7.4 × 10^{-6}		
3.7 × 10^{-6}	21		

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2 × 10^{-6} must use a DAC for a filter with a 3.7 × 10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9 × 10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9 × 10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

[c] The filter H_2 diffusivity for SWBs, TDOPs, or SLB2s is the sum of the diffusivities for all of the filters on the container because SWBs, TDOPs, and SLB2s have more than 1 filter.

[d] Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable. Packaging Configuration Group 7 DAC values apply to drums with up to two lids.

[e] While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section C1-1a (i.e., 72 hours at 18°C or higher). The equilibrium requirement for headspace gas sampling shall be met separately.

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FIGURES

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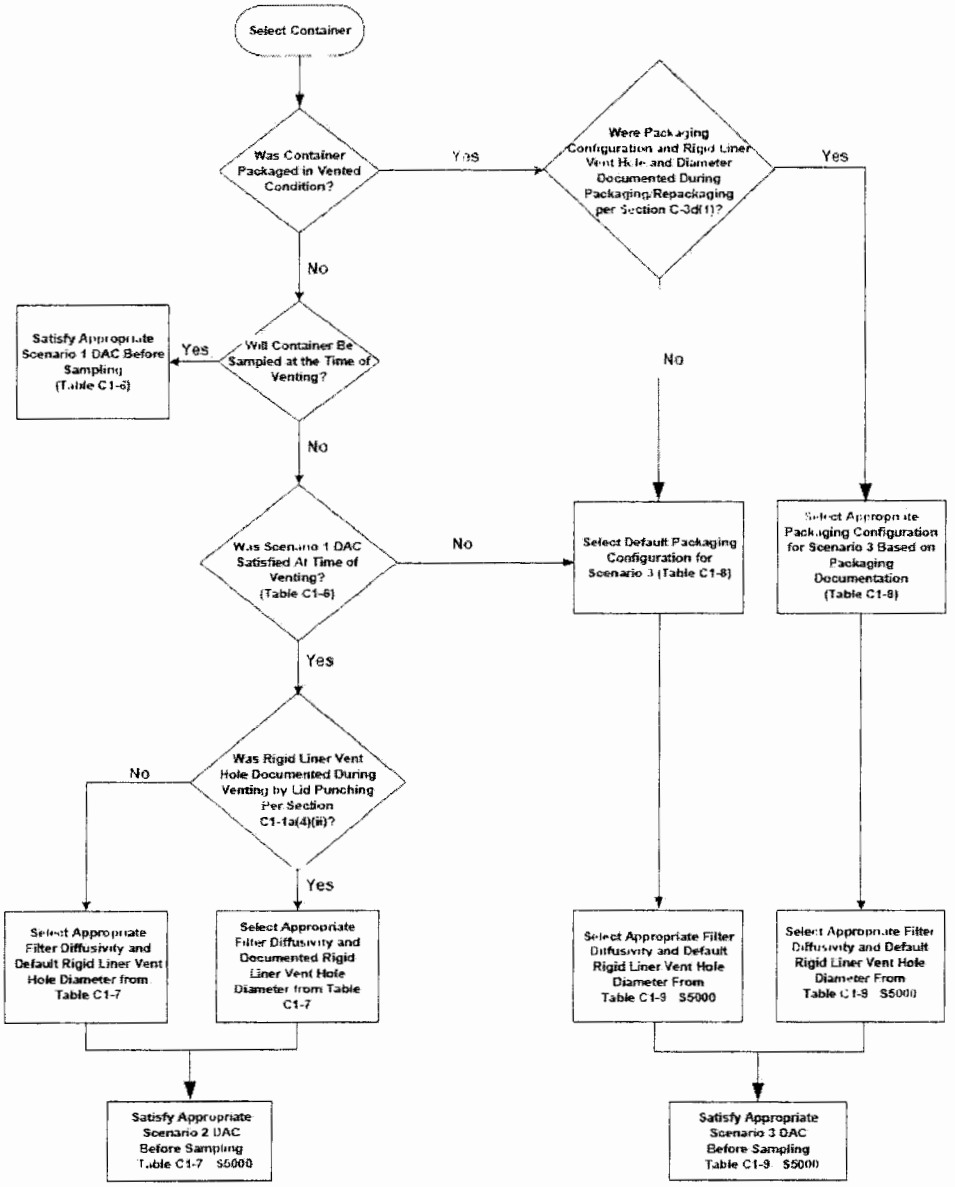

Figure C1-1
Headspace Gas Drum Age Criteria Sampling Scenario Selection Process

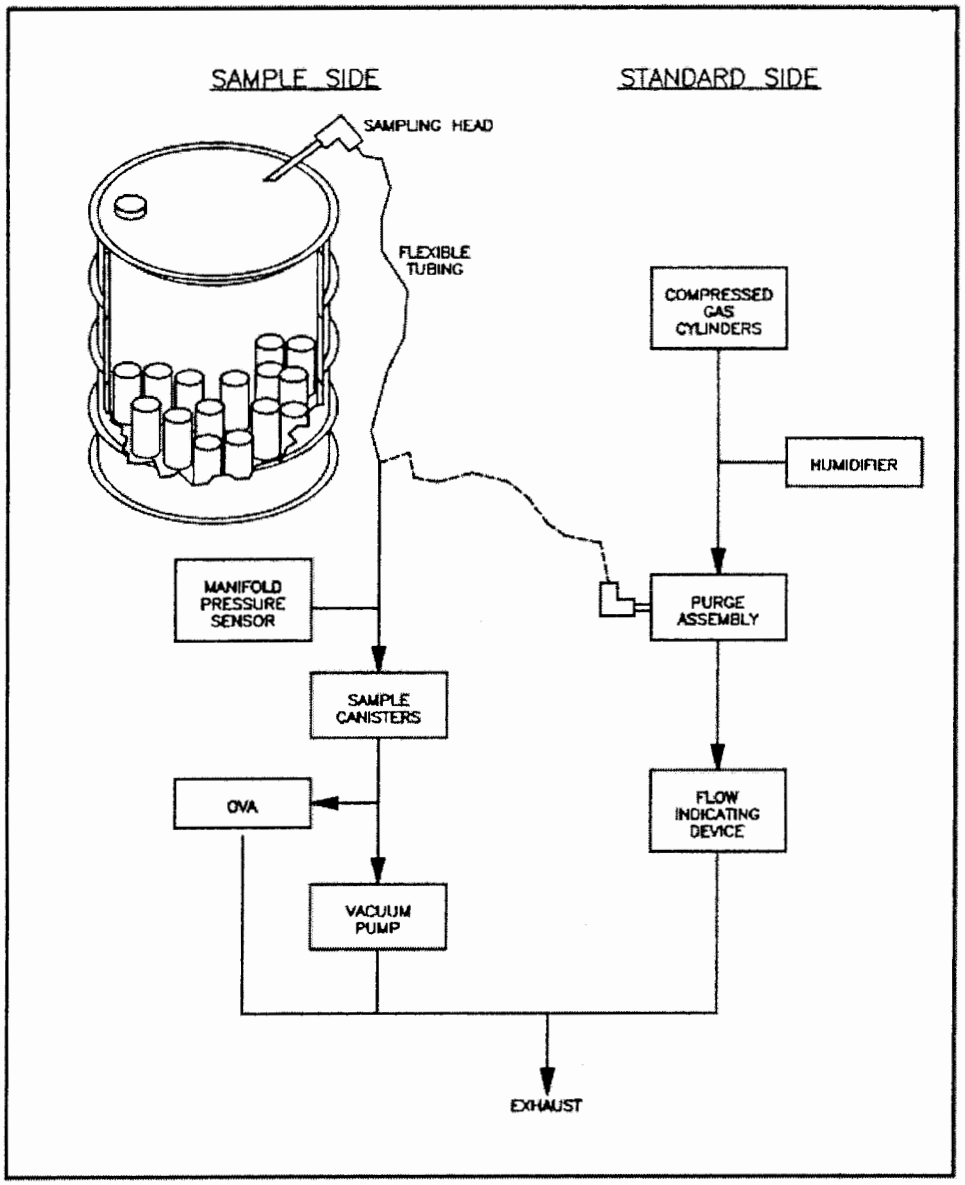

Figure C1-2
Headspace Sampling Manifold

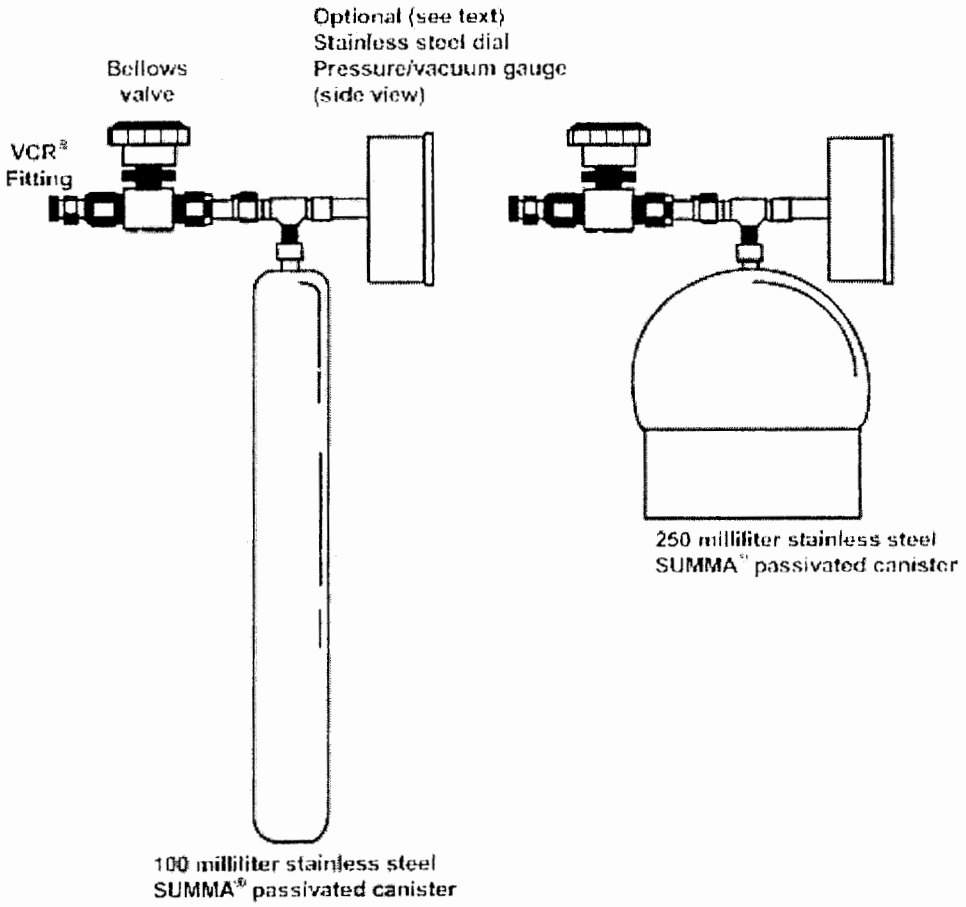

Figure C1-3
SUMMA® Canister Components Configuration (Not to Scale)

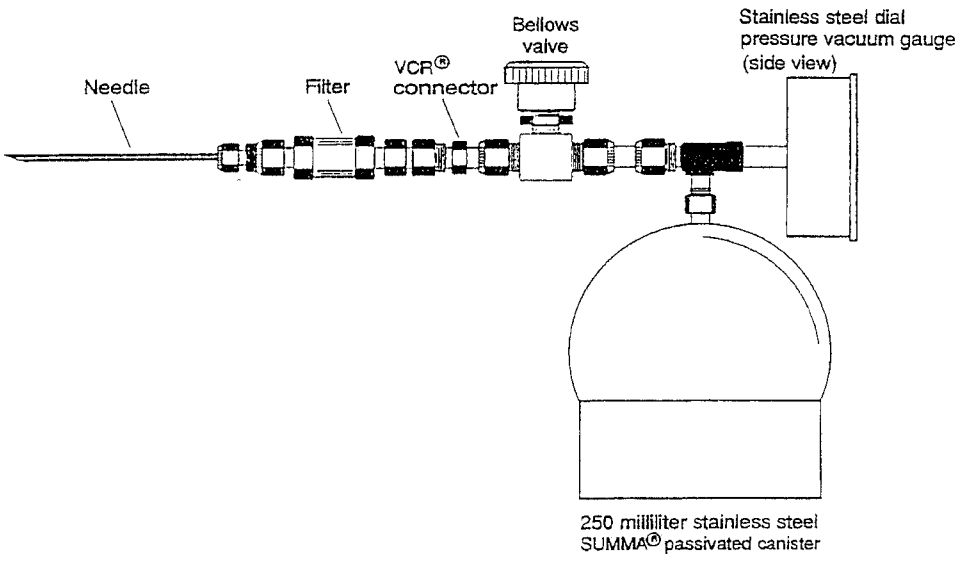

Figure C1-4
Schematic Diagram of Direct Canister with the Poly Bag Sampling Head

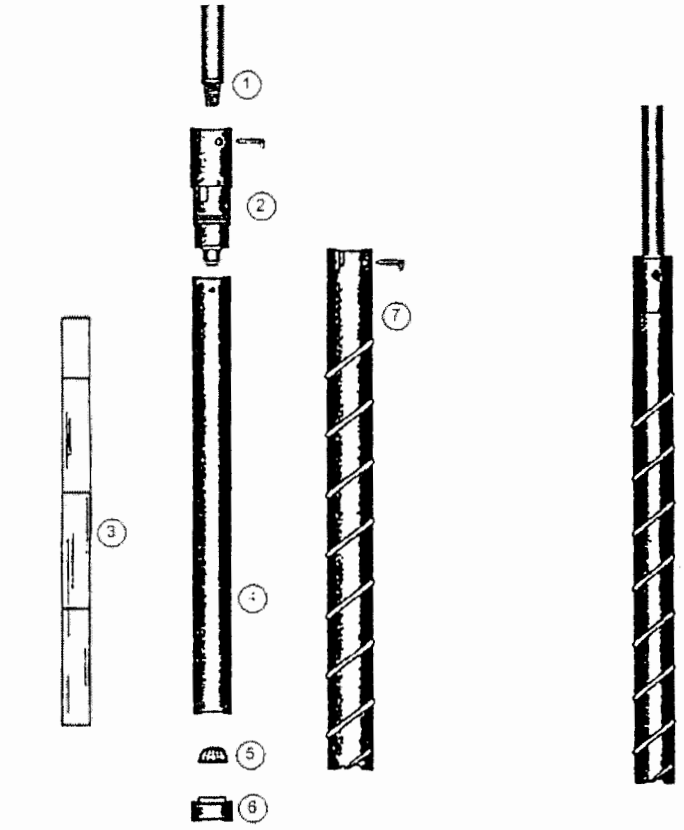

Figure C1-5
Rotational Coring Tool (Light Weight Auger)

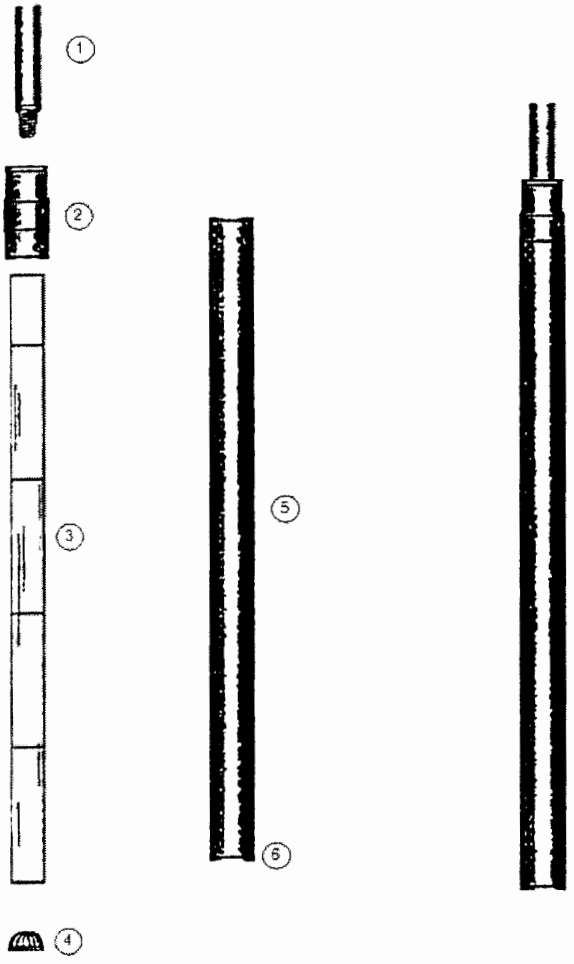

Figure C1-6
Non-Rotational Coring Tool (Thin Walled Sampler)

Archives

- December 2012 (1)
- June 2012 (4)
- May 2012 (2)
- April 2012 (1)
- March 2012 (3)
- February 2012 (1)
- January 2012 (3)
- December 2011 (8)
- November 2011 (4)
- October 2011 (10)
- March 2011 (1)
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- December 2010 (1)
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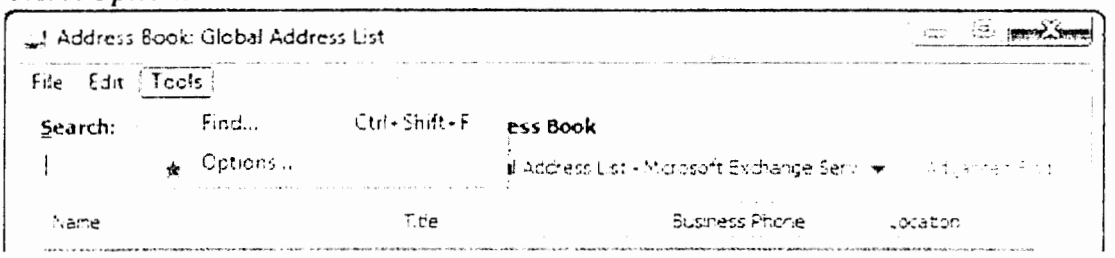
- July 2007 (1)
- April 2007 (1)
- February 2007 (1)
- January 2007 (3)
- November 2005 (1)
- November 2004 (1)
- October 2004 (2)

Mon, Dec 21 2009 5:24 jeffl

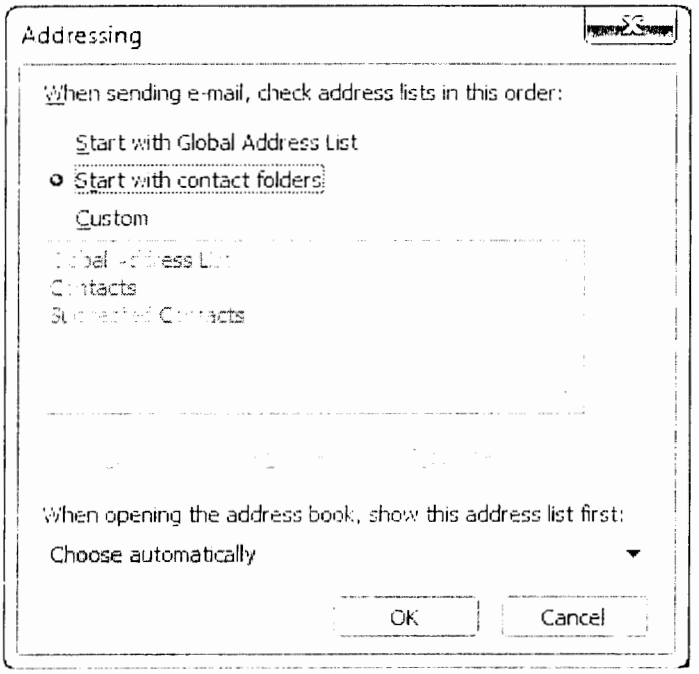
Outlook 2010: How to change your default Contacts Address Book

Have you ever wondered how to change the default address book in Outlook when you are using Exchange. If you have ever sent an email and tried to find your contacts using the To: button you know that by default the Exchange Global Address Book is the first source of contacts. What a pain.

6. The ***Address Book: Global Address List*** windows will open
    1. Select the ***Tools*** Menu
    2. Select ***Options***



3.
4. The Addressing Window will open
    1. Choose ***Start with contact folders***
    2. Select ***OK***



3.
5. Close the ***Address Book: Global Address List*** window

From now on when you click the To: button your default address list will be the outlook contacts folder. If you don't remember how to do it in the future, remember you found it here. I know I will be back to this post the next time I have to do this

Jeff Loucks
Available Technology

Available Technology

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Filed under: Outlook 2010, Change Default, Global Address Book, Contacts

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Field Code Changed

ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

Introduction

The Permittees will require generator/storage sites (**sites**) to use the following methods, as applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at WIPP. These methods include requirements for headspace-gas sampling, sampling of homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this Attachment provides quality control, sample custody, and sample packing and shipping requirements.

C1-1 Sampling of Debris Waste (Summary Category S5000)

Headspace gas sampling and analysis shall be used to resolve the assignment of Environmental Protection Agency (**EPA**) hazardous waste numbers to debris waste streams.

C1-1a Method Requirements

The Permittees shall require all headspace-gas sampling be performed in an appropriate radiation containment area on waste containers that are in compliance with the container equilibrium requirements (i.e., 72 hours at 18° C or higher).

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using

the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

The determination of packaging configuration consists of identifying the number of confinement layers and the identification of rigid poly liners when present. Generator/storage sites shall use either the default conditions specified in Tables C1-7 through C1-9 for retrievably stored waste or the data documented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) for determining the appropriate DAC for each container from which a headspace gas sample is collected. These drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling documents for each container from which a headspace gas sample is collected:

- sampling scenario from Table C1-5 and associated information from Tables C1-6 and/or Table C1-7;
- the packaging configuration from Table C1-8 and associated information from Table C1-9, including the diameter of the rigid liner vent hole, the number of inner bags, the number of liner bags, the presence/absence of drum liner, and the filter hydrogen diffusivity,
- the permit-required equilibrium time,
- the drum age,
- for supercompacted waste, both
  - the absence of rigid liners in the compacted 55-gallon drums which have not been headspace gas sampled in accordance with this permit prior to compaction, and
  - the absence of layers of confinement must be documented in the WWIS if Packaging Configuration Group 7 is used.

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and

100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly liners) shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a representative sample is collected (using a sampling needle connected to the sampling head to pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies this requirement). The configuration of the containment area and remote-handling equipment at each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the analytes listed in Table C3-2 of Permit Attachment C3. If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000). Consistent with footnote "a" in Table C1-8, any waste container selected for headspace gas sampling that cannot be assigned a packaging configuration specified in Table C1-8 shall be assigned a conservative default packaging configuration..

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, ~~and~~ SLB2s, and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

The Permittees shall require site personnel to collect samples in SUMMA® or equivalent canisters using standard headspace-gas sampling methods that meet the general guidelines established by the EPA in the Compendium Method TO-14A or TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by using on-line integrated sampling/analysis systems. Samples will be directed to an analytical instrument instead of being collected in SUMMA® or equivalent canisters if a single-sample on-line integrated sampling/analysis system is used. If a multi-sample on-line integrated sampling/analysis system is used, samples will be directed to an integrated holding area that meets the cleaning requirements of Section C1-1c(1). The leak proof and inert nature of the integrated holding area interior surface must be demonstrated and documented. Samples are not transported to another location when using on-line integrated sampling/analysis systems; therefore, the sample custody requirements of Section C1-4 and C1-5 do not apply. The same sampling manifold and sampling heads are used with on-line integrated sampling/analysis systems and all of the requirements associated with sampling manifolds and sampling heads must be met. However, when using an on-line integrated sampling/analysis system, the sampling batch and analytical batch quality control (**QC**) samples are combined as on-line batch QC samples as outlined in Section C1-1b.

C1-1a(2) Manifold Headspace Gas Sampling

This headspace-gas sampling protocol employs a multiport manifold capable of collecting multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be used to collect samples in SUMMA® or equivalent canisters or as part of an on-line integrated sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to first use and as needed thereafter. The manifold and sample canisters will be evacuated to 0.0039 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet valve is opened. The manifold inlet valve will be attached to a changeable filter connected to either a side port needle sampling head capable of forming an airtight seal (for penetrating a

filter or rigid poly liner when necessary), a drum punch sampling head capable of forming an airtight seal (capable of punching through the metal lid of a drum for sampling through the drum lid), or a sampling head with an airtight fitting for sampling through a pipe overpack container filter vent hole. Refer to Section C1-1a(4) for descriptions of these sampling heads.

The manifold shall also be equipped with a purge assembly that allows applicable QC samples to be collected through all sampling components that may affect compliance with the quality assurance objectives (**QAOs**). The Permittees shall require the sites to demonstrate and document the effectiveness of the sampling equipment design in meeting the QAOs. Field blanks shall be samples of room air collected in the sampling area in the immediate vicinity of the waste container to be sampled. If using SUMMA® or equivalent canisters, field blanks shall be collected directly into the canister, without the use of the manifold.

The manifold, the associated sampling heads, and the headspace-gas sample volume requirements shall be designed to ensure that a representative sample is collected. The manifold internal volume must be calculated and documented in a field logbook dedicated to headspace-gas sample collection. The total volume of headspace gases collected during each sampling operation will be determined by adding the combined volume of the canisters attached to the manifold and the internal volume of the manifold. The sample volume should remain small in comparison to the volume of the waste container. When an estimate of the available headspace gas volume in the drum can be made, less than 10 percent of that volume should be withdrawn.

As illustrated in Figure C1-2, the sampling manifold must consist of a sample side and a standard side. The dotted line in Figure C1-2 indicates how the sample side shall be connected to the standard side for cleaning and collecting equipment blanks and field reference standards. The sample side of the sampling manifold shall consist of the following major components:

- An applicable sampling head that forms a leak-tight connection with the headspace sampling manifold.

- A flexible hose that allows movement of the sampling head from the purge assembly (standard side) to the waste container.

- A pressure sensor(s) that must be pneumatically connected to the manifold. This manifold pressure sensor(s) must be able to measure absolute pressure in the range from 0.002 in. (0.05 mm) Hg to 39.3 in. (1,000 mm) Hg. Resolution for the manifold pressure sensors must be ±0.0004 in. (0.01 mm) Hg at 0.002 in. (0.05 mm) of Hg. The manifold pressure sensor(s) must have an operating range from approximately 59°F (15°C) to 104°F (40°C).

- Available ports for attaching sample canisters. If using canister-based sampling methods, a sufficient number of ports shall be available to allow simultaneous collection of headspace-gas samples and duplicates for VOC analyses. If using an on-line integrated sampling/analysis system, only one port is necessary for the collection of comparison samples. Ports not occupied with sample canisters during cleaning or headspace-gas sampling activities require a plug to prevent ambient air from entering the system. In place of using plugs, sites may choose to install valves that can be closed to prevent intrusion of ambient air into the manifold. Ports shall have VCR®

fittings for connection to the sample canister(s) to prevent degradation of the fittings on the canisters and manifold.

- Sample canisters, as illustrated in Figure C1-3, are leak-free, stainless steel pressure vessels, with a chromium-nickel oxide (**Cr-NiO**) SUMMA®-passivated interior surface, bellows valve, and a pressure/vacuum gauge. Equivalent designs, such as Silco Steel canisters, may be used so long as the leak proof and inert nature of the canister interior surface is demonstrated and documented. All sample canisters must have VCR® fittings for connection to sampling and analytical equipment. The pressure/vacuum gauge must be mounted on each manifold. The canister must be helium-leak tested to 1.5×10^{-7} standard cubic centimeters per second (cc/s), have all stainless steel construction, and be capable of tolerating temperatures to 125°C. The gauge range shall be capable of operating in the leak test range as well as the sample collection range.

- A dry vacuum pump with the ability to reduce the pressure in the manifold to 0.05 mm Hg. A vacuum pump that requires oil may be used, but precautions must be taken to prevent diffusion of oil vapors back to the manifold. Precautions may include the use of a molecular sieve and a cryogenic trap in series between the headspace sampling ports and the pump.

- A minimum distance, based upon the design of the manifold system, between the tip of the needle and the valve that isolates the pump from the manifold in order to minimize the dead volume in the manifold.

- If real-time equipment blanks are not available, the manifold must be equipped with an organic vapor analyzer (**OVA**) that is capable of detecting all analytes listed in Table C3-2 of Permit Attachment C3. The OVA shall be capable of measuring total VOC concentrations below the lowest headspace gas PRQL. Detection of 1,1,2-trichloro-1,2,2-trifluoroethane may not be possible if a photoionization detector is used. The OVA measurement shall be verified by the collection of equipment blanks at the frequency specified in Section C1-1 to check for manifold cleanliness.

The standard side must consist of the following major elements:

- A cylinder of compressed zero air, helium, argon, or nitrogen gas that is hydrocarbon and carbon dioxide (**CO_2**)-free (only hydrocarbon and CO_2-free gases required for Fourier Transform Infrared System [**FTIRS**]) to clean the manifold between samples and to provide gas for the collection of equipment blanks or on-line blanks. These high-purity gases shall be certified by the manufacturer to contain less than one ppm total VOCs. The gases must be metered into the standard side of the manifold using devices that are corrosion proof and that do not allow for the introduction of manifold gas into the purge gas cylinders or generator. Alternatively, a zero air or nitrogen generator may be used, provided a sample of the zero air or nitrogen is collected and demonstrated to contain less than one ppm total VOCs. Zero air or nitrogen from a generator shall be humidified (except for use with FTIRS).

- Cylinders of field-reference standard gases or on-line control sample gases. These cylinders provide gases for evaluating the accuracy of the headspace-gas sampling

process. Each cylinder of field-reference gas or on-line control sample gas shall have a flow-regulating device. The field-reference standard gases or on-line control sample gas shall be certified by the manufacturer to contain analytes from Table C3-2 of Permit Attachment C3 at known concentrations.

- If using an analytical method other than FTIRS a humidifier filled with American Society for Testing and Materials (**ASTM**) Type I or II water, connected, and opened to the standard side of the manifold between the compressed gas cylinders and the purge assembly shall be used. Dry gases flowing to the purge assembly will pick up moisture from the humidifier. Moisture is added to the dry gases to condition the equipment blanks and field-reference standards and to assist with system cleaning between headspace-gas sample collection. If using FTIRS for analysis, the sample and sampling system shall be kept dry.

  NOTE: Caution should be exercised to isolate the humidifier during the evacuation of the system to prevent flooding the manifold. In lieu of the humidifier, the compressed gas cylinders (e.g., zero air and field-reference standard gas) may contain water vapor in the concentration range of 1,000 to 10,000 parts per million by volume (**ppmv**).

- A purge assembly that allows the sampling head (sample side) to be connected to the standard side of the manifold. The ability to make this connection is required to transfer gases from the compressed gas cylinders to the canisters or on-line analytical instrument. This connection is also required for system cleaning.

- A flow-indicating device or a pressure regulator that is connected to the purge assembly to monitor the flow rate of gases through the purge assembly. The flow rate or pressure through the purge assembly shall be monitored to assure that excess flow exists during cleaning activities and during QC sample collection. Maintaining excess flow will prevent ambient air from contaminating the QC samples and allow samples of gas from the compressed gas cylinders to be collected near ambient pressure.

In addition to a manifold consisting of a sample side and a standard side, the area in which the manifold is operated shall contain sensors for measuring ambient pressure and ambient temperature, as follows:

- The ambient-pressure sensor must have a sufficient measurement range for the ambient barometric pressures expected at the sampling location. It must be kept in the sampling area during sampling operations. Its resolution shall be 0.039 in. (1.0 mm) Hg or less, and calibration performed by the manufacturer shall be based on National Institute of Standards and Technology (**NIST**), or equivalent, standards.

- The temperature sensor shall have a sufficient measurement range for the ambient temperatures expected at the sampling location. The measurement range of the temperature sensor must be from 18°C to 50°C. The temperature sensor calibration shall be traceable to NIST, or equivalent, standards.

C1-1a(3) Direct Canister Headspace Gas Sampling

This headspace-gas sampling protocol employs a canister-sampling system to collect headspace-gas samples for analysis and QC purposes without the use of the manifold

described above. Rather than attaching sampling heads to a manifold, in this method the sampling heads are attached directly to an evacuated sample canister as shown in Figure C1-4.

Canisters shall be evacuated to 0.0039 in. (0.10 mm) Hg prior to use and attached to a changeable filter connected to the appropriate sampling head. The sampling head(s) must be capable of either punching through the metal lid of the drums (and/or the rigid poly liner when necessary) while maintaining an airtight seal when sampling through the drum lid, penetrating a filter or the septum in the orifice of the self-tapping screw, or maintaining an airtight seal for sampling through a pipe overpack container filter vent hole to obtain the drum headspace samples. Field duplicates must be collected at the same time, in the same manner, and using the same type of sampling apparatus as used for headspace-gas sample collection. Field blanks shall be samples of room air collected in the immediate vicinity of the waste-drum sampling area prior to removal of the drum lid. Equipment blanks and field-reference standards must be collected using a purge assembly equivalent to the standard side of the manifold described above. These samples shall be collected from the needle tip through the same components (e.g., needle and filter) that the headspace-gas samples pass through.

The sample canisters, associated sampling heads, and the headspace-sample volume requirements ensure that a representative sample is collected. When an estimate of the available headspace-gas volume of the waste container can be made, less than 10 percent of that volume should be withdrawn. A determination of the sampling head internal volume shall be made and documented. The total volume of headspace gases collected during each headspace gas sampling operation can be determined by adding the volume of the sample canister(s) attached to the sampling head to the internal volume of the sampling head. Every effort shall be made to minimize the internal volume of sampling heads.

Each sample canister used with the direct canister method shall have a pressure/vacuum gauge capable of indicating leaks and sample collection volumes. Canister gauges are intended to be gross leak-detection devices not vacuum-certification devices. If a canister pressure/vacuum gauge indicates an unexpected pressure change, determination of whether the change is a result of ambient temperature and pressure differences or a canister leak shall be made. This gauge shall be helium-leak tested to 1.5×10^{-7} standard cc/s, have all stainless steel construction, and be capable of tolerating temperatures to 125°C.

The SUMMA® or equivalent sample canisters as specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) shall be used when sampling each drum. These heads shall form a leak-tight connection with the canister and allow sampling through the drum-lid filter, through the drum lid itself and/or rigid poly liner when necessary (by use of a punch or self-tapping screw), using an airtight fitting to collect the sample through the filter vent hole of a pipe overpack container, or using a hollow side port needle. Figure C1-4 illustrates the direct canister-sampling equipment.

C1-1a(4) Sampling Heads

A sample of the headspace gas directly under the container lid, pipe overpack filter vent hole, or rigid poly liner shall be collected. Several methods have been developed for collecting a representative sample: sampling through the filter, sampling through the drum lid by drum punching, sampling through a pipe overpack container filter vent hole, and sampling through the rigid poly liner. The chosen sampling method shall preserve the integrity of the drum to contain

radionuclides (e.g., replace the damaged filter, replace set screw in filter housing, seal the punched drum lid).

C1-1a(4)(i) Sampling Through the Filter

To sample the drum-headspace gas through the drum's filter, a side-port needle (e.g., a hollow needle sealed at the tip with a small opening on its side close to the tip) shall be pressed through the filter and into the headspace beneath the drum lid. This permits the gas to be drawn into the manifold or directly into the canister(s). To assure that the sample collected is representative, all of the general method requirements, sampling apparatus requirements, and QC requirements described in this section shall be met in addition to the following requirements that are pertinent to drum headspace-gas sampling through the filter:

- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If the sample is collected by removing the drum lid, the sampling device shall form an airtight seal with the rigid poly liner to prevent the intrusion of outside air into the sample (using a sampling needle connected to the sampling head to pierce the rigid poly liner satisfies this requirement). If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.

- For sample collection, the drum's filter shall be sealed to prevent outside air from entering the drum and diluting and/or contaminating the sample.

The sampling head for collecting drum headspace by penetrating the filter shall consist of a side-port needle, a filter to prevent particles from contaminating the gas sample, and an adapter to connect the side-port needle to the filter. To prevent cross contamination, the sampling head shall be cleaned or replaced after sample collection, after field-reference standard collection, and after field-blank collection. The following requirements shall also be met:

- The housing of the filter shall allow insertion of the sampling needle through the filter element or a sampling port with septum that bypasses the filter element into the drum headspace.

- The side-port needle shall be used to reduce the potential for plugging.

- The purge assembly shall be modified for compatibility with the side-port needle.

C1-1a(4)(ii) Sampling Through the Drum Lid By Drum Lid Punching

Sampling through the drum lid at the time of drum punching or thereafter may be performed as an alternative to sampling through the drum's filter if an airtight seal can be maintained. To sample the drum headspace-gas through the drum lid at the time of drum punching or thereafter, the lid shall be breached using an appropriate punch. The punch shall form an airtight seal between the drum lid and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method requirements,

sampling apparatus requirements, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the drum lid and sampling head shall be designed to minimize intrusion of ambient air.
- All components of the sampling system that come into contact with sample gases shall be purged with humidified zero air, nitrogen, or helium prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the punch that contact the headspace-gas sample.
- Pressure shall be applied to the punch until the drum lid has been breached.
- Provisions shall be made to relieve excessive drum pressure increases during drum-punch operations; potential pressure increases may occur during sealing of the drum punch to the drum lid.
- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.
- During sampling, the drum's filter, if present, shall be sealed to prevent outside air from entering the drum.
- While sampling through the drum lid using manifold sampling, a flow-indicating device or pressure regulator to verify flow of gases shall be pneumatically connected to the drum punch and operated in the same manner as the flow-indicating device described above in Section C1-1a(2).
- Equipment shall be used to adequately secure the drum-punch sampling system to the drum lid.
- If the headspace gas sample is not taken at the time of drum punching, the presence and diameter of the rigid liner vent hole shall be documented during the punching operation for use in determining an appropriate Scenario 2 DAC.

C1-1a(4)(iii) Sampling Through a Pipe Overpack Container Filter Vent Hole

Sampling through an existing filter vent hole in a pipe overpack container (**POC**) may be performed as an alternative to sampling through the POC's filter if an airtight seal can be maintained. To sample the container headspace-gas through a POC filter vent hole, an appropriate airtight seal shall be used. The sampling apparatus shall form an airtight seal

between the POC surface and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method, sampling apparatus, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the POC surface and sampling apparatus shall be designed to minimize intrusion of ambient air.
- The filter shall be replaced as quickly as is practicable with the airtight sampling apparatus to ensure that a representative sample can be taken. Sites must provide documentation demonstrating that the time between removing the filter and installing the airtight sampling device has been established by testing to assure a representative sample.
- All components of the sampling system that come into contact with sample gases shall be cleaned according to requirements for direct canister sampling or manifold sampling, whichever is appropriate, prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the sampling system that contact the headspace-gas sample.
- During sampling, openings in the POC shall be sealed to prevent outside air from entering the container.
- A flow-indicating device shall be connected to sampling system and operated according to the direct canister or manifold sampling requirements, as appropriate.

C1-1b Quality Control

For manifold and direct canister sampling systems, field QC samples shall be collected on a per sampling batch basis. A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding QC samples), all of which shall be collected within 14 days of the first sample in the batch. For on-line integrated sampling/analysis systems, QC samples shall be collected and analyzed on a per on-line batch basis. Holding temperatures and container requirements for gas sample containers are provided in Table C1-1. An on-line batch is the number of headspace-gas samples collected within a 12-hour period using the same on-line integrated analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system. Table C1-2 provides a summary of field QC sample collection requirements. Table C1-3 provides a summary of QC sample acceptance criteria.

For on-line integrated sampling analysis systems, the on-line batch QC samples serve as combined sampling batch/analytical batch QC samples as follows:

- The on-line blank replaces the equipment blank and laboratory blank
- The on-line control sample replaces the field reference standard and laboratory control sample

- The on-line duplicate replaces the field duplicate and laboratory duplicate

The acceptance criteria for on-line batch QC samples are the same as for the sampling batch and analytical batch QC samples they replace. Acceptance criteria are shown in Table C1-3. A separate field blank shall still be collected and analyzed for each on-line batch. However, if the results of a field blank collected through the sampling manifold meets the acceptance criterion, a separate on-line blank need not be collected and analyzed.

The Permittees shall require the site project manager to monitor and document field QC sample results and fill out a nonconformance report if acceptance or frequency criteria are not met. The Permittees shall require the site project manager to ensure appropriate corrective action is taken if acceptance criteria are not met.

C1-1b(1) Field Blanks

Field blanks shall be collected to evaluate background levels of program-required analytes. Field blanks shall be collected prior to sample collection, and at a frequency of one per sampling batch. The Permittees shall require the site project manager to use the field blank data to assess impacts of ambient contamination, if any, on the sample results. Field blank results determined by gas chromatography/mass spectrometry and gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the method detection limit (**MDL**) listed in Table C3-2 in Permit Attachment C3. Field blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2. A nonconformance report shall be initiated and resolved if the final reported QC sample results do not meet the acceptance criteria.

C1-1b(2) Equipment Blanks

Equipment blanks shall be collected to assess cleanliness prior to first use after cleaning of all sampling equipment. On-line blanks will be used to assess equipment cleanliness as well as analytical contamination. After the initial cleanliness check, equipment blanks collected through the manifold shall be collected at a frequency of one per sampling batch for VOC analysis or one per day, whichever is more frequent. If the direct canister method is used, field blanks may be used in lieu of equipment blanks. The Permittees shall require the site project manager to use the equipment blank data to assess impacts of potentially contaminated sampling equipment on the sample results. Equipment blank results determined by gas chromatography/mass spectrometry or gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the MDL listed in Table C3-2 in Permit Attachment C3. Equipment blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2.

C1-1b(3) Field Reference Standards

Field reference standards shall be used to assess the accuracy with which the sampling equipment collects VOC samples into SUMMA® or equivalent canisters prior to first use of the sampling equipment. The on-line control sample will be used to assess the accuracy with which the sampling equipment collects VOC samples as well as an indicator of analytical accuracy for the on-line sampling system. Field reference standards shall contain a minimum of six of the

analytes listed in Table C3-2 in Permit Attachment C3 at concentrations within a range of 10 to 100 ppmv and greater than the MDL for each compound. Field reference standards shall have a known valid relationship to a nationally recognized standard (e.g., NIST), if available. If NIST traceable standards are not available and commercial gases are used, a Certificate of Analysis from the manufacturer documenting traceability is required. Commercial stock gases shall not be used beyond their manufacturer-specified shelf life. After the initial accuracy check, field reference standards collected through the manifold shall be collected at a frequency of one per sampling batch and submitted as blind samples to the analytical laboratory. For the direct canister method, field reference standard collection may be discontinued if the field reference standard results demonstrate the QAO for accuracy specified in Attachment C3. Field reference standard results shall be acceptable if the accuracy for each tested compound has a recovery of 70 to 130 percent.

C1-1b(4) Field Duplicates

Field duplicate samples shall be collected sequentially and in accordance with Table C1-1 to assess the precision with which the sampling procedure can collect samples into SUMMA® or equivalent canisters. Field duplicates will also serve as a measure of analytical precision for the on-line sampling system. Field duplicate results shall be acceptable if the relative percent difference is less than or equal to 25 for each tested compound found in concentrations greater than the PRQL in both duplicates.

C1-1c Equipment Testing, Inspection and Maintenance

All sampling equipment components that come into contact with headspace sample gases shall be constructed of relatively inert materials such as stainless steel or Teflon®. A passivated interior surface on the stainless steel components is recommended.

To minimize the potential for cross contamination of samples, the headspace sampling manifold and sample canisters shall be properly cleaned and leak-checked prior to each headspace-gas sampling event. Procedures used for cleaning and preparing the manifold and sample canisters shall be equivalent to those provided in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). Cleaning requirements are presented below.

C1-1c(1) Headspace-Gas Sample Canister Cleaning

SUMMA® or equivalent canisters used in these methods shall be subjected to a rigorous cleaning and certification procedures prior to use in the collection of any samples. Guidance for the development of this procedure has been derived from Method TO-14A or TO-15 (EPA 1999). Specific detailed instructions shall be provided in laboratory standard operating procedures (**SOPs**) for the cleaning and certification of canisters.

Canisters shall be cleaned and certified on an equipment cleaning batch basis. An equipment cleaning batch is any number of canisters cleaned together at one time using the same cleaning method. A cleaning system, capable of processing multiple canisters at a time, composed of an oven (optional) and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump shall be used to clean SUMMA® or equivalent canisters. Prior to cleaning, a positive or negative pressure leak test shall be performed on all canisters. The duration of the leak test must be greater than or equal to the time it takes to collect a sample,

but no greater than 24 hours. For a leak test, a canister passes if the pressure does not change by a rate greater than ±2 psig per 24 hours. Any canister that fails shall be checked for leaks, repaired, and reprocessed. One canister per equipment cleaning batch shall be filled with humid zero air or humid high purity nitrogen and analyzed for VOCs. The equipment cleaning batch of canisters shall be considered clean if there are no VOCs above three times the MDLs listed in Table C3-2 of Permit Attachment C3. After the canisters have been certified for leak-tightness and found to be free of background contamination, they shall be evacuated to 0.0039 in. (0.10 mm) Hg or less for storage prior to shipment. The Permittees shall require the laboratory responsible for canister cleaning and certification to maintain canister certification documentation and initiate the canister tags as described in Permit Attachment C3.

C1-1c(2) Sampling Equipment Initial Cleaning and Leak Check

The surfaces of all headspace-gas sampling equipment components that will come into contact with headspace gas shall be thoroughly inspected and cleaned prior to assembly. The manifold and associated sampling heads shall be purged with humidified zero air, nitrogen, or helium, and leak checked after assembly. This cleaning shall be repeated if the manifold and/or associated sampling heads are contaminated to the extent that the routine system cleaning is inadequate.

C1-1c(3) Sampling Equipment Routine Cleaning and Leak Check

The manifold and associated sampling heads which are reused shall be cleaned and checked for leaks in accordance with the cleaning and leak check procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). The procedures shall be conducted after headspace gas and field duplicate collection; after field blank collection, after field blanks are collected through the manifold; and after the additional cleaning required for field reference standard collection has been completed. The protocol for routine manifold cleaning and leak check requires that sample canisters be attached to the canister ports, or that the ports be capped or closed by valves, and requires that the sampling head be attached to the purge assembly.

VOCs shall be removed from the internal surfaces of the headspace sampling manifold to levels that are less than or equal to three times the MDLs of the analytes listed in Table C3-2 of Permit Attachment C3, as determined by analysis of an equipment blank or through use of an OVA. It is recommended that the headspace sampling manifold be heated to 150° Centigrade and periodically evacuated and flushed with humidified zero air, nitrogen, or helium. When not in use, the manifold shall be demonstrated clean before storage with a positive pressure of high purity gas (i.e., zero air, nitrogen, or helium) in both the standard and sample sides.

Sampling shall be suspended and corrective actions shall be taken when the analysis of an equipment blank indicates that the VOC limits have been exceeded or if a leak test fails. The Permittees shall require the site project manager to ensure that corrective action has been taken prior to resumption of sampling.

C1-1c(4) Manifold Cleaning After Field Reference Standard Collection

The sampling system shall be specially cleaned after a field reference standard has been collected, because the field reference standard gases contaminate the standard side of the headspace sampling manifold when they are regulated through the purge assembly. This

cleaning requires the installation of a gas-tight connector in place of the sampling head, between the flexible hose and the purge assembly. This configuration allows both the sample and standard sides of the sampling system to be flushed (evacuated and pressurized) with humidified zero air, nitrogen, or helium which, combined with heating the pneumatic lines, should sweep and adequately clean the system's internal surfaces. After this protocol has been completed and prior to collecting another sample, the routine system cleaning and leak check (see previous section) shall also be performed.

C1-1c(5) Sampling Head Cleaning

To prevent cross contamination, the needle, airtight fitting or airtight seal, adapters, and filter of the sampling heads shall be cleaned in accordance with the cleaning procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). After sample collection, a sampling head shall be disposed of or cleaned in accordance with EPA's Compendium Method TO-14A or TO-15 (EPA1999), prior to reuse. As a further QC measure, the needle, airtight fitting or airtight seal, and filter, after cleaning, should be purged with zero air, nitrogen, or helium and capped for storage to prevent sample contamination by VOCs potentially present in ambient air.

C1-1d Equipment Calibration and Frequency

The manifold pressure sensor shall be certified prior to initial use, then annually, using NIST traceable, or equivalent, standards. If necessary, the pressure indicated by the pressure sensor(s) shall be temperature compensated. The ambient air temperature sensor, if present, shall be certified prior to initial use, then annually, to NIST traceable, or equivalent, temperature standards.

The OVA shall be calibrated once per day, prior to first use, or as necessary according to the manufacturer's specifications. Calibration gases shall be certified to contain known analytes from Table C3-2 of Permit Attachment C3 at known concentrations. The balance of the OVA calibration gas shall be consistent with the manifold purge gas when the OVA is used (i.e., zero air, nitrogen, or helium).

C1-2 Sampling of Homogeneous Solids and Soil/Gravel (Summary Categories S3000/S4000)

For those waste streams without an AK Sufficiency Determination approved by DOE, randomly selected containers of homogeneous solid and/or soil/gravel waste streams (S3000/S4000) shall be sampled and analyzed to resolve the assignment of EPA hazardous waste numbers. For example, analytical results may be useful to resolve uncertainty regarding hazardous constituents used in a process that generated the waste stream when the hazardous constituents are not documented in the acceptable knowledge information for the waste.

C1-2a Method Requirements

The methods used to collect samples of transuranic (**TRU**) mixed waste, classified as homogeneous solids and soil/gravel from waste containers, shall be such that the samples are representative of the waste from which they were taken. To minimize the quantity of investigation-derived waste, laboratories conducting the analytical work may require no more sample than is required for the analysis, based on the analytical methods. However, a sufficient number of samples shall be collected to adequately represent waste being sampled. For those

waste streams defined as Summary Category Groups S3000 or S4000 in Attachment C, debris that may also be present within these wastes need not be sampled.

Samples of retrievably stored waste containers will be collected using appropriate coring equipment or other EPA approved methods to collect a representative sample. Newly generated wastes that are sampled from a process as it is generated may be sampled using EPA approved methods, including scoops and ladles, that are capable of collecting a representative sample. All sampling and core sampling will comply with the QC requirements specified in C1-2b.

C1-2a(1) Core Collection

Coring tools shall be used to collect cores of homogeneous solids and soil/gravel from waste containers, when possible, in a manner that minimizes disturbance to the core. A rotational coring tool (i.e., a tool that is rotated longitudinally), similar to a drill bit, to cut, lift the waste cuttings, and collect a core from the bore hole, shall be used to collect sample cores from waste containers. For homogeneous solids and soil/gravel that are relatively soft, non-rotational coring tools may be used in lieu of a rotational coring tool.

To provide a basis for describing the requirements for core collection, diagrams of a rotational coring tool (i.e., a light weight auger) and a non-rotational coring tool (i.e., a thin-walled sampler) are provided in Figures C1-5 and C1-6, respectively.

The following requirements apply to the use of coring tools:

- Each coring tool shall contain a removable tube (liner) that is constructed of fairly rigid material unlikely to affect the composition and/or concentrations of target analytes in the sample core. Materials that are acceptable for use for coring device sleeves are polycarbonate, teflon, or glass for most samples, and stainless steel or brass if samples are not to be analyzed for metals. The Permittees shall require site quality assurance project plans (**QAPjPs**) to document that analytes of concern are not present in liner material. The Permittees shall also require sites to document that the materials are unlikely to affect sample results through the collection and analysis of an equipment blank prior to first use as specified in the 'Equipment Blanks' section of this appendix. Liner outer diameter is recommended to be no more than 2 in. and no less than one in. Liner wall thickness is recommended to be no greater than 1/16 in. Before use, the liner shall be cleaned in accordance the requirements in Section C1-2b. The liner shall fit flush with the inner wall of the coring tool and shall be of sufficient length to hold a core that is representative of the waste along the entire depth of the waste. The depth of the waste is calculated as the distance from the top of the sludge to the bottom of the drum (based on the thickness of the liner and the rim at the bottom of the drum). The liner material shall have sufficient transparency to allow visual examination of the core after sampling. If sub-sampling is not conducted immediately after core collection and liner extrusion, then end caps constructed of material unlikely to affect the composition and/or concentrations of target analytes in the core (e.g., Teflon®) shall be placed over the ends of the liner. End caps shall fit tightly to the ends of the liner. The Permittees shall require site specific QAPjPs to indicate the acceptable materials for core liners and end caps.

- A spring retainer, similar to that illustrated in Figures C1-5 and C1-6, shall be used with each coring tool when the physical properties of the waste are such that the waste may fall out of the coring tool's liner during sampling activities. The spring retainer shall be constructed of relatively inert material (e.g., stainless steel or Teflon®) and its inner diameter shall not be less than the inner diameter of the liner. Before use, spring retainers shall be cleaned in accordance with the requirements in Section C1-2b.

- Coring tools may have an air-lock mechanism that opens to allow air inside the liners to escape as the tool is pressed into the waste (e.g., ball check valve). If used, this air-lock mechanism shall also close when the core is removed from the waste container.

- After disassembling the coring tool, a device (extruder) to forcefully extrude the liner from the coring tool shall be used if the liner does not slide freely. All surfaces of the extruder that may come into contact with the core shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- Coring tools shall be of sufficient length to hold the liner and shall be constructed to allow placement of the liner leading edge as close as possible to the coring tools leading edge.

- All surfaces of the coring tool that have the potential to contact the sample core or sample media shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- The leading edge of the coring tools may be sharpened and tapered to a diameter equivalent to, or slightly smaller than, the inner diameter of the liner to reduce the drag of the homogeneous solids and soil/gravel against the internal surfaces of the liner, thereby enhancing sample recovery.

- Rotational coring tools shall have a mechanism to minimize the rotation of the liner inside the coring tool during coring activities, thereby minimizing physical disturbance to the core.

- Rotational coring shall be conducted in a manner that minimizes transfer of frictional heat to the core, thereby minimizing potential loss of VOCs.

- Non-rotational coring tools shall be designed such that the tool's kerf width is minimized. Kerf width is defined as one-half of the difference between the outer diameter of the tool and the inner diameter of the tool's inlet.

C1-2a(2) Sample Collection

Sampling of cores shall be conducted in accordance with the following requirements:

- Sampling shall be conducted as soon as possible after core collection. If a substantial delay (i.e., more than 60 minutes) is expected between core collection and sampling, the core shall remain in the liner and the liner shall be capped at each end. If the liner containing the core is not extruded from the coring tool and capped, then two alternatives are permissible: 1) the liner shall be left in the coring tool and the coring

tool shall be capped at each end, or 2) the coring tool shall remain in the waste container with the air-lock mechanism attached.

- Samples of homogeneous solids and soil/gravel for VOC analyses shall be collected prior to extruding the core from the liner. These samples may be collected by collecting a single sample from the representative subsection of the core, or three sub-samples may be collected from the vertical core to form a single 15-gram composite sample. Smaller sample sizes may be used if method PRQL requirements are met for all analytes. The sampling locations shall be randomly selected. If a single sample is used, the representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). If the three sub-sample method is used, the sampling locations shall be randomly selected within three equal-length subsections of the core along the long axis of the liner and access to the waste shall be gained by making a perpendicular cut through the liner and the core. The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. A sampling device such as the metal coring cylinder described in EPA's SW-846 Manual (1996), or equivalent, shall be immediately used to collect the sample once the core has been exposed to air. Immediately after sample collection, the sample shall be extruded into 40-ml volatile organics analysis (**VOA**) vials (or other containers specified in appropriate SW-846 methods), the top rim of the vial visually inspected and wiped clean of any waste residue, and the vial cap secured. Sample handling requirements are outlined in Table C1-4. Additional guidance for this type of sampling can be found in SW-846 (EPA 1996).

- Samples of the homogeneous solids and soil/gravel for semi-volatile organic compound and metals analyses shall be collected. These samples may be collected from the same sub-sample locations and in the same manner as the sample collected for VOC analysis, or they may be collected by splitting or compositing the representative subsection of the core. The representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. Guidance for splitting and compositing solid materials can be found in SW-846 (EPA 1996). All surfaces of the sampling tools that have the potential to come into contact with the sample shall be constructed of materials unlikely to affect the composition or concentrations of target analytes in the waste (e.g., Teflon®). In addition, all surfaces that have the potential to come into contact with core sample media shall either be disposed or decontaminated according to the procedures found in Section C1-2(b). Sample sizes and handling requirements are outlined in Table C1-4.

Newly generated waste samples may be collected using methods other than coring, as discussed in Section C1-2a. Newly generated wastes samples will be collected as soon as possible after sampling, but the spatial and temporal homogeneity of the waste stream dictate

whether a representative grab sample or composite sample shall be collected. As part of the site audit, DOE shall assess waste sampling to ensure collection of representative samples.

C1-2b Quality Control

QC requirements for sampling of homogeneous solids and soil/gravel include collecting co-located samples from cores or other sample types to determine precision; equipment blanks to verify cleanliness of the sampling and coring tools and sampling equipment; and analysis of reagent blanks to ensure reagents, such as deionized or high pressure liquid chromatography (**HPLC**) water, are of sufficient quality. Coring and sampling of homogeneous solids and soil/gravel shall comply, at minimum, with the following QC requirements.

C1-2b(1) Co-located Samples

In accordance with the requirement to collect field duplicates required by the EPA methods found in SW-846 (EPA 1996), samples shall be collected to determine the combined precision of the coring and sampling procedures. The co-located core methodology is a duplicate sample collection methodology intended to collect samples from a second core placed at approximately the same location within the drum when samples are collected by coring. Waste may not be amenable to coring in some instances. In this case, a co-located sample may be collected from a sample (e.g. scoop) collected from approximately the same location in the waste stream. A sample from each co-located core or waste sample collected by other means shall be collected side by side as close as feasible to one another, handled in the same manner, visually inspected through the transparent liner (if cored), and sampled in the same manner at the same randomly selected sample location(s). If the visual examination detects inconsistencies such as color, texture, or waste type in the waste at the sample location, another sampling location may be randomly selected, or the samples may be invalidated and co-located samples or cores may again be collected. Co-located samples, from either core or other sample type, shall be collected at a frequency of one per sampling batch or once per week, whichever is more frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

C1-2b(2) Equipment Blanks

In accordance with SW-846 (EPA 1996), equipment blanks shall be collected from fully assembled sampling and coring tools (i.e., at least those portions of the sampling equipment that contact the sample) prior to first use after cleaning at a frequency of one per equipment cleaning batch. An equipment cleaning batch is the number of sampling equipment items cleaned together at one time using the same cleaning method. The equipment blank shall be collected from the fully assembled sampling or coring tool, in the area where the sampling or coring tools are cleaned, prior to covering with protective wrapping and storage. The equipment blank shall be collected by pouring clean water (e.g., deionized water, HPLC water) down the inside of the assembled sampling or coring tool. The water shall be collected in a clean sample container placed at the leading edge of the sampling or coring tool and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the analysis indicates no analyte at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 or in the Program Required Detection Limits (**PRDL**) in Table C3-8 of Permit Attachment C3. If analytes

are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling or coring tools shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Equipment blanks for coring tools shall be collected from liners that are cleaned separately from the coring tools. These equipment blanks shall be collected at a frequency of one per equipment cleaning batch. The equipment blanks shall be collected by randomly selecting a liner from the equipment cleaning batch, pouring clean water (e.g., deionized water or HPLC water) across its internal surface, collecting the water in a clean sample container, and analyzing the water for the analytes listed in Tables C3-4, C3-6, and the PRDLs in Table C3-8 of Permit Attachment C3. The results of the equipment blank analysis will be considered acceptable if the results indicate no analyte at a concentration greater than three times the MDLs listed in Tables C3-4, C3-6, or C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of liners shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Sampling equipment (e.g., bowls, spoons, chisel, VOC sub-sampler) shall also be cleaned. Equipment blanks shall be collected for the sampling equipment at a frequency of one per equipment cleaning batch. After the sampling equipment has been cleaned, one item from the equipment cleaning batch is randomly selected, water (e.g., deionized water, HPLC water) is passed over its surface, collected in a clean container, and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the results indicate no analyte present at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 and in the PRDLs in C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank. The above equipment blanks may be performed on a purchased batch basis for sampling equipment purchased sterile and sealed in protective packaging. Equipment blanks need not be performed for equipment purchased in sealed protective packaging accompanied by a certificate certifying cleanliness.

The results of equipment blanks shall be traceable to the items in the equipment cleaning batch that the equipment blank represents. All sampling items should be identified, and the associated equipment cleaning batch should be documented. The method of documenting the connection between equipment and equipment cleaning batches shall be documented. Equipment blank results for the coring tools, liners, and sampling equipment shall be reviewed prior to use. A sufficient quantity of these items should be maintained in storage to prevent disruption of sampling operations.

The Permittees may require a site to use certified clean disposable sampling equipment and discard liners and sampling tools after one use. In this instance, cleaning and equipment blank collection is not required.

C1-2b(3) Coring Tool and Sampling Equipment Cleaning

Coring tools and sampling equipment shall be cleaned in accordance with the following requirements:

- All surfaces of coring tools and sampling equipment that will come into contact with the samples shall be clean prior to use. All sampling equipment shall be cleaned in the same manner. Immediately following cleaning, coring tools and sampling equipment shall be assembled and sealed inside clean protective wrapping.

- Each reusable sampling or coring tool shall have a unique identification number. Each number shall be referenced to the waste container on which it was used. This information shall be recorded in the field records. One sampling or coring tool from each equipment cleaning batch shall be tested for cleanliness in accordance with the requirements specified above. The identification number of the sampling or coring tool from which the equipment blank was collected shall be recorded in the field records. The results of the equipment blank analysis for the equipment cleaning batch in which each sampling or coring tool was cleaned shall be submitted to the sampling facility with the identification numbers of all sampling or coring tools in the equipment cleaning batch. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

- Sample containers shall be cleaned in accordance with SW-846 (EPA 1996).

C1-2c Equipment Testing, Inspection and Maintenance

Prior to initiation of sampling or coring activities, sampling and coring tools shall be tested in accordance with manufacturer specifications to ensure operation within the manufacturer's tolerance limits. Other specifications specific to the sampling operations (e.g., operation of containment structure and safety systems) should also be tested and verified as operating properly prior to initiating coring activities. Coring tools shall be assembled, including liners, and tested. Air-lock mechanisms and rotation mechanisms shall be inspected for free movement of critical parts. Sampling and coring tools found to be malfunctioning shall be repaired or replaced prior to use.

Coring tools and sample collection equipment shall be maintained in accordance with manufacturer's specifications. Clean sampling and coring tools and sampling equipment shall be sealed inside clean protective wrapping and maintained in a clean storage area prior to use. Sampling equipment shall be properly maintained to avoid contamination. A sufficient supply of spare parts should be maintained to prevent delays in sampling activities due to equipment down time. Records of equipment maintenance and repair shall be maintained in the field records in accordance with site SOPs.

Inspection of sampling equipment and work areas shall include the following:

- Sample collection equipment in the immediate area of sample collection shall be inspected daily for cleanliness. Visible contamination on any equipment (e.g., waste on

floor of sampling area, hydraulic fluid from hoses) that has the potential to contaminate a waste core or waste sample shall be thoroughly cleaned upon its discovery.

- The waste coring and sampling work areas shall be maintained in clean condition to minimize the potential for cross contamination between waste (including cores) and samples.

- Expendable equipment (e.g., plastic sheeting, plastic gloves) shall be visually inspected for cleanliness prior to use and properly discarded after each sample.

- Prior to removal of the protective wrapping from a coring tool designated for use, the condition of the protective wrapping shall be visually assessed. Coring tools with torn protective wrapping should be returned for cleaning. Coring tools visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Sampling equipment shall be visually inspected prior to use. All sampling equipment that comes into contact with waste samples shall be stored in protective wrapping until use. Prior to removal of the protective wrapping from sampling equipment, the condition of the protective wrapping shall be visually assessed. Sampling equipment with torn protective wrapping should be discarded or returned for cleaning. Sampling equipment visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Cleaned sampling and coring equipment will be physically segregated from all equipment that has been used for a sampling event and has not been decontaminated.

C1-2d Equipment Calibration and Frequency

The scale used for weighing sub-samples shall be calibrated as necessary to maintain its operation within manufacturer's specification, and after repairs and routine maintenance. Weights used for calibration shall be traceable to a nationally recognized standard. Calibration records shall be maintained in the field records.

C1-3 Radiography

Radiography has been developed by the Permittees specifically to aid in the examination and identification of containerized waste. The Permittees shall require that sites describe all activities required to achieve the radiography objectives in site QAPjPs and SOPs. These SOPs should include instructions specific to the radiography system(s) used at the site. For example, to detect liquids, some systems require the container to be rotated back and forth while other systems require the container to be tilted.

A radiography system (e.g., real time radiography, digital radiography/computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, an audio/video recording system, and an operator control and data acquisition station. Although these six components are required, it is expected there will be some variation within a given component between sites. The radiography system shall have controls or an equivalent process which allow the operator to control image quality. On some radiography systems, it should be possible to vary the voltage, typically

between 150 to 400 kilovolts (**kV**), to provide an optimum degree of penetration through the waste. For example, high-density material should be examined with the X-ray device set on the maximum voltage. This ensures maximum penetration through the waste container. Low-density material should be examined at lower voltage settings to improve contrast and image definition. The imaging system typically utilizes either a fluorescent screen and a low-light television camera or x-ray detectors to generate the image.

To perform radiography, the waste container is scanned while the operator views the television screen. A video and audio recording is made of the waste container scan and is maintained as a non-permanent record. A radiography data form is also used to document the Waste Matrix Code to ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary. Containers whose contents prevent full examination of the remaining contents shall be subject to visual examination unless the site certifies that visual examination would provide no additional relevant information for that container based on the acceptable knowledge information for the waste stream. Such certification shall be documented in the generator/storage site's record.

For containers which contain classified shapes and undergo radiography, the radiography video and audio recording will be considered classified. The radiography data forms will not contain classified information.

The radiography system involves qualitative and semiquantitative evaluations of visual displays. Operator training and experience are the most important considerations for ensuring quality controls in regard to the operation of the radiography system and for interpretation and disposition of radiography results. Only trained personnel shall be allowed to operate radiography equipment.

Standardized training requirements for radiography operators shall be based upon existing industry standard training requirements.

The Permittees shall require each site to develop a training program that provides radiography operators with both formal and on-the-job (**OJT**) training. Radiography operators shall be instructed in the specific waste generating practices, typical packaging configurations, and associated waste material parameters expected to be found in each Waste Matrix Code at the site. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography operator prior to qualification of the training candidate. The training programs will be site-specific due to differences in equipment, waste configurations, and the level of waste characterization efforts. For example, certain sites use digital radiography equipment, which is more sensitive than real-time radiography equipment. In addition, the particular physical forms and packaging configurations at each site will vary; therefore, radiography operators shall be trained on the types of waste that are generated, stored, and/or characterized at that particular site.

Although the Permittees shall require each site to develop its own training program, all of the radiography QC requirements specified in this WAP shall be incorporated into the training programs and radiography operations. In this way data quality and comparability will not be affected.

Radiography training programs will be the subject of the Audit and Surveillance Program (Permit Attachment C6).

One or more training containers with items (including prohibited items) common to the waste streams to be characterized and internal containers of various sizes shall be scanned semiannually by each operator. The audio and video media shall then be reviewed by a supervisor to ensure that operators' interpretations remain consistent and accurate. Imaging system characteristics shall be verified on a routine basis.

Independent replicate scans and replicate observations of the video output of the radiography process shall be performed under uniform conditions and procedures. Independent replicate scans shall be performed on one waste container per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. Independent observations of one scan (not the replicate scan) shall also be made once per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. A testing batch is a suite of waste containers undergoing radiography using the same testing equipment. A testing batch can be up to 20 waste containers without regard to waste matrix.

Oversight functions include periodic audio/video media reviews of accepted waste containers and shall be performed by qualified radiography operators that were not involved in the original scans of the waste containers. The results of this independent verification shall be available to the radiography operators who performed the original scans. The Permittees shall require the site project manager to be responsible for monitoring the quality of the radiography data and calling for corrective action, when necessary.

C1-4 Visual Examination

The waste container contents may be verified directly by visual examination (**VE**) of the waste container contents. Visual examination may be performed by physically examining the contents of waste containers to verify the Waste Matrix Code and to verify that the container is properly included in the appropriate waste stream. Visual examination shall be conducted on a waste container to identify and describe all waste items, packaging materials, and waste material parameters in the waste container. Visual examination activities shall be documented on video/audio media, or by using a second operator to provide additional verification by reviewing the contents of the waste container to ensure correct reporting. When VE is performed using a second operator, each operator performing the VE shall observe for themselves the waste being placed in the waste container or the contents within the examined waste container when waste is not removed. The results of all VE shall be documented on VE data forms, which are used to document the Waste Matrix Code, ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary.

Field Code Changed

Visual examination recorded on video/audio media shall meet the following minimum requirements:

- The video/audio media shall record the waste packaging event for the container such that all waste items placed into the container are recorded in sufficient detail and shall

contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.

- The video/audio media shall capture the waste container identification number.
- The personnel loading the waste container shall be identified on the video/audio media or on packaging records traceable to the loading of the waste container.
- The date of loading of the waste container will be recorded on the video/audio media or on packaging records traceable to the loading of the waste container.

Visual examination performed using two generator site personnel shall meet the following minimum requirements:

- At least two generator site personnel who witnessed the packaging of the waste shall approve the data forms or packaging records attesting to the contents of the waste container.
- The data forms or packaging records shall contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.
- The waste container identification number shall be recorded on the data forms or packaging records.

Visual examination video/audio media of containers which contain classified shapes shall be considered classified information. Visual examination data forms or packaging records will not contain classified information.

Waste container packaging records may be used to meet the VE data quality objectives (**DQOs**) (Permit Attachment C, Section C-4a(1)). These records must meet the minimum requirements listed above for either VE recorded on video/audio media or VE performed by two generator/storage site personnel, and shall be reviewed by operators trained and qualified to the requirements listed below. The operators will prepare data forms based on the visual examination records. Visual examination batch data reports will be prepared, reviewed, and approved as described in Permit Attachment C, Section C-4, and Permit Attachment C3.

Standardized training for VE shall be developed. Visual examination operators shall be instructed in the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code at the site. The training shall be site specific to include the various waste configurations generated/stored at the site. For example, the particular physical forms and packaging configurations at each site will vary so operators shall be trained to examine the types of waste that are generated, stored, and/or characterized at that particular site. Training will include the following regardless of Summary Category Group:

- Identifying and describing the contents of a waste container by examining all items in waste containers of previously packaged waste
- Identifying when VE cannot be used to meet the DQOs

Visual examination personnel shall be requalified once every two years.

Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste generating processes that have taken place at that site and also be familiar with all of the types of waste being characterized at that site. The VE expert shall be responsible for the overall direction and implementation of the VE at that facility. The Permittees shall require site QAPjPs to specify the selection, qualification, and training requirements of the VE expert.

C1-5 Custody of Samples

Chain-of-Custody on field samples (including field QC samples) will be initiated immediately after sample collection or preparation. Sample custody will be maintained by ensuring that samples are custody sealed during shipment to the laboratory. After samples are accepted by the analytical laboratory, custody is maintained by assuring the samples are in the possession of an authorized individual, in that individual's view, in a sealed or locked container controlled by that individual, or in a secure controlled access location. Sample custody will be maintained until the sample is released by the site project manager or until the sample is expended. The Permittees shall require that site QAPjPs or site-specific procedures include a copy of the sample chain-of-custody form and instructions for completing sample chain-of-custody forms in a legally defensible manner. This form will include provisions for each of the following:

- Signature of individual initiating custody control, along with the date and time.
- Documentation of sample numbers for each sample under custody. Sample numbers will be referenced to a specific sampling event description that will identify the sampler(s) through signature, the date and time of sample collection, type/number containers for each sample, sample matrix, preservatives (if applicable), requested methods of analysis, place/address of sample collection and the waste container number.
- For off-site shipping, method of shipping transfer, responsible shipping organization or corporation, and associated air bill or lading number.
- Signatures of custodians relinquishing and receiving custody, along with date and time of the transfer.
- Description of final sample container disposition, along with signature of individual removing sample container from custody.
- Comment section.
- Documentation of discrepancies, breakage or tampering.

All samples and sampling equipment will be identified with unique identification numbers. Sampling Coring tools and equipment will be identified with unique equipment numbers to ensure that all sampling equipment, coring tools, and sampling canisters are traceable to equipment cleaning batches.

All samples will be uniquely identified to ensure the integrity of the sample and can be used to identify the generator/storage site and date of collection. Sample tags or labels will be affixed to all samples and will identify at a minimum:

- Sample ID number
- Sampler initials and organization
- Ambient temperature and pressure (for gas samples only)
- Sample description
- Requested analyses
- Data and time of collection
- QC designation (if applicable)

C1-6 Sample Packing and Shipping

In the event that the analytical facilities are not at the generator/storage site, the samples shall be packaged and shipped to an off-site laboratory. Sample containers shall be packed to prevent any damage to the sampling container and maintain the preservation temperature, if necessary. Department of Transportation (**DOT**) regulations shall be adhered to for shipment of the package.

When preparing SUMMA® or equivalent canisters for shipment, special care shall be taken with the pressure gauge and the associated connections. Metal boxes which have separate compartments, or cardboard boxes with foam inserts are standard shipping containers. The chosen shipping container shall meet selected DOT regulations. If temperatures shall be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package.

Glass jars are wrapped in bubble wrap or another type of protection. The wrapped jar should be placed in a plastic bag inside of the shipping container, so that if the jar breaks, the inside of the shipping container and the other samples will not be contaminated. The plastic bag will enable the receiving analytical lab to prevent contamination of their shipping and receiving area. Plastic jars do not present a problem for shipping purposes. All shipping containers will contain appropriate blank samples to detect any VOC cross-contamination. A DOT approved cooler, or similar package may be used as the shipping container. If temperatures must be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package. If fill material is needed, compatibility between the samples and the fill should be evaluated prior to use.

All sample containers should be affixed with signed tamper-proof seals or devices so that it is apparent if the sample integrity has been compromised and that the identity of the seal or device is traceable to the individual who affixed the seal. A seal should also be placed on the outside of the shipping container for the same reason. Sample custody documentation shall be placed inside the sealed or locked shipping container, with the current custodian signing to release custody. Transfer of custody is completed when the receiving custodian opens the shipping container and signs the custody documentation. The shipping documentation will serve to track the physical transfer of samples between the two custodians.

A Uniform Hazardous Waste Manifest is not required, since samples are exempted from the definition of hazardous waste under RCRA. All other shipping documentation specified in the

site specific SOP for sample shipment (i.e., bill of lading, site-specific shipping documentation) is required.

C1-7 List of References

Bechtel BWXT Idaho, LLC (BWXT), 2000, Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations, INEEL/EXT-2000-01207, October 2000, Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

Lockheed Idaho Technologies Company, 1995, Position for Determining Gas Phase Volatile Organic Compound Concentrations in Transuranic Waste Containers, INEL-95/0109/Revision 1, M.J. Connolly, et. al.

U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/10b, January 1999).

U.S. Environmental Protection Agency (EPA), 1996. Test Methods for Evaluating Solid Waste, "Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. EPA, OSW and ER, Washington D.C.

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TABLES

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Table C1-1
Gas Sample Requirements

Parameter	Container [a]	Minimum Drum Headspace Sample Volume [b]	Holding Temperatures
VOCs	SUMMA® Canister	250 ml	0-40 °C

[a] Alternately, canisters that meet QAOs may be used.

[b] Alternatively, if available headspace is limited, a single 100 ml sample may be collected for determination of VOCs.

Table C1-2
Summary of Drum Field QC Headspace Sample Frequencies

QC Samples	Manifold	Direct Canister	On-Line Systems
Field blanks [a]	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]
Equipment blanks [b]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field reference standards [c]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field duplicates	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]

[a] Analysis of field blanks for VOCs (Table C3-2 of Attachment C3), only, is required. For on-line integrated sampling/analysis systems, if field blank results meet the acceptance criterion, a separate on-line blank is not required.

[b] One equipment blank or on-line sample shall be collected, analyzed for VOCs (Table C3-2), and demonstrated clean prior to first use of the headspace gas sampling equipment with each of the sampling heads, then at the specified frequency, for VOCs only thereafter. Daily, prior to work, the sampling manifold, if in use, shall be verified clean using an OVA.

[c] One field reference standard or on-line control sample shall be collected, analyzed, and demonstrated to meet the QAOs specified in Permit Attachment C3 prior to first use, then at the specified frequency thereafter.

[d] A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

[e] One equipment blank and field reference standard shall be collected after equipment purchase, cleaning, and assembly.

[f] An on-line batch is the number of samples collected within a 12-hour period using the same on-line integrated sampling/analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system.

Table C1-3
Summary of Sampling Quality Control Sample Acceptance Criteria

QC Sample	Acceptance Criteria	Corrective Action [a]
Field blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any VOC amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Equipment blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 of for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any analyte amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Field reference standards or on-line control sample	70 - 130 %R	Nonconformance if %R < 70 or > 130
Field duplicates or on-line duplicate	RPD ≤ 25	Nonconformance if RPD > 25

[a] Corrective action is only required if the final reported QC sample results do not meet the acceptance criteria.

MDL = Method detection limit

%R = Percent recovery

RPD = Relative percent difference

Table C1-4
Sample Handling Requirements for Homogeneous Solids and Soil/Gravel

Parameter	Suggested Quantity [a]	Required Preservative	Suggested Container	Maximum Holding Time [b]
VOCs	15 grams	Cool to 4°C	Glass Vial [c]	14 Days Prep/ 40 Days Analyze [d]
SVOCs	50 grams	Cool to 4°C	Glass Jar [e]	14 Days Prep/ 40 Days Analyze [d]
Metals	10 grams	Cool to 4°C	Plastic Jar [f]	180 Days [g]

[a] Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.

[b] Holding time begins at sample collection (holding times are consistent with SW-846 requirements).

[c] 40-ml VOA vial or other appropriate containers shall have an airtight cap.

[d] 40-day holding time allowable only for methanol extract - 14-day holding time for non-extracted VOCs.

[e] Appropriate containers should be used and should have Teflon® lined caps.

[f] Polyethylene or polypropylene preferred, glass jar is allowable.

[g] Holding time for mercury analysis is 28 days.

Note: Preservation requirements in the most recent version of SW-846 may be used if appropriate.

Table C1-5
Headspace Gas Drum Age Criteria Sampling Scenarios

Scenario	Description
1	A. Unvented 55-gallon drums without rigid poly liners are sampled through the drum lid at the time of venting. B1. Unvented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. B2. Vented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. C. Unvented 55-gallon drums with vented rigid poly liners are sampled through the drum lid at the time of venting.
2	55-gallon drums that have met the criteria for Scenario 1 and then are vented, but not sampled at the time of venting. [a]
3	Containers (i.e., 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, SLB2s and pipe components) that are initially packaged in a vented condition and sampled in the container headspace and containers that are not sampled under Scenario 1 or 2.

[a] Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. This requires the additional information required of each container in Scenario 3 (i.e., determination of packaging configuration), and such containers can only be sampled after meeting the appropriate Scenario 3 DAC.

Table C1-6
Scenario 1 Drum Age Criteria (in days) Matrix

Summary Category Group	DAC (Days)
S5000	53

Note: Containers that are sampled using the Scenario 1 DAC do not require information on the packaging configuration because the Scenario 1 DAC are based on a bounding packaging configuration. In addition, information on the rigid liner vent hole presence and diameter do not apply to containers that are sampled using the Scenario 1 DAC because they are unvented prior to sampling.

Table C1-7
Scenario 2 Drum Age Criteria (in days) Matrix

	Summary Category Group S5000			
Filter H_2 Diffusivity [a]	**Rigid Liner Vent Hole Diameter (in) [b]**			
(mol/s/mod fraction)	0.30	0.375	0.75	1.0
1.9×10^{-6}	29	22	13	12
3.7×10^{-6}	25	20	12	11
3.7×10^{-5}	7	6	6	4

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging (Attachment C, Section C-3d(1)), repackaging (Attachment C, Section C-3d(1)), and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

Note: Containers that are sampled using the Scenario 2 DAC do not require information on the packaging configuration because the Scenario 2 DAC are based on a bounding packaging configuration.

Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

1

Table C1-9
Scenario 3 Drum Age Criteria (In Days) Matrix for S5000 Waste by Packaging Configuration Group

Packaging Configuration Group 1						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	131	95	37	24	4	4
3.7×10^{-6}	111	85	36	24	4	4
3.7×10^{-5}	28	28	23	19	4	4
Packaging Configuration Group 2						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	175	138	75	60	30	11
3.7×10^{-6}	152	126	73	59	30	11
3.7×10^{-5}	58	57	52	47	28	8
Packaging Configuration Group 3						
	Rigid Liner Vent Hole Diameter [b]					
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole	No Liner Lid	No Liner
1.9×10^{-6}	199	161	96	80	46	16
3.7×10^{-6}	175	148	93	79	46	16
3.7×10^{-5}	72	72	67	62	42	10
Packaging Configuration Group 4						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Headspace Sample Taken Inside Pipe Component					
$> 1.9 \times 10^{-6}$	152					
Packaging Configuration Group 5						
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP/SLB2					
$> 7.4 \times 10^{-6}$ (SWB)	15					
3.33×10^{-5} (TDOP)	15					
6.60×10^{-4} (SLB2)	21					

Packaging Configuration Group 6			
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	**Headspace Sample Taken Inside SWB/TDOP/SLB2**		
> 7.4×10^{-6} (SWB)	56		
3.33×10^{-5} (TDOP)	56		
6.60×10^{-4} (SLB2)	56		
Packaging Configuration Group 7 [d]			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction) [a]**		
	7.4×10^{-6}	**1.85×10^{-5}**	**9.25×10^{-5} [e]**
3.7×10^{-6}	13	7	2
7.4×10^{-6}	10	6	2
1.85×10^{-5}	6	4	2
Packaging Configuration Group 8			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	**Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction)**		
	7.4×10^{-6}		
3.7×10^{-6}	21		

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

[c] The filter H_2 diffusivity for SWBs, TDOPs, or SLB2s is the sum of the diffusivities for all of the filters on the container because SWBs, TDOPs, and SLB2s have more than 1 filter.

[d] Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable. Packaging Configuration Group 7 DAC values apply to drums with up to two lids.

[e] While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section C1-1a (i.e., 72 hours at 18°C or higher). The equilibrium requirement for headspace gas sampling shall be met separately.

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FIGURES

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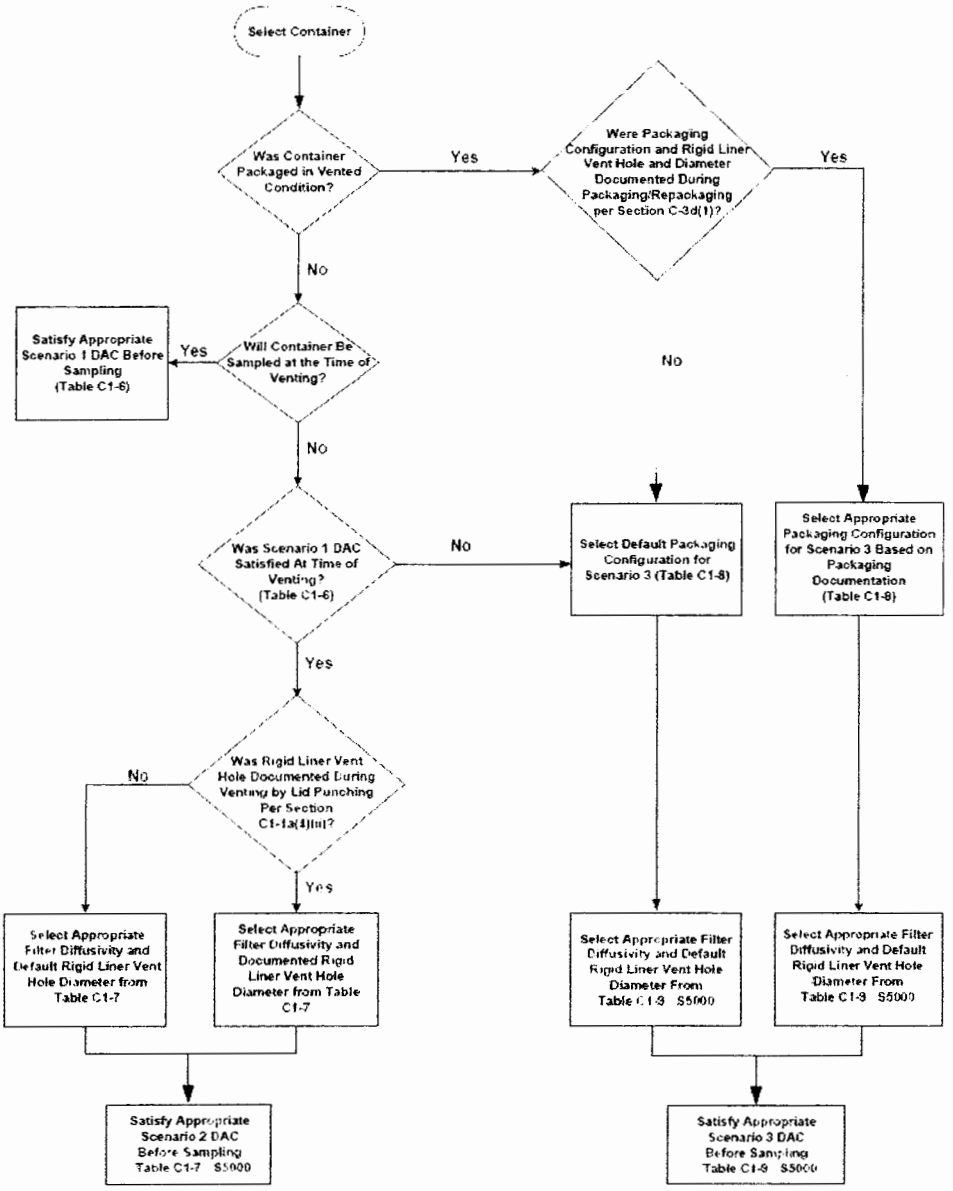

Figure C1-1
Headspace Gas Drum Age Criteria Sampling Scenario Selection Process

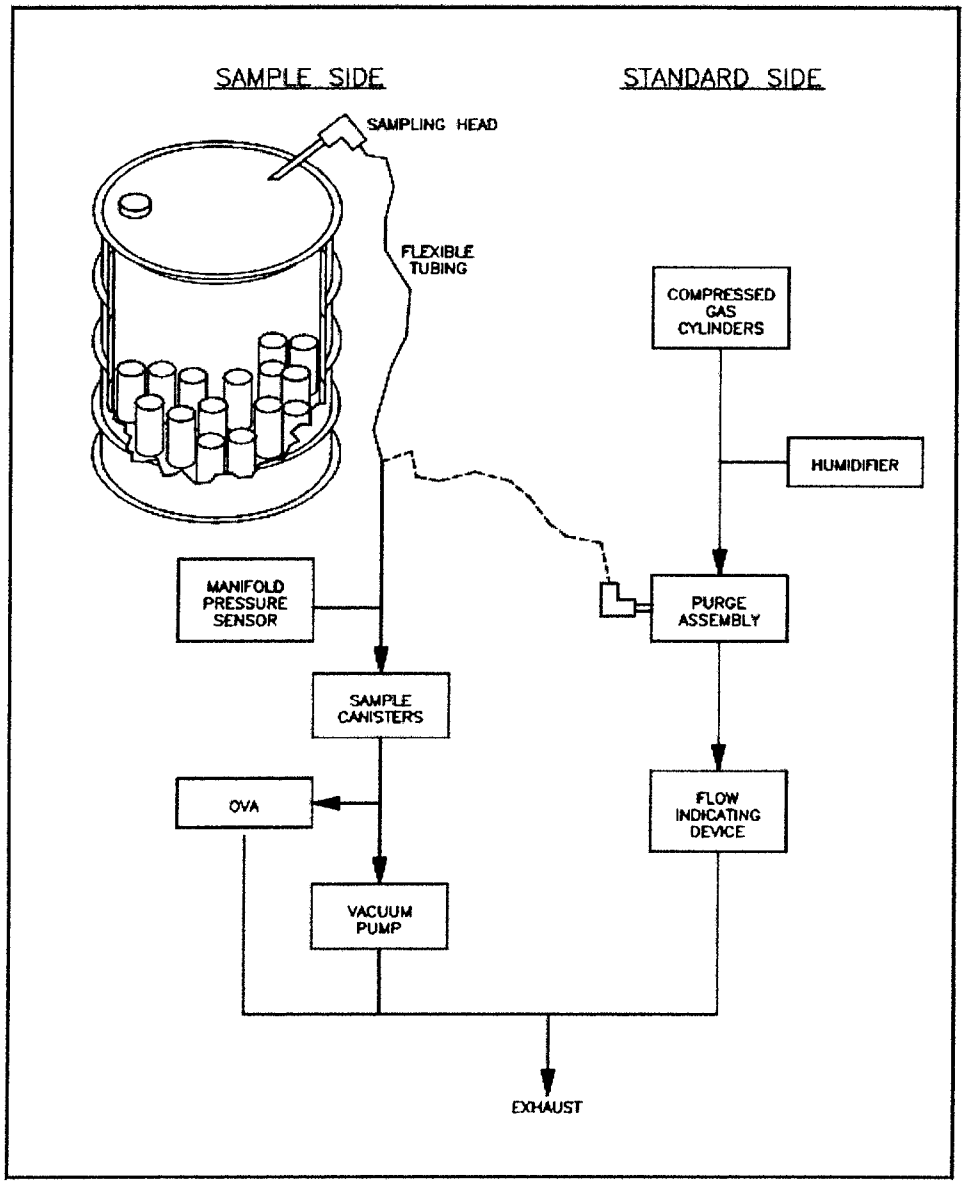

Figure C1-2
Headspace Sampling Manifold

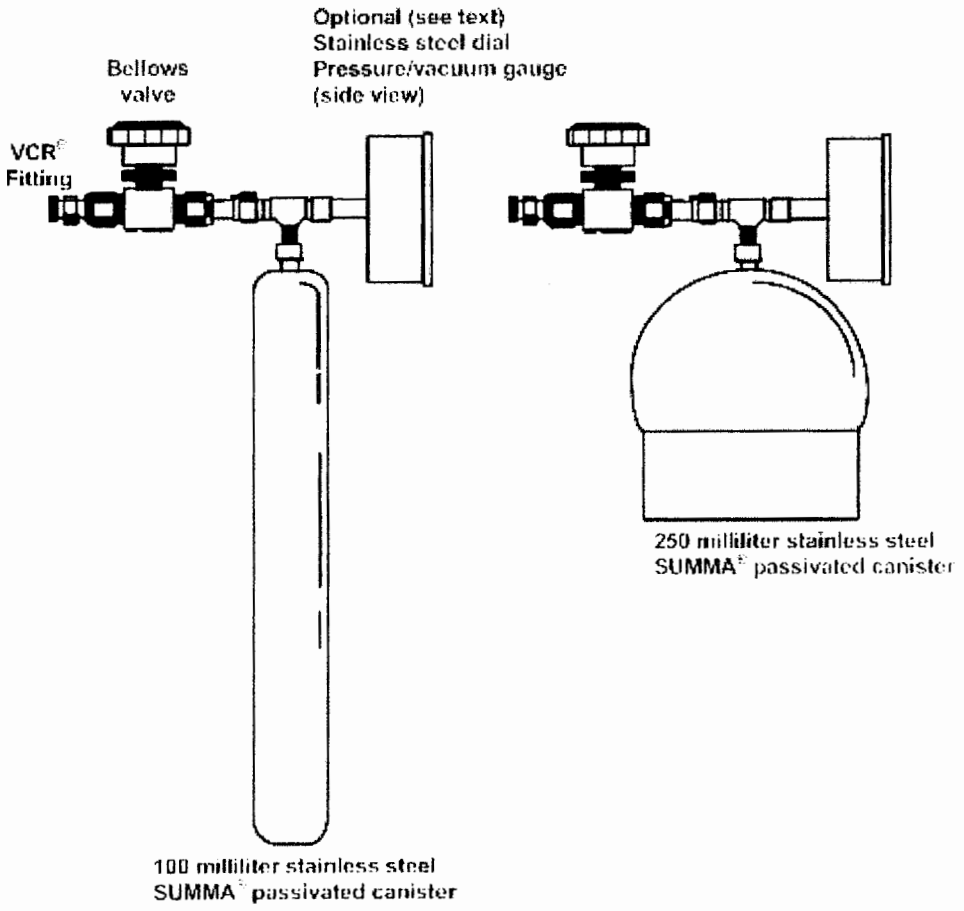

Figure C1-3
SUMMA® Canister Components Configuration (Not to Scale)

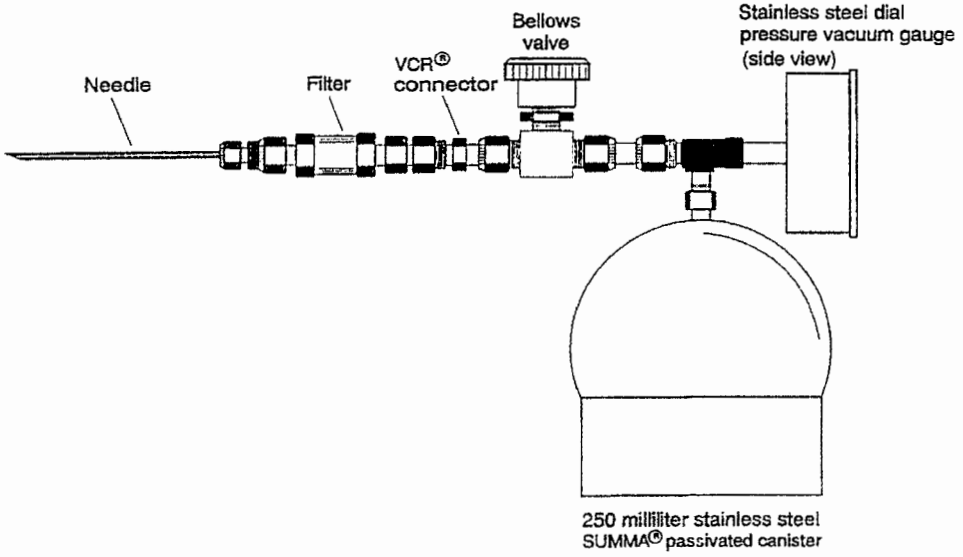

Figure C1-4
Schematic Diagram of Direct Canister with the Poly Bag Sampling Head

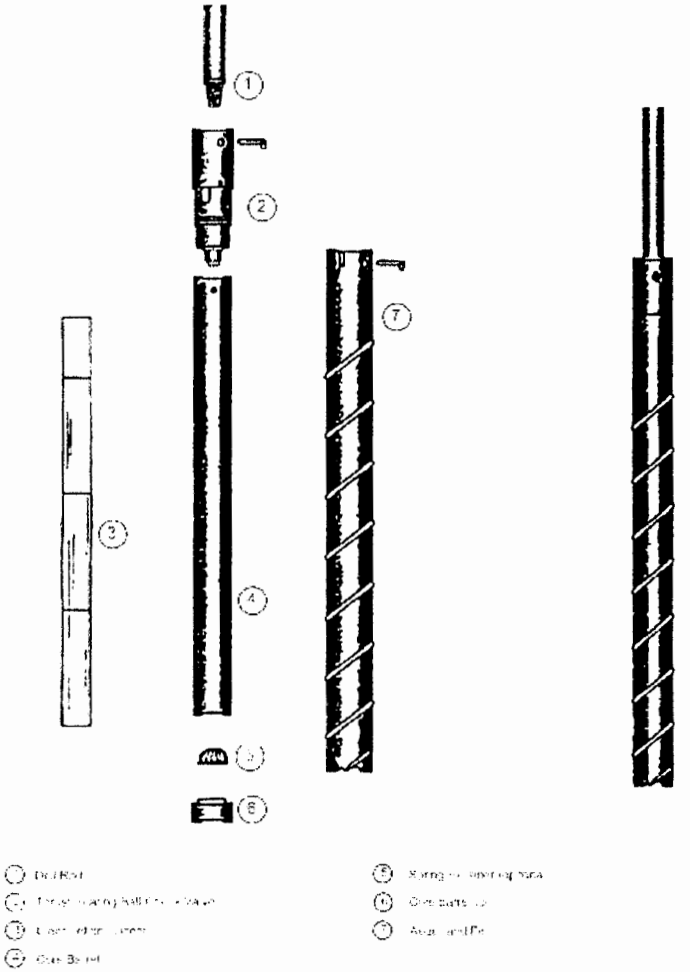

Figure C1-5
Rotational Coring Tool (Light Weight Auger)

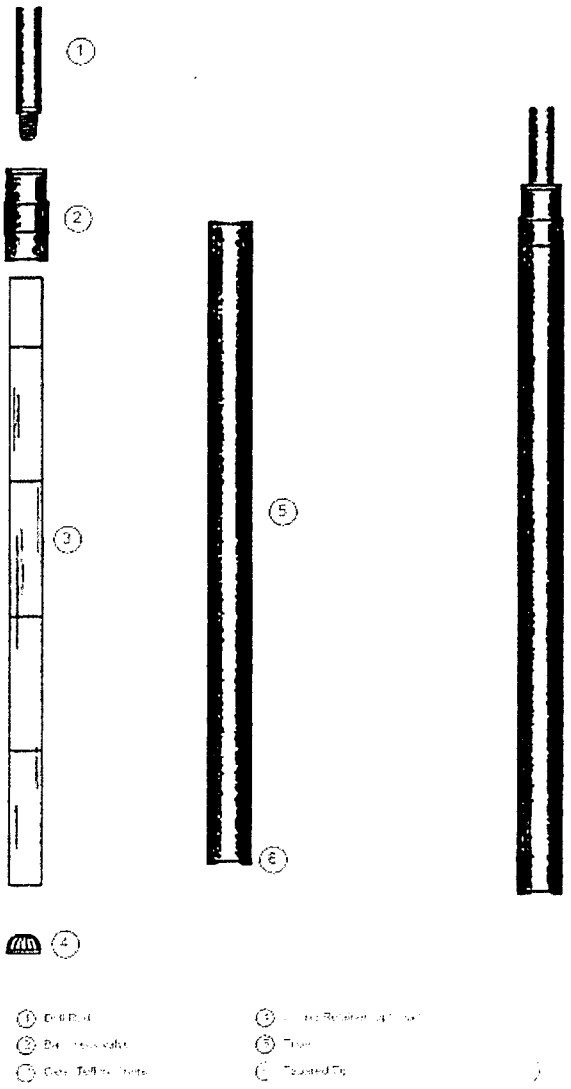

Figure C1-6
Non-Rotational Coring Tool (Thin Walled Sampler)

Field Code Changed

ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

Introduction

The WIPP facility is owned and co-operated by the U.S. Department of Energy (**DOE**) and co-operated by its designated Management and Operating Contractor (**MOC**) (Permit Section 1.5.3).

This Contingency Plan was prepared in accordance with the Resource Conservation and Recovery Act (**RCRA**) requirements codified in 20.4.1.500 NMAC (incorporating 40 CFR §264.50 to §264.56), "Contingency Plan and Emergency Procedures," and submitted in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(7)). The purpose of this document is to define responsibilities, to describe coordination of activities, and to minimize hazards to human health and the environment from fires, explosions, or any sudden or nonsudden release of hazardous waste, or hazardous waste constituents to air, soil, or surface water (20.4.1.500 NMAC (incorporating 40 CFR §264.51 [a])). This plan consists of descriptions of processes and emergency responses specific to hazardous substances, contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste and other hazardous waste handled at the WIPP facility.

D-1 General Information

The WIPP facility is located 26 miles (mi) (42 kilometers [km]) east of Carlsbad, in Eddy County in southeastern New Mexico, and includes an area of 10,240 acres (ac) (4,144 hectares [ha]). The facility is located in an area of low-population density, with fewer than 30 permanent residents living within a 10 mi (16 km) radius of the facility. The area surrounding the facility is used primarily for grazing, potash mining, and mineral exploration. Resource development that would affect WIPP facility operations or the long-term integrity of the facility is not allowed within the 10,240 ac (4,144 ha) that have been set aside for the WIPP Project.

The WIPP facility is designed to receive containers of TRU waste, which will be transported to the WIPP facility from the ten major and other minor DOE TRU mixed waste generator and/or storage sites. The waste will be emplaced in the bedded salt of the Salado Formation, 2,150 feet (ft) (655 meters [m]) below ground surface.

As a geologic facility for the management of TRU mixed waste, the WIPP repository is regulated as a "miscellaneous unit," as defined under 20.4.1.500 NMAC (incorporating 40 CFR §264.601 to §264.603). The areas at the WIPP facility subject to this permit include the surface container storage areas in the Waste Handling Building (**WHB**) Container Storage Unit (**WHB Unit**) and the Parking Area Container Storage Unit (**Parking Area Unit**), located south of the WHB, and the areas below ground in which waste will be emplaced.

The WIPP facility includes other surface structures, shafts, and underground areas (Figures D-1, D-2, and D-3). Surface structures other than the WHB, that support TRU mixed waste management include:

Exhaust Filter Building - houses the filter banks to which the underground ventilation can be diverted in the unlikely event of an underground release of radionuclides.

Guard and Security Building - houses the facility security personnel and communications equipment necessary for them to perform their duties. Section D-4a specifies the duties of the security officers relative to contingency actions.

Safety and Emergency Services Building - houses the surface emergency response vehicles (fire truck, rescue truck, ambulance), Health Services (first aid), Emergency Operations Center, and the Dosimetry Laboratory. The Hazardous Material Response Trailer is staged at the WIPP facility in an area that is readily accessible to Emergency Services. Emergency Services is located in Building 452. Table D-6 describes emergency equipment and associated locations.

Support Building - houses the Central Monitoring Room (see section D-4a).

Transuranic Package Transporter-II (**TRUPACT-II**) Maintenance Facility - is located west of the CH bay. No TRU mixed waste management activities will occur in this facility.

Surface facilities used for storage of support equipment are identified in Table D-6.

Building 452, Safety and Emergency Services Facility, houses the emergency response vehicles, emergency equipment, the mine rescue room, mine rescue team equipment, and the Emergency Operations Center (**EOC**). The Hazardous Material Response Trailer is staged at the WIPP facility in an area readily accessible to Emergency Services. Emergency Services is located in Building 452.

The RCRA permit addresses TRU mixed waste management activities in the WHB Unit, the Parking Area Unit, and the disposal units. The provisions of this Contingency Plan apply to hazardous waste disposal units (**HWDU**) in the underground waste disposal panels, storage in the WHB Unit and the Parking Area Unit, the Waste Shaft, and supporting TRU mixed waste handling areas. The remainder of the facility will not manage TRU mixed waste. This Contingency Plan has also been designed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR § 262.34(a)(4) - Standards for Generators of Hazardous Waste), and will be implemented whenever there is a fire, explosion, or release of hazardous waste which could threaten human health or the environment. Hazardous substances in the remainder of the facility are included as possible triggers of the Contingency Plan but are outside the scope of the regulations promulgated pursuant to RCRA. This allows WIPP to maintain one emergency response plan which is consistent with the National Response Teams Integrated Contingency Plan Guidance (Federal Register, Vol. 61, No. 109, June 5, 1996). Inclusion is based on their National Fire Protection Association (**NFPA**) ratings in addition to their storage quantities. The majority of hazardous substances on-site are not expected to trigger the Contingency Plan because they are present in the same form and concentration as the product packaged for distribution and use by the general public or are used in a laboratory under the direct supervision of a technically qualified individual. Superfund Amendments and Reauthorization Act (**SARA**) Title III excludes these from emergency planning reporting. The list of hazardous substances in large enough quantities to constitute a Level II incident (Section D-3) is provided in Table D-1. In addition to TRU mixed waste, these are the only hazardous substances currently on site which, if spilled, may be of sufficient impact to cause this Contingency Plan to be implemented. Magnesium Oxide (**MgO**) is stored on-site in large quantities. It is used as backfill in the waste emplacement rooms as a pH buffer. The pH buffer will limit the solubility of radionuclides after the underground rooms are filled and closed. MgO is not a hazardous

substance, a release of MgO will not create hazardous waste and poses no threat to human health or the environment, and is therefore not addressed in the Contingency Plan.

Wastes generated as a result of maintenance or response actions will be categorized into one of three groups and disposed of accordingly. These are: 1) nonhazardous wastes to be disposed of in an approved landfill, 2) hazardous nonradioactive wastes to be disposed of at an off-site RCRA permitted facility, and 3) TRU mixed waste to be disposed of in the underground HWDUs. Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees will demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the HWDUs in the underground, will be met. In addition, the technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178) are applied to the operation of the container storage units in the WHB Unit and in the Parking Area Unit south of the WHB. Liquid wastes that may be generated as a result of the fire fighting water or decontamination solutions will be managed as follows:

Non-Mixed - Hazardous waste liquids contaminated only with hazardous constituents will be placed into containers and managed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34) requirements. The waste will be shipped to an approved off-site treatment, storage, or disposal facility.

Mixed - Liquids contaminated with TRU mixed waste (inside the WHB Unit) will be solidified as they are placed into containers with cement, Aquaset, or absorbent material in them. The solidified materials will be disposed of in the underground WIPP repository as derived waste.

This chapter of the permit application describes the HWDUs, the TRU mixed waste management facilities and operations, compliance with the environmental performance standards, and with the applicable technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178 and §264.601, respectively). The configuration of the WIPP facility consists of completed structures; including all buildings and systems for the operation of the facility.

D-1a Disposal Phase Overview

The Disposal Phase will consist of receiving CH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations.

The TRU mixed waste that will be disposed at the WIPP facility results primarily from activities related to the reprocessing of plutonium-bearing reactor fuel and fabrication of plutonium-bearing weapons, as well as from research and development. This TRU mixed waste consists largely of such items as paper, cloth, and other organic material; laboratory glassware and utensils; tools; scrap metal; shielding; and solidified sludges from the treatment of wastewater. Much of this TRU mixed waste is also contaminated with substances that are defined as hazardous under 20.4.1.200 NMAC.

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D-1b Waste Description

Waste destined for WIPP are, or were, produced as a byproduct of weapons production and have been identified in terms of waste streams based on the processes that produced them. Each waste stream identified by generators is assigned to a Waste Summary Category to facilitate RCRA waste characterization, and reflect the final waste forms acceptable for WIPP disposal.

These Waste Summary Categories are:

S3000—Homogeneous Solids

Solid process residues defined as solid materials, excluding soil, that do not meet the applicable regulatory criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2[g] and [h])). Included in solid process residues are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Waste Summary Category based on the specific waste stream types and final waste form. This category includes wastes that are at least 50 percent by volume solid process residues.

S4000—Soils/Gravel

This waste summary category includes waste streams that are at least 50 percent by volume soil. Soils are further categorized by the amount of debris included in the matrix.

S5000—Debris Wastes

This waste summary category includes waste that is at least 50 percent by volume materials that meet the criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2)). Debris is a material for which a specific treatment is not provided by 20.4.1.800 NMAC (incorporating 40 CFR §268 Subpart D), including process residuals such as smelter slag from the treatment of wastewater, sludges or emission residues.

> Debris means solid material exceeding a 2.36 inch (60 millimeter) particle size that is intended for disposal and that is: 1) a manufactured object, 2) plant or animal matter, or 3) natural geologic material.

Included in the S5000 Waste Summary Category are metal debris, lead containing metal debris, inorganic nonmetal debris, asbestos debris, combustible debris, graphite debris, heterogeneous debris, and composite filters, as well as other minor waste streams. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

Examples of waste that might be included in the S5000 Waste Summary Category are asbestos-containing gloves, fire hoses, aprons, flooring tiles, pipe insulation, boiler jackets, and laboratory tabletops. Also included are combustible debris constructed of plastic, rubber, wood, paper, cloth, graphite, and biological materials. Examples of graphite waste that would be included are crucibles, graphite components, and pure graphite.

Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such generated waste may occur in either the WHB Unit or the Underground. For example, when TRU mixed wastes are received at the WHB Unit, the CH or RH Package shipping containers and the TRU mixed waste containers are checked for surface contamination. Under some circumstances,[1] if contamination is detected, the shipping container and/or the TRU mixed waste containers will be decontaminated. In the underground, waste may be generated as a result of radiation control procedures used during monitoring activities. The waste generated from radiation control procedures will be assumed to be TRU and/or TRU mixed waste. Throughout the remainder of this plan, this waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

D-1c Containers

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

TRU mixed waste containers, containing off-site waste, will not be opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Waste, including "derived waste," containing liquid in excess of TSDF-WAC limits shall not be emplaced in the WIPP (See Permit Attachment C, Section C-1c).

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 177). The RCRA Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) precludes ignitable, reactive, or incompatible TRU mixed waste from being placed into storage or disposed of at WIPP.

D-1d Description of Containers

CH TRU mixed waste containers will be either 55-gallon (gal) (208-liter (L)) drums singly or arranged into seven (7)-packs, 85-gal (322-L) drums (used as singly or arranged into four (4)-packs, 100-gal (379 L) drums singly or arranged into three (3)-packs, ten-drum overpacks (**TDOP**), 66.3 ft^3 (1.88 m^3) SWBs, or standard large box 2s (**SLB2**).

RH TRU mixed waste containers are either canisters or drums. Canisters will be loaded singly in an RH-TRU 72-B cask and drums will be loaded in a CNS 10-160B cask. Drums in the CNS 10-160B cask will be arranged singly or in drum carriage units containing up to five drums each. Canisters and drums are described in Permit Attachment M1.

Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs.

[1] Typically contamination that is less than six square feet in area and less than 2000 disintegrations per minute (dpm) alpha or 20,000 dpm beta/gamma, may be decontaminated. Containers that exceed these thresholds will be returned to the point of origin for decontamination.

D-1e Description of Surface Hazardous Waste Management Units

The WHB is the surface facility where waste handling activities will take place. The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters [m^2]) of which 49,710 ft^2 (4,618 m^2) are designated as the WHB Unit for TRU mixed waste management. Within the WHB Unit, 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for the handling and storage of RH TRU mixed waste. These areas are being permitted as container storage units. The concrete floors within the WHB Unit are sealed with an impermeable coating that has excellent resistance to the chemicals in TRU mixed waste and, consequently, provide secondary containment for TRU mixed waste. In addition, a Parking Area Unit south of the WHB will be used for storage of waste in sealed shipping containers awaiting unloading. This area is also being permitted as a container storage unit. The sealed shipping containers provide secondary containment in this hazardous waste management unit (**HWMU**).

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (3-pack of shielded containers, 7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

In addition, four Contact-Handled Packages, containing up to 640 ft^3 of CH TRU waste in containers, may occupy positions at the TRUPACT-II Unloading Docks (**TRUDOCK**).

Aisle space shall be maintained in all CH Bay waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire response personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space between facility and containment pallets will be maintained in all CH TRU mixed waste storage areas.

D-1e(2) RH Complex Operations

Loaded RH TRU casks are received in the RH Bay of the WHB. The RH Bay is served by an overhead bridge crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. A maximum of two loaded casks may be stored in the RH Bay and a maximum of one cask in the Cask Unloading Room may be stored at one time. A minimum of 44 inches (1.1 m) will be maintained between loaded casks in the RH Bay. The cask serves as secondary containment in the RH Bay for the RH TRU mixed waste payload container. In addition, the RH Bay has a concrete floor.

Single RH TRU mixed waste canisters are unloaded from the RH-TRU 72-B casks in the Transfer Cell of the RH Complex where they are transferred to facility casks. Drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, into the Hot Cell, and loaded into a canister. Storage in the Hot Cell occurs in either drums or canisters. A maximum

of 12 55-gallon drums of RH TRU mixed waste and one 55-gallon drum of derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell. Except for the derived waste drum, individual 55-gallon drums may not be stored in the Hot Cell for more than 25 days. The Transfer Cell houses the Transfer Cell Shuttle Car, which is used to facilitate transferring the canister to the facility cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in a shielded insert in the Transfer Cell Shuttle Car or in a RH-TRU 72-B cask.

The Facility Cask Loading Room provides for transfer of a canister to the facility cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit. The Facility Cask Loading Room also functions as an air lock between the waste shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask in the Facility Cask Loading Room.

Derived waste will be stored in the RH Bay and in the Hot Cell.

D-1e(3) Parking Area Container Storage Unit (Parking Area Unit)

The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Container Storage Unit. This area provides storage for up to 6,734 ft^3 (191 m^3) of CH and/or RH TRU mixed waste contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing rainwater are provided by the transportation containers. Up to 12 additional Contact-Handled Packages and four additional Remote-Handled Packages may be stored in the Parking Area Surge Area so long as the requirements of Permit Sections 3.1.2.3 and 3.1.2.4 are met. No more than 50 Contact-Handled and 12 Remote-Handled Packages may be stored in the Parking Area Storage Unit.

The safety criteria for Contact-Handled and Remote-Handled Packages require that they be opened and vented at a frequency of at least once every 60 days. During normal operations, Contact-Handled and Remote-Handled Packages will not require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be mitigated by returning the shipment to the generator prior to the expiration of the 60 day NRC venting period or by moving the Contact-Handled or Remote-Handled Package inside the WHB Unit where the waste will be removed and placed in one of the permitted storage areas or in the underground hazardous waste disposal unit.

D-1f Off-Normal Events

Off-normal events could interrupt normal operations in the waste management process line. Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

D-1g Containment

The WHB Unit has concrete floors, which are sealed with a coating designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be

accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor.

During normal operations, the floor of the normal storage areas within the CH Bay and RH Complex shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. When a RH TRU mixed waste container is present in the RH Complex, inspections will be conducted visually and/or using closed-circuit television cameras in order to manage worker dose and minimize radiation exposures. Manual inspections of the areas are performed at least annually during routine maintenance periods when waste is not present.

Floor areas of the WHB used during off-normal events will be inspected prior to use and weekly while in use. Containers located in the permitted storage areas shall be elevated from the surface of the floor. Facility pallets provide at least 6 in (15 centimeters [cm]) of elevation from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packages shall be stored at a designated storage area inside the WHB so as to preclude exposure to the elements.

Secondary containment at permitted storage areas inside the WHB Unit shall be provided by the floor. The Parking Area Unit and TRUDOCK storage area of the WHB Unit do not require engineered secondary containment, since waste is not stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging. Floor drains, the fire suppression water collection sump, and portable dikes, if needed, will provide containment for liquids that may be generated by fire fighting. Sump capacities and locations are shown in Drawing 41-F-087-014. Residual fire fighting liquids will be placed in containers and managed as described above. Secondary containment at storage locations inside the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room is provided by the cask or canisters that contain drums of RH TRU mixed waste. In the Hot Cell, secondary containment is provided by the Hot Cell subfloor. In addition, the RH Complex contains a 220-gallon (833-L) sump in the Hot Cell, a 11,400-gallon (43,152-L) sump in the RH Bay, and a 220-gallon (833-L) sump in the Transfer Cell to collect any liquids.

D-2 Response Personnel

Persons qualified to act as the RCRA Emergency Coordinator, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55), are listed in Table D-2.

A RCRA Emergency Coordinator will be on-site at the WIPP facility 24 hours a day, seven days a week, with the responsibility for coordinating emergency response measures. RCRA Emergency Coordinators are listed in Table D-2, where four individuals have been designated primary RCRA Emergency Coordinators. This is because the on-duty Facility Shift Manager (**FSM**) is designated as the RCRA Emergency Coordinator. The four individuals shown serve as FSM on a rotating shift basis.

Persons qualified to act as the RCRA Emergency Coordinator are thoroughly familiar with this Contingency Plan, the TRU mixed waste and hazardous waste operations and activities at the WIPP facility, the locations of TRU mixed waste and hazardous waste activities, the locations on the site where hazardous materials are stored and used, and the locations of waste staging and accumulation areas. They are familiar with the characteristics of hazardous substances, TRU mixed waste and hazardous waste handled at the WIPP facility, the location of TRU mixed

waste and hazardous waste records within the WIPP facility, and the facility layout. In addition, persons qualified to act as the RCRA Emergency Coordinator have the authority to commit the necessary resources to implement this Contingency Plan. Figure D-4 outlines the RCRA Emergency Coordinator's position relative to other organizations that provide support.

In addition to the RCRA Emergency Coordinator, the following individuals or groups have specified responsibilities during any WIPP facility emergency:

- Assistant Chief Office Warden (**ACOW**)—Persons assigned to take accountability for sections of the site, and then reporting the accountability to the Chief Office Warden.

- Central Monitoring Room Operator (**CMRO**)—The on-shift operator responsible for Central Monitoring Room (**CMR**) operations, including coordination of facility communications. The facility log is maintained by the CMRO.

- Chief Office Warden (**COW**)—A predesignated individual with responsibilities for complete surface accountability at staging areas in the event of an evacuation. The Chief Office Warden receives reports from the ACOWs.

- Emergency Response Team (**ERT**)—Supplemental group trained to respond to surface emergencies, to provide emergency first aid, and to respond to releases of hazardous waste or hazardous material. ERT members are part of the WIPP Supplemental Emergency Response Program.

- Emergency Services Technician (**EST**)/Fire Protection Technician (**FPT**)—Regular employee whose job is that of full-time emergency responder. During non-emergency conditions, the EST/FPT inspects facility fire suppression systems and emergency equipment. The EST/FPT completes specific sections of the "WIPP Hazardous Material Incident Report." Additional technical personnel complete identified sections of the report.

- Fire Brigade—The fire brigade is a team of five personnel who respond to site emergencies. The team consists of an Incident Commander and four fire fighters. The fire fighters are trained in accordance with NFPA Standards for Industrial Fire Brigades (Fire Brigades that perform both advanced exterior and interior structural fire fighting).

- First Line Initial Response Team (**FLIRT**)—Supplemental primary responders in the event of a general underground emergency for medical and hazardous material response. The FLIRT also provides backup support for the ERT in the event of a general surface-facility emergency. FLIRT members are part of the WIPP Supplemental Emergency Response Program.

- Mine Rescue Team (**MRT**)—Supplemental group responsible for underground reentry and rescue after an emergency evacuation. The MRT responds in accordance with 30 CFR Part 49 requirements. MRT members are part of the WIPP Supplemental Emergency Response Program.

- Office Warden—An individual assigned responsibility for assuring that personnel are evacuated from his/her assigned area or building during evacuations. Office Wardens

maintain a list of all personnel in their specific area. This list is compared with the physical presence of personnel who assemble at the staging areas. The Office Wardens report area accountability to the ACOWs.

- EOC Staff-The EOC consists of a minimum staff of three MOC management positions (the Crisis Manager, a Safety Representative and an Operations Representative) to activate the EOC. The full EOC Staff includes the Crisis Manager, the Deputy Crisis Manager, a Safety Representative, an Operations Representative and the EOC Coordinator. Additional technical and logistics personnel will provide support as necessary. The EOC is activated by the FSM. Since EOC staff are performing duties similar to their normal job functions and providing support related to their area of expertise, no specific RCRA training is required.

D-3 Implementation

The provisions of this Contingency Plan will be implemented immediately whenever there is an emergency event (e.g., a fire, an explosion, or a natural occurrence that involves or threatens hazardous or TRU mixed wastes or a release of hazardous substances, hazardous materials, or hazardous wastes) that could threaten human health or the environment, or whenever the potential for such an event exists as determined by the RCRA Emergency Coordinator, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)). The following information is utilized for categorization of events to determine implementation of the Contingency Plan:

1. Medical Emergencies (does not implement the Contingency Plan)
2. Non-emergency (does not implement the Contingency Plan)
   a. Fire already out, did not involve any hazardous materials.
   b. Spill or release involved materials excluded according to the SARA Title III, Statute 42 U.S.C. 11021 (e). Such as:
      1) Any substance present in the same form and concentration as product packaged for distribution and use by the general public. (Example: Cleaning solutions)
      2) Any substance to the extent it is used in a laboratory under the direct supervision of a technically qualified individual.
      3) Petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance by Comprehensive Environmental Response, Compensation and Liability Act (**CERCLA**).

3. Incident Level I: According to the NFPA 471, Responding to Hazardous Materials Incidents (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level I incident and does not implement the Contingency Plan.

   a. The product does not require a U.S. Department of Transportation (**DOT**) placard, is a NFPA listed 0 or 1 for all categories, or is Other Regulated Materials A, B, C, or D.

   b. The fire is under control and the reactivity rating of the material is less than a rating 2, indicating a low potential for subsequent explosion as the hazardous material can be considered normally stable.

   c. There was no release or the release can be confined with readily available resources.

   d. There is no life-threatening situation.

   e. There is no potential environmental impact.

4. Incident Level II: According to NFPA 471, Responding to Hazardous Materials Incidents, (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level II incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

   a. The product requires a DOT placard, is an NFPA 2 for any categories, or is Environmental Protection Agency (**EPA**) regulated waste (Site-specific: Table D-1 and TRU mixed waste) AND

   b. The incident involves multiple packages.

   c. There is potential for the fire to spread since the hazardous material's flammability level (rating 2) is below 200 degrees Fahrenheit, or the reactivity (rating 2) indicates that violent chemical changes are possible and thus may be explosive.

   d. The release may not be controllable without special resources.

   e. The incident requires evacuation of a limited area for life safety.

   f. The potential for environmental impact is limited to soil and air within incident boundaries.

   g. The container is damaged but able to contain the contents to allow handling or transfer of product.

5. Incident Level III: According to NFPA 471, Responding to Hazardous Materials Incidents (See Table D--3). If the product(s) involved in the fire, explosion, spill or leakage meet the following criteria, it will be classified as a Level III incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

    a. The product is a poison A (gas), an explosive A/B, organic peroxide, flammable solid, material that is dangerous when wet, chlorine, fluorine, anhydrous ammonia, NFPA 3 and 4 for any categories including special hazards, EPA extremely hazardous substances, and cryogenics.

    b. The site-specific container size for this incident level will be a tank truck.

    c. There is potential for the fire to spread since the hazardous material's flammability level (rating 3 or 4) is below 100 degrees Fahrenheit, or the reactivity (rating 3 or 4) indicates that the material may explode.

    d. The release may not be controlled even with special resources.

    e. The incident requires mass evacuation of a large area for life safety.

    f. Even though the NFPA guidelines for this incident level indicate that the potential for environmental impact is severe, due to the site engineering controls, the impact is contained within the HWMUs.

    g. The container is damaged to such an extent that catastrophic rupture is possible.

The above categories include fire situations, weather conditions, natural phenomena, and explosions which will have to be evaluated to make an incident level determination. A Level II (potential threat to human health in localized area, potential for moderate on-site environmental impact) or Level III (potential threat to human health in a larger area, potential for severe environmental impact) incident by definition is considered to be a potential threat to human health or the environment and, therefore, is considered to be an emergency requiring activation of the Contingency Plan.

D-4 Emergency Response Method

Methods that describe how and when the WIPP Contingency Plan will be implemented cover the following 11 implementation areas:

1. Notification (Section D-4a)
2. Identification of hazardous materials (Section D-4b)
3. Assessment of the nature and extent of the emergency (Section D-4c)
4. Control, containment, and correction of the emergency (Section D-4d)
5. Prevention of recurrence or spread of fires, explosions, or releases (Section D-4e)
6. Management and containment of released material and waste (Section D-4f)
7. Incompatible waste (Section D-4g)
8. Post-emergency facility and equipment maintenance and reporting (Section D-4h)
9. Container spills and leakage (Section D-4i)
10. Tank spills and leakage (Section D-4j)
11. Surface impoundment spills and leakage (Section D-4k)

D-4a Notification

Notification requirements in the event of an emergency at a RCRA hazardous waste management facility are defined by 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(a) and (d)). Necessary notifications in case of an emergency at the WIPP facility are described in this section (Figure D-4a). Personnel at the WIPP facility are trained to respond to emergency notifications.

D-4a(1) Initial Emergency Response and Alerting the RCRA Emergency Coordinator

The first person to become aware of an incident shall immediately report the situation to the CMRO, and provide the following information, as appropriate:

- Name and telephone number of the caller
- Location of the incident and the caller
- Time and type of incident
- Severity of the incident
- Magnitude of the incident
- Cause of the incident
- Assistance needed to deal with or control the incident
- Areas or personnel affected by the incident

In addition to receiving incident reports, the CMRO, who is located in the Support Building (Building 451) (Figure D-1), continuously monitors (24 hours a day) the status of mechanical, electrical, and/or radiological conditions at selected points on the site, both above and below ground. Alarms to indicate abnormal conditions are located throughout the WIPP facility. The alarm(s) (e.g., fire, radiation) may be the first notification of an emergency situation received by the CMRO. The CMRO monitors alarms, takes telephone calls and radio messages, and initiates outgoing calls to emergency staff and outside agencies.

Once the CMRO is notified of a fire, explosion, or a release anywhere in the facility (either by eyewitness or an alarm), the RCRA Emergency Coordinator is immediately notified. Once notified, the RCRA Emergency Coordinator assumes responsibility for the management of activities related to the assessment, abatement, and/or cleanup of the incident.

A RCRA Emergency Coordinator is on-site at all times and, therefore, can be reached at any time via a two-way radio or over the public address (**PA**) and plectrons on-site. If the RCRA Emergency Coordinator is unavailable or unable to perform these duties, a qualified alternate RCRA Emergency Coordinator is available.

The EST/FPT is also notified in case of fire, explosion, or release. The RCRA Emergency Coordinator, as incident commander, determines if supplemental emergency responders are necessary. Notification of the ERT (surface) is made by using the ERT pagers and/or the public announcement system. Notification of the FLIRT is by using the Mine Page Phone System. If the MRT is needed the RCRA Emergency Coordinator will instruct the CMRO to make a PA announcement for the MRT to assemble in the Mine Rescue Room, located in a predetermined location.

Off-shift personnel may be notified using the on-call list, which is updated weekly by the Permittees. The FSM/CMRO, each individual on the on-call list, and WIPP Security receive copies of the on-call list. The CMRO may direct Security to make the notifications.

The response to an unplanned event will be performed in accordance with procedures based on the applicable Federal, State, or local regulations and/or guidelines for that response. These include the U.S. Mine Safety and Health Administration (**MSHA**); NMAC; CERCLA; Chapter 74, Article 4B, New Mexico Statutes Annotated 1978, New Mexico Emergency Management Act; and agreements between the Permittees and local authorities (Section D-6) for emergencies throughout the WIPP facility.

After notification by the CMRO, the EST/FPT shall immediately investigate to determine pertinent information relevant to the actual or potential threat posed to human health or the environment. The information will include the location of release, type, and quantity of spilled or released material (or potential for release due to fire, explosion, weather conditions, or other naturally occurring phenomena), source, areal extent, and date and time of release. The EST/FPT shall provide information for classification of the incident, according to the emergency response guidelines, to the RCRA Emergency Coordinator. The RCRA Emergency Coordinator then classifies the incident after evaluation of all pertinent information. This classification will consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).

When the RCRA Emergency Coordinator determines that an Incident Level II or III has occurred, the Contingency Plan is implemented. The RCRA Emergency Coordinator then may choose to activate the EOC for additional support (Figure D-4). If the RCRA Emergency Coordinator determines that due to extenuating circumstances the potential to upgrade to an incident Level II or III exists, the RCRA Emergency Coordinator also may activate the EOC. The EOC will assist the RCRA Emergency Coordinator in mitigation of the incident with use of communications equipment and technical expertise from any WIPP organization (see Section D-4c).

The EOC staff will assess opportunities for coordination and the use of mutual-aid agreements with local outside agencies making additional emergency personnel and equipment available (Section D-6), as well as the use of specialized response teams available through various State and Federal agencies. As a DOE-owned facility, the WIPP facility may use the resources available from the Federal Response Plan, signed by 27 Federal departments and agencies in April 1987, and developed under the authorities of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7701 et seq.) and amended by the Stafford Disaster Relief Act of 1988. Most resources are available within 24 hours. The WIPP facility maintains its own emergency response capabilities on-site. In addition to the supplemental emergency responders, radiological control technicians, environmental sampling technicians, wildlife biologists, and various other technical experts are available for use on an as-needed basis.

D-4a(2) Communication of Emergency Conditions to Facility Employees

Procedures for notifying facility personnel of emergencies depend upon the type of emergency. Methods of notification are:

- Local Fire Alarms

  The local fire alarms sound a bell tone and may be activated automatically or manually in the event of a fire.

- Surface Evacuation Signal

  The evacuation signal is a yelp[2] tone and is manually activated by the CMRO when needed. The CMRO shall follow the evacuation signal with verbal instructions and ensure the Site Notification System (i.e., the plectron) has been activated.

- Underground Evacuation Warning System

  The evacuation signal is a yelp tone and flashing strobe light. In the event of an evacuation signal, underground personnel will proceed to the nearest egress hoist station (Section D-7b) to be apprised of the nature of the emergency and the evacuation route to take. Underground personnel are trained to report to the underground assembly areas and await further instruction if all power fails or if ventilation stops. If evacuation of underground personnel is required, this will be done using the backup electric generators and in accordance with the applicable requirements of MSHA.

- Contingency Evacuation Notification

  If the primary warning system consisting of alarms and signals fails to operate when activated (as in a total power outage and failure of the back-up power systems), WIPP Security will be notified by the CMRO to initiate the contingency evacuation plan. In this event Security officers will alert personnel to evacuate the area and will check trailers, if possible, to ensure that personnel have been alerted/evacuated.

WIPP facility personnel are trained and given instruction during General Employee Training to recognize the various alarm signals and the significance of each alarm. WIPP facility employees and site visitors are required to comply with directions from emergency personnel and alarm system notifications and to follow instructions concerning emergency equipment, shutdown procedures, and emergency evacuation routes and exits.

D-4a(3) Notification of Local, State, and Federal Authorities

If it is determined that the facility has had a fire, an explosion, a spill, or a release of hazardous waste or hazardous waste constituents (included in 20.4.1.200 NMAC (incorporating 40 CFR § 261)) in the miscellaneous unit or TRU mixed waste handling areas, or an emergency resulting in a release of a hazardous substance (included in 40 CFR §302.4 and §302.6 or the New

[2] The yelp tone increases from 500 to 1,000 hertz and drops to 500 hertz.

Mexico Emergency Management Act, §74-4B-3 and §74-4B-5) that could threaten human health or the environment outside the facility, the RCRA Emergency Coordinator, after consultation with the DOE as the owner of the facility, will assure that local authorities are notified by telephone and/or radio, including:

- Carlsbad Police Department (telephone number: [575] 885-2111) (or 911)
- Carlsbad Fire Department (telephone number: [575] 885-2111) (or 911)
- Eddy County Sheriff (telephone number: [575] 887-7551)
- Hobbs Fire Department (telephone number: [575] 397-9265)

After local authorities are notified, the RCRA Emergency Coordinator will ensure notification of the following:

- New Mexico Environment Department (**NMED**)
  Department of Public Safety
  24-Hour Emergency Reporting Telephone Number: (505) 827-9329
  FAX number: (505) 827-9368

- Department of Public Safety WIPP Coordinator
  Telephone Number: (505) 827-9221
  FAX number: (505) 829-3434

- Hazardous Materials Emergency Response, Chemical Safety Office, Department of Public Safety, State Emergency Response Commission
  Telephone number: (505) 476-9681
  FAX number: (505) 476-9695

- National Response Center
  Telephone number: 1-800-424-8802
  FAX number: (202) 479-7181

- Local Emergency Planning Committee
  Telephone number: (575) 885-3581
  Fax number: (575) 628-3973

The first notification of public safety and regulatory agencies will include the following:

- The name and address of the facility and the name and phone number of the reporter
- The type of incident (fire, explosion, or release)
- The date and time of the incident
- The type and quantity of material(s) involved, to the extent known
- The exact location of the incident
- The source of the incident

- The extent of injuries, if any
- Possible hazards to human health and the environment (air, soil, water, wildlife, etc.) outside the facility
- The name, address, and telephone number of the party in charge of or responsible for the facility or activity associated with the incident
- The name and the phone number of the RCRA Emergency Coordinator
- The identity of any surface and/or groundwater involved or threatened and the extent of actual and potential water pollution
- The steps being taken or proposed to contain and clean up the material involved in the incident

The RCRA Emergency Coordinator will also be available to advise the appropriate local, State, or Federal officials on whether or not local areas should be evacuated.

D-4a(4) Notification of the General Public

Immediate notification of the general public through the public safety and emergency agencies listed above will be made by, or under the direction of, the RCRA Emergency Coordinator following an evaluation to determine if local adjacent areas need to be evacuated. This evaluation will be made in consultation with the DOE who, as the owner of the facility, has management responsibility for the land withdrawal area. DOE policy is to provide accurate and timely information to the public by the most expeditious means possible concerning emergency situations at the WIPP site that may affect off-site personnel, public health and safety, and/or the environment. A DOE (**DOE**) Management representative is always on-call. This person is available by pager or telephone 24 hours a day.

A Hazards Assessment was conducted, which indicated no need for protective actions or emergency action levels, as defined by the Permittees, for the facility. Therefore, no procedures are in place for evacuation of the public. Procedures are in place for notification of the public by radio, television, and newspapers for news items which might include notification of on-site emergency situations. These procedures include a Public Affairs Coordinator in the EOC who writes and transmits press releases to the DOE office, where formal press conferences are conducted.

D-4b Identification of Hazardous Materials

The identification of hazardous wastes, hazardous waste constituents, or hazardous materials involved in a fire, an explosion, or a release to the environment is a necessary part of the assessment of an incident, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). RCRA hazardous waste and hazardous substances and materials listed in 40 CFR §302.4 and §302.6 or New Mexico Emergency Management Act, §74-4B-3 and §74-4B-5 and, involved in any release at the WIPP facility will be identified. The identification of likely hazardous materials at any location is enhanced because hazardous materials and hazardous waste are only stored or managed in specified locations throughout the WIPP facility. An attempt will be made to identify products involved by occupancy/location, container shape,

markings/color, placards/labels, United Nations/North America/Product Identification Number, on-site technical experts, or field sampling. Further, the ES&H department maintains an updated inventory of hazardous materials/substances that are brought on site, and a master MSDS listing in the Safety and Emergency Services Facility, Building 452.

Sources of information available to identify the hazardous wastes, substances, or materials involved in a fire, an explosion, or a release at the WIPP facility include operator/supervisor knowledge of their work areas, materials used, and work activities underway; the WIPP Waste Information System (**WWIS**), which identifies the location within the facility of emplaced TRU mixed waste, including emplaced derived waste; and waste manifests and other waste characterization information in the operating record. The WWIS also includes information on wastes that are in the waste handling process. Also available are MSDSs for hazardous material in the various user areas throughout the facility, waste acceptance records, and materials inventories for buildings and operating groups at the WIPP facility. Information or data from the derived waste accumulation areas, the hazardous waste staging area, satellite staging areas, and nonregulated waste accumulation areas are included.

TRU mixed waste received by the WIPP facility during the Disposal Phase will be characterized for hazardous constituents prior to receipt, and acceptable knowledge will be used to characterize derived waste prior to emplacement.

Information required for identifying TRU mixed hazardous constituents in case of an incident is readily available through the WWIS and the waste acceptance records. Waste accepted at WIPP is already known to be compatible with all materials used to respond to an emergency. All non-TRU mixed waste materials received on site, other than those listed in Table D-1, are in such small quantities that no reaction could develop which would trigger an Incident Level II or III response.

The RCRA Emergency Coordinator will have access to the WWIS through Operations, or through the Facility Shift Manager's Office.

The RCRA Emergency Coordinator has access to the inventory lists and MSDSs in the Safety and Emergency Services Facility at all times.

D-4c Assessment of the Nature and Extent of the Emergency

Once the required notifications have been made, the RCRA Emergency Coordinator will ensure that the identity, exact source, amount, and areal extent of any released materials are determined, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). The RCRA Emergency Coordinator will determine whether the occurrence constitutes an emergency based on knowledge of the area and access to the waste identification/characterization information described in Section D-4b. An emergency will require response by only trained emergency response personnel. The RCRA Emergency Coordinator will be responsible for responding to immediate and potential hazards, using the services of trained personnel to determine: 1) the identity of hazardous wastes, hazardous waste constituents, and other hazardous materials involved in a release, as described in Section D-4b; 2) whether or not a release involved a reportable quantity of a hazardous substance; 3) the areal extent of a release; 4) the exact source of a release; and 5) the potential hazards to human health or to the environment.

After the materials involved in an emergency are identified, the specific information on the associated hazards, appropriate personal protective equipment (**PPE**), decontamination, etc., will be obtained from MSDSs and from appropriate chemical reference materials at the same location. These information sources may be accessed by the RCRA Emergency Coordinator or through several WIPP facility organizations.

The emergency assessment requires determination of hazards involving evaluation of several criteria, including:

- Exposure: magnitude of actual or potential exposure to employees, the general public, and the environment; duration of human and environmental exposure; pathways of exposure
- Toxicity: types of adverse health or environmental effects associated with exposures; the relationship between the magnitude of exposure and adverse effects
- Reactivity: hazardous materials or hazardous wastes, which are not TRU mixed wastes, involved in an incident will be assessed for reactivity through accessing the MSDSs for the affected material and the recommended method(s) for managing such waste
- Uncertainties: considerations for undeterminable or future exposures; uncertain or unknown health effects, including future health effects

D-4d Control, Containment, and Correction of the Emergency

The WIPP facility is required to control an emergency and to minimize the potential for the occurrence, recurrence, or spread of releases due to the emergency situation, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56 (e)). The WIPP Emergency Response procedures utilize the incident mitigation guidelines in NFPA 471, Responding to Hazardous Materials Incidents, with initial response priority being on control, and those actions necessary to ensure confinement and containment (the first line of defense) in the early, critical stages of a spill or leak. The RCRA Emergency Coordinator is responsible for stopping processes and operations when necessary, and removing or isolating containers. TRU mixed waste will remain within the WHB Unit, the Parking Area Unit, and the underground HWDU.

D-4d(1) All Emergencies

The WIPP Emergency Response procedures include, but are not limited to, the following actions appropriate for control:

1. Isolate the area from unauthorized person by fences, barricades, warning signs, or other security and site control precautions. Isolation and evacuation distances vary, depending upon the chemical/product, fire, and weather situations.
2. Identify the chemical/product according to Section D-4b.
3. Drainage controls.
4. Stabilization of physical controls (such as dikes or impoundment[s]).

5. Capping of contaminated soils to reduce migration.

6. Using chemicals and other materials to retard the spread of the release or to mitigate its effects.

7 Excavation, consolidation, removal, or disposal of contaminated soils.

8. Removal of drums, barrels, or tanks where it will reduce exposure risk during situations such as fires.

If the facility stops operations in response to a fire, explosion, or release, the RCRA Emergency Coordinator shall ensure continued monitoring for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever appropriate. If operations continue, personnel normally assigned to these tasks will continue.

Both natural and synthetic methods will be employed to limit the releases of hazardous materials so that effective recovery and treatment can be accomplished with minimum additional risk to human health or the environment. A combination of the above methods to achieve protection of human health and the environment, with emphasis on two basic methods for mitigation of hazardous materials incidents - Physical and Chemical (Tables D-4, D-5) mitigation, will be used.

1 Physical methods of control involve any of several processes to reduce the area of the spill/leak, or other release mechanism (such as fire suppression).

A. Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume of the sorbate/sorbent system through the process of swelling. Some of the materials utilized in response to Level I incidents or Level II incidents involving liquids will be absorbent sheets of polyolefin-type fibers, spill control bucket materials (specifically for solvents, neutralization, or for acids/caustics), and absorbent socks for general liquids or oils.

B. Covering refers to a temporary form of mitigation for radioactive incidents that will be utilized in response to Level II or Level III incidents involving CH TRU mixed waste. These could include absorbent sheets, plastic, or actual ambulance blankets.

C. Dikes or Diversions refer to the use of physical barriers to prevent or reduce the quantity of liquid flowing into the environment. Dikes may be soil or other barriers temporarily utilized to hold back the spill or leak. Diversion refers to the methods used to physically change the direction of the flow of the liquid. Absorbent socks or earth may be utilized as dikes or diversions for all levels of incidents.

D. Overpacking is accomplished by the use of an oversized container. Overpack containers will be compatible with the hazards of the materials involved.

E. Plug and Patch refers to the use of compatible plugs and patches to reduce or temporarily stop the flow of materials from small holes, rips, tears, or gashes in containers. A Series "A" hazardous response kit containing nonsparking

equipment to control and plug leaks may be utilized for response to all levels of incidents.

F Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually or by pump, from a leaking or damaged container. Scoops, shovels, jugs, and pails as well as drum transfer pumps for chemical and petroleum transfer are utilized as needed in response to all levels of incidents.

G. Vapor Suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents such as an aqueous foam blanket.

2. Chemical Methods of Mitigation

A. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. This would include using the neutralizing adsorbents.

B. Solidification is the process whereby a hazardous liquid is added to material such as an absorbent so that a solid material results.

The established procedures are based upon the incident level and a graded approach for nonradioactive or CH TRU waste emergencies and initiated to:

1. Minimize contamination or contact (through PPE, etc.)
2. Limit migration of contaminants
3. Properly dispose of contaminated materials

For RH TRU mixed waste that is not managed in shielded containers, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(2) Fire

The incident level emergency response identified in Section D-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using

control doors associated with the underground ventilation system. The following actions are implemented in the event of a fire:

1. All emergency response personnel at an incident will wear appropriate PPE.

2. Only fire extinguishing materials that are compatible with the materials involved in the fire will be used to extinguish fires. Compatibility with materials involved in a fire are determined by pre-fire plans, Emergency Response Guide Book (DOT, 1993), DOT labeling, and site-specific knowledge of the emergency response personnel. Water and dry chemical materials have been determined to be compatible with all components of the TRU mixed waste. Pre-fire plans for the WHB are included in Figures D-10 and D-11.

   Fires in areas of the WHB Unit should not propagate, due to limited amount of combustibles, and the concrete and steel construction of the structures. Administrative controls, such as landlord inspections and EST/FPT inspections, help to insure good housekeeping is maintained. Combustible material and TRU mixed waste will be isolated, if possible. Firewater drain trenches collect the water and channel it into a sump. In areas not adjacent to the trenches, portable absorbent dikes (pigs) will be used to retain as much as possible, until it can be transferred to containers or sampled and analyzed for hazardous constituents.

3. If the fire spreads or increases in intensity, personnel will be directed to evacuate.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards.

5. In order to ensure that storm drains and/or sewers do not receive potentially hazardous runoff, dikes will be built around storm drains to control discharge as needed. Collected waste will be sampled and analyzed for hazardous constituents, before being discharged to evaporation ponds. There are two ponds south of the security fence, opposite the WHB Unit, that will collect drainage from the parking area. The rest of the site, inside the security fence, drains to the large pond to the west. Samples will be taken from these ponds, after the emergency has been abated, to determine any cleanup requirements. NMED will approve any procedures associated with the sampling and analysis of the ponds.

6. The RCRA Emergency Coordinator maintains overall control of the emergency and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains overall responsibility.

7. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

8. Materials involved in a fire can be identified in the following ways:

   - According to Section D-4b.

   - If the contents of the waste container cannot be determined based on its location and the label is destroyed by fire, the material will be treated as an

unknown, evaluated for radiological contamination, and analyzed according to methods in the EPA's "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (**SW-846**), Third Edition, after the fire has been extinguished.

- Airborne radioactivity samples may be obtained during a fire involving radioactive materials, using portable and fixed air samplers. Response personnel will be adequately protected from airborne radioactivity by their PPE required for fire response.

9. Only materials compatible with the waste may be used for fire response.

10. When cleanup has proceeded to the point of finding no radionuclide activity, then the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

    - For waste containers, once radiologically clean and free of any visible evidence of hazardous waste spills on the container, it will be placed in the underground without further action.

    - For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues (for further information see Section D-4d, Emergency Termination Procedures).

11. Fire suppression materials used in response to incidents will be retained on-scene, where an evaluation will be performed to determine appropriate recovery and disposal methods.

D-4d(3) Explosion

The following actions will be implemented in the event that an explosion that involves or threatens hazardous or TRU mixed waste or hazardous materials has occurred:

1. The area will be evacuated immediately.

2. The CMRO will immediately notify the appropriate emergency response personnel and the RCRA Emergency Coordinator about the explosion.

3. Injured personnel will be treated and transported as necessary.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards involved and the degree and location of the explosion and associated fires.

5. The RCRA Emergency Coordinator will be in command and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains the overall responsibility. Selections of methods and tactics of response are the responsibility of the Incident Commander.

6. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

7. When cleanup has proceeded to the point of finding no radionuclide activity, then samples may be taken for chemical analysis if there is visible evidence to suspect additional hazardous waste residues. Chemical residues on floor surfaces resulting from a hazardous waste explosion will be evaluated, sampled, analyzed (if required), isolated, and returned to appropriate containers, and surfaces will be cleaned using appropriate cleaners.

8. The RCRA Emergency Coordinator may shut down operational units (e.g., process equipment and ventilation equipment) that have been affected directly or indirectly by the explosion. Once the areas have been determined safe for reentry, processes may be reactivated.

D-4d(4) Spills

Protection of response personnel at a hazardous material incident is paramount. The primary methods to protect personnel are time, distance, and shielding. If a Level II or III incident exists, the RCRA Emergency Coordinator will implement the following actions:

1. The immediate area will be evacuated.

2. The RCRA Emergency Coordinator will review facility records to determine the identity and chemical nature of released material.

3. Entry team procedures will be utilized, with special attention to the following:

    - Buddy system
    - Appropriate PPE
    - Backup rescue team
    - Supplemental communication signals (hand signals and hand-light signals)
    - Monitoring equipment
    - Exposure time limitations

4. If possible, the source of the release will be secured.

5. A dike to contain runoff may be built.

6. Emergency responders will ensure that storm drains and/or sewers do not receive potentially hazardous runoff or spilled material. They may build dikes around storm drains to control discharge.

7. Released wastes may be collected and contained by stabilizing or neutralizing the spilled material, as appropriate, pouring an absorbent over the spilled material, and sweeping or shoveling the absorbed material into drums or other appropriate containers. The absorbents have been determined to be compatible with all components of the TRU mixed waste.

8. No TRU mixed waste that may be incompatible with the released material will be managed in the affected area until cleanup procedures are complete.

9. The RCRA Emergency Coordinator will direct spill control, decontamination, and termination procedures described below.

D-4d(5) Decontamination of Personnel

Decontamination of personnel with radioactive contamination is the responsibility of the Radiological Control (**RC**) section. If a person is contaminated with radioactivity during a site evacuation to the staging areas, the contaminated area will be covered before the person can be moved (under escort by RC personnel) to the staging area. The RC personnel will ensure the contaminated person remains segregated from other site personnel while under RC supervision.

In the event of an emergency that requires immediate evacuation of the area, the contamination can be covered by any method warranted, given the circumstance (e.g., clean clothing wrapped around the area). If the size of the radioactive contamination on the body is small and localized, it can be covered with clothing (e.g., glove, shoe cover, coveralls). If the size of the radioactive contamination on the body is large, it may be covered by dressing the individual in a full set of Anti-Contamination clothing (coveralls, hood, gloves, shoe covers, etc.).

If time and location permit and the contamination is on the face, it will be decontaminated immediately using a cloth moistened with tepid water (and a mild detergent, if necessary). If the size of the radioactive contamination on the individual's body is small and localized, it will be decontaminated using the same method as for the face, but after the individual has been transferred to an area appropriate for conducting decontamination.

If the individual is transferred to the staging area prior to decontamination, he/she will be decontaminated at the staging area using site procedures for personnel decontamination and using decontamination supplies and equipment as appropriate for the extent and magnitude of the contamination.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

In the event of spills or leaking or punctured containers of CH and RH TRU mixed waste, the WIPP responds to three distinct phases: 1) the event, 2) the re-entry, and 3) the recovery.

During the event, the following immediate actions are completed: 1) stop work, 2) warn others (notify CMR), 3) isolate the area, 4) minimize exposure, and 5) close off unfiltered ventilation. These actions can take place simultaneously, as long as they are completed before proceeding to the re-entry phase.

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers that are managed as CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and or any approved fixatives such as polyvinyl alcohol (**PVA**) or paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and

counted. This information is used by cognizant managers, RC personnel, and As Low As Reasonably Achievable (**ALARA**) Committee representatives to determine an appropriate course of action to recover the area. A plan to decontaminate and recover affected areas and equipment will be approved with a separate RWP written to establish the radiological controls required for the recovery.

During the recovery phase, the plan will be executed to utilize the necessary resources to conduct decontamination and/or overpacking operations as needed. The completion of this phase will occur prior to returning the affected area and/or equipment to normal activities. The recovery phase will include activities to minimize the spread of contamination to other areas. These activities will involve placing the waste material in another container; vacuuming the waste material; overpacking or plugging/patching the spilled, leaking, or punctured waste container; and/or decontaminating the affected area(s). If an affected surface cannot be decontaminated to releasable levels, it may be covered with a fixative coating and established as a Fixed Contamination Area to prevent spread of contamination, or it may be removed using heavy machinery and tools, packaged in approved waste containers, and emplaced in the underground. Every reasonable effort to minimize the amount of derived waste, while providing for the health and safety of personnel, will be made.

Should a breach of a CH TRU mixed waste container occur at the WIPP that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into an available overpack container (e.g., 85-gal drum, SWB, TDOP), except that TDOPs and SLB2s will be decontaminated, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. The decontamination of equipment and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations CH TRU mixed waste will be handled only in the areas of the WHB Unit. Therefore, it is within these same areas that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced.

Equipment used during a spill cleanup or CH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and others as needed for a given incident.

At the underground emplacement room, salt contaminated by a spill of CH TRU mixed waste would be either covered or cleaned up, depending on location, extent, and spilled material, due to potential radioactive contamination spread via the salt dust. The contaminated salt would be covered to isolate it from the workers, and the stacking of waste containers would resume or would be removed and packaged as site-derived waste using applicable site procedures for decontaminating surfaces.

The decontamination methods will initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container

When decontamination is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for uncontrolled use. The free release criteria for items, equipment, and areas is < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to verify the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log.

RH TRU Mixed Waste

For RH TRU mixed waste, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using the following measures, as appropriate:

During the re-entry phase, an evaluation of the incident, including the nature of the release, amount, location, and other appropriate factors, will be performed. A RWP will be written and approved prior to personnel entering the Hot Cell with the appropriate PPE to further assess the situation, perform surveys and take samples, and, if possible, mitigate problems that could compound the hazards in the area. Based on the results of the evaluation, a determination will be made by the RCRA Emergency Coordinator, with input from the cognizant managers, radiological control personnel, and ALARA Committee representatives whether to implement the Contingency Plan and to determine the appropriate course of action to recover from the event. An action response plan to decontaminate and recover affected areas and equipment, together with an RWP establishing the radiological controls required for the recovery will be developed and approved.

Should a breach of a RH TRU mixed waste container occur in the Hot Cell that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into a canister and processed for disposal. The decontamination of equipment, cleanup of spilled material and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations RH TRU mixed waste in 55-gallon drums will be handled only in the Hot Cell. Therefore, it is within this area that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas

for decontamination or overpacking, the risk of spreading contamination is reduced. Contaminated materials for the cleanup and overpacking of a breached RH TRU mixed waste container may be managed as CH TRU mixed waste, depending on the surface dose rate.

Equipment used during a spill cleanup or RH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and other equipment as needed for a given incident.

The decontamination methods may initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment within the Hot Cell may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination of the Hot Cell is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for continued use. The free release criteria for items and equipment that will be released for uncontrolled use are < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to confirm the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log. The recovery phase must be completed before the affected area and/or equipment are returned to service.

D-4d(7) Natural Emergencies

After a natural emergency (earthquake, flood, lightning strike, etc.) that involves hazardous waste or hazardous materials, the FSM will ensure the following actions are taken:

1. Inspect containers which have not been disposed and containment for signs of leakage or damage. Inspect areas where containers are stored looking for leaking containers and for deterioration of containers and the containment system.

2. Inspect affected equipment or areas associated with hazardous waste management activities for proper operating mode in accordance with site procedures and manually check to ensure automatic and alarmed features on the units are working.

3. Inspect affected equipment or areas within the HWMUs in accordance with site procedures for damage.

4. Inspect electrical boards and overhead electrical lines for damage.

5. Check container areas for signs of leakage or damage to drums and containers.

6. Check affected buildings and fencing directly related to hazardous waste management activities for damage.

7. Conduct a general survey of the site looking for signs of land movement, etc.

8. Take any necessary corrective measures, however temporary, to rectify potential or real problems.

9. Record inspection results.

D-4d(8) Roof Fall

Roof fall is not expected to affect RH TRU mixed waste because it is emplaced in the rib of the disposal room and not subject to impact from a roof fall. The following incident description and mitigation apply to CH TRU mixed waste.

The WIPP underground is routinely evaluated for stability and safety of the underground openings. These evaluations can be as simple as the MSHA required visual checks by personnel working in the area or as extensive as the expert review of the roof support system for Room 1 Panel 1 conducted in 1991. An in-depth evaluation of all of the accessible underground is performed on an annual basis as part of the formal ground control operating plans. Weekly visual and sounding inspections are performed by the Permittees. More frequent inspections and evaluations are performed in areas where roof or ribs are in need of evaluations, based on visual observations, analysis of rock deformation data, excavation effects program data acquired from observation holes, and support system performance.

This process applies not only to the waste disposal rooms but to the entire WIPP underground. Prior to waste emplacement, stability of each room will be evaluated. This evaluation will concentrate on the age and current performance of the installed support systems (if any) and the rate of roof beam expansion based on data from installed instrumentation. The roof support system's performance and surety, to provide the support necessary for the required time will be addressed. Criteria used will include design parameters such as the amount of load, the deformation of the installed system, and the number and type of component failures observed, if any. Geotechnical criteria will include parameters such as the type and quantity of fracturing, roof beam expansion rates, and future ground performance based on a predictive model.

Should the evaluation results indicate that remedial actions are necessary prior to placement of waste, experiences at the WIPP indicate that rebolting or installing supplemental support can extend the safe life of a room for several years.

After waste emplacement commences, geomechanical monitoring will continue with monitors that are tied into a computer network program. The readings obtained will provide information needed for the roof beam stability assessment. Visual observations of the ground and the support systems will also continue in all accessible areas. Based on the experiences from the Site and Preliminary Design Validation test rooms, it has been proven that any developing instability will be detected through monitoring. Multiple measures to deal with the observed conditions can be implemented months before an event to mitigate any risk associated with a roof fall in the storage room or any affected area within the mine. At a minimum, the affected

area will be isolated and withdrawn from ventilation flow. Isolation operations will utilize current available methods, materials, and equipment.

Ground control conditions which could result in a fall can be divided into two scenarios: The first consists of spalling (falling) of individual small and localized rock falling on waste containers.

By definition, they can be considered insignificant as no damage to the drums can occur. The second consists of an entire section of roof falling on multiple stacks of waste containers. Each of these scenarios is discussed below.

Spalling-of-Ground Scenario

The maximum distance between the room roof and a container of waste is 10 ft. Waste containers are designed to withstand impact loads of at least 1,000 pounds (lbs) dropped from a height of 6 ft. flat or 450 lbs dropped on a circumferential edge from a height of 4 ft. Both of which correspond to an allowable impact stress of 25,450 pounds per square inch (psi). Rocks from spalling are small and would not be of sufficient weight when striking a drum from a 10 ft vertical height to cause an impact stress of more than 25,450 psi. Taking into account the falling distance, average weight, and the typical shape of the salt rock, the conclusion is that puncturing a drum by spalling is non-credible.

Fall-of-Ground Scenario

Fall-of-ground occurs when a large section of roof beam falls onto the waste containers. As previously discussed, the possibility of this occurring in an active room is remote, due to continuous monitoring and engineered roof support systems.

The following actions have been developed and will be taken by the RCRA Emergency Coordinator should a rock fall occur in an active waste emplacement area of the repository:

Spalling-of-Ground Actions

1 Determine whether the roof conditions allow for safe entry and if the waste container or containers in question are accessible.

The process used to determine if a roof condition of a room will allow for safe entry is the same as the ground control inspection process used for inspection of the ground conditions and roof bolt integrity. The inspection will begin at a safe and sound roof starting point and consist of visual inspections of roof bolts, roof, and rib areas for missing or damaged bolts: deformed roof bolt plates; or roof and rib cracks, fractures, or separations. If during the visual inspection suspicious roof bolts, roof, or ribs are found, then operators will proceed with sounding the area in question with a scaling bar for loose roof bolts, bad roof, or ribs (loose roof bolts will not ring when sounded). Bad roof or ribs will have a drummy, hollow, or un-solid sound when struck with the scaling bar. When this operation is performed, a safe avenue for retreat is always maintained. Also maintained is a position such that an unexpected event will not place personnel in a position where the scaling bar or material being scaled could fall on personnel. If the inspection reveals ground that cannot be safely scaled manually or with the available mining equipment, the affected area, up to and including the entire room, will be barricaded and removed from ventilation flow.

The criteria used to determine whether a waste container is accessible is based on the location of the container, the amount of waste in the room, and the expense of reaching the waste container safely versus the expense of abandonment of the room. For example, if the room is 95% filled and spalling-of-ground punctured a waste container at or near the exit of the room, the decision to isolate the room and move waste emplacement activities to the next room would be prudent.

2. Restrict access in ventilation flow path downstream of the incident.

3. Restrict ventilation to the affected room to ensure that there is no spread of contamination that may have been released. Survey for contamination and establish the boundaries.

4. Inspect accessible and affected containers and containment for signs of leakage or damage.

5. Cover the spill area with material such as plastic or fabric sheets or PVA, in a way that would safely isolate the area.

6. Determine if the covered spill area safely allows for continued waste disposal operations or whether further cleanup is required. If further cleanup is required, provide with cleanup methods described below. Note: Cleaning may not be required since this is the permitted disposal area.

7 Inspect any affected equipment (vehicles, handling equipment, and communication and alarm equipment) for proper function.

8. Repackage spilled waste and repackage, plug, or patch breached waste containers into 55 or 85-gallon drums, SWBs, or TDOPs, depending on volume. Temporarily locate overpack waste containers in an adjacent room. Remove only those intact waste containers necessary to clear the area for decontamination.

9. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets or PVA to isolate it from the workers or removed and packaged as site derived waste in accordance with site procedures for decontaminating surfaces.

10. Manage the radioactive debris as derived waste.

11 Characterize containers of waste based on the waste containers that were damaged.

12. Replace the removed and derived waste containers into the waste stack as appropriate and update the WWIS.

13. Document activities and record results.

Fall-of-Ground Actions

1 Restrict access in ventilation flow path downstream of the incident.

2. Restrict the room from ventilation flow by closing bulkhead regulators.

3. Survey for radiological contamination and establish the boundary for a Radiological Buffer Area.

4. Install barricade devices to remove access.

5. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets, or PVA to isolate it from the worker or removed and packaged as site derived waste using damp rags, hand tools, and HEPA filtered vacuums.

   The criteria used to determine whether to close the entire panel or just the affected room of waste containers would include the location of the roof fall and the stability of the unaffected roof area in the panel. Techniques to determine the stability would be the same as previously described in this section.

D-4d(9) Structural Integrity Emergencies

In the event of a WIPP facility emergency involving underground structural integrity, the situation will be handled as a natural emergency. Monitoring and inspection procedures ensure the safety and integrity of the WIPP facility underground.

D-4d(10) Emergency Termination Procedures

For the transition from emergency phase to cleanup phase, the following items will be complete:

- Emergency scene will be stable
- Release of hazardous substance will be stopped
- Reaction of hazardous substance will be controlled
- The released hazardous substance will be contained within a localized and manageable area
- The area of contamination will be adequately secure from unauthorized entry

At every incident involving hazardous materials, there is a possibility that response personnel and their equipment will become contaminated. Emergency response personnel have procedures to minimize contamination or contact, and to properly dispose of contaminated materials.

For nonemergencies and Incident Level I emergencies, the following methods of decontamination are available for personnel, environment, and/or equipment according to emergency response procedures:

- Absorption
- Adsorption
- Chemical degradation

- Dilution
- Disposal
- Isolation
- Neutralization
- Solidification

Any necessary verification of air, soil, or water samples will be directed by the RCRA Emergency Coordinator. Immediately after an emergency, the RCRA Emergency Coordinator will provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility in accordance with standard operating procedures.

For Level II and III incidents after the emergency itself is controlled and contained, the RCRA Emergency Coordinator will be responsible for the development and implementation of an incident-specific decontamination plan.

PPE will be decontaminated or disposed according to procedure before it is returned to its storage location.

As part of the facility's defense-in-depth approach, equipment will be assumed to be contaminated after each hazardous material response and a thorough check for radioactive contamination will be conducted. If contamination is found, a technically sound decontamination process will be followed. Many types of equipment are difficult to decontaminate and may have to be discarded as hazardous or derived waste. Whenever possible, pieces of equipment will be disposable or made of nonporous material.

If radioactive contamination is detected on equipment or on structures, it will be assumed that hazardous constituents may also be present. Radiological surveys to determine whether a potential release of hazardous constituents has occurred (Permit Attachment I3) will be used along with other techniques as a detection method to determine when decontamination is required. Radiological cleanup standards will be used to determine the effectiveness of decontamination efforts. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses become documentation of the condition of the container at the time of emplacement. These containers will be placed in the underground without further action, once the radiological contamination is removed, unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground. In no case shall these containers contain a total liquid content equal to, or which exceeds, one volume percent of the container.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed. The sampling plan will be approved by the NMED before it is implemented. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether

further cleaning will be beneficial or whether final clean up will be deferred until closure. Appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore, measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

For all Contingency Plan emergency responses, the RCRA Emergency Coordinator will ensure, in keeping with standard operating procedures, that, in the affected area(s) of the facility:

- No waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed
- All emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use, or replaced before operations are resumed

D-4e Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the RCRA Emergency Coordinator will ensure that reasonable measures are taken so that fires, explosions, and releases do not occur, recur, or spread to TRU mixed waste or other hazardous materials at the facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(e) and (f)). These measures include:

- Stopping processes and operations.
- Collecting and containing released wastes and materials.
- Removing or isolating containers of waste or hazardous substances posing a threat.
- Ensuring that wastes managed during an emergency are handled, stored, or treated with due consideration for compatibility with other wastes and materials on site and with containers utilized (Section D-4h).
- Restricting personnel not needed for response activities from the scene of the incident.
- Evacuating the area.
- Curtailing nonessential activities in the area.
- Conducting preliminary inspections of adjacent facilities and equipment to assess damage.
- Overpacking and/or removing damaged containers/drums from affected areas. Damaged equipment and facilities will be repaired as appropriate.
- Constructing, monitoring, and reinforcing temporary dikes as needed.
- Maintaining fire equipment on standby at the incident site in cases where ignitable liquids have been or may be released and ensuring that all ignition sources are kept

out of the area. Ignitable liquids will be segregated, contained, confined, diluted, or otherwise controlled to preclude inadvertent explosion or detonation.

No operation that has been shut down in response to the incident will be restarted until authorized by the RCRA Emergency Coordinator. Sections D-4g, Incompatible Waste, and D-4h, Post-Emergency Facility and Equipment Maintenance and Reporting, address specific issues related to decreasing the possibility of a recurrence or spread of a release, a fire, or an explosion.

After resolution of the incident, a Root Cause Analysis will be conducted to review all Level II and Level III incidents for determination of cause, and the corrective action plan to prevent recurrence.

D-4f Management and Containment of Released Material and Waste

Once initial release or spill containment has been completed, the RCRA Emergency Coordinator will ensure that recovered hazardous materials and waste are properly stored and/or disposed, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.56(g)). For spills of liquid, the perimeter of the spill will be diked with an absorbent material that is compatible with the material(s) released. Free-standing liquid will be transferred to a marked compatible container. The remaining liquid will be absorbed with an absorbent material and swept or scooped into a marked compatible container. Spill residue will be removed. Spills of dry material will be swept or shoveled into a labeled compatible recovery container. Material recovered from the spill will be transferred to clean containers or tanks or to containers or tanks that have held a compatible material. All containers will meet DOT specifications for shipping the wastes, and materials will be recovered.

Nonradioactive hazardous waste resulting from the cleanup of a fire, an explosion, or a release involving a nonradioactive hazardous waste or hazardous substance at the WIPP facility will be contained and managed as a hazardous waste until such time as the waste is disposed of, or determined to be nonhazardous, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §261) Subparts C and D. In most cases, hazardous materials inventories for the various buildings and areas at the facility will allow a determination of the hazardous materials present in any cleanup of a release or of the residues from an emergency condition (The quantities of such spills are so small, it is not likely to trigger an Incident Level II or III). When necessary samples of the waste will be collected and analyzed to determine the presence of any hazardous characteristics and/or hazardous waste constituents; this information is needed to evaluate disposal options. EPA-approved sampling and analytical methods will be utilized. Hazardous wastes will be transferred to the Hazardous Waste Staging Area. The staging area is used to store hazardous waste awaiting transfer to an off-site treatment or disposal facility in accordance with applicable regulations (e.g., 20.4.1 NMAC and DOT regulations). The Hazardous Waste Staging Area for nonradioactive hazardous waste is Buildings 474A and 474B, as shown in Figure D-1. Nonradioactive hazardous wastes will be shipped off-site for disposal at a RCRA permitted disposal facility.

Under normal operations, administrative controls will be implemented to ensure that hazardous materials and incompatible materials will not be introduced to the radioactive materials area during TRU mixed waste handling operations. Examples of administrative controls include restricting the waste received in the TRU mixed waste management area(s) to TRU mixed waste properly manifested from the generator sites and ensuring that materials used in these

area(s) are restricted to only those that have previously been determined to be compatible with the TRU mixed waste. The RCRA Emergency Coordinator will have access to building design information and information on specific equipment used within an area upon which to base a determination of the compatibility of materials with the area. If necessary, the RCRA Emergency Coordinator will use EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Waste," (EPA, 1980) for making compatibility determinations. Waste resulting from the cleanup of a fire, explosion, or release in the miscellaneous unit, the CH TRU mixed waste handling areas, or the RH Complex will be considered derived from the received TRU mixed waste and may be treated and managed as CH TRU mixed waste depending on the surface dose rate.

In the event of a prolonged cessation of TRU mixed waste handling operations, TRU mixed waste can be placed in areas of the WHB Unit that are available for such contingencies. These areas and the TRU mixed waste containers in them would be located so that adequate aisle space would be maintained for unobstructed movement of personnel and equipment in an emergency. Permit Attachments A1 and A2 describe the HWMUs in detail, including the facility description, support structures and equipment, security, waste handling areas, ventilation, and fire protection.

The contaminated area will be decontaminated. If a release is to a permeable surface, such as soil, asphalt, concrete, or other surface, the surface material will be removed and placed in containers meeting applicable DOT requirements. Contaminated soil, asphalt, concrete, or other surface material, as well as materials used in the cleanup (e.g., rags and absorbent material) will be contained and disposed of in the same manner as dictated for the contaminant. Clean soil, new asphalt, or new concrete will be emplaced at the spill location.

If a spill occurs on an impermeable surface, the surface will be decontaminated with water and/or a detergent. In the event that the spilled material is water reactive, a compatible nonhazardous cleaning solution will be used. Contaminated wash water or cleaning solution will be transferred to an appropriate container, marked, and managed as described above for nonradioactive or radioactive liquid wastes.

In the event of a hazardous material or hazardous waste release, the RCRA Emergency Coordinator will ensure that no wastes will be received or disposed of in the affected areas until cleanup operations have been completed. This is to ensure that incompatible waste will not be present in the vicinity of the release.

Because of the restrictions which the WIPP facility places on generators, and because of control of WIPP operations, TRU mixed wastes and derived wastes will not contain any incompatible wastes. However, the areas established for the temporary holding of nonradioactive waste routinely generated at the WIPP facility is divided into bays to accommodate the management of wastes that may be incompatible. If waste is generated as the result of a spill or release of hazardous materials or nonradioactive hazardous waste, the waste generated as a result of abatement and cleanup will be evaluated to determine its compatibility with other wastes being managed in the temporary holding areas. The evaluation will be by identifying the material or waste that was spilled or released and determining its characteristics (e.g., ignitable, reactive, corrosive, or toxic). The waste generated by the abatement and cleanup activities will be stored in that part of the temporary holding area that has been established to manage wastes with which it is compatible.

For small nonemergency liquid spills (e.g., a detergent solution leaking out of the pump handle during decontamination, a spill of hydraulic fluid while servicing a vehicle), spill control procedures will be used to contain and absorb free-standing liquid. The contaminated absorbent will be swept or shoveled into a compatible container and managed as described above. No notifications will be required, but site procedures require documentation of the incident.

D-4g Incompatible Waste

Implementation of the TSDF-WAC for the WIPP ensures that incompatible TRU mixed waste will not be shipped to the WIPP facility. Nonradioactive waste at the WIPP facility will be carefully segregated during handling and holding and will be transported within and off the facility. The RCRA Emergency Coordinator will not allow hazardous or TRU mixed waste operations to resume in a building or area in which incompatible materials have been released prior to completion of necessary post-emergency cleanup operations to remove potentially incompatible materials. In making the determination of compatibility, the RCRA Emergency Coordinator will have available the resources and information described in Section D-4b, Identification of Hazardous Materials. In addition, ES&H department personnel will be available for consultation. Finally, the RCRA Emergency Coordinator may use EPA-600/2-80-076, (EPA, 1980).

D-4h Post-Emergency Facility and Equipment Maintenance and Reporting

The RCRA Emergency Coordinator will ensure that emergency equipment that is located or used in the affected area(s) of the facility and listed in the Contingency Plan is cleaned and ready for its intended use before operations are resumed, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(h)(2)). Any equipment that cannot be decontaminated will be discarded as waste (e.g., hazardous, mixed, solid), as appropriate. The WIPP facility is committed to replacing any needed equipment or supplies that cannot be reused following an emergency. After the equipment has been cleaned, repaired, or replaced, a post-emergency facility and equipment inspection will be performed, and the results will be documented.

Cleaning and decontaminating equipment will be accomplished by physically removing gross or solid residue; rinsing with water or another suitable liquid, if required; and/or washing with detergent and water. Decontamination and cleaning will be conducted in a confined area, such as a wash pad or building equipped with a floor drain and sump isolated from the environment. Care will be taken to prevent wind dispersion of particles and spray. Liquid or particulate resulting from cleaning and decontamination of equipment will be placed in clean, compatible containers. Waste produced in an emergency cleanup in the TRU mixed waste handling areas is derived waste and will be emplaced in the underground derived waste emplacement area. Waste resulting from decontamination operations elsewhere in the WIPP facility will be analyzed for hazardous waste constituents and/or hazardous waste characteristics to ensure proper management.

When the WIPP facility has completed post-emergency cleanup of waste and hazardous residues from areas where waste management operations are ready to resume and the RCRA Emergency Coordinator has ensured that emergency equipment used in managing the emergency has been cleaned or replaced and is fit for service, the notifications will be made by the Permittees to the following: the EPA Region VI Administrator; the Secretary of the NMED; and any relevant local authorities. This post-emergency notification complies with 20.4.1.500

NMAC (incorporating 40 CFR §264.56(i)), and is the responsibility of the RCRA Emergency Coordinator.

D-4i Container Spills and Leakage

The waste received at the WIPP facility will meet stringent TSDF-WAC (e.g., no more than one percent liquid), which will minimize the possibility of waste container degradation and liquid spills. Should a spill or release occur from a container, following an initial assessment of the event, the WIPP facility will immediately take the following actions, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.52(a) and §264.171):

- Assemble the required response equipment, such as protective clothing and gear, heavy equipment, empty drums, overpack drums, and hand tools
- Transfer the released material to a container that is in good condition or overpack the leaking container into another container that is in good condition
- Once the release has been contained, determine the areal extent of migration of the release and proceed with appropriate cleanup action, such as chemical neutralization, vacuuming, or excavation

D-4j Tank Spills and Leakage

The TRU mixed waste handling areas at the WIPP facility do not include tank storage or treatment of hazardous waste, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR §264) Subpart J. At the WIPP facility, tanks are used to store water and petroleum fuels only. The petroleum tanks store diesel and unleaded gasoline.

D-4k Surface Impoundment Spills and Leakage

The WIPP facility does not manage hazardous or TRU mixed waste using a surface impoundment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR, §264) Subpart K. Surface impoundment regulations are not applicable to the WIPP facility.

D-5 Emergency Equipment

A variety of equipment is available at the facility for emergency response, containment, and cleanup operations in both the HWMUs and the facility in general. This includes equipment for spill control, fire control, personnel protection, monitoring, first aid and medical attention, communications, and alarms. This equipment is immediately available to emergency response personnel. A listing of major emergency equipment available at the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.52(e)), is shown in Table D-6. Table D-7 identifies the locations where fire suppression systems are provided. Locations of the underground emergency equipment are shown in Figure D-5. The firewater-distribution system map is shown in Figure D-6. The underground fuel area fire-protection system is shown in Figure D-7.

D-6 Coordination Agreements

The Permittees have established MOUs with off-site emergency response agencies for firefighting, medical assistance, hazardous materials response, and law enforcement. In the event that on-site response resources are unable to provide all the needed response actions during either a medical, fire, hazardous materials, or security emergency, the RCRA Emergency Coordinator will notify appropriate off-site response agencies and request assistance. Once on site, off-site emergency response agency personnel will be under the direction of the RCRA Emergency Coordinator.

The MOUs with off-site cooperating agencies are available from the Permittees. A listing and description of the MOUs with state and local agencies and mining operations in the vicinity of the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37 and §264.52(c)), are:

- An agreement among the Permittees, Intrepid Potash NM LLC, and Mosaic Potash Carlsbad Inc., provides for the mutual aid and assistance, in the form of MRTs, in the event of a mine disaster or other circumstance at either of the two facilities. This provision ensures that the WIPP MOC will have two MRTs available at all times when miners are underground.

- A memorandum of agreement between the City of Carlsbad, New Mexico, and the WIPP MOC for ambulance service assistance provides that, upon notification by the WIPP MOC, the Carlsbad Fire Department/Ambulance Service will be dispatched from Carlsbad toward the WIPP site by a designated route and will accept the transfer of patient(s) being transported by the WIPP facility ambulance at the point both ambulances meet. If the patient(s) is not transferrable, the Carlsbad Fire Department/Ambulance Service will provide equipment and personnel to the WIPP facility ambulance, as necessary.

- A MOU between the DOE and the Carlsbad Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Carlsbad Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the Lea Regional Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Lea Regional Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the U.S. Department of Interior (**DOI**), represented by the Bureau of Land Management (**BLM**), Roswell District, provides for a fire-management program that will ensure a timely, well-coordinated, and cost-effective response to suppress wild fire within the withdrawal area using the WIPP incident commander for fire-management activities. The DOI will provide firefighting support if requested. In addition, the MOU provides for responsibilities concerning cultural resources, grazing, wildlife, mining, gas and oil production, realty/lands/rights-of-way, and reclamation.

- A mutual-aid firefighting agreement between the Eddy County Commission and the DOE provides for the assistance of the Otis and Joel Fire Departments (a volunteer fire district created under the Eddy County Commission and the New Mexico State Fire Marshall's Office), including equipment and personnel, at any location within the WIPP Fire Protection Area upon request by an authorized representative of the WIPP Project. These responsibilities are reciprocal.

- A mutual-aid agreement between the City of Hobbs and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Hobbs during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A mutual-aid agreement between the City of Carlsbad and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Carlsbad during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A MOU between the DOE and the New Mexico Department of Public Safety (**DPS**) concerning Mutual Assistance and Emergency Management applies to any actual or potential emergency or incident that: 1) involves a significant threat to employees of the Permittees or general public; 2) involves property under the control or jurisdiction of either the DOE or the State; 3) involves a threat to the environment which is reportable to an off-site agency; 4) requires the combined resources of the DOE and the state; 5) requires a resource that the DOE has which the State does not have, or a resource the State has which DOE does not have; or 6) involves any other incident for which a joint determination has been made by the DOE and the State that the provisions of this MOU will apply. The MOU provides that the DPS shall permit qualified and security cleared DOE Emergency Management members into the State EOC for the purpose of: a) coordinating communications functions; b) evaluating and maintaining communications capabilities; c) participating in exercises; d) link the State's High Frequency radio communications network with the DOE; and e) assisting the State during radioactive materials accidents that require joint operations or the use of the DOE Radiological Assistance Program team. The DOE shall permit qualified and security cleared members the State Emergency Management community into the DOE's EOCs for the purposes of coordinating communications and activities. Additional duties for each participant are specified for assistance in incidents or emergencies.

D-7 Evacuation Plan

If it becomes necessary to evacuate the WIPP facility, the assigned on-site and off-site staging areas have been established. The off-site staging areas are outside the security fence. The WIPP facility has implementation procedures for both surface and underground evacuations. Drills are performed on these procedures at the WIPP facility at least once annually. The following sections describe the evacuation plan for the WIPP facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.52(f)).

D-7a Surface Evacuation On-site and Off-site Staging Areas

Figure D-8 shows the surface staging areas. Personnel report to their Office Wardens at designated staging areas where accountability is conducted. If site evacuation is necessary, the RCRA Emergency Coordinator will decide which staging areas are to be used and will advise Office Wardens of the selections. The RCRA Emergency Coordinator will communicate the locations to Office Wardens via office warden pager, radio, plectron, WIPP Security, or telephone, as appropriate. Office Wardens will direct personnel to the selected staging area outside the security fence. Personnel who are working in a contaminated area when site evacuation is announced, will assemble at specific staging areas to minimize contact with other personnel during the evacuation (Figure D-8).

Office Wardens conduct accountability of personnel assigned to their specific areas. For complete surface accountability, the Office Wardens report to their ACOW, who reports to the COW. When the COW has reports from all ACOWs, surface accountability is reported to the CMRO, who then notifies the RCRA Emergency Coordinator of the accountability.

The COW and all ACOWs have radios for communication between them and the CMRO. The Office Wardens, Assistant Office Wardens, ACOWs, and COW also have pagers with which they are notified of evacuations. At the staging areas Office Wardens report directly to their ACOW.

There are three off-site staging areas identified on Figure D-8. The RCRA Emergency Coordinator determines which staging area will be used. Security officers remain at the primary staging area gate 24 hours a day, and the vehicle trap is opened for personnel during emergency evacuations. The north gate has a single person gate and large gate which can be opened, similar to the main gates for the primary staging area. The east gate is a turnstile gate. Upon notification by the RCRA Emergency Coordinator, Security will respond, open gates, and facilitate egress for evacuation.

The on-site staging areas are identified in Figure D-8. These are used for building or area evacuations as determined by the RCRA Emergency Coordinator.

D-7b Underground Assembly Areas and Egress Hoist Stations

In the event of an underground or surface event, the RCRA Emergency Coordinator can call for underground personnel to report to assembly areas (Figure D-9). Underground personnel are also trained to immediately report to assembly areas under specific circumstances (i.e. loss of underground power or ventilation). If accountability is required, the underground will be evacuated. The Underground Controller is responsible for underground accountability by comparing the brass numbers with the brass tags signed out in the lamproom. Each assembly area contains a Mine Page Phone, miner's aid station, and evacuation maps.

In accordance with 30 CFR §57.11, the mine maintains two escapeways. These escapeways are designated as Egress Hoist Stations. When an underground evacuation is called for, all underground personnel report to the Egress Hoist Stations.

Decontamination of underground personnel will be conducted the same way as described for surface decontamination. Contaminated personnel are trained to remain segregated from other personnel until RC personnel can respond to the incident at the underground location.

D-7c Plan for Surface Evacuation

Surface evacuation notification is initiated by the RCRA Emergency Coordinator directing the CMRO to sound the surface evacuation alarm. The Office Wardens assist personnel in evacuation from their areas. Evacuation routes and instructions are posted throughout the site.

If the EST/FPT notifies the ERT members by pager to respond to an identified area, these members will not depart the site during an evacuation, but will report to the EST/FPT for instructions and accountability. The EST/FPT notifies the COW of response members present. These personnel will not evacuate until released by the RCRA Emergency Coordinator

D-7d Plan for Underground Evacuation

Notification for underground evacuation will be made using the underground evacuation alarm and strobe light signals.

Personnel will evacuate to the nearest egress hoist station. Primary underground evacuation routes (identified by green reflectors on the rib) will be used, if possible. Secondary underground evacuation routes (identified by red reflectors on the rib) will be used if necessary (Figure D-5). Brass tags will be collected from personnel at the hoist collar on the surface, and taken to the Underground Controller, who functions as an Office Warden. When all brass tags are accounted for, underground accountability is reported to the RCRA Emergency Coordinator.

Upon reaching the surface, personnel will report to their on-site staging area to receive further instructions.

Members of the FLIRT and the MRT who may be underground, will evacuate the underground when an underground evacuation is called for. A reentry by the MRT will be performed according to 30 CFR 49 and MSHA regulations for reentry into a mine. The two MRTs are trained in compliance with 30 CFR 49 in mine mapping, mine gases, ventilation, exploration, mine fires, rescue, and recovery.

D-7e Further Site Evacuation

In the event of an evacuation involving the need to transport employees, the following transportation will be available:

- Buses/vans—WIPP facility buses/vans will be available for evacuation of personnel. The buses/vans are stationed in the employee parking lot.

- Privately Owned Vehicles—Because many employees drive to work in their own vehicles, these vehicles may be utilized in an emergency. Personnel may be directed as to routes to be taken when leaving the facility.

These vehicles may be used to transport personnel who have been released from the site by the RCRA Emergency Coordinator.

D-8 Required Reports

The RCRA Emergency Coordinator, on behalf of the Permittees, will note in the operating record the time, date, and details of any incident that requires implementing this Contingency Plan. This notation will be in the facility log maintained by the CMRO. In compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)), within 15 days after the incident, the Permittees will ensure that a written report on the incident will be submitted to the EPA Region VI Administrator and to the Secretary of the NMED. The report will include:

- The name, address, and telephone number of the Owner/Operator
- The name, address, and telephone number of the facility
- The date, time, and type of incident (e.g., fire, explosion or release)
- The name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where this is applicable
- The estimated quantity and disposition of recovered material that resulted from the incident

In addition to the above report, the Permittees will ensure that the ES&H Manager, or designee, submits reports to the appropriate agencies as listed in Tables D-8 and D-9.

In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), the Permittees will notify the Secretary of the NMED and EPA Region VI Administrator that the WIPP facility is in compliance with requirements for the cleanup of areas affected by the emergency and that emergency equipment used in the emergency response has been cleaned, repaired, or replaced and is fit for its intended use prior to the resumption of waste management operations in affected areas. The means the WIPP facility will use to meet these requirements are described in Sections D-4e, D-4f, D-4g, and D-4h.

The WIPP requires the EST/FPT to initiate the "WIPP Hazardous Materials Incident Report" if the Contingency Plan is implemented. A form is attached as Figure D-12. The form is initiated by the EST/FPT The RCRA Emergency Coordinator, CMRO, and Environmental Compliance representatives complete their respective sections.

D-9 Location of the Contingency Plan and Plan Revision

The owner/operator of the WIPP facility will ensure that copies of this Contingency Plan are available through the WIPP electronic controlled-document distribution system or in appropriate controlled-document locations throughout the facility, and the alternate Emergency Operations Center and the Joint Information Center at the Skeen Whitlock Building, and are, consequently, available to all emergency personnel and organizations described in Section D-2. In addition, the owner/operator will make copies available to the following outside agencies:

- Intrepid Potash NM LLC and Mosaic Potash Carlsbad Inc.
- Carlsbad Fire Department, Carlsbad
- Carlsbad Medical Center, Carlsbad
- Lea Regional Medical Center, Hobbs
- Otis Fire Department, Otis
- Hobbs Fire Department, Hobbs
- Joel Fire Department, Carlsbad
- BLM, Carlsbad
- New Mexico State Police

The owner/operator of the WIPP facility will ensure that this plan is reviewed annually and amended whenever:

- Applicable regulations are revised
- The RCRA Part B permit for the WIPP facility is revised in any way that would affect the Contingency Plan
- This plan fails in an emergency
- The WIPP facility design, construction, operation, maintenance, or other circumstances change in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents or change the response necessary in an emergency
- The list of RCRA Emergency Coordinators change
- The list of WIPP facility emergency equipment changes.

References

U.S. Environmental Protection Agency, "A Method for Determining the Compatibility of Hazardous Waste," EPA-600/2-80-076, 1980.

U.S. Department of Transportation, Emergency Response Guidebook, U.S. Government Printing Office, 1993.

Westinghouse Electric Corporation, 1994, "Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling," WP 02-EM1, Westinghouse Electric Corporation, Carlsbad, New Mexico.

U. S. Department of Energy, "WIPP Safety Analysis Report," DOE/WIPP-95-2065, Rev. 2

U. S. Department of Energy, "WP 12-5, WIPP Radiation Safety Manual".

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TABLES

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Table D-1
Hazardous Substances in Large Enough Quantities to Constitute a Level II Incident

Chemical Description	Building Location	Hazard Category
Ethylene Glycol Solution - 35%	Buildings 411; 412; 451; 452; 486; 463; 474C; FAC 414	Immediate (acute) Delayed (chronic)
Gasoline, Unleaded GASC0001	FAC 480	Fire Immediate (acute) Delayed (chronic)
No. 1 Diesel Fuel Oil GASC0210	Oil Depot U/G; FACs 480, 255.1 & 255.2; Transport Tank; Building 456 Trailer 911F	Fire Immediate (acute) Delayed (chronic)
Multiple containers of TRU Waste as described in Permit Section 3.3.1	WHB Waste Shaft U/G	Delayed (chronic)
Hazardous materials in quantities that exceed 5 times the Reportable Quantity (Per DOE O 151 1) values as defined in 40 CFR 302	It should be noted that WIPP is not expected to possess such quantities.	Fire Immediate (acute) Delayed (chronic)

Table D-2
Resource Conservation and Recovery Act Emergency Coordinators

Name	Address*	Office Phone	Personal Phone*
R. C. (Russ) Stroble (primary)[1]		234-8276 or 234-8554	
J. E. (Joseph) Bealler[2]		234-8276 or 234-8916	
M. G. (Mike) Proctor[2]		234-8276 or 234-8143	
G. L. (Gary) Kessler[2]		234-8326	
A. E. (Alvy) Williams[1] (primary)		234-8276 or 234-8216	
P. J. (Paul) Paneral[1] (primary)		234-8498	
J. R. (Joel) Howard[2]		234-8325	
M. L. (Mark) Long[1] (primary)		234-8170	
A.C (Andy) Cooper[2]		234-8197	

* NOTE: Personal information (home addresses and personal phone numbers) has been removed from informational copies of this Permit.

[1] The on-duty Facility Shift Manager is the primary RCRA Emergency Coordinator pursuant to 20.4.1.500 NMAC (incorporating 40 CFR §264.52), and is designated to serve as the RCRA Emergency Coordinator.

[2] The on-duty Facility Operations Engineer is the alternate RCRA Emergency Coordinator and is available as needed.

Table D-3
Planning Guide for Determining Incident Levels and Response

Incident Condition	Incident Level		
	I	II *	III *
Product identifications	Placard not required, NFPA 0 or 1 all categories, all Other Regulated Materials A, B, C, and D.	DOT placarded, NFPA 2 for any categories, PCBs without fire, EPA regulated waste. SITE SPECIFIC: Table D-1 and TRU mixed waste AND	Poison A (gas), explosive A/B, organic peroxide, flammable, solid, materials dangerous when wet, chlorine, fluorine, anhydrous ammonia, radioactive materials, NFPA 3 and 4 for any categories including special hazards, PCBs and fire including special hazards, PCBs and fire DOT inhalation hazard, EPA extremely hazardous substances, and cryogenics.
Container size	Container size does not impact this incident level.	Involves multiple packages.	Tank truck.
Fire/explosion potential	Under control.	May spread/may be explosive.	May spread/may be explosive.
Leak severity	No release or small release contained or confined with readily available resources.	Release may not be controllable without special resources.	Release may not be controllable even with special resources.
Life safety	No life-threatening situation from materials involved.	Localized area, limited evacuation area.	Localized area, limited evacuation area.
Environmental impact (Potential)	None.	Limited to incident boundaries	Contained within the Hazardous waste Management Units.
Container integrity	Not damaged.	Damaged but able to contain the contents to allow handling or transfer of product.	Damaged to such an extent that catastrophic rupture is possible.

* Contingency Plan is implemented

Table D-4
Physical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Absorption	Yes	No	Yes	No
Covering	Yes	Yes	Yes	Yes
Dikes, diversions	Yes	Yes	Yes	Yes
Overpack	Yes	Yes	Yes	Yes
Plug/patch	Yes	Yes	Yes	Yes
Transfer	Yes	Yes	Yes	Yes
Vapor suppression	Yes	Yes	No	No

Table D-5
Chemical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Neutralization	Yes	Yes[1]	No	No
Solidification	Yes	No	Yes[2]	No

(1) When solid neutralizing agents are used, they will be used simultaneously with water.

(2) This method could be utilized for mitigation of firewater involving TRU-waste.

Table D-6
Emergency Equipment Maintained at the Waste Isolation Pilot Plant

Equipment	Description and Capabilities	Location
Communications		
Building Fire Alarms	Manual pull stations and automatic devices (sprinkler system flow, and smoke and thermal detectors) trigger fire alarm; locally visible and audible; visual display and alarm in Central Monitoring Room (CMR)	Guard and Security Building, Pumphouse, Warehouse/Shops, Exhaust Filter Building, Support Building, CMR/ Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, SH Hoisthouse, Maintenance Shops, Guard Shack*, Auxiliary Warehouse, Core Storage Building, Engineering Building, Training Facility, Safety Building, Maintenance Shop, Hazardous Waste Storage (non-TRU) Area (Facility 474) *local alarms; not connected to the CMR
Underground Fire Alarms	Automatic/Manual; have priority over other paging channel signals but not override intercom channels; alarms sound in the general area of the control panel and are connected to the underground evacuation alarms; they also interface with the CMR.	Fire detection and control panel locations: Waste Shaft Underground Station, SH Shaft Underground Station, Between E-140 and E-300 in S-2180 Drift, E-O/N-1200, Fuel Station
Site-wide Evacuation Alarm	Transmitted over paging channel of the public address system, overriding its normal use; manually initiated according to procedures requiring evacuation; audible alarm produced by tone generator at 10 decibels above ambient noise level (or at least 75 decibels); flashing strobe lights; radios and/or pagers are used to notify facility personnel outside alarm range. Monthly test are performed on the PA, site notification alarms, and plectrons.	Site-wide
Vehicle Siren	Manual; oscillating; emergency services/surface response vehicles, is mechanical and electronic.	WIPP surface emergency vehicles
Public Address System	Includes intercom phones; handset stations and loudspeaker assemblies, each with own amplifiers; multichannel, one for public address and pages, and others for independent party lines.	Surface and underground
Intraplant Phones	Private automatic branch exchange; direct dial; provide communication link between surface and underground operations	Throughout surface and underground

Equipment	Description and Capabilities	Location
Mine Page Phones	Battery-operated paging system	CMR, Mine Rescue Room, EOC, lamproom, underground at S550/W30, S100/W30, S1950/E140, SH Shaft Collar and Underground Station, Waste Shaft Collar and Underground Station, FSM desk.
Emergency Pagers	Manual; , intermittent alarm signals	Issued to appropriate emergency personnel
Plectrons	Tone-alert radio receivers placed in areas not accessible by the public address system	Site-wide
Portable Radios	Two-way, portable; transmits and monitors information to/from other transmitters	Issued to individuals
Plant Base Radios	Two-way, stationary, VHF-FM; linked to Eddy County Sheriff Department, NM State Police, and Otis Fire Department), and WIPP Channels 1-18 (Communication with the Lea County Sheriff's Department, the Hobbs Fire Department, Carlsbad Medical Center and Lea Regional Hospital is available via the Eddy County dispatcher) (Site Security, Site Operations and Site Emergency, maintenance, repeater to Carlsbad). Wireless communications such as cellular phones may be used to contact the Eddy County emergency responders.	Various site locations
Mobile Phones	Provide communications link between WIPP Security and key personnel	Issued to individuals plus emergency vehicles,
Spill Response		
SPILL-X-S Guns and Recharge Powder	Containment; (1)SPILL-X model SC-30-C(Gun) (1)SPILL-X model XC-30-S(Gun) (1)SPILL-X model SC-30-A(Gun); (1) A-Acid, 5 gallon bucket (Recharge Powder) (1)S-Solvent, 5 gallon bucket (Recharge Powder) (1)C-Caustic, 5 gallon bucket (Recharge Powder)	HAZMAT trailer
Absorbent Sheets	Containment or cleanup; (1) 3' x 100' Sheet	HAZMAT trailer
Absorbents	Grab and Go container; spill control bucket; (1) for solvents and neutralizing absorbents; 5 gallon bucket (1) for acids/caustics; 5 gallon bucket	HAZMAT trailer
Absorbent Material	Containment or cleanup; (1) 100 ft. rolled or equivalent socks "Pig" for general liquid (1) 100 ft. rolled or equivalent socks "Pig" for oil	HAZMAT trailer

Equipment	Description and Capabilities	Location
Air Bag System	Extrication, Stabilization, Cribbing (1) bag system with tank kit and the following bag sizes: (1)12-ton, (1) 21.8-ton, (1)17-ton	Surface rescue truck
Air Chisel	Extrication (1) Capable of cutting 3/16" steel	Surface rescue truck
Drum Transfer Pumps and Drum Opener	Containment or cleanup; (1) unit for chemical transfer (1) hand operated pump for petroleum transfer (1) drum opener	HAZMAT trailer
Floor Squeegee	Containment or cleanup; (1) straight rubber blade, nonwood handle	HAZMAT trailer
Foam Concentrate	AFFF 6% (4) 5-gallon pail	Fire truck # 1
Gas Cylinder Leak Control Kit	(1)Series A Hazardous Material Response Kit; contains nonsparking equipment to control and plug leaks	HAZMAT trailer
Portable Generator	(1)Backup power; 5,000 watt; 120 or 240 volt	Surface rescue truck

Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
Medical Resources		
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
Fire Detection and Fire Suppression Equipment		
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

Equipment	Description and Capabilities	Location
Water Tanks, Hydrants	Fire suppression water supply; one 180,000-gallon capacity tank, plus a second tank with 100,000 gallon reserve	Tanks are at southwestern edge of WIPP facility; pipelines and hydrants are throughout the surface
Fire Water Pumps	Fire suppression water supply; 125 pounds per square inch, 1,500 gallons per minute centrifugal pump, one with electric motor drive, the other with diesel engine; pressure maintenance pump	Pumphouse
Personal Protection Equipment		
Headlamps	Mounted on hard hat; battery operated	Each person underground
Underground Self-Rescuer Units	Short-term rebreathers; approximately 300	Each person underground
Self-Contained Self-Rescuer	At least 60 minutes of oxygen available. Approximately 400 units cached throughout the underground	Cached throughout the underground
Self-Contained Breathing Apparatus (SCBA)	Oxygen supply; 4-hour units; approximately 14 Mine Rescue Team Draeger units	Mine Rescue Training Room
Chemical and Chemical-Supported Gloves	Body protection; (12 pair) inner-cloth, (12 pair) outer-pvc, (5 pair) outer-viton	HAZMAT trailer
Suit, Acid	Body protection; (4) acid	HAZMAT trailer
Suit, Fully Encapsulated	Body protection; used with SCBAs; full outerboot; (4) Level A; (4) Level B	HAZMAT trailer
Emergency Medical Equipment		
Antishock Trousers	Shock treatment; (2) inflatable, one on each ambulance	Ambulance # 1 and # 2
Zoll 1600 Heart Monitor and Defibrillator	Heart Monitor/defibrillator	Ambulance # 1 and # 2
Oxygen	Patient care; Size D: (2) Ambulance #1 (1) Underground Ambulance (1) Health Services Size E: (1) Rescue Truck (2) Underground Ambulance Size M: (1) Ambulance #1	Ambulance # 1 and # 2, surface rescue truck

Equipment	Description and Capabilities	Location
Resuscitators (Bag)	Disposable bag resuscitation Ambulance #1: (2) adult size (1) child size Underground Ambulance: (2) adult size	Ambulance # 1, Ambulance # 2
Splints	Immobilize limbs; (1) Adult traction splint, lower extremity, with limb-supporting slings, padded ankle hitch and traction device per ambulance. (2) Rigid splinting devices or equivalents, suitable for immobilization of upper extremities per ambulance. (2) Rigid splinting devices or equivalents, suitable for the immobilization of lower extremities. (1) Set of Airsplints: 6 assorted splints; hand/wrist, half arm, full arm, foot/ankle, half leg, and full leg per miner's aid stations.	Ambulance # 1 and # 2, Miner's Aid Stations
Stretchers	Patient transport; (2) Spine Boards, one short and one long, with nylon straps per ambulance. (also used to perform cardiopulmonary resuscitation) (2) Emergency Stretchers or scoops, or combination per ambulance (1) All-purpose multi-level ambulance stretch (gurney), with 3 safety straps and locking mechanism per ambulance. (1) Stretcher in each miner's aid station.	Various combinations in Ambulance # 1 and # 2, Miner's Aid Station
Suctions	For medical emergencies: Portable (1) Suction unit, capable of delivering at least 300 mm. HG on each ambulance.	Ambulances #1 and #2
Trauma Kits	(1) adult blood pressure cuff and stethoscope (4) soft-roller bandages (3) triangular bandages (1) pkg. band-aids (2) trauma dressings (25) 4X4 sponges (1) roll adhesive tape (1) bite stick (1) penlight (1) sterile burn sheet (1) oropharyngeal airway (1) glucose substance (2) sterile gauze dressings	(1) kit in each: Ambulances #1 and #2, surface rescue truck

Equipment	Description and Capabilities	Location
Miner's Aid Station	For First Aid Stations in the Underground (1) Stretcher--as referenced above per station (1) Set of airsplints--as referenced above per station (1) Blanket per station (1) Box of latex gloves (50) per station (5) Pathogen Wipes per station (1) First Aid Kit (24) per station; includes, (3) Band-Aid Combo Paks (2) Swabs, PVP (1) Antibiotic Ointment (1) Sting-Kill Swab (2) Dressing, compresses (2) Roller Bandages (2) Tape (2) Triangle Bandage (1) Eyedressing Pak (1) Burn Dressing (1) Ammonia Inhalants (1) User Log Sheet	Miner's Aid Stations - Various Underground Locations
First Aid Supplies	According to General Order #35 (12) bandages, soft roller, self-adhering type--4" or 6" x 5 yards. (6) triangular bandages, 40" (1) box band-aids (1) 1 pair bandage shears (6) Trauma dressings, 30" x 10" (6) Trauma dressings, 5" x 7" (50) 4" x 4" sponges, individually wrapped and sterile (2) rolls adhesive tape (1) penlight (2) sterile burn sheets (2) oropharyngeal airways -- adult (2) oropharyngeal airways -- child (Ambulance #1 only) (2) oropharyngeal airways -- infant (Ambulance #1 only) (1) Glucose substance (3) Occlusive dressings (1) Roll aluminum foil (6) Rigid cervical collars--2 each small, medium and large sizes (4) Cold packs (4) Heat packs (2) Bite sticks	Ambulance #1
First Aid Supplies	(2) Transfer sheets (2) Blankets	Ambulances #1 and #2

Equipment	Description and Capabilities	Location
First Aid Supplies	(2) #16g angiosets (2) #18g angiosets (2) #20g angiosets (1) 1000cc LR IV fluid (1) 500cc NS IV fluid	Ambulances #1 and #2, surface rescue truck
General Plant Emergency Equipment		
Emergency Lighting	For employee rescue and evacuation, and fire/spill containment; linked to main power supply, and selectively linked to back up diesel power supply and/or battery-backed power supply	Surface and underground
Backup Power Sources	Two diesel generators, and battery-powered uninterruptible power supply (UPS); use limited to essential loads; manual or remote starting 1,100-kilowatt diesel generators with on-site fuel for 62% load for 3 days for selected loads; 30-minute battery capacity for essential loads	Generators are east of Safety and Emergency Services Building; UPS is located at the essential loads
Hoists	Hoists in Waste Shaft, Air Intake Shaft, and SH Shaft	Waste Shaft, Air Intake Shaft, SH Shaft
Radiation Monitoring Equipment	(5) Portable alpha and beta survey meters, portable air samplers, and portable continuous air monitors	Building 412
Emergency Shower	For emergency flushing of contaminated individual	Surface
Eye Wash Fountains	For emergency flushing of affected eyes	Various locations on surface and in the underground
Decon Shower Equipment	Self-contained decon shower trailer, portable decon shower unit, disposable decon shower	Surface
Overpack containers	14-85 Gallon drums 4-SWBs 1-TDOP	Building 481 Building 481 Building 481
HEPA Vacuums	2 HEPA Vacuums to be utilized for removal of contamination.	Building 481
Aquaset or Cement	100 lbs. of aquaset or cement material for solidification of liquid waste generated as a result of fire fighting water or decontamination solutions.	Building 481
Polyvinyl Alcohol or Paint	1 - 5 gallon bucket of approved fixative to be used during recovery.	Building 481
TDOP Upender	Upender facilitates overpacking standard waste boxes	Building 481
Non hazardous Decontaminating Agents	4-1 Gallon bottles for decontamination of surfaces, equipment, and personnel	Building 481

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Table D-7
Types of Fire Suppression Systems by Location

Location	AS	AD	MPS	PFE
Waste Handling Building	*		*	*
Support Building	*		*	*
Exhaust Filter Building	*		*	*
Water Pumphouse	*		*	*
Underground Support Areas (also has rescue truck) (as illustrated in Figure D-5)		*	*	*
Station A Effluent Monitoring Shed			*	*
Station B Effluent Monitoring Shed			*	*

(1) Symbols for WIPP fire-protection systems:

AS = Automatic Wet Pipe Sprinkler System
AD = Automatic Dry Chemical Extinguishing System
MPS = Manual Pull Stations
PFE = Portable Fire Extinguishers

(2) The Waste Handling Building and the Support Building contain the following:

- Automatic wet pipe sprinklers
- Fire detection in the heating, ventilation, and air conditioning instrumentation (Support Building, only)
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Safety and Emergency Services Building contains the following:

- Automatic wet pipe sprinklers
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Core Storage Building contains the following:

- Automatic wet pipe sprinklers
- Portable fire extinguishers

(3) The Exhaust Filter Building, Underground Facilities, Warehouse/Shops Building, Water Pumphouse, and Salt Handling Hoist house also have portable fire extinguishers, manual pull stations, and automatic detectors.

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Table D-8
Hazardous Release Reporting, Federal

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA) (40 CFR Part 302)	"Reportable quantities" of CERCLA/SARA "hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Chemical identification; 2) what hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g., evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA). EPA may request a written report.
Emergency Planning and Community Right-to-Know Act (SARA Title III) (40 CFR Parts 302 and 355)	SARA Title III "extremely hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581.	1) Chemical identification; 2) what extremely hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g. evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA) for an address if a written report is requested by EPA.
Resource Conservation and Recovery Act (RCRA), 40 CFR §§264.56(a) and 265.56(a)	Any imminent or actual emergency situation.	State or local agencies with designated response roles, if their help is needed: Carlsbad Police Department: 885-2111; Carlsbad Fire Department: 885-2111; Eddy County Sheriff: 887-7551.	What assistance is required.	Not Applicable (NA)

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
RCRA, 40 CFR §§264.56(d), 264.56(i), 265.56(d), and 265.56(i)	RCRA "hazardous waste" release, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802 and State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response).	(1) Name and telephone number of reporter; (2) name and telephone number of facility; (3) time and type of incident; (4) name and quantity of materials involved; (5) extent of injuries, if any; and (6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: (1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and (2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
RCRA, 40 CFR §§264.56(i), 264.56(j), 265.56(i), and 265.56(j)	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	NA	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g. fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

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Table D-9
Hazardous Release Reporting, State of New Mexico

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
20.4.1.500 and 600 NMAC	RCRA "hazardous waste" releases, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802; State Emergency Response Commission and (505) 476-9620 (New Mexico State Police, Hazardous Materials Emergency Response)	1) Name and telephone number of reporter; 2) name and telephone number of facility; 3) time and type of incident; 4) name and quantity of material involved; 5) extent of injuries, if any; and 6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
20.4.1.500 and .600 NMAC	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	1) Name and telephone number of reporter; 2) name and address of facility; 3) name and quantity of materials involved, to extent known; 4) extent of injuries, if any; and 5) possible hazards to human health or the environment, outside the facility.	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g., fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; and 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Emergency Management Act, Section 74-4B-5	Any accident (spill) involving hazardous materials (including hazardous substances, radioactive substances, or a combination thereof) which may endanger human health or the environment.	New Mexico Environment Department: (505) 827-9329, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Name, address and telephone number of owner or operator; 2) name, address and telephone number of facility; 3) date, time and type of incident; 4) name and quantity of material(s) involved; 5) extent of any injuries; 6) assessment of actual or potential threat to environment or human health; and 7) estimated quantity and disposition of recovered material.	Written submission within one week of time permittees become aware of discharge. Same as oral and description of noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence. Send reports to New Mexico Environment Department, Chief, Ground Water Quality Bureau, P.O. Box 26110, Santa Fe, New Mexico, 87502, New Mexico State Emergency Response Commission Department of Public Safety, Title III Bureau, P.O. Box 1628 Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220.
New Mexico Water Quality Control Commission, Part 1, Section 203	Any discharge from any facility of oil or any other water contaminant in such quantities as may, with reasonable probability, injure or be detrimental to human health, animal or plant life, or property.	Chief, Ground Water Quality Bureau, New Mexico Environment Department, or his counterpart in any constituent agency delegated responsibility for enforcement of the rules as to any facility subject to such delegation (505) 827-2918.	Within 24 hours: 1) the name, address, and telephone number of the person or persons in charge of the facility; 2) the name, address, and telephone number of the owner/operator of the facility; 3) the date, time, location, and duration of the discharge; 4) the source and cause of the discharge; 5) a description of the discharge, including its chemical composition; and 6) the estimated volume of discharge, and immediate damage from the discharge.	Submit within seven days: verification of the prior oral notification, also provide any appropriate additions or corrections to the information contained in the prior oral notification. Within 15 days: submit a written report describing any corrective actions taken and/or to be taken relative to the discharge. Send reports to Chief, Ground Water Quality Bureau, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Underground Storage Tank Regulations-2	Any known or suspected release from an Underground Storage Tank (UST) system, any spill or any other emergency situation.	New Mexico Environment Department Petroleum Storage Tank Bureau (505) 984-1741.	Within 24 hours: 1) the name, address, and telephone number of the agent in charge of the site at which the UST system is located, as well as the owner/operator of the system; 2) the name and address of the site and the location of the UST system on that site; 3) the date, time, location, and duration of the spill, release, or suspected release; 4) the source and cause of the spill, release, or suspected release; 5) a description of the spill, release, or suspected release, including its chemical composition; 6) the estimated volume of the spill, release, or suspected release; and 7) action taken to mitigate immediate damage from the spill, release, or suspected release.	Mail or deliver within seven days of the incident, a written notice describing the spill, release, or suspected release and any investigation or follow-up action taken or to be taken. Send reports to Petroleum Storage Tank Bureau, New Mexico Environment Department, 2044 Galisteo Street, Santa Fe, New Mexico, 87504.

FIGURES

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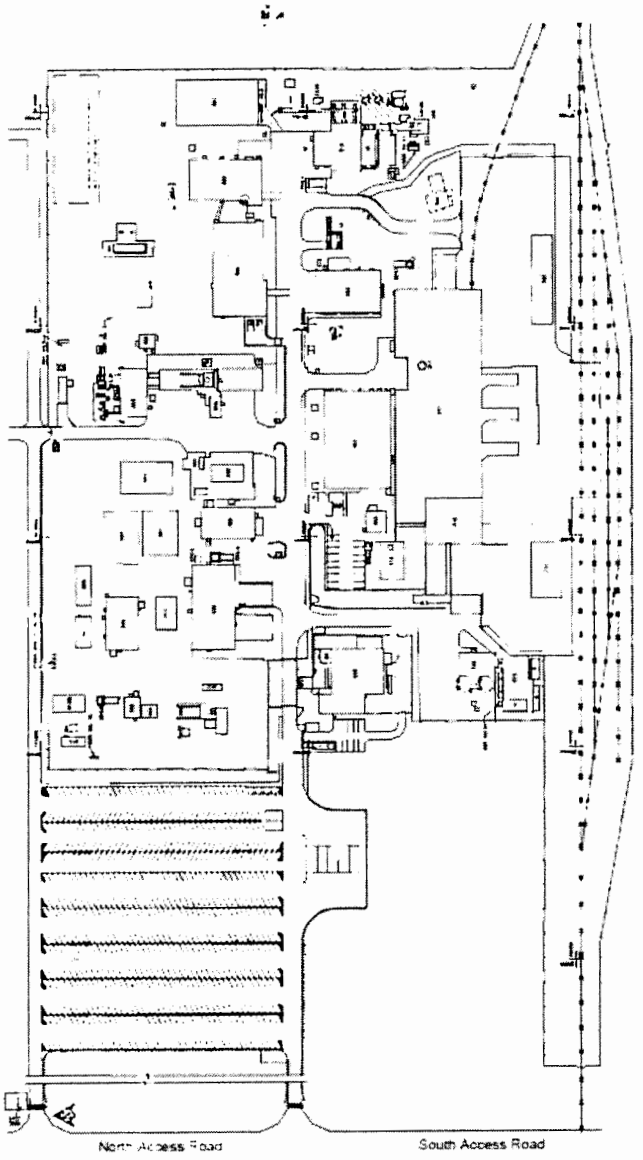

Figure D-1
WIPP Surface Structures

BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION
#241	EQUIPMENT SHED	#384	SALT HANDLING SHAFT HOISTHOUSE	#475	GATEHOUSE
#242	GUARDSHACK	#384A	MINING OPERATIONS	#480	VEHICLE FUEL STATION
#243	SALT HAULING TRUCKS SHELTER	#411	WASTE HANDLING BUILDING	#481	WAREHOUSE ANNEX
#245	TRUPACT TRAILER SHELTER	#412	TRUPACT MAINTENANCE BUILDING	#482	EXHAUST SHAFT HOIST EQUIP. WAREHOUSE
#246	MgO STORAGE SHELTER	#413	EXHAUST SHAFT FILTER BUILDING	#485	SULLAIR COMPRESSOR BUILDING
#253	13.8 KV SWITCHGEAR 25p-SWG15/1	#413A	MONITORING STATION A	#486	ENGINEERING BUILDING
#254.1	AREA SUBSTATION NO. 1 25P-SW15.1	#413B	MONITORING STATION B	#489	TRAINING BUILDING
#254.2	AREA SUBSTATION NO. 2 25P-SW15.2	#414	WATER CHILLER FACILITY & BLDG	#H-16	SANDIA TEST WELL
#254.3	AREA SUBSTATION NO. 3 25P-SW15.3	#451	SUPPORT BUILDING	#917	AIS MONITORING
#254.4	AREA SUBSTATION NO. 4 25P-SW15.4	#452	SAFETY & EMERGENCY SERVICES FACILITY	#918	VOC TRAILER
#254.5	AREA SUBSTATION NO. 5 25P-SW15.5	#453	WAREHOUSE/SHOPS BUILDING	#918A	VOC AIR MONITORING STATION
#254.6	AREA SUBSTATION NO. 6 25P-SW15.6	#455	AUXILIARY WAREHOUSE BUILDING	#918B	VOC LAB TRAILER
#254.7	AREA SUBSTATION NO. 7 25P-SW15.7	#456	WATER PUMPHOUSE	#950	WORK CONTROL TRAILER
#254.8	AREA SUBSTATION NO. 8 25P-SW15.8	#457N	WATER TANK 25-D-001B	#951	PROCUREMENT/PURCHASING
#254.9	480V SWITCHGEAR (25P-SWGO4/9)	#457S	WATER TANK 25-D-001A	#952	TRAILER
#255.1	BACK-UP DIESEL GENERATOR #1 25-PE 503	#458	GUARD AND SECURITY BUILDING	#953	MODULAR OFFICE COMPLEX
#255.2	BACK-UP DIESEL GENERATOR #2 25-PE 504	#459	CORE STORAGE BUILDING	#971	HUMAN RESOURCES TRAILER
#256.4	SWITCHBOARD #4 (25P-SBD04/4)	#463	COMPRESSOR BUILDING	#986	PUBLICATIONS & PROCEDURES TRAILER
#311	WASTE SHAFT	#465	AUXILIARY AIR INTAKE	SWR NO. 6	SWITCHRACK NO. 6
#351	EXHAUST SHAFT	#468	TELEPHONE HUT	SWR NO. 7	7A, 7B SWITCHRACK NO. 7, 7A, 7B
#361	AIR INTAKE SHAFT	#473	ARMORY BUILDING	SWR NO. 7C	SWITCHRACK NO. 7C
#362	AIR INTAKE SHAFT/HOIST HOUSE	#474	HAZARDOUS WASTE STORAGE FACILITY	SWR NO. 10	SWITCHRACK NO. 10
#363	AIR INTAKE SHAFT/WINCH HOUSE	#474A	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 11	SWITCHRACK NO. 11
#364	EFFLUENT MONITORING INSTRUMENT SHED A	#474B	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 12	SWITCHRACK NO. 12
#365	EFFLUENT MONITORING INSTRUMENT SHED B	#474C	OIL & GREASE STORAGE BUILDING	SWR NO. 15	SWITCHRACK NO. 15
#366	AIR INTAKE SHAFT HEADFRAME	#474D	GAS BOTTLE STORAGE BUILDING		
#371	SALT HANDLING SHAFT	#474E	HAZARD MATERIAL STORAGE BUILDING		
#372	SALT HANDLING SHAFT HEADFRAME	#474F	WASTE OIL RETAINER		

Figure D-1a
Legend to Figure D-1

Field Code Changed

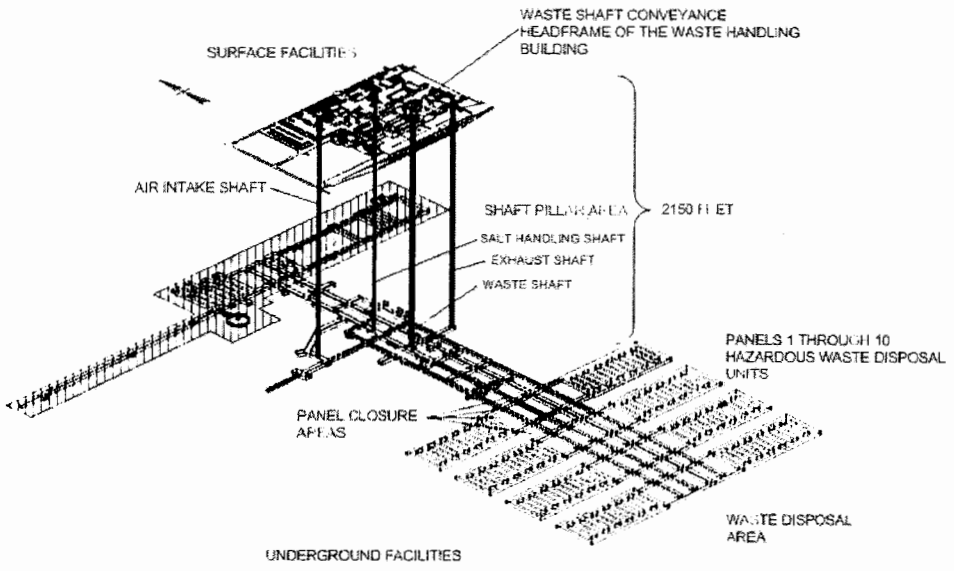

Figure D-2
Spatial View of the WIPP Facility

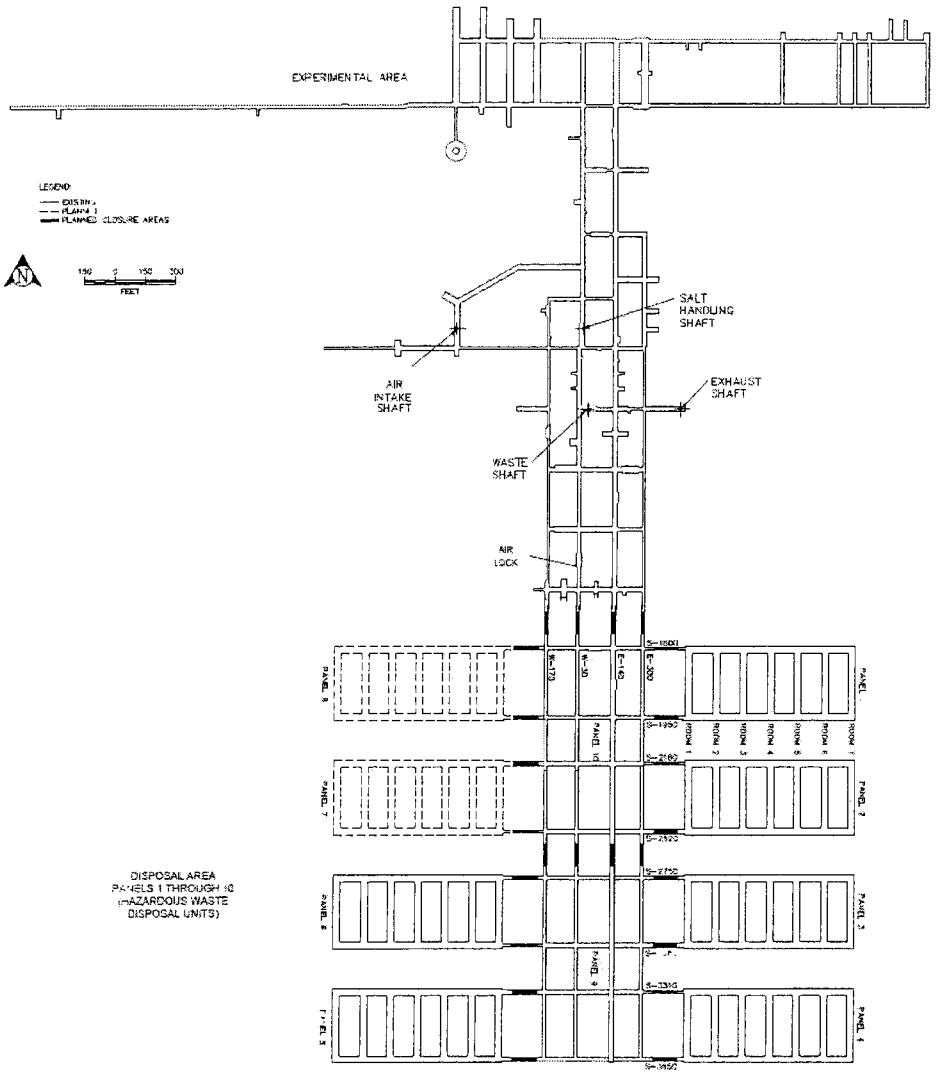

Figure D-3
WIPP Underground Facilities

Field Code Changed

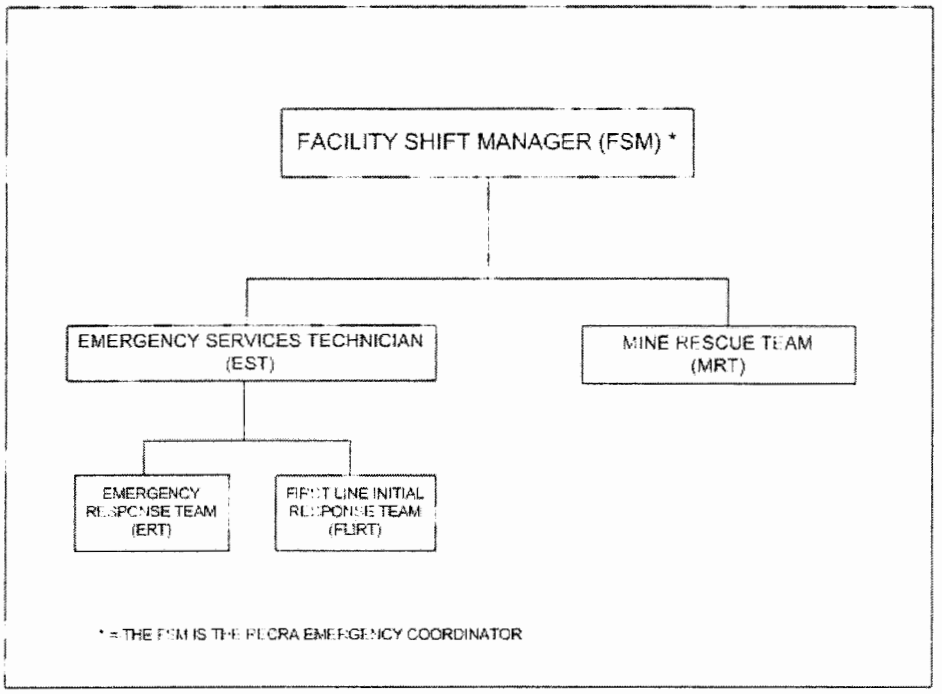

Figure D-4
Direction and Control Under Emergency Conditions in Which the Plan Has Been Implemented

Field Code Changed

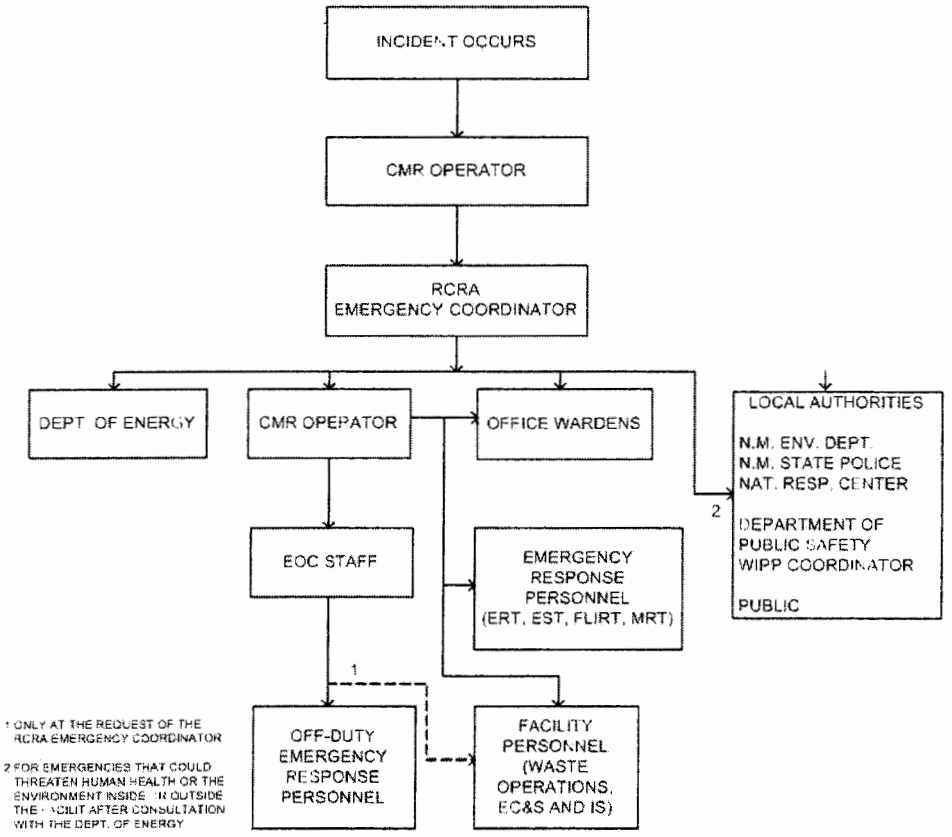

Figure D-4a
WIPP Facility Emergency Notifications

Field Code Changed

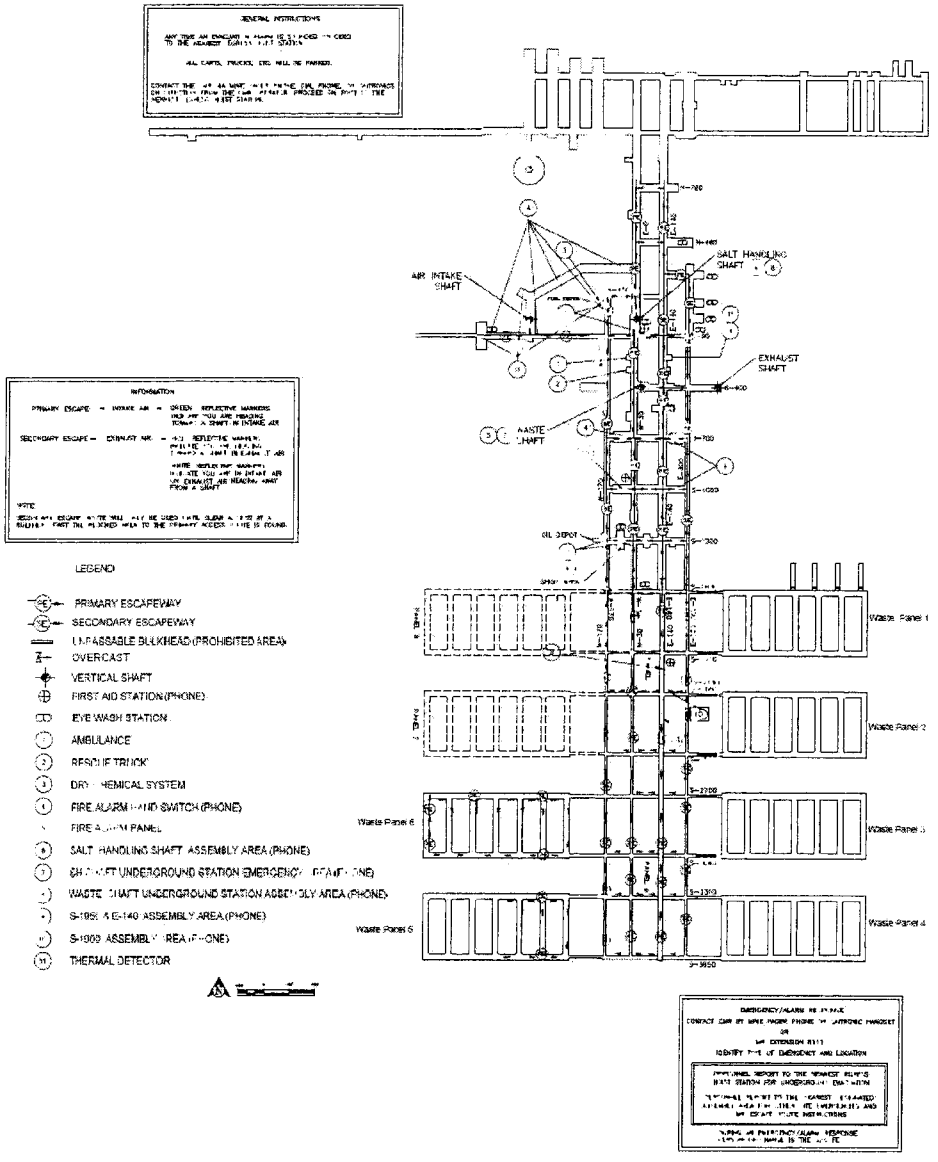

Figure D-5
Underground Emergency Equipment Locations and Underground Evacuation Routes

Field Code Changed

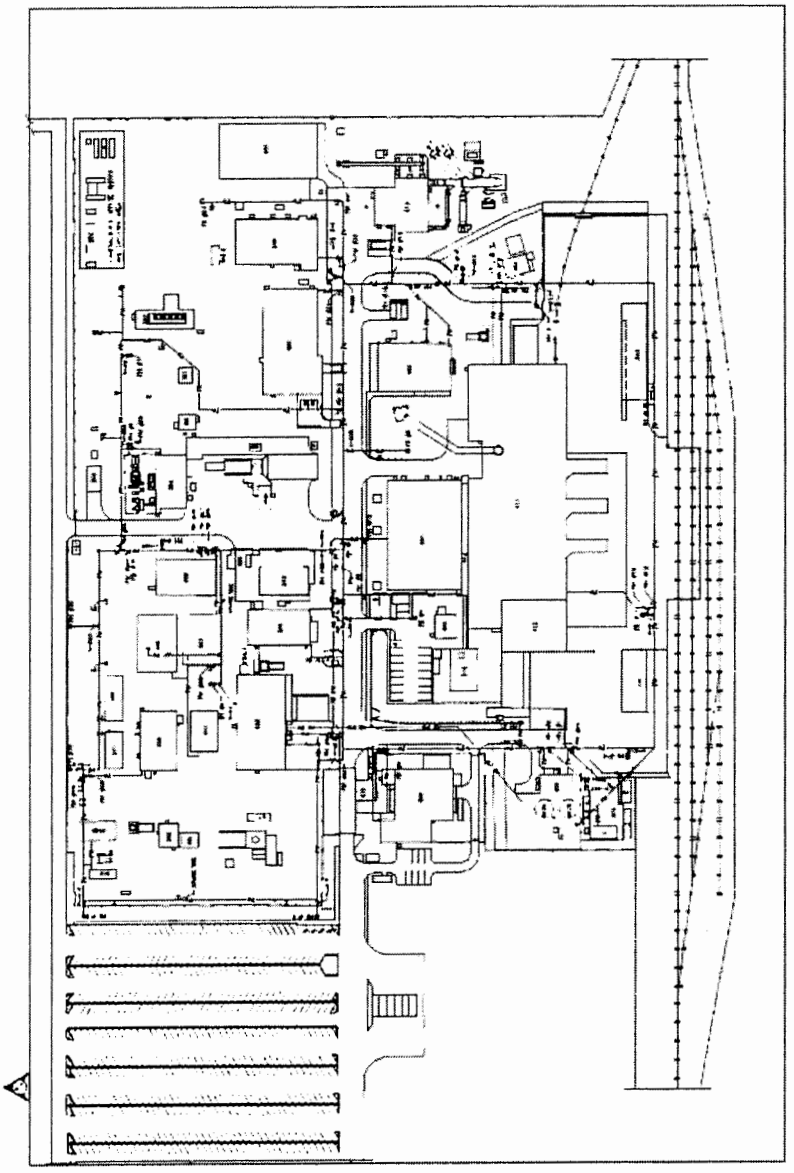

Figure D-6
Fire-Water Distribution System

Field Code Changed

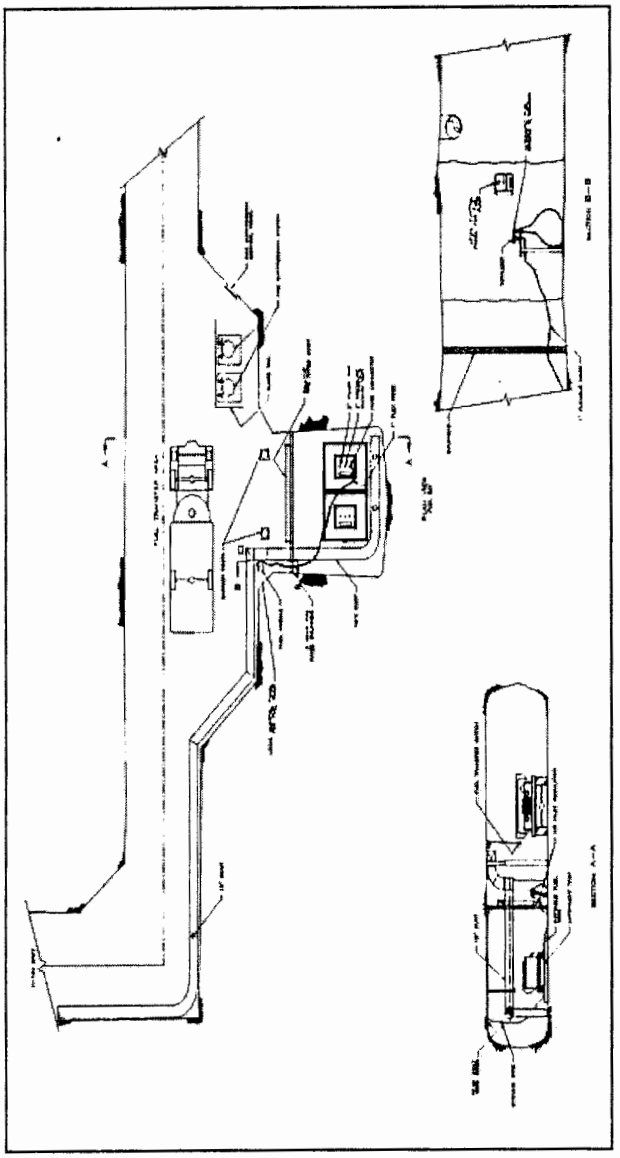

Figure D-7
Underground Diesel Fuel-Station Area Fire-Protection System

Field Code Changed

325W5

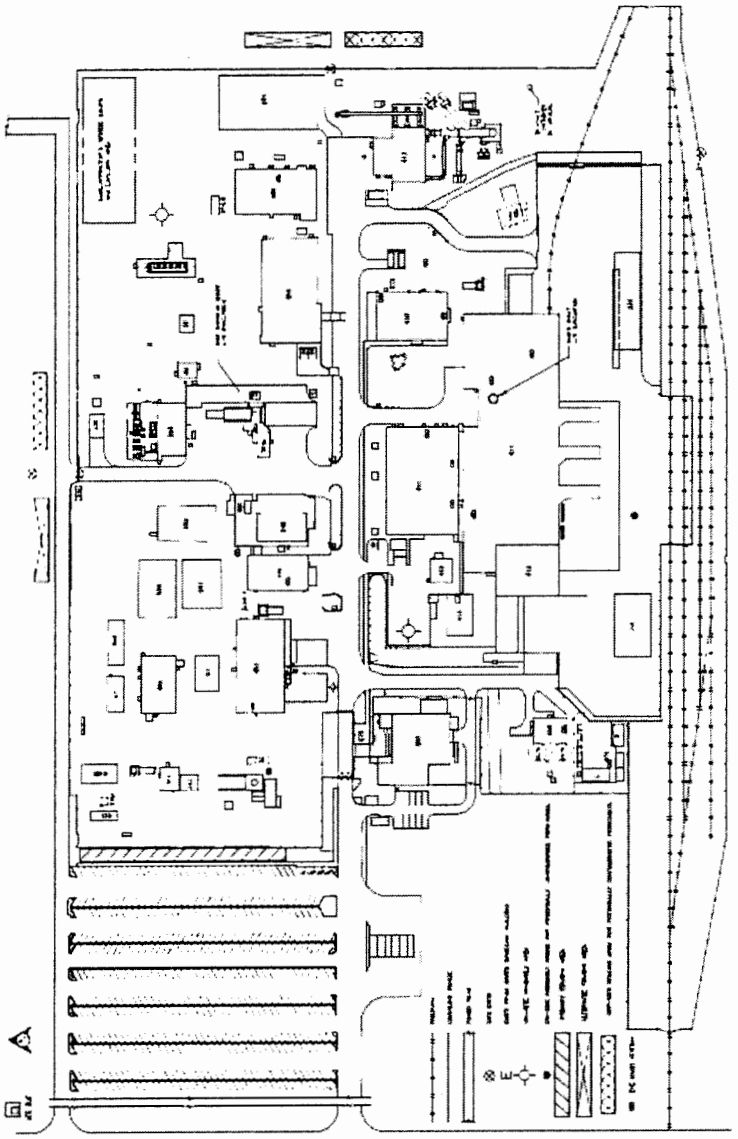

Figure D-8
WIPP On-Site Assembly Areas and WIPP Staging Areas

Field Code Changed

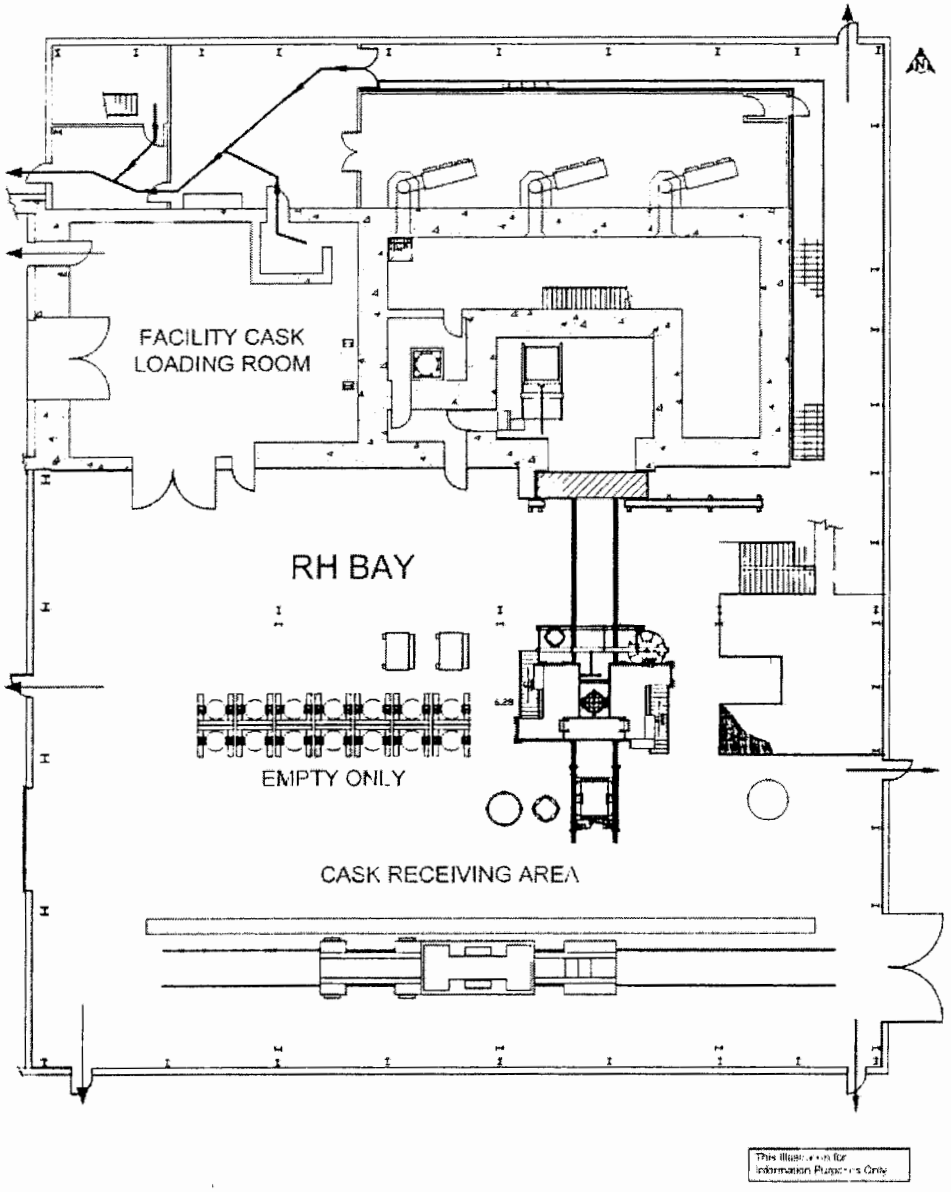

Figure D-8a
RH Bay Evacuation Routes

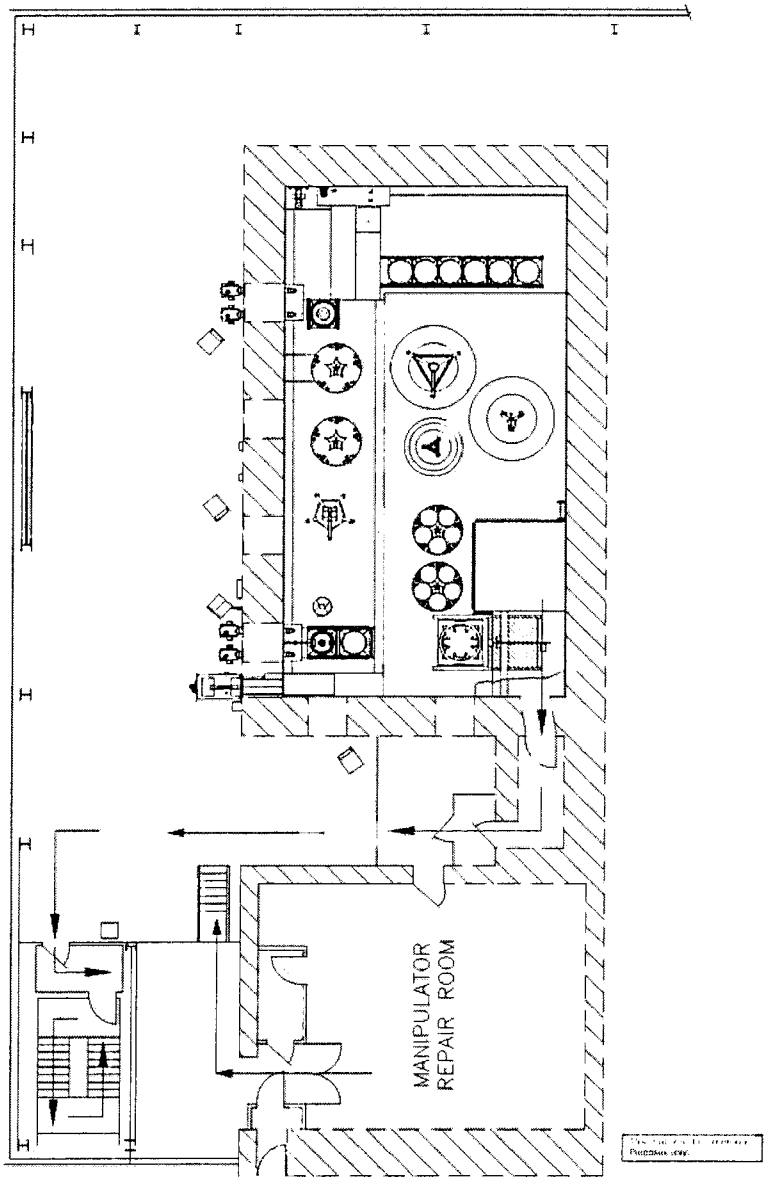

Figure D-8b
RH Bay Hot Cell Evacuation Route

Field Code Changed

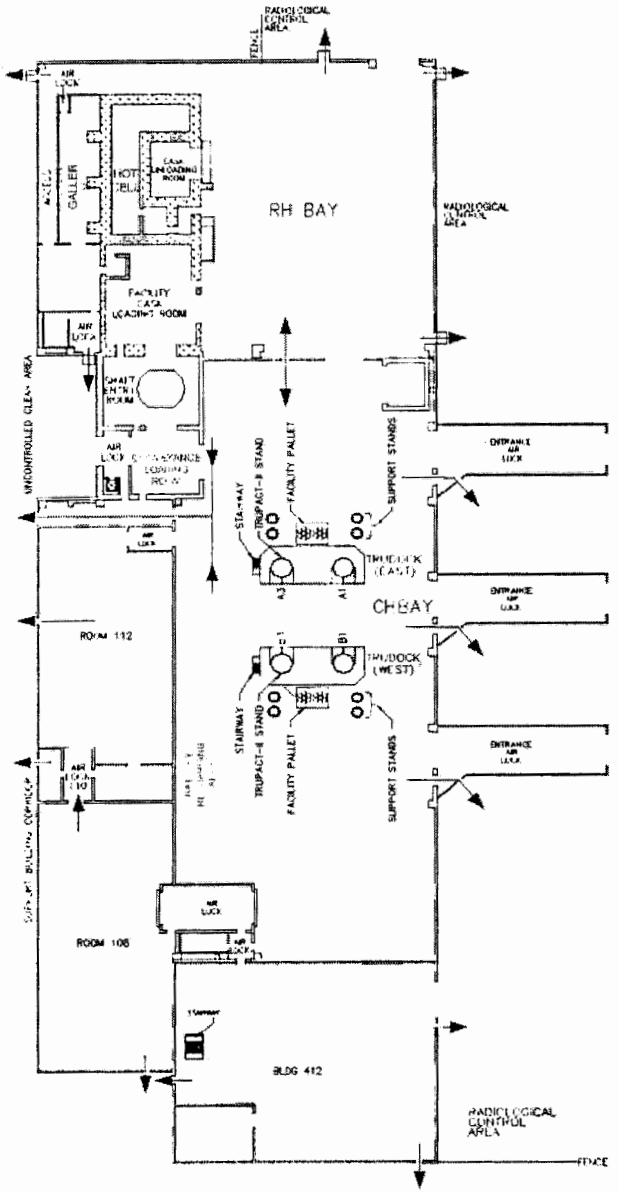

Figure D-8c
Evacuation Routes in the Waste Handling Building

Field Code Changed

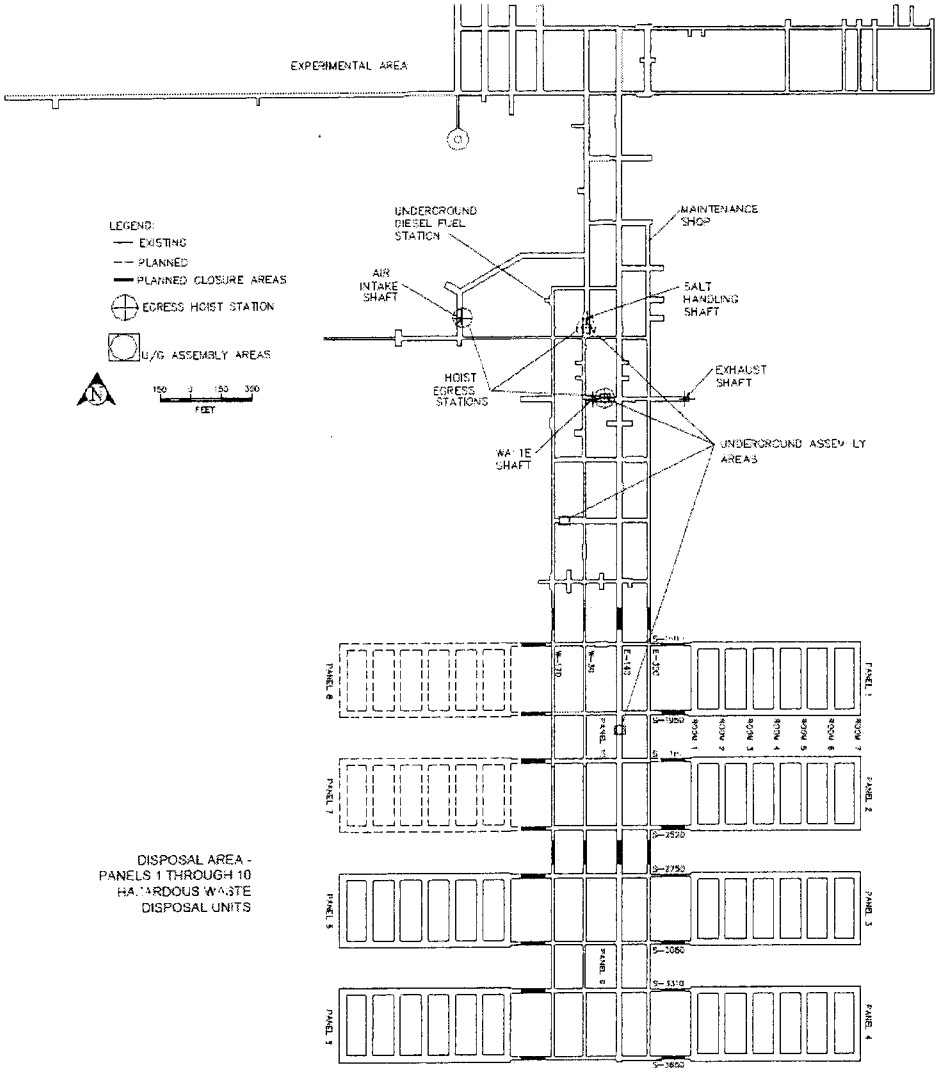

Figure D-9
Designated Underground Assembly Areas

Field Code Changed

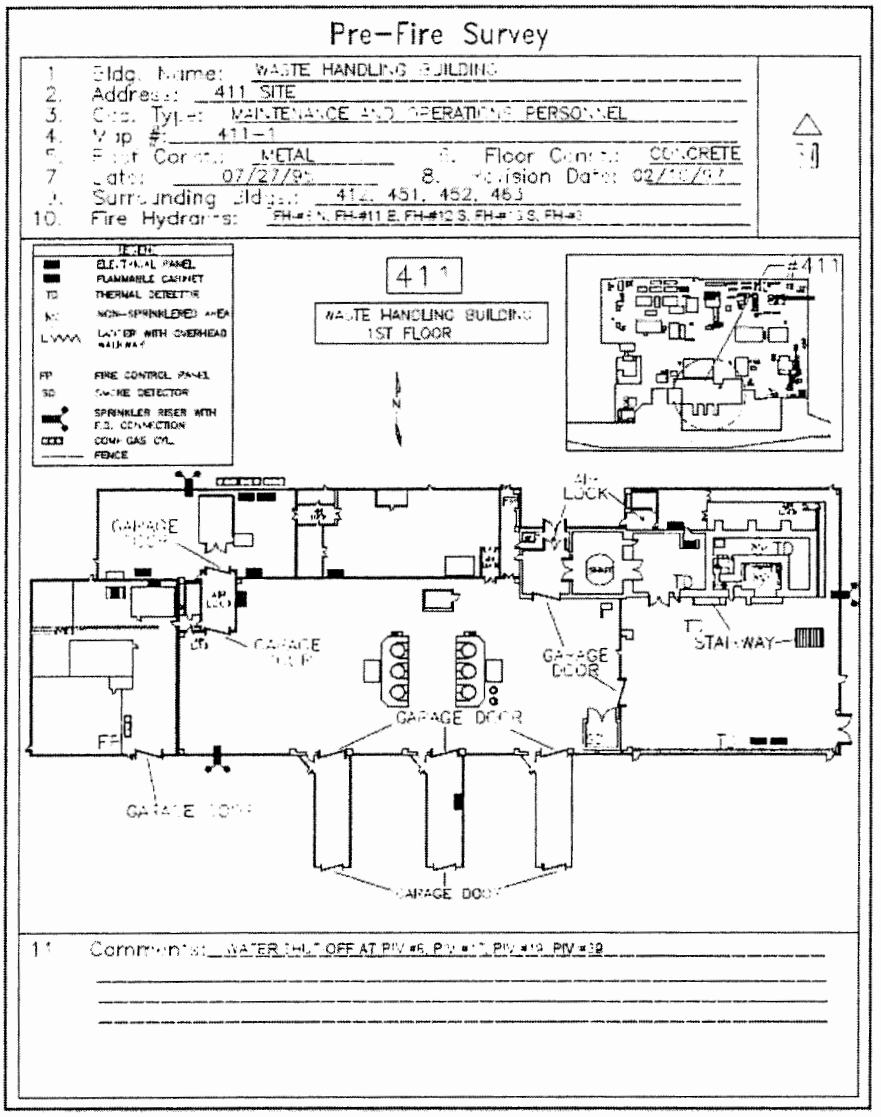

Figure D-10
Waste Handling Building Pre-Fire Survey (First Floor)

Field Code Changed

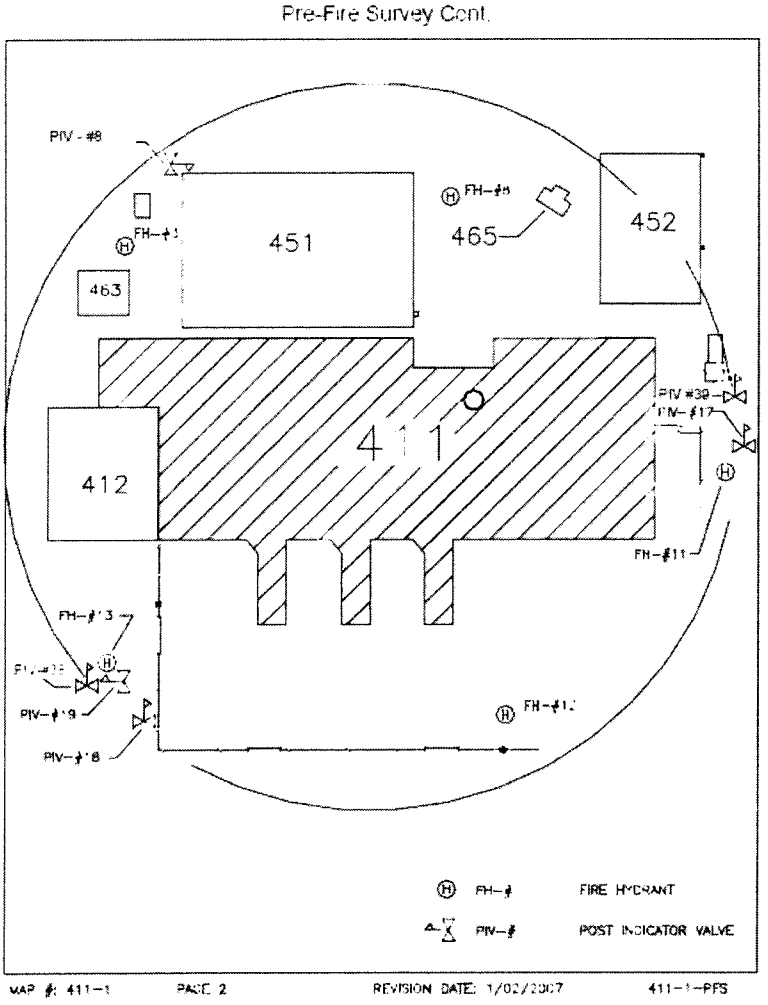

Figure D-10a
Waste Handling Building Pre-Fire Survey
(First Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

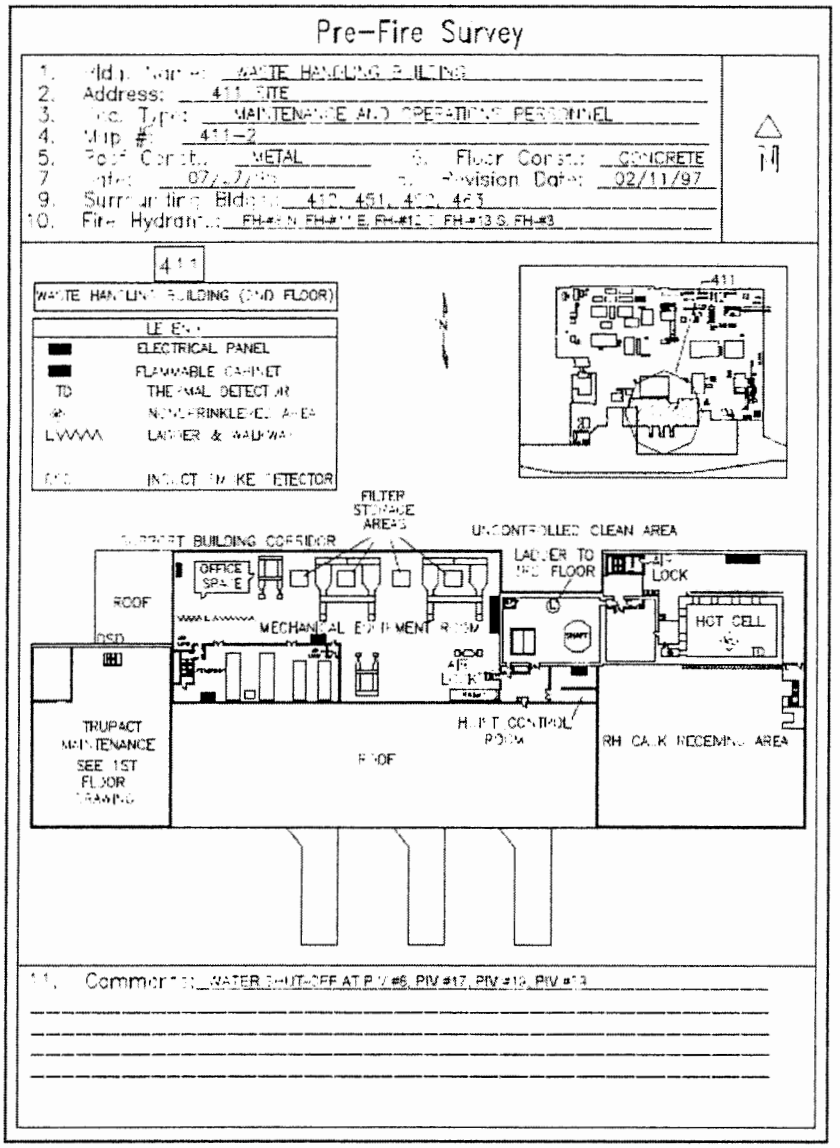

Figure D-11
Waste Handling Building Pre-Fire Survey (Second Floor)

Field Code Changed

Pre-Fire Survey Cont.

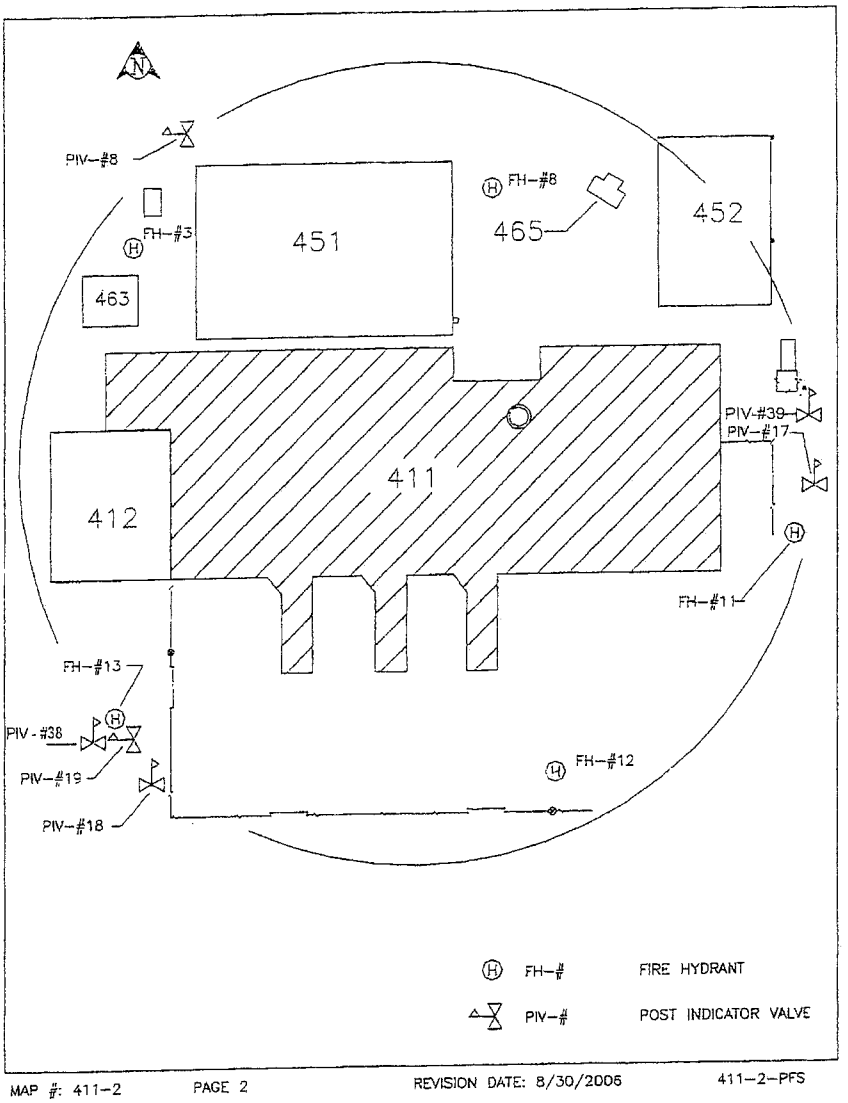

Figure D-11a
Waste Handling Building Pre-Fire Survey
(Second Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

I. INITIAL INFORMATION DATE:_____ TIME:_____
EST:_____ REPORTED LOCATION:_____
REPORTED BY:_____ DEPT.:_____
INITIALLY REPORTED TO:_____ DEPT.:_____
RESPONSIBLE MANAGER:_____ DEPT.:_____

II. WEATHER CONDITIONS WIND DIRECTION_____ WIND SPEED:_____mph TEMP.:_____F
CONDITIONS (i.e., icy, snowing, raining, cloudy, sunny):_____

III. TYPE OF INCIDENT (SPILL, LEAK, ETC.):_____ Fire involved: [ ]YES [ ]NO
(If fire is involved attach a copy of the fire report)

MATERIALS INVOLVED	UN/NA NO.	QUANTITY	HAZARD CLASS	NFPA CLASS

IV. PERSONNEL INVOLVED IN CLEAN-UP ACTIVITIES

PERSONNEL/DEPT	DECON METHOD/MEDICAL TREATMENT

V. PERSONNEL CONTAMINATED NOT INVOLVED IN THE CLEANUP ACTIVITIES

PERSONNEL/DEPT	MATERIAL CONTACTED	DECON/MEDICAL TREATMENT

Figure D-12
WIPP Hazardous Materials Incident Report, Page 1 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

VI. EQUIPMENT USED FOR CLEAN-UP AND CONTROL MEASURES

EQUIPMENT/MATERIAL/PPE	QUANTITY	DISPOSITION (decon or replacement)

VII. DESCRIPTION OF INCIDENT AND RESPONSE (including containment and control)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

VIII. ENVIRONMENTAL COMPLIANCE

Date:_____ Time:_____of evaluation.

Waste Category_____

Disposition_____

ORGANIZATION	DATE	TIME

EC Representative:_____
Print name Signature Date

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 2 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

IX. INITIAL NOTIFICATION BY CMRO

DEPARTMENT	PERSON CONTACTED	TIME	NOTIFIED BY
Facility Ops (FSM)			
Emerg. Mgmt (EST)			
EC			
Industrial Safety			
Facility Ops. (FM/FMD)			

CMRO:_____
Print name Signature Date
FSM:_____
Print name Signature Date

X. CONTINGENCY PLAN IMPLEMENTATION

Contingency Plan implemented [ ]YES [ ]NO

FSM:_____
Print name Signature Date

XI. REVIEWS

Report submitted by:_____
Print name Signature Date
Emergency Management Manger:_____
Print name Signature Date
EC Manager:_____
Print name Signature Date
COMMENTS:_____

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 3 of 3

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DRAWINGS

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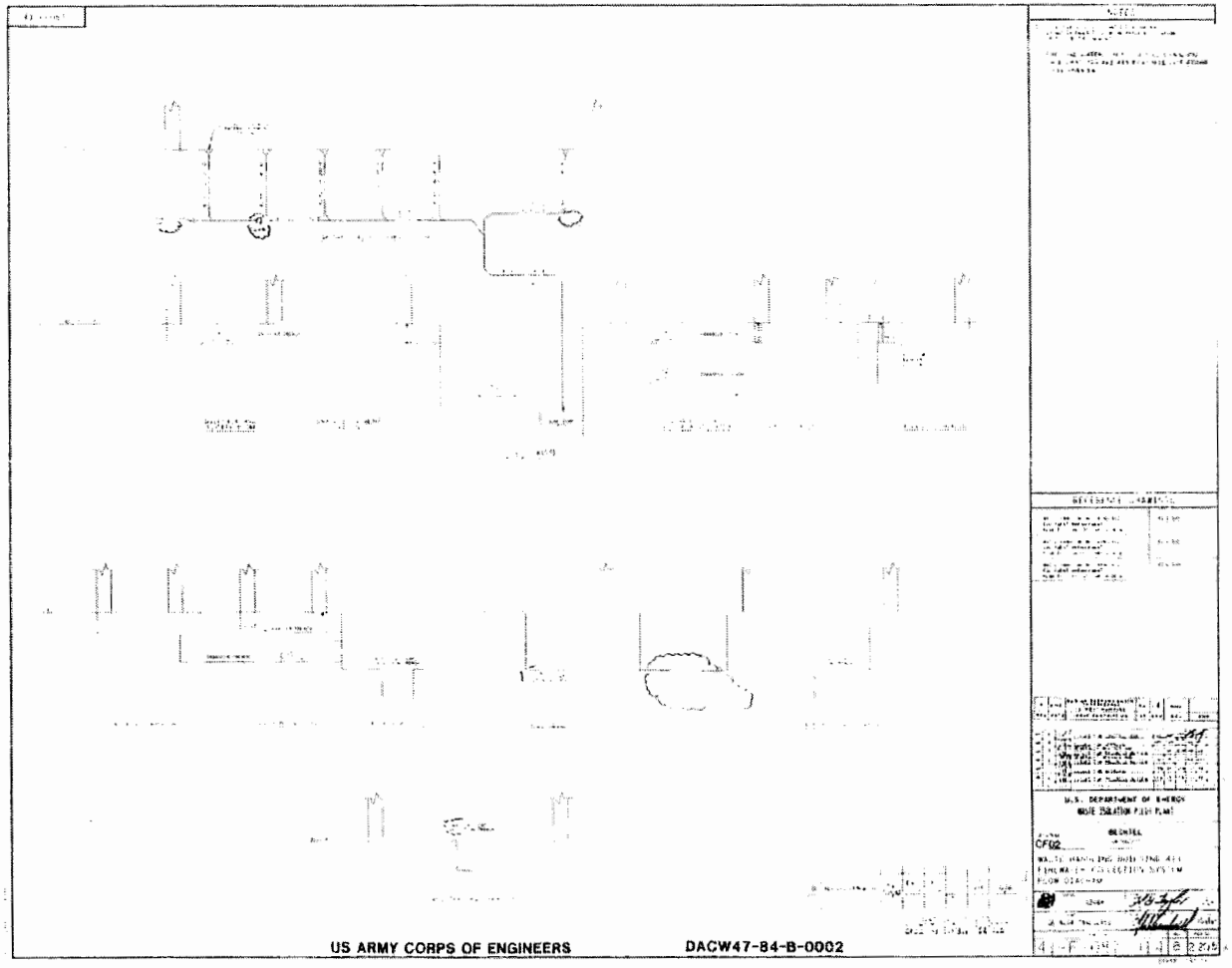

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Field Code Changed

ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

Introduction

The WIPP facility is owned and co-operated by the U.S. Department of Energy (**DOE**) and co-operated by its designated Management and Operating Contractor (**MOC**) (Permit Section 1.5.3).

This Contingency Plan was prepared in accordance with the Resource Conservation and Recovery Act (**RCRA**) requirements codified in 20.4.1.500 NMAC (incorporating 40 CFR §264.50 to §264.56), "Contingency Plan and Emergency Procedures," and submitted in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(7)). The purpose of this document is to define responsibilities, to describe coordination of activities, and to minimize hazards to human health and the environment from fires, explosions, or any sudden or nonsudden release of hazardous waste, or hazardous waste constituents to air, soil, or surface water (20.4.1.500 NMAC (incorporating 40 CFR §264.51 [a])). This plan consists of descriptions of processes and emergency responses specific to hazardous substances, contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste and other hazardous waste handled at the WIPP facility.

D-1 General Information

The WIPP facility is located 26 miles (mi) (42 kilometers [km]) east of Carlsbad, in Eddy County in southeastern New Mexico, and includes an area of 10,240 acres (ac) (4,144 hectares [ha]). The facility is located in an area of low-population density, with fewer than 30 permanent residents living within a 10 mi (16 km) radius of the facility. The area surrounding the facility is used primarily for grazing, potash mining, and mineral exploration. Resource development that would affect WIPP facility operations or the long-term integrity of the facility is not allowed within the 10,240 ac (4,144 ha) that have been set aside for the WIPP Project.

The WIPP facility is designed to receive containers of TRU waste, which will be transported to the WIPP facility from the ten major and other minor DOE TRU mixed waste generator and/or storage sites. The waste will be emplaced in the bedded salt of the Salado Formation, 2,150 feet (ft) (655 meters [m]) below ground surface.

As a geologic facility for the management of TRU mixed waste, the WIPP repository is regulated as a "miscellaneous unit," as defined under 20.4.1.500 NMAC (incorporating 40 CFR §264.601 to §264.603). The areas at the WIPP facility subject to this permit include the surface container storage areas in the Waste Handling Building (**WHB**) Container Storage Unit (**WHB Unit**) and the Parking Area Container Storage Unit (**Parking Area Unit**), located south of the WHB, and the areas below ground in which waste will be emplaced.

The WIPP facility includes other surface structures, shafts, and underground areas (Figures D-1, D-2, and D-3). Surface structures other than the WHB, that support TRU mixed waste management include:

Exhaust Filter Building - houses the filter banks to which the underground ventilation can be diverted in the unlikely event of an underground release of radionuclides.

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Guard and Security Building - houses the facility security personnel and communications equipment necessary for them to perform their duties. Section D-4a specifies the duties of the security officers relative to contingency actions.

Safety and Emergency Services Building - houses the surface emergency response vehicles (fire truck, rescue truck, ambulance), Health Services (first aid), Emergency Operations Center, and the Dosimetry Laboratory. The Hazardous Material Response Trailer is staged at the WIPP facility in an area that is readily accessible to Emergency Services. Emergency Services is located in Building 452. Table D-6 describes emergency equipment and associated locations.

Support Building - houses the Central Monitoring Room (see section D-4a).

Transuranic Package Transporter-II (**TRUPACT-II**) Maintenance Facility - is located west of the CH bay. No TRU mixed waste management activities will occur in this facility.

Surface facilities used for storage of support equipment are identified in Table D-6.

Building 452, Safety and Emergency Services Facility, houses the emergency response vehicles, emergency equipment, the mine rescue room, mine rescue team equipment, and the Emergency Operations Center (**EOC**). The Hazardous Material Response Trailer is staged at the WIPP facility in an area readily accessible to Emergency Services. Emergency Services is located in Building 452.

The RCRA permit addresses TRU mixed waste management activities in the WHB Unit, the Parking Area Unit, and the disposal units. The provisions of this Contingency Plan apply to hazardous waste disposal units (**HWDU**) in the underground waste disposal panels, storage in the WHB Unit and the Parking Area Unit, the Waste Shaft, and supporting TRU mixed waste handling areas. The remainder of the facility will not manage TRU mixed waste. This Contingency Plan has also been designed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR § 262.34(a)(4) - Standards for Generators of Hazardous Waste), and will be implemented whenever there is a fire, explosion, or release of hazardous waste which could threaten human health or the environment. Hazardous substances in the remainder of the facility are included as possible triggers of the Contingency Plan but are outside the scope of the regulations promulgated pursuant to RCRA. This allows WIPP to maintain one emergency response plan which is consistent with the National Response Teams Integrated Contingency Plan Guidance (Federal Register, Vol. 61, No. 109, June 5, 1996). Inclusion is based on their National Fire Protection Association (**NFPA**) ratings in addition to their storage quantities. The majority of hazardous substances on-site are not expected to trigger the Contingency Plan because they are present in the same form and concentration as the product packaged for distribution and use by the general public or are used in a laboratory under the direct supervision of a technically qualified individual. Superfund Amendments and Reauthorization Act (**SARA**) Title III excludes these from emergency planning reporting. The list of hazardous substances in large enough quantities to constitute a Level II incident (Section D-3) is provided in Table D-1. In addition to TRU mixed waste, these are the only hazardous substances currently on site which, if spilled, may be of sufficient impact to cause this Contingency Plan to be implemented. Magnesium Oxide (**MgO**) is stored on-site in large quantities. It is used as backfill in the waste emplacement rooms as a pH buffer. The pH buffer will limit the solubility of radionuclides after the underground rooms are filled and closed. MgO is not a hazardous

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substance, a release of MgO will not create hazardous waste and poses no threat to human health or the environment, and is therefore not addressed in the Contingency Plan.

Wastes generated as a result of maintenance or response actions will be categorized into one of three groups and disposed of accordingly. These are: 1) nonhazardous wastes to be disposed of in an approved landfill, 2) hazardous nonradioactive wastes to be disposed of at an off-site RCRA permitted facility, and 3) TRU mixed waste to be disposed of in the underground HWDUs. Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees will demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the HWDUs in the underground, will be met. In addition, the technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178) are applied to the operation of the container storage units in the WHB Unit and in the Parking Area Unit south of the WHB. Liquid wastes that may be generated as a result of the fire fighting water or decontamination solutions will be managed as follows:

Non-Mixed - Hazardous waste liquids contaminated only with hazardous constituents will be placed into containers and managed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34) requirements. The waste will be shipped to an approved off-site treatment, storage, or disposal facility.

Mixed - Liquids contaminated with TRU mixed waste (inside the WHB Unit) will be solidified as they are placed into containers with cement, Aquaset, or absorbent material in them. The solidified materials will be disposed of in the underground WIPP repository as derived waste.

This chapter of the permit application describes the HWDUs, the TRU mixed waste management facilities and operations, compliance with the environmental performance standards, and with the applicable technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178 and §264.601, respectively). The configuration of the WIPP facility consists of completed structures; including all buildings and systems for the operation of the facility.

D-1a Disposal Phase Overview

The Disposal Phase will consist of receiving CH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations.

The TRU mixed waste that will be disposed at the WIPP facility results primarily from activities related to the reprocessing of plutonium-bearing reactor fuel and fabrication of plutonium-bearing weapons, as well as from research and development. This TRU mixed waste consists largely of such items as paper, cloth, and other organic material; laboratory glassware and utensils; tools; scrap metal; shielding; and solidified sludges from the treatment of wastewater. Much of this TRU mixed waste is also contaminated with substances that are defined as hazardous under 20.4.1.200 NMAC.

D-1b Waste Description

Waste destined for WIPP are, or were, produced as a byproduct of weapons production and have been identified in terms of waste streams based on the processes that produced them. Each waste stream identified by generators is assigned to a Waste Summary Category to facilitate RCRA waste characterization, and reflect the final waste forms acceptable for WIPP disposal.

These Waste Summary Categories are:

S3000—Homogeneous Solids

Solid process residues defined as solid materials, excluding soil, that do not meet the applicable regulatory criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2[g] and [h])). Included in solid process residues are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Waste Summary Category based on the specific waste stream types and final waste form. This category includes wastes that are at least 50 percent by volume solid process residues.

S4000—Soils/Gravel

This waste summary category includes waste streams that are at least 50 percent by volume soil. Soils are further categorized by the amount of debris included in the matrix.

S5000—Debris Wastes

This waste summary category includes waste that is at least 50 percent by volume materials that meet the criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2)). Debris is a material for which a specific treatment is not provided by 20.4.1.800 NMAC (incorporating 40 CFR §268 Subpart D), including process residuals such as smelter slag from the treatment of wastewater, sludges or emission residues.

> Debris means solid material exceeding a 2.36 inch (60 millimeter) particle size that is intended for disposal and that is: 1) a manufactured object, 2) plant or animal matter, or 3) natural geologic material.

Included in the S5000 Waste Summary Category are metal debris, lead containing metal debris, inorganic nonmetal debris, asbestos debris, combustible debris, graphite debris, heterogeneous debris, and composite filters, as well as other minor waste streams. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

Examples of waste that might be included in the S5000 Waste Summary Category are asbestos-containing gloves, fire hoses, aprons, flooring tiles, pipe insulation, boiler jackets, and laboratory tabletops. Also included are combustible debris constructed of plastic, rubber, wood, paper, cloth, graphite, and biological materials. Examples of graphite waste that would be included are crucibles, graphite components, and pure graphite.

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Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such generated waste may occur in either the WHB Unit or the Underground. For example, when TRU mixed wastes are received at the WHB Unit, the CH or RH Package shipping containers and the TRU mixed waste containers are checked for surface contamination. Under some circumstances,[1] if contamination is detected, the shipping container and/or the TRU mixed waste containers will be decontaminated. In the underground, waste may be generated as a result of radiation control procedures used during monitoring activities. The waste generated from radiation control procedures will be assumed to be TRU and/or TRU mixed waste. Throughout the remainder of this plan, this waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

D-1c Containers

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

TRU mixed waste containers, containing off-site waste, will not be opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Waste, including "derived waste," containing liquid in excess of TSDF-WAC limits shall not be emplaced in the WIPP (See Permit Attachment C, Section C-1c).

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 177). The RCRA Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) precludes ignitable, reactive, or incompatible TRU mixed waste from being placed into storage or disposed of at WIPP.

D-1d Description of Containers

CH TRU mixed waste containers will be either 55-gallon (gal) (208-liter (L)) drums singly or arranged into seven (7)-packs, 85-gal (322-L) drums (used as singly or arranged into four (4)-packs, 100-gal (379 L) drums singly or arranged into three (3)-packs, ten-drum overpacks (**TDOP**), 66.3 ft^3 (1.88 m^3) SWBs, or standard large box 2s (**SLB2**).

RH TRU mixed waste containers are either canisters or drums. Canisters will be loaded singly in an RH-TRU 72-B cask and drums will be loaded in a CNS 10-160B cask. Drums in the CNS 10-160B cask will be arranged singly or in drum carriage units containing up to five drums each. Canisters and drums are described in Permit Attachment M1.

Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs.

[1] Typically contamination that is less than six square feet in area and less than 2000 disintegrations per minute (dpm) alpha or 20,000 dpm beta/gamma, may be decontaminated. Containers that exceed these thresholds will be returned to the point of origin for decontamination.

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D-1e Description of Surface Hazardous Waste Management Units

The WHB is the surface facility where waste handling activities will take place. The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters [m^2]) of which 49,710 ft^2 (4,618 m^2) are designated as the WHB Unit for TRU mixed waste management. Within the WHB Unit, 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for the handling and storage of RH TRU mixed waste. These areas are being permitted as container storage units. The concrete floors within the WHB Unit are sealed with an impermeable coating that has excellent resistance to the chemicals in TRU mixed waste and, consequently, provide secondary containment for TRU mixed waste. In addition, a Parking Area Unit south of the WHB will be used for storage of waste in sealed shipping containers awaiting unloading. This area is also being permitted as a container storage unit. The sealed shipping containers provide secondary containment in this hazardous waste management unit (**HWMU**).

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (3-pack of shielded containers, 7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

In addition, four Contact-Handled Packages, containing up to 640 ft^3 of CH TRU waste in containers, may occupy positions at the TRUPACT-II Unloading Docks (**TRUDOCK**).

Aisle space shall be maintained in all CH Bay waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire response personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space between facility and containment pallets will be maintained in all CH TRU mixed waste storage areas.

D-1e(2) RH Complex Operations

Loaded RH TRU casks are received in the RH Bay of the WHB. The RH Bay is served by an overhead bridge crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. A maximum of two loaded casks may be stored in the RH Bay and a maximum of one cask in the Cask Unloading Room may be stored at one time. A minimum of 44 inches (1.1 m) will be maintained between loaded casks in the RH Bay. The cask serves as secondary containment in the RH Bay for the RH TRU mixed waste payload container. In addition, the RH Bay has a concrete floor.

Single RH TRU mixed waste canisters are unloaded from the RH-TRU 72-B casks in the Transfer Cell of the RH Complex where they are transferred to facility casks. Drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, into the Hot Cell, and loaded into a canister. Storage in the Hot Cell occurs in either drums or canisters. A maximum

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of 12 55-gallon drums of RH TRU mixed waste and one 55-gallon drum of derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell. Except for the derived waste drum, individual 55-gallon drums may not be stored in the Hot Cell for more than 25 days. The Transfer Cell houses the Transfer Cell Shuttle Car, which is used to facilitate transferring the canister to the facility cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in a shielded insert in the Transfer Cell Shuttle Car or in a RH-TRU 72-B cask.

The Facility Cask Loading Room provides for transfer of a canister to the facility cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit. The Facility Cask Loading Room also functions as an air lock between the waste shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask in the Facility Cask Loading Room.

Derived waste will be stored in the RH Bay and in the Hot Cell.

D-1e(3) Parking Area Container Storage Unit (Parking Area Unit)

The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Container Storage Unit. This area provides storage for up to 6,734 ft^3 (191 m^3) of CH and/or RH TRU mixed waste contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing rainwater are provided by the transportation containers. Up to 12 additional Contact-Handled Packages and four additional Remote-Handled Packages may be stored in the Parking Area Surge Area so long as the requirements of Permit Sections 3.1.2.3 and 3.1.2.4 are met. No more than 50 Contact-Handled and 12 Remote-Handled Packages may be stored in the Parking Area Storage Unit.

The safety criteria for Contact-Handled and Remote-Handled Packages require that they be opened and vented at a frequency of at least once every 60 days. During normal operations, Contact-Handled and Remote-Handled Packages will not require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be mitigated by returning the shipment to the generator prior to the expiration of the 60 day NRC venting period or by moving the Contact-Handled or Remote-Handled Package inside the WHB Unit where the waste will be removed and placed in one of the permitted storage areas or in the underground hazardous waste disposal unit.

D-1f Off-Normal Events

Off-normal events could interrupt normal operations in the waste management process line. Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

D-1g Containment

The WHB Unit has concrete floors, which are sealed with a coating designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be

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accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor.

During normal operations, the floor of the normal storage areas within the CH Bay and RH Complex shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. When a RH TRU mixed waste container is present in the RH Complex, inspections will be conducted visually and/or using closed-circuit television cameras in order to manage worker dose and minimize radiation exposures. Manual inspections of the areas are performed at least annually during routine maintenance periods when waste is not present.

Floor areas of the WHB used during off-normal events will be inspected prior to use and weekly while in use. Containers located in the permitted storage areas shall be elevated from the surface of the floor. Facility pallets provide at least 6 in (15 centimeters [cm]) of elevation from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packages shall be stored at a designated storage area inside the WHB so as to preclude exposure to the elements.

Secondary containment at permitted storage areas inside the WHB Unit shall be provided by the floor. The Parking Area Unit and TRUDOCK storage area of the WHB Unit do not require engineered secondary containment, since waste is not stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging. Floor drains, the fire suppression water collection sump, and portable dikes, if needed, will provide containment for liquids that may be generated by fire fighting. Sump capacities and locations are shown in Drawing 41-F-087-014. Residual fire fighting liquids will be placed in containers and managed as described above. Secondary containment at storage locations inside the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room is provided by the cask or canisters that contain drums of RH TRU mixed waste. In the Hot Cell, secondary containment is provided by the Hot Cell subfloor. In addition, the RH Complex contains a 220-gallon (833-L) sump in the Hot Cell, a 11,400-gallon (43,152-L) sump in the RH Bay, and a 220-gallon (833-L) sump in the Transfer Cell to collect any liquids.

D-2 Response Personnel

Persons qualified to act as the RCRA Emergency Coordinator, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55), are listed in Table D-2.

A RCRA Emergency Coordinator will be on-site at the WIPP facility 24 hours a day, seven days a week, with the responsibility for coordinating emergency response measures. RCRA Emergency Coordinators are listed in Table D-2, where four individuals have been designated primary RCRA Emergency Coordinators. This is because the on-duty Facility Shift Manager (**FSM**) is designated as the RCRA Emergency Coordinator. The four individuals shown serve as FSM on a rotating shift basis.

Persons qualified to act as the RCRA Emergency Coordinator are thoroughly familiar with this Contingency Plan, the TRU mixed waste and hazardous waste operations and activities at the WIPP facility, the locations of TRU mixed waste and hazardous waste activities, the locations on the site where hazardous materials are stored and used, and the locations of waste staging and accumulation areas. They are familiar with the characteristics of hazardous substances, TRU mixed waste and hazardous waste handled at the WIPP facility, the location of TRU mixed

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waste and hazardous waste records within the WIPP facility, and the facility layout. In addition, persons qualified to act as the RCRA Emergency Coordinator have the authority to commit the necessary resources to implement this Contingency Plan. Figure D-4 outlines the RCRA Emergency Coordinator's position relative to other organizations that provide support.

In addition to the RCRA Emergency Coordinator, the following individuals or groups have specified responsibilities during any WIPP facility emergency:

- Assistant Chief Office Warden (**ACOW**)—Persons assigned to take accountability for sections of the site, and then reporting the accountability to the Chief Office Warden.

- Central Monitoring Room Operator (**CMRO**)—The on-shift operator responsible for Central Monitoring Room (**CMR**) operations, including coordination of facility communications. The facility log is maintained by the CMRO.

- Chief Office Warden (**COW**)—A predesignated individual with responsibilities for complete surface accountability at staging areas in the event of an evacuation. The Chief Office Warden receives reports from the ACOWs.

- Emergency Response Team (**ERT**)—Supplemental group trained to respond to surface emergencies, to provide emergency first aid, and to respond to releases of hazardous waste or hazardous material. ERT members are part of the WIPP Supplemental Emergency Response Program.

- Emergency Services Technician (**EST**)/Fire Protection Technician (**FPT**)—Regular employee whose job is that of full-time emergency responder. During non-emergency conditions, the EST/FPT inspects facility fire suppression systems and emergency equipment. The EST/FPT completes specific sections of the "WIPP Hazardous Material Incident Report." Additional technical personnel complete identified sections of the report.

- Fire Brigade—The fire brigade is a team of five personnel who respond to site emergencies. The team consists of an Incident Commander and four fire fighters. The fire fighters are trained in accordance with NFPA Standards for Industrial Fire Brigades (Fire Brigades that perform both advanced exterior and interior structural fire fighting).

- First Line Initial Response Team (**FLIRT**)—Supplemental primary responders in the event of a general underground emergency for medical and hazardous material response. The FLIRT also provides backup support for the ERT in the event of a general surface-facility emergency. FLIRT members are part of the WIPP Supplemental Emergency Response Program.

- Mine Rescue Team (**MRT**)—Supplemental group responsible for underground reentry and rescue after an emergency evacuation. The MRT responds in accordance with 30 CFR Part 49 requirements. MRT members are part of the WIPP Supplemental Emergency Response Program.

- Office Warden—An individual assigned responsibility for assuring that personnel are evacuated from his/her assigned area or building during evacuations. Office Wardens

maintain a list of all personnel in their specific area. This list is compared with the physical presence of personnel who assemble at the staging areas. The Office Wardens report area accountability to the ACOWs.

- EOC Staff-The EOC consists of a minimum staff of three MOC management positions (the Crisis Manager, a Safety Representative and an Operations Representative) to activate the EOC. The full EOC Staff includes the Crisis Manager, the Deputy Crisis Manager, a Safety Representative, an Operations Representative and the EOC Coordinator. Additional technical and logistics personnel will provide support as necessary. The EOC is activated by the FSM. Since EOC staff are performing duties similar to their normal job functions and providing support related to their area of expertise, no specific RCRA training is required.

D-3 Implementation

The provisions of this Contingency Plan will be implemented immediately whenever there is an emergency event (e.g., a fire, an explosion, or a natural occurrence that involves or threatens hazardous or TRU mixed wastes or a release of hazardous substances, hazardous materials, or hazardous wastes) that could threaten human health or the environment, or whenever the potential for such an event exists as determined by the RCRA Emergency Coordinator, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)). The following information is utilized for categorization of events to determine implementation of the Contingency Plan:

1. Medical Emergencies (does not implement the Contingency Plan)
2. Non-emergency (does not implement the Contingency Plan)
   a. Fire already out, did not involve any hazardous materials.
   b. Spill or release involved materials excluded according to the SARA Title III, Statute 42 U.S.C. 11021 (e). Such as:
      1) Any substance present in the same form and concentration as product packaged for distribution and use by the general public. (Example: Cleaning solutions)
      2) Any substance to the extent it is used in a laboratory under the direct supervision of a technically qualified individual.
      3) Petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance by Comprehensive Environmental Response, Compensation and Liability Act (**CERCLA**).

3. Incident Level I: According to the NFPA 471, Responding to Hazardous Materials Incidents (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level I incident and does not implement the Contingency Plan.

   a. The product does not require a U.S. Department of Transportation (**DOT**) placard, is a NFPA listed 0 or 1 for all categories, or is Other Regulated Materials A, B, C, or D.

   b. The fire is under control and the reactivity rating of the material is less than a rating 2, indicating a low potential for subsequent explosion as the hazardous material can be considered normally stable.

   c. There was no release or the release can be confined with readily available resources.

   d. There is no life-threatening situation.

   e. There is no potential environmental impact.

4. Incident Level II: According to NFPA 471, Responding to Hazardous Materials Incidents, (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level II incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

   a. The product requires a DOT placard, is an NFPA 2 for any categories, or is Environmental Protection Agency (**EPA**) regulated waste (Site-specific: Table D-1 and TRU mixed waste) AND

   b. The incident involves multiple packages.

   c. There is potential for the fire to spread since the hazardous material's flammability level (rating 2) is below 200 degrees Fahrenheit, or the reactivity (rating 2) indicates that violent chemical changes are possible and thus may be explosive.

   d. The release may not be controllable without special resources.

   e. The incident requires evacuation of a limited area for life safety.

   f. The potential for environmental impact is limited to soil and air within incident boundaries.

   g. The container is damaged but able to contain the contents to allow handling or transfer of product.

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5. Incident Level III: According to NFPA 471, Responding to Hazardous Materials Incidents (See Table D--3). If the product(s) involved in the fire, explosion, spill or leakage meet the following criteria, it will be classified as a Level III incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

    a. The product is a poison A (gas), an explosive A/B, organic peroxide, flammable solid, material that is dangerous when wet, chlorine, fluorine, anhydrous ammonia, NFPA 3 and 4 for any categories including special hazards, EPA extremely hazardous substances, and cryogenics.

    b. The site-specific container size for this incident level will be a tank truck.

    c. There is potential for the fire to spread since the hazardous material's flammability level (rating 3 or 4) is below 100 degrees Fahrenheit, or the reactivity (rating 3 or 4) indicates that the material may explode.

    d. The release may not be controlled even with special resources.

    e. The incident requires mass evacuation of a large area for life safety.

    f. Even though the NFPA guidelines for this incident level indicate that the potential for environmental impact is severe, due to the site engineering controls, the impact is contained within the HWMUs.

    g. The container is damaged to such an extent that catastrophic rupture is possible.

The above categories include fire situations, weather conditions, natural phenomena, and explosions which will have to be evaluated to make an incident level determination. A Level II (potential threat to human health in localized area, potential for moderate on-site environmental impact) or Level III (potential threat to human health in a larger area, potential for severe environmental impact) incident by definition is considered to be a potential threat to human health or the environment and, therefore, is considered to be an emergency requiring activation of the Contingency Plan.

D-4 Emergency Response Method

Methods that describe how and when the WIPP Contingency Plan will be implemented cover the following 11 implementation areas:

1. Notification (Section D-4a)
2. Identification of hazardous materials (Section D-4b)
3. Assessment of the nature and extent of the emergency (Section D-4c)
4. Control, containment, and correction of the emergency (Section D-4d)
5. Prevention of recurrence or spread of fires, explosions, or releases (Section D-4e)
6. Management and containment of released material and waste (Section D-4f)
7. Incompatible waste (Section D-4g)
8. Post-emergency facility and equipment maintenance and reporting (Section D-4h)
9. Container spills and leakage (Section D-4i)
10. Tank spills and leakage (Section D-4j)
11. Surface impoundment spills and leakage (Section D-4k)

D-4a Notification

Notification requirements in the event of an emergency at a RCRA hazardous waste management facility are defined by 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(a) and (d)). Necessary notifications in case of an emergency at the WIPP facility are described in this section (Figure D-4a). Personnel at the WIPP facility are trained to respond to emergency notifications.

D-4a(1) Initial Emergency Response and Alerting the RCRA Emergency Coordinator

The first person to become aware of an incident shall immediately report the situation to the CMRO, and provide the following information, as appropriate:

- Name and telephone number of the caller
- Location of the incident and the caller
- Time and type of incident
- Severity of the incident
- Magnitude of the incident
- Cause of the incident
- Assistance needed to deal with or control the incident
- Areas or personnel affected by the incident

In addition to receiving incident reports, the CMRO, who is located in the Support Building (Building 451) (Figure D-1), continuously monitors (24 hours a day) the status of mechanical, electrical, and/or radiological conditions at selected points on the site, both above and below ground. Alarms to indicate abnormal conditions are located throughout the WIPP facility. The alarm(s) (e.g., fire, radiation) may be the first notification of an emergency situation received by the CMRO. The CMRO monitors alarms, takes telephone calls and radio messages, and initiates outgoing calls to emergency staff and outside agencies.

Once the CMRO is notified of a fire, explosion, or a release anywhere in the facility (either by eyewitness or an alarm), the RCRA Emergency Coordinator is immediately notified. Once notified, the RCRA Emergency Coordinator assumes responsibility for the management of activities related to the assessment, abatement, and/or cleanup of the incident.

A RCRA Emergency Coordinator is on-site at all times and, therefore, can be reached at any time via a two-way radio or over the public address (**PA**) and plectrons on-site. If the RCRA Emergency Coordinator is unavailable or unable to perform these duties, a qualified alternate RCRA Emergency Coordinator is available.

The EST/FPT is also notified in case of fire, explosion, or release. The RCRA Emergency Coordinator, as incident commander, determines if supplemental emergency responders are necessary. Notification of the ERT (surface) is made by using the ERT pagers and/or the public announcement system. Notification of the FLIRT is by using the Mine Page Phone System. If the MRT is needed the RCRA Emergency Coordinator will instruct the CMRO to make a PA announcement for the MRT to assemble in the Mine Rescue Room, located in a predetermined location.

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Off-shift personnel may be notified using the on-call list, which is updated weekly by the Permittees. The FSM/CMRO, each individual on the on-call list, and WIPP Security receive copies of the on-call list. The CMRO may direct Security to make the notifications.

The response to an unplanned event will be performed in accordance with procedures based on the applicable Federal, State, or local regulations and/or guidelines for that response. These include the U.S. Mine Safety and Health Administration (**MSHA**); NMAC; CERCLA; Chapter 74, Article 4B, New Mexico Statutes Annotated 1978, New Mexico Emergency Management Act; and agreements between the Permittees and local authorities (Section D-6) for emergencies throughout the WIPP facility.

After notification by the CMRO, the EST/FPT shall immediately investigate to determine pertinent information relevant to the actual or potential threat posed to human health or the environment. The information will include the location of release, type, and quantity of spilled or released material (or potential for release due to fire, explosion, weather conditions, or other naturally occurring phenomena), source, areal extent, and date and time of release. The EST/FPT shall provide information for classification of the incident, according to the emergency response guidelines, to the RCRA Emergency Coordinator. The RCRA Emergency Coordinator then classifies the incident after evaluation of all pertinent information. This classification will consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).

When the RCRA Emergency Coordinator determines that an Incident Level II or III has occurred, the Contingency Plan is implemented. The RCRA Emergency Coordinator then may choose to activate the EOC for additional support (Figure D-4). If the RCRA Emergency Coordinator determines that due to extenuating circumstances the potential to upgrade to an incident Level II or III exists, the RCRA Emergency Coordinator also may activate the EOC. The EOC will assist the RCRA Emergency Coordinator in mitigation of the incident with use of communications equipment and technical expertise from any WIPP organization (see Section D-4c).

The EOC staff will assess opportunities for coordination and the use of mutual-aid agreements with local outside agencies making additional emergency personnel and equipment available (Section D-6), as well as the use of specialized response teams available through various State and Federal agencies. As a DOE-owned facility, the WIPP facility may use the resources available from the Federal Response Plan, signed by 27 Federal departments and agencies in April 1987, and developed under the authorities of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7701 et seq.) and amended by the Stafford Disaster Relief Act of 1988. Most resources are available within 24 hours. The WIPP facility maintains its own emergency response capabilities on-site. In addition to the supplemental emergency responders, radiological control technicians, environmental sampling technicians, wildlife biologists, and various other technical experts are available for use on an as-needed basis.

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D-4a(2) Communication of Emergency Conditions to Facility Employees

Procedures for notifying facility personnel of emergencies depend upon the type of emergency. Methods of notification are:

- Local Fire Alarms

  The local fire alarms sound a bell tone and may be activated automatically or manually in the event of a fire.

- Surface Evacuation Signal

  The evacuation signal is a yelp[2] tone and is manually activated by the CMRO when needed. The CMRO shall follow the evacuation signal with verbal instructions and ensure the Site Notification System (i.e., the plectron) has been activated.

- Underground Evacuation Warning System

  The evacuation signal is a yelp tone and flashing strobe light. In the event of an evacuation signal, underground personnel will proceed to the nearest egress hoist station (Section D-7b) to be apprised of the nature of the emergency and the evacuation route to take. Underground personnel are trained to report to the underground assembly areas and await further instruction if all power fails or if ventilation stops. If evacuation of underground personnel is required, this will be done using the backup electric generators and in accordance with the applicable requirements of MSHA.

- Contingency Evacuation Notification

  If the primary warning system consisting of alarms and signals fails to operate when activated (as in a total power outage and failure of the back-up power systems), WIPP Security will be notified by the CMRO to initiate the contingency evacuation plan. In this event Security officers will alert personnel to evacuate the area and will check trailers, if possible, to ensure that personnel have been alerted/evacuated.

WIPP facility personnel are trained and given instruction during General Employee Training to recognize the various alarm signals and the significance of each alarm. WIPP facility employees and site visitors are required to comply with directions from emergency personnel and alarm system notifications and to follow instructions concerning emergency equipment, shutdown procedures, and emergency evacuation routes and exits.

D-4a(3) Notification of Local, State, and Federal Authorities

If it is determined that the facility has had a fire, an explosion, a spill, or a release of hazardous waste or hazardous waste constituents (included in 20.4.1.200 NMAC (incorporating 40 CFR § 261)) in the miscellaneous unit or TRU mixed waste handling areas, or an emergency resulting in a release of a hazardous substance (included in 40 CFR §302.4 and §302.6 or the New

[2] The yelp tone increases from 500 to 1,000 hertz and drops to 500 hertz.

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Mexico Emergency Management Act, §74-4B-3 and §74-4B-5) that could threaten human health or the environment outside the facility, the RCRA Emergency Coordinator, after consultation with the DOE as the owner of the facility, will assure that local authorities are notified by telephone and/or radio, including:

- Carlsbad Police Department (telephone number: [575] 885-2111) (or 911)
- Carlsbad Fire Department (telephone number: [575] 885-2111) (or 911)
- Eddy County Sheriff (telephone number: [575] 887-7551)
- Hobbs Fire Department (telephone number: [575] 397-9265)

After local authorities are notified, the RCRA Emergency Coordinator will ensure notification of the following:

- New Mexico Environment Department (**NMED**)
  Department of Public Safety
  24-Hour Emergency Reporting Telephone Number: (505) 827-9329
  FAX number: (505) 827-9368

- Department of Public Safety WIPP Coordinator
  Telephone Number: (505) 827-9221
  FAX number: (505) 829-3434

- Hazardous Materials Emergency Response, Chemical Safety Office, Department of Public Safety, State Emergency Response Commission
  Telephone number: (505) 476-9681
  FAX number: (505) 476-9695

- National Response Center
  Telephone number: 1-800-424-8802
  FAX number: (202) 479-7181

- Local Emergency Planning Committee
  Telephone number: (575) 885-3581
  Fax number: (575) 628-3973

The first notification of public safety and regulatory agencies will include the following:

- The name and address of the facility and the name and phone number of the reporter
- The type of incident (fire, explosion, or release)
- The date and time of the incident
- The type and quantity of material(s) involved, to the extent known
- The exact location of the incident
- The source of the incident

- The extent of injuries, if any
- Possible hazards to human health and the environment (air, soil, water, wildlife, etc.) outside the facility
- The name, address, and telephone number of the party in charge of or responsible for the facility or activity associated with the incident
- The name and the phone number of the RCRA Emergency Coordinator
- The identity of any surface and/or groundwater involved or threatened and the extent of actual and potential water pollution
- The steps being taken or proposed to contain and clean up the material involved in the incident

The RCRA Emergency Coordinator will also be available to advise the appropriate local, State, or Federal officials on whether or not local areas should be evacuated.

D-4a(4) Notification of the General Public

Immediate notification of the general public through the public safety and emergency agencies listed above will be made by, or under the direction of, the RCRA Emergency Coordinator following an evaluation to determine if local adjacent areas need to be evacuated. This evaluation will be made in consultation with the DOE who, as the owner of the facility, has management responsibility for the land withdrawal area. DOE policy is to provide accurate and timely information to the public by the most expeditious means possible concerning emergency situations at the WIPP site that may affect off-site personnel, public health and safety, and/or the environment. A DOE (**DOE**) Management representative is always on-call. This person is available by pager or telephone 24 hours a day.

A Hazards Assessment was conducted, which indicated no need for protective actions or emergency action levels, as defined by the Permittees, for the facility. Therefore, no procedures are in place for evacuation of the public. Procedures are in place for notification of the public by radio, television, and newspapers for news items which might include notification of on-site emergency situations. These procedures include a Public Affairs Coordinator in the EOC who writes and transmits press releases to the DOE office, where formal press conferences are conducted.

D-4b Identification of Hazardous Materials

The identification of hazardous wastes, hazardous waste constituents, or hazardous materials involved in a fire, an explosion, or a release to the environment is a necessary part of the assessment of an incident, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). RCRA hazardous waste and hazardous substances and materials listed in 40 CFR §302.4 and §302.6 or New Mexico Emergency Management Act, §74-4B-3 and §74-4B-5 and, involved in any release at the WIPP facility will be identified. The identification of likely hazardous materials at any location is enhanced because hazardous materials and hazardous waste are only stored or managed in specified locations throughout the WIPP facility. An attempt will be made to identify products involved by occupancy/location, container shape,

markings/color, placards/labels, United Nations/North America/Product Identification Number, on-site technical experts, or field sampling. Further, the ES&H department maintains an updated inventory of hazardous materials/substances that are brought on site, and a master MSDS listing in the Safety and Emergency Services Facility, Building 452.

Sources of information available to identify the hazardous wastes, substances, or materials involved in a fire, an explosion, or a release at the WIPP facility include operator/supervisor knowledge of their work areas, materials used, and work activities underway; the WIPP Waste Information System (**WWIS**), which identifies the location within the facility of emplaced TRU mixed waste, including emplaced derived waste; and waste manifests and other waste characterization information in the operating record. The WWIS also includes information on wastes that are in the waste handling process. Also available are MSDSs for hazardous material in the various user areas throughout the facility, waste acceptance records, and materials inventories for buildings and operating groups at the WIPP facility. Information or data from the derived waste accumulation areas, the hazardous waste staging area, satellite staging areas, and nonregulated waste accumulation areas are included.

TRU mixed waste received by the WIPP facility during the Disposal Phase will be characterized for hazardous constituents prior to receipt, and acceptable knowledge will be used to characterize derived waste prior to emplacement.

Information required for identifying TRU mixed hazardous constituents in case of an incident is readily available through the WWIS and the waste acceptance records. Waste accepted at WIPP is already known to be compatible with all materials used to respond to an emergency. All non-TRU mixed waste materials received on site, other than those listed in Table D-1, are in such small quantities that no reaction could develop which would trigger an Incident Level II or III response.

The RCRA Emergency Coordinator will have access to the WWIS through Operations, or through the Facility Shift Manager's Office.

The RCRA Emergency Coordinator has access to the inventory lists and MSDSs in the Safety and Emergency Services Facility at all times.

D-4c Assessment of the Nature and Extent of the Emergency

Once the required notifications have been made, the RCRA Emergency Coordinator will ensure that the identity, exact source, amount, and areal extent of any released materials are determined, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). The RCRA Emergency Coordinator will determine whether the occurrence constitutes an emergency based on knowledge of the area and access to the waste identification/characterization information described in Section D-4b. An emergency will require response by only trained emergency response personnel. The RCRA Emergency Coordinator will be responsible for responding to immediate and potential hazards, using the services of trained personnel to determine: 1) the identity of hazardous wastes, hazardous waste constituents, and other hazardous materials involved in a release, as described in Section D-4b; 2) whether or not a release involved a reportable quantity of a hazardous substance; 3) the areal extent of a release; 4) the exact source of a release; and 5) the potential hazards to human health or to the environment.

After the materials involved in an emergency are identified, the specific information on the associated hazards, appropriate personal protective equipment (**PPE**), decontamination, etc., will be obtained from MSDSs and from appropriate chemical reference materials at the same location. These information sources may be accessed by the RCRA Emergency Coordinator or through several WIPP facility organizations.

The emergency assessment requires determination of hazards involving evaluation of several criteria, including:

- Exposure: magnitude of actual or potential exposure to employees, the general public, and the environment; duration of human and environmental exposure; pathways of exposure
- Toxicity: types of adverse health or environmental effects associated with exposures; the relationship between the magnitude of exposure and adverse effects
- Reactivity: hazardous materials or hazardous wastes, which are not TRU mixed wastes, involved in an incident will be assessed for reactivity through accessing the MSDSs for the affected material and the recommended method(s) for managing such waste
- Uncertainties: considerations for undeterminable or future exposures; uncertain or unknown health effects, including future health effects

D-4d Control, Containment, and Correction of the Emergency

The WIPP facility is required to control an emergency and to minimize the potential for the occurrence, recurrence, or spread of releases due to the emergency situation, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56 (e)). The WIPP Emergency Response procedures utilize the incident mitigation guidelines in NFPA 471, Responding to Hazardous Materials Incidents, with initial response priority being on control, and those actions necessary to ensure confinement and containment (the first line of defense) in the early, critical stages of a spill or leak. The RCRA Emergency Coordinator is responsible for stopping processes and operations when necessary, and removing or isolating containers. TRU mixed waste will remain within the WHB Unit, the Parking Area Unit, and the underground HWDU.

D-4d(1) All Emergencies

The WIPP Emergency Response procedures include, but are not limited to, the following actions appropriate for control:

1. Isolate the area from unauthorized person by fences, barricades, warning signs, or other security and site control precautions. Isolation and evacuation distances vary, depending upon the chemical/product, fire, and weather situations.
2. Identify the chemical/product according to Section D-4b.
3. Drainage controls.
4. Stabilization of physical controls (such as dikes or impoundment[s]).

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5. Capping of contaminated soils to reduce migration.

6. Using chemicals and other materials to retard the spread of the release or to mitigate its effects.

7. Excavation, consolidation, removal, or disposal of contaminated soils.

8. Removal of drums, barrels, or tanks where it will reduce exposure risk during situations such as fires.

If the facility stops operations in response to a fire, explosion, or release, the RCRA Emergency Coordinator shall ensure continued monitoring for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever appropriate. If operations continue, personnel normally assigned to these tasks will continue.

Both natural and synthetic methods will be employed to limit the releases of hazardous materials so that effective recovery and treatment can be accomplished with minimum additional risk to human health or the environment. A combination of the above methods to achieve protection of human health and the environment, with emphasis on two basic methods for mitigation of hazardous materials incidents - Physical and Chemical (Tables D-4, D-5) mitigation, will be used.

1. Physical methods of control involve any of several processes to reduce the area of the spill/leak, or other release mechanism (such as fire suppression).

   A. Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume of the sorbate/sorbent system through the process of swelling. Some of the materials utilized in response to Level I incidents or Level II incidents involving liquids will be absorbent sheets of polyolefin-type fibers, spill control bucket materials (specifically for solvents, neutralization, or for acids/caustics), and absorbent socks for general liquids or oils.

   B. Covering refers to a temporary form of mitigation for radioactive incidents that will be utilized in response to Level II or Level III incidents involving CH TRU mixed waste. These could include absorbent sheets, plastic, or actual ambulance blankets.

   C. Dikes or Diversions refer to the use of physical barriers to prevent or reduce the quantity of liquid flowing into the environment. Dikes may be soil or other barriers temporarily utilized to hold back the spill or leak. Diversion refers to the methods used to physically change the direction of the flow of the liquid. Absorbent socks or earth may be utilized as dikes or diversions for all levels of incidents.

   D. Overpacking is accomplished by the use of an oversized container. Overpack containers will be compatible with the hazards of the materials involved.

   E. Plug and Patch refers to the use of compatible plugs and patches to reduce or temporarily stop the flow of materials from small holes, rips, tears, or gashes in containers. A Series "A" hazardous response kit containing nonsparking

equipment to control and plug leaks may be utilized for response to all levels of incidents.

F. Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually or by pump, from a leaking or damaged container. Scoops, shovels, jugs, and pails as well as drum transfer pumps for chemical and petroleum transfer are utilized as needed in response to all levels of incidents.

G. Vapor Suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents such as an aqueous foam blanket.

2. Chemical Methods of Mitigation

A. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. This would include using the neutralizing adsorbents.

B. Solidification is the process whereby a hazardous liquid is added to material such as an absorbent so that a solid material results.

The established procedures are based upon the incident level and a graded approach for nonradioactive or CH TRU waste emergencies and initiated to:

1. Minimize contamination or contact (through PPE, etc.)
2. Limit migration of contaminants
3. Properly dispose of contaminated materials

For RH TRU mixed waste that is not managed in shielded containers, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(2) Fire

The incident level emergency response identified in Section D-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using

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control doors associated with the underground ventilation system. The following actions are implemented in the event of a fire:

1. All emergency response personnel at an incident will wear appropriate PPE.

2. Only fire extinguishing materials that are compatible with the materials involved in the fire will be used to extinguish fires. Compatibility with materials involved in a fire are determined by pre-fire plans, Emergency Response Guide Book (DOT, 1993), DOT labeling, and site-specific knowledge of the emergency response personnel. Water and dry chemical materials have been determined to be compatible with all components of the TRU mixed waste. Pre-fire plans for the WHB are included in Figures D-10 and D-11.

   Fires in areas of the WHB Unit should not propagate, due to limited amount of combustibles, and the concrete and steel construction of the structures. Administrative controls, such as landlord inspections and EST/FPT inspections, help to insure good housekeeping is maintained. Combustible material and TRU mixed waste will be isolated, if possible. Firewater drain trenches collect the water and channel it into a sump. In areas not adjacent to the trenches, portable absorbent dikes (pigs) will be used to retain as much as possible, until it can be transferred to containers or sampled and analyzed for hazardous constituents.

3. If the fire spreads or increases in intensity, personnel will be directed to evacuate.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards.

5. In order to ensure that storm drains and/or sewers do not receive potentially hazardous runoff, dikes will be built around storm drains to control discharge as needed. Collected waste will be sampled and analyzed for hazardous constituents, before being discharged to evaporation ponds. There are two ponds south of the security fence, opposite the WHB Unit, that will collect drainage from the parking area. The rest of the site, inside the security fence, drains to the large pond to the west. Samples will be taken from these ponds, after the emergency has been abated, to determine any cleanup requirements. NMED will approve any procedures associated with the sampling and analysis of the ponds.

6. The RCRA Emergency Coordinator maintains overall control of the emergency and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains overall responsibility.

7. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

8. Materials involved in a fire can be identified in the following ways:

   - According to Section D-4b.

   - If the contents of the waste container cannot be determined based on its location and the label is destroyed by fire, the material will be treated as an

unknown, evaluated for radiological contamination, and analyzed according to methods in the EPA's "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (**SW-846**), Third Edition, after the fire has been extinguished.

- Airborne radioactivity samples may be obtained during a fire involving radioactive materials, using portable and fixed air samplers. Response personnel will be adequately protected from airborne radioactivity by their PPE required for fire response.

9. Only materials compatible with the waste may be used for fire response.

10. When cleanup has proceeded to the point of finding no radionuclide activity, then the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

    - For waste containers, once radiologically clean and free of any visible evidence of hazardous waste spills on the container, it will be placed in the underground without further action.

    - For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues (for further information see Section D-4d, Emergency Termination Procedures).

11. Fire suppression materials used in response to incidents will be retained on-scene, where an evaluation will be performed to determine appropriate recovery and disposal methods.

D-4d(3) Explosion

The following actions will be implemented in the event that an explosion that involves or threatens hazardous or TRU mixed waste or hazardous materials has occurred:

1. The area will be evacuated immediately.

2. The CMRO will immediately notify the appropriate emergency response personnel and the RCRA Emergency Coordinator about the explosion.

3. Injured personnel will be treated and transported as necessary.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards involved and the degree and location of the explosion and associated fires.

5. The RCRA Emergency Coordinator will be in command and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains the overall responsibility. Selections of methods and tactics of response are the responsibility of the Incident Commander.

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6. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

7. When cleanup has proceeded to the point of finding no radionuclide activity, then samples may be taken for chemical analysis if there is visible evidence to suspect additional hazardous waste residues. Chemical residues on floor surfaces resulting from a hazardous waste explosion will be evaluated, sampled, analyzed (if required), isolated, and returned to appropriate containers, and surfaces will be cleaned using appropriate cleaners.

8. The RCRA Emergency Coordinator may shut down operational units (e.g., process equipment and ventilation equipment) that have been affected directly or indirectly by the explosion. Once the areas have been determined safe for reentry, processes may be reactivated.

D-4d(4) Spills

Protection of response personnel at a hazardous material incident is paramount. The primary methods to protect personnel are time, distance, and shielding. If a Level II or III incident exists, the RCRA Emergency Coordinator will implement the following actions:

1. The immediate area will be evacuated.

2. The RCRA Emergency Coordinator will review facility records to determine the identity and chemical nature of released material.

3. Entry team procedures will be utilized, with special attention to the following:

   - Buddy system
   - Appropriate PPE
   - Backup rescue team
   - Supplemental communication signals (hand signals and hand-light signals)
   - Monitoring equipment
   - Exposure time limitations

4. If possible, the source of the release will be secured.

5. A dike to contain runoff may be built.

6. Emergency responders will ensure that storm drains and/or sewers do not receive potentially hazardous runoff or spilled material. They may build dikes around storm drains to control discharge.

7. Released wastes may be collected and contained by stabilizing or neutralizing the spilled material, as appropriate, pouring an absorbent over the spilled material, and sweeping or shoveling the absorbed material into drums or other appropriate containers. The absorbents have been determined to be compatible with all components of the TRU mixed waste.

8. No TRU mixed waste that may be incompatible with the released material will be managed in the affected area until cleanup procedures are complete.

9. The RCRA Emergency Coordinator will direct spill control, decontamination, and termination procedures described below.

D-4d(5) Decontamination of Personnel

Decontamination of personnel with radioactive contamination is the responsibility of the Radiological Control (**RC**) section. If a person is contaminated with radioactivity during a site evacuation to the staging areas, the contaminated area will be covered before the person can be moved (under escort by RC personnel) to the staging area. The RC personnel will ensure the contaminated person remains segregated from other site personnel while under RC supervision.

In the event of an emergency that requires immediate evacuation of the area, the contamination can be covered by any method warranted, given the circumstance (e.g., clean clothing wrapped around the area). If the size of the radioactive contamination on the body is small and localized, it can be covered with clothing (e.g., glove, shoe cover, coveralls). If the size of the radioactive contamination on the body is large, it may be covered by dressing the individual in a full set of Anti-Contamination clothing (coveralls, hood, gloves, shoe covers, etc.).

If time and location permit and the contamination is on the face, it will be decontaminated immediately using a cloth moistened with tepid water (and a mild detergent, if necessary). If the size of the radioactive contamination on the individual's body is small and localized, it will be decontaminated using the same method as for the face, but after the individual has been transferred to an area appropriate for conducting decontamination.

If the individual is transferred to the staging area prior to decontamination, he/she will be decontaminated at the staging area using site procedures for personnel decontamination and using decontamination supplies and equipment as appropriate for the extent and magnitude of the contamination.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

In the event of spills or leaking or punctured containers of CH and RH TRU mixed waste, the WIPP responds to three distinct phases: 1) the event, 2) the re-entry, and 3) the recovery.

During the event, the following immediate actions are completed: 1) stop work, 2) warn others (notify CMR), 3) isolate the area, 4) minimize exposure, and 5) close off unfiltered ventilation. These actions can take place simultaneously, as long as they are completed before proceeding to the re-entry phase.

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers that are managed as ~~of~~ CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and or any approved fixatives such as polyvinyl alcohol (**PVA**) or paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and

counted. This information is used by cognizant managers, RC personnel, and As Low As Reasonably Achievable (**ALARA**) Committee representatives to determine an appropriate course of action to recover the area. A plan to decontaminate and recover affected areas and equipment will be approved with a separate RWP written to establish the radiological controls required for the recovery.

During the recovery phase, the plan will be executed to utilize the necessary resources to conduct decontamination and/or overpacking operations as needed. The completion of this phase will occur prior to returning the affected area and/or equipment to normal activities. The recovery phase will include activities to minimize the spread of contamination to other areas. These activities will involve placing the waste material in another container; vacuuming the waste material; overpacking or plugging/patching the spilled, leaking, or punctured waste container; and/or decontaminating the affected area(s). If an affected surface cannot be decontaminated to releasable levels, it may be covered with a fixative coating and established as a Fixed Contamination Area to prevent spread of contamination, or it may be removed using heavy machinery and tools, packaged in approved waste containers, and emplaced in the underground. Every reasonable effort to minimize the amount of derived waste, while providing for the health and safety of personnel, will be made.

Should a breach of a CH TRU mixed waste container occur at the WIPP that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into an available overpack container (e.g., 85-gal drum, SWB, TDOP), except that TDOPs and SLB2s will be decontaminated, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. The decontamination of equipment and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations CH TRU mixed waste will be handled only in the areas of the WHB Unit. Therefore, it is within these same areas that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced.

Equipment used during a spill cleanup or CH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and others as needed for a given incident.

At the underground emplacement room, salt contaminated by a spill of CH TRU mixed waste would be either covered or cleaned up, depending on location, extent, and spilled material, due to potential radioactive contamination spread via the salt dust. The contaminated salt would be covered to isolate it from the workers, and the stacking of waste containers would resume or would be removed and packaged as site-derived waste using applicable site procedures for decontaminating surfaces.

The decontamination methods will initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

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RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for uncontrolled use. The free release criteria for items, equipment, and areas is < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to verify the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log.

RH TRU Mixed Waste

For RH TRU mixed waste, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using the following measures, as appropriate:

During the re-entry phase, an evaluation of the incident, including the nature of the release, amount, location, and other appropriate factors, will be performed. A RWP will be written and approved prior to personnel entering the Hot Cell with the appropriate PPE to further assess the situation, perform surveys and take samples, and, if possible, mitigate problems that could compound the hazards in the area. Based on the results of the evaluation, a determination will be made by the RCRA Emergency Coordinator, with input from the cognizant managers, radiological control personnel, and ALARA Committee representatives whether to implement the Contingency Plan and to determine the appropriate course of action to recover from the event. An action response plan to decontaminate and recover affected areas and equipment, together with an RWP establishing the radiological controls required for the recovery will be developed and approved.

Should a breach of a RH TRU mixed waste container occur in the Hot Cell that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into a canister and processed for disposal. The decontamination of equipment, cleanup of spilled material and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations RH TRU mixed waste in 55-gallon drums will be handled only in the Hot Cell. Therefore, it is within this area that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas

for decontamination or overpacking, the risk of spreading contamination is reduced. Contaminated materials for the cleanup and overpacking of a breached RH TRU mixed waste container may be managed as CH TRU mixed waste, depending on the surface dose rate.

Equipment used during a spill cleanup or RH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and other equipment as needed for a given incident.

The decontamination methods may initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment within the Hot Cell may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination of the Hot Cell is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for continued use. The free release criteria for items and equipment that will be released for uncontrolled use are < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to confirm the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log. The recovery phase must be completed before the affected area and/or equipment are returned to service.

D-4d(7) Natural Emergencies

After a natural emergency (earthquake, flood, lightning strike, etc.) that involves hazardous waste or hazardous materials, the FSM will ensure the following actions are taken:

1. Inspect containers which have not been disposed and containment for signs of leakage or damage. Inspect areas where containers are stored looking for leaking containers and for deterioration of containers and the containment system.

2. Inspect affected equipment or areas associated with hazardous waste management activities for proper operating mode in accordance with site procedures and manually check to ensure automatic and alarmed features on the units are working.

3. Inspect affected equipment or areas within the HWMUs in accordance with site procedures for damage.

4. Inspect electrical boards and overhead electrical lines for damage.

5. Check container areas for signs of leakage or damage to drums and containers.

6. Check affected buildings and fencing directly related to hazardous waste management activities for damage.

7. Conduct a general survey of the site looking for signs of land movement, etc.

8. Take any necessary corrective measures, however temporary, to rectify potential or real problems.

9. Record inspection results.

D-4d(8) Roof Fall

Roof fall is not expected to affect RH TRU mixed waste because it is emplaced in the rib of the disposal room and not subject to impact from a roof fall. The following incident description and mitigation apply to CH TRU mixed waste.

The WIPP underground is routinely evaluated for stability and safety of the underground openings. These evaluations can be as simple as the MSHA required visual checks by personnel working in the area or as extensive as the expert review of the roof support system for Room 1 Panel 1 conducted in 1991. An in-depth evaluation of all of the accessible underground is performed on an annual basis as part of the formal ground control operating plans. Weekly visual and sounding inspections are performed by the Permittees. More frequent inspections and evaluations are performed in areas where roof or ribs are in need of evaluations, based on visual observations, analysis of rock deformation data, excavation effects program data acquired from observation holes, and support system performance.

This process applies not only to the waste disposal rooms but to the entire WIPP underground. Prior to waste emplacement, stability of each room will be evaluated. This evaluation will concentrate on the age and current performance of the installed support systems (if any) and the rate of roof beam expansion based on data from installed instrumentation. The roof support system's performance and surety, to provide the support necessary for the required time will be addressed. Criteria used will include design parameters such as the amount of load, the deformation of the installed system, and the number and type of component failures observed, if any. Geotechnical criteria will include parameters such as the type and quantity of fracturing, roof beam expansion rates, and future ground performance based on a predictive model.

Should the evaluation results indicate that remedial actions are necessary prior to placement of waste, experiences at the WIPP indicate that rebolting or installing supplemental support can extend the safe life of a room for several years.

After waste emplacement commences, geomechanical monitoring will continue with monitors that are tied into a computer network program. The readings obtained will provide information needed for the roof beam stability assessment. Visual observations of the ground and the support systems will also continue in all accessible areas. Based on the experiences from the Site and Preliminary Design Validation test rooms, it has been proven that any developing instability will be detected through monitoring. Multiple measures to deal with the observed conditions can be implemented months before an event to mitigate any risk associated with a roof fall in the storage room or any affected area within the mine. At a minimum, the affected

area will be isolated and withdrawn from ventilation flow. Isolation operations will utilize current available methods, materials, and equipment.

Ground control conditions which could result in a fall can be divided into two scenarios: The first consists of spalling (falling) of individual small and localized rock falling on waste containers.

By definition, they can be considered insignificant as no damage to the drums can occur. The second consists of an entire section of roof falling on multiple stacks of waste containers. Each of these scenarios is discussed below.

Spalling-of-Ground Scenario

The maximum distance between the room roof and a container of waste is 10 ft. Waste containers are designed to withstand impact loads of at least 1,000 pounds (lbs) dropped from a height of 6 ft. flat or 450 lbs dropped on a circumferential edge from a height of 4 ft. Both of which correspond to an allowable impact stress of 25,450 pounds per square inch (psi). Rocks from spalling are small and would not be of sufficient weight when striking a drum from a 10 ft vertical height to cause an impact stress of more than 25,450 psi. Taking into account the falling distance, average weight, and the typical shape of the salt rock, the conclusion is that puncturing a drum by spalling is non-credible.

Fall-of-Ground Scenario

Fall-of-ground occurs when a large section of roof beam falls onto the waste containers. As previously discussed, the possibility of this occurring in an active room is remote, due to continuous monitoring and engineered roof support systems.

The following actions have been developed and will be taken by the RCRA Emergency Coordinator should a rock fall occur in an active waste emplacement area of the repository:

Spalling-of-Ground Actions

1. Determine whether the roof conditions allow for safe entry and if the waste container or containers in question are accessible.

   The process used to determine if a roof condition of a room will allow for safe entry is the same as the ground control inspection process used for inspection of the ground conditions and roof bolt integrity. The inspection will begin at a safe and sound roof starting point and consist of visual inspections of roof bolts, roof, and rib areas for missing or damaged bolts; deformed roof bolt plates; or roof and rib cracks, fractures, or separations. If during the visual inspection suspicious roof bolts, roof, or ribs are found, then operators will proceed with sounding the area in question with a scaling bar for loose roof bolts, bad roof, or ribs (loose roof bolts will not ring when sounded). Bad roof or ribs will have a drummy, hollow, or un-solid sound when struck with the scaling bar. When this operation is performed, a safe avenue for retreat is always maintained. Also maintained is a position such that an unexpected event will not place personnel in a position where the scaling bar or material being scaled could fall on personnel. If the inspection reveals ground that cannot be safely scaled manually or with the available mining equipment, the affected area, up to and including the entire room, will be barricaded and removed from ventilation flow.

The criteria used to determine whether a waste container is accessible is based on the location of the container, the amount of waste in the room, and the expense of reaching the waste container safely versus the expense of abandonment of the room. For example, if the room is 95% filled and spalling-of-ground punctured a waste container at or near the exit of the room, the decision to isolate the room and move waste emplacement activities to the next room would be prudent.

2. Restrict access in ventilation flow path downstream of the incident.

3. Restrict ventilation to the affected room to ensure that there is no spread of contamination that may have been released. Survey for contamination and establish the boundaries.

4. Inspect accessible and affected containers and containment for signs of leakage or damage.

5. Cover the spill area with material such as plastic or fabric sheets or PVA, in a way that would safely isolate the area.

6. Determine if the covered spill area safely allows for continued waste disposal operations or whether further cleanup is required. If further cleanup is required, provide with cleanup methods described below. Note: Cleaning may not be required since this is the permitted disposal area.

7. Inspect any affected equipment (vehicles, handling equipment, and communication and alarm equipment) for proper function.

8. Repackage spilled waste and repackage, plug, or patch breached waste containers into 55 or 85-gallon drums, SWBs, or TDOPs, depending on volume. Temporarily locate overpack waste containers in an adjacent room. Remove only those intact waste containers necessary to clear the area for decontamination.

9. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets or PVA to isolate it from the workers or removed and packaged as site derived waste in accordance with site procedures for decontaminating surfaces.

10. Manage the radioactive debris as derived waste.

11. Characterize containers of waste based on the waste containers that were damaged.

12. Replace the removed and derived waste containers into the waste stack as appropriate and update the WWIS.

13. Document activities and record results.

Fall-of-Ground Actions

1. Restrict access in ventilation flow path downstream of the incident.

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2. Restrict the room from ventilation flow by closing bulkhead regulators.

3. Survey for radiological contamination and establish the boundary for a Radiological Buffer Area.

4. Install barricade devices to remove access.

5. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets, or PVA to isolate it from the worker or removed and packaged as site derived waste using damp rags, hand tools, and HEPA filtered vacuums.

   The criteria used to determine whether to close the entire panel or just the affected room of waste containers would include the location of the roof fall and the stability of the unaffected roof area in the panel. Techniques to determine the stability would be the same as previously described in this section.

D-4d(9) Structural Integrity Emergencies

In the event of a WIPP facility emergency involving underground structural integrity, the situation will be handled as a natural emergency. Monitoring and inspection procedures ensure the safety and integrity of the WIPP facility underground.

D-4d(10) Emergency Termination Procedures

For the transition from emergency phase to cleanup phase, the following items will be complete:

- Emergency scene will be stable
- Release of hazardous substance will be stopped
- Reaction of hazardous substance will be controlled
- The released hazardous substance will be contained within a localized and manageable area
- The area of contamination will be adequately secure from unauthorized entry

At every incident involving hazardous materials, there is a possibility that response personnel and their equipment will become contaminated. Emergency response personnel have procedures to minimize contamination or contact, and to properly dispose of contaminated materials.

For nonemergencies and Incident Level I emergencies, the following methods of decontamination are available for personnel, environment, and/or equipment according to emergency response procedures:

- Absorption
- Adsorption
- Chemical degradation

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- Dilution
- Disposal
- Isolation
- Neutralization
- Solidification

Any necessary verification of air, soil, or water samples will be directed by the RCRA Emergency Coordinator. Immediately after an emergency, the RCRA Emergency Coordinator will provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility in accordance with standard operating procedures.

For Level II and III incidents after the emergency itself is controlled and contained, the RCRA Emergency Coordinator will be responsible for the development and implementation of an incident-specific decontamination plan.

PPE will be decontaminated or disposed according to procedure before it is returned to its storage location.

As part of the facility's defense-in-depth approach, equipment will be assumed to be contaminated after each hazardous material response and a thorough check for radioactive contamination will be conducted. If contamination is found, a technically sound decontamination process will be followed. Many types of equipment are difficult to decontaminate and may have to be discarded as hazardous or derived waste. Whenever possible, pieces of equipment will be disposable or made of nonporous material.

If radioactive contamination is detected on equipment or on structures, it will be assumed that hazardous constituents may also be present. Radiological surveys to determine whether a potential release of hazardous constituents has occurred (Permit Attachment I3) will be used along with other techniques as a detection method to determine when decontamination is required. Radiological cleanup standards will be used to determine the effectiveness of decontamination efforts. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses become documentation of the condition of the container at the time of emplacement. These containers will be placed in the underground without further action, once the radiological contamination is removed, unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground. In no case shall these containers contain a total liquid content equal to, or which exceeds, one volume percent of the container.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed. The sampling plan will be approved by the NMED before it is implemented. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether

further cleaning will be beneficial or whether final clean up will be deferred until closure. Appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore, measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

For all Contingency Plan emergency responses, the RCRA Emergency Coordinator will ensure, in keeping with standard operating procedures, that, in the affected area(s) of the facility:

- No waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed
- All emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use, or replaced before operations are resumed

D-4e Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the RCRA Emergency Coordinator will ensure that reasonable measures are taken so that fires, explosions, and releases do not occur, recur, or spread to TRU mixed waste or other hazardous materials at the facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(e) and (f)). These measures include:

- Stopping processes and operations.
- Collecting and containing released wastes and materials.
- Removing or isolating containers of waste or hazardous substances posing a threat.
- Ensuring that wastes managed during an emergency are handled, stored, or treated with due consideration for compatibility with other wastes and materials on site and with containers utilized (Section D-4h).
- Restricting personnel not needed for response activities from the scene of the incident.
- Evacuating the area.
- Curtailing nonessential activities in the area.
- Conducting preliminary inspections of adjacent facilities and equipment to assess damage.
- Overpacking and/or removing damaged containers/drums from affected areas. Damaged equipment and facilities will be repaired as appropriate.
- Constructing, monitoring, and reinforcing temporary dikes as needed.
- Maintaining fire equipment on standby at the incident site in cases where ignitable liquids have been or may be released and ensuring that all ignition sources are kept

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out of the area. Ignitable liquids will be segregated, contained, confined, diluted, or otherwise controlled to preclude inadvertent explosion or detonation.

No operation that has been shut down in response to the incident will be restarted until authorized by the RCRA Emergency Coordinator. Sections D-4g, Incompatible Waste, and D-4h, Post-Emergency Facility and Equipment Maintenance and Reporting, address specific issues related to decreasing the possibility of a recurrence or spread of a release, a fire, or an explosion.

After resolution of the incident, a Root Cause Analysis will be conducted to review all Level II and Level III incidents for determination of cause, and the corrective action plan to prevent recurrence.

D-4f Management and Containment of Released Material and Waste

Once initial release or spill containment has been completed, the RCRA Emergency Coordinator will ensure that recovered hazardous materials and waste are properly stored and/or disposed, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.56(g)). For spills of liquid, the perimeter of the spill will be diked with an absorbent material that is compatible with the material(s) released. Free-standing liquid will be transferred to a marked compatible container. The remaining liquid will be absorbed with an absorbent material and swept or scooped into a marked compatible container. Spill residue will be removed. Spills of dry material will be swept or shoveled into a labeled compatible recovery container. Material recovered from the spill will be transferred to clean containers or tanks or to containers or tanks that have held a compatible material. All containers will meet DOT specifications for shipping the wastes, and materials will be recovered.

Nonradioactive hazardous waste resulting from the cleanup of a fire, an explosion, or a release involving a nonradioactive hazardous waste or hazardous substance at the WIPP facility will be contained and managed as a hazardous waste until such time as the waste is disposed of, or determined to be nonhazardous, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §261) Subparts C and D. In most cases, hazardous materials inventories for the various buildings and areas at the facility will allow a determination of the hazardous materials present in any cleanup of a release or of the residues from an emergency condition (The quantities of such spills are so small, it is not likely to trigger an Incident Level II or III). When necessary samples of the waste will be collected and analyzed to determine the presence of any hazardous characteristics and/or hazardous waste constituents; this information is needed to evaluate disposal options. EPA-approved sampling and analytical methods will be utilized. Hazardous wastes will be transferred to the Hazardous Waste Staging Area. The staging area is used to store hazardous waste awaiting transfer to an off-site treatment or disposal facility in accordance with applicable regulations (e.g., 20.4.1 NMAC and DOT regulations). The Hazardous Waste Staging Area for nonradioactive hazardous waste is Buildings 474A and 474B, as shown in Figure D-1. Nonradioactive hazardous wastes will be shipped off-site for disposal at a RCRA permitted disposal facility.

Under normal operations, administrative controls will be implemented to ensure that hazardous materials and incompatible materials will not be introduced to the radioactive materials area during TRU mixed waste handling operations. Examples of administrative controls include restricting the waste received in the TRU mixed waste management area(s) to TRU mixed waste properly manifested from the generator sites and ensuring that materials used in these

area(s) are restricted to only those that have previously been determined to be compatible with the TRU mixed waste. The RCRA Emergency Coordinator will have access to building design information and information on specific equipment used within an area upon which to base a determination of the compatibility of materials with the area. If necessary, the RCRA Emergency Coordinator will use EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Waste," (EPA, 1980) for making compatibility determinations. Waste resulting from the cleanup of a fire, explosion, or release in the miscellaneous unit, the CH TRU mixed waste handling areas, or the RH Complex will be considered derived from the received TRU mixed waste and may be treated and managed as CH TRU mixed waste depending on the surface dose rate.

In the event of a prolonged cessation of TRU mixed waste handling operations, TRU mixed waste can be placed in areas of the WHB Unit that are available for such contingencies. These areas and the TRU mixed waste containers in them would be located so that adequate aisle space would be maintained for unobstructed movement of personnel and equipment in an emergency. Permit Attachments A1 and A2 describe the HWMUs in detail, including the facility description, support structures and equipment, security, waste handling areas, ventilation, and fire protection.

The contaminated area will be decontaminated. If a release is to a permeable surface, such as soil, asphalt, concrete, or other surface, the surface material will be removed and placed in containers meeting applicable DOT requirements. Contaminated soil, asphalt, concrete, or other surface material, as well as materials used in the cleanup (e.g., rags and absorbent material) will be contained and disposed of in the same manner as dictated for the contaminant. Clean soil, new asphalt, or new concrete will be emplaced at the spill location.

If a spill occurs on an impermeable surface, the surface will be decontaminated with water and/or a detergent. In the event that the spilled material is water reactive, a compatible nonhazardous cleaning solution will be used. Contaminated wash water or cleaning solution will be transferred to an appropriate container, marked, and managed as described above for nonradioactive or radioactive liquid wastes.

In the event of a hazardous material or hazardous waste release, the RCRA Emergency Coordinator will ensure that no wastes will be received or disposed of in the affected areas until cleanup operations have been completed. This is to ensure that incompatible waste will not be present in the vicinity of the release.

Because of the restrictions which the WIPP facility places on generators, and because of control of WIPP operations, TRU mixed wastes and derived wastes will not contain any incompatible wastes. However, the areas established for the temporary holding of nonradioactive waste routinely generated at the WIPP facility is divided into bays to accommodate the management of wastes that may be incompatible. If waste is generated as the result of a spill or release of hazardous materials or nonradioactive hazardous waste, the waste generated as a result of abatement and cleanup will be evaluated to determine its compatibility with other wastes being managed in the temporary holding areas. The evaluation will be by identifying the material or waste that was spilled or released and determining its characteristics (e.g., ignitable, reactive, corrosive, or toxic). The waste generated by the abatement and cleanup activities will be stored in that part of the temporary holding area that has been established to manage wastes with which it is compatible.

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For small nonemergency liquid spills (e.g., a detergent solution leaking out of the pump handle during decontamination, a spill of hydraulic fluid while servicing a vehicle), spill control procedures will be used to contain and absorb free-standing liquid. The contaminated absorbent will be swept or shoveled into a compatible container and managed as described above. No notifications will be required, but site procedures require documentation of the incident.

D-4g Incompatible Waste

Implementation of the TSDF-WAC for the WIPP ensures that incompatible TRU mixed waste will not be shipped to the WIPP facility. Nonradioactive waste at the WIPP facility will be carefully segregated during handling and holding and will be transported within and off the facility. The RCRA Emergency Coordinator will not allow hazardous or TRU mixed waste operations to resume in a building or area in which incompatible materials have been released prior to completion of necessary post-emergency cleanup operations to remove potentially incompatible materials. In making the determination of compatibility, the RCRA Emergency Coordinator will have available the resources and information described in Section D-4b, Identification of Hazardous Materials. In addition, ES&H department personnel will be available for consultation. Finally, the RCRA Emergency Coordinator may use EPA-600/2-80-076, (EPA, 1980).

D-4h Post-Emergency Facility and Equipment Maintenance and Reporting

The RCRA Emergency Coordinator will ensure that emergency equipment that is located or used in the affected area(s) of the facility and listed in the Contingency Plan is cleaned and ready for its intended use before operations are resumed, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(h)(2)). Any equipment that cannot be decontaminated will be discarded as waste (e.g., hazardous, mixed, solid), as appropriate. The WIPP facility is committed to replacing any needed equipment or supplies that cannot be reused following an emergency. After the equipment has been cleaned, repaired, or replaced, a post-emergency facility and equipment inspection will be performed, and the results will be documented.

Cleaning and decontaminating equipment will be accomplished by physically removing gross or solid residue; rinsing with water or another suitable liquid, if required; and/or washing with detergent and water. Decontamination and cleaning will be conducted in a confined area, such as a wash pad or building equipped with a floor drain and sump isolated from the environment. Care will be taken to prevent wind dispersion of particles and spray. Liquid or particulate resulting from cleaning and decontamination of equipment will be placed in clean, compatible containers. Waste produced in an emergency cleanup in the TRU mixed waste handling areas is derived waste and will be emplaced in the underground derived waste emplacement area. Waste resulting from decontamination operations elsewhere in the WIPP facility will be analyzed for hazardous waste constituents and/or hazardous waste characteristics to ensure proper management.

When the WIPP facility has completed post-emergency cleanup of waste and hazardous residues from areas where waste management operations are ready to resume and the RCRA Emergency Coordinator has ensured that emergency equipment used in managing the emergency has been cleaned or replaced and is fit for service, the notifications will be made by the Permittees to the following: the EPA Region VI Administrator; the Secretary of the NMED; and any relevant local authorities. This post-emergency notification complies with 20.4.1.500

NMAC (incorporating 40 CFR §264.56(i)), and is the responsibility of the RCRA Emergency Coordinator.

D-4i Container Spills and Leakage

The waste received at the WIPP facility will meet stringent TSDF-WAC (e.g., no more than one percent liquid), which will minimize the possibility of waste container degradation and liquid spills. Should a spill or release occur from a container, following an initial assessment of the event, the WIPP facility will immediately take the following actions, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.52(a) and §264.171):

- Assemble the required response equipment, such as protective clothing and gear, heavy equipment, empty drums, overpack drums, and hand tools
- Transfer the released material to a container that is in good condition or overpack the leaking container into another container that is in good condition
- Once the release has been contained, determine the areal extent of migration of the release and proceed with appropriate cleanup action, such as chemical neutralization, vacuuming, or excavation

D-4j Tank Spills and Leakage

The TRU mixed waste handling areas at the WIPP facility do not include tank storage or treatment of hazardous waste, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR §264) Subpart J. At the WIPP facility, tanks are used to store water and petroleum fuels only. The petroleum tanks store diesel and unleaded gasoline.

D-4k Surface Impoundment Spills and Leakage

The WIPP facility does not manage hazardous or TRU mixed waste using a surface impoundment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR, §264) Subpart K. Surface impoundment regulations are not applicable to the WIPP facility.

D-5 Emergency Equipment

A variety of equipment is available at the facility for emergency response, containment, and cleanup operations in both the HWMUs and the facility in general. This includes equipment for spill control, fire control, personnel protection, monitoring, first aid and medical attention, communications, and alarms. This equipment is immediately available to emergency response personnel. A listing of major emergency equipment available at the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.52(e)), is shown in Table D-6. Table D-7 identifies the locations where fire suppression systems are provided. Locations of the underground emergency equipment are shown in Figure D-5. The firewater-distribution system map is shown in Figure D-6. The underground fuel area fire-protection system is shown in Figure D-7.

D-6 Coordination Agreements

The Permittees have established MOUs with off-site emergency response agencies for firefighting, medical assistance, hazardous materials response, and law enforcement. In the event that on-site response resources are unable to provide all the needed response actions during either a medical, fire, hazardous materials, or security emergency, the RCRA Emergency Coordinator will notify appropriate off-site response agencies and request assistance. Once on site, off-site emergency response agency personnel will be under the direction of the RCRA Emergency Coordinator.

The MOUs with off-site cooperating agencies are available from the Permittees. A listing and description of the MOUs with state and local agencies and mining operations in the vicinity of the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37 and §264.52(c)), are:

- An agreement among the Permittees, Intrepid Potash NM LLC, and Mosaic Potash Carlsbad Inc., provides for the mutual aid and assistance, in the form of MRTs, in the event of a mine disaster or other circumstance at either of the two facilities. This provision ensures that the WIPP MOC will have two MRTs available at all times when miners are underground.

- A memorandum of agreement between the City of Carlsbad, New Mexico, and the WIPP MOC for ambulance service assistance provides that, upon notification by the WIPP MOC, the Carlsbad Fire Department/Ambulance Service will be dispatched from Carlsbad toward the WIPP site by a designated route and will accept the transfer of patient(s) being transported by the WIPP facility ambulance at the point both ambulances meet. If the patient(s) is not transferrable, the Carlsbad Fire Department/Ambulance Service will provide equipment and personnel to the WIPP facility ambulance, as necessary.

- A MOU between the DOE and the Carlsbad Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Carlsbad Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the Lea Regional Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Lea Regional Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the U.S. Department of Interior (**DOI**), represented by the Bureau of Land Management (**BLM**), Roswell District, provides for a fire-management program that will ensure a timely, well-coordinated, and cost-effective response to suppress wild fire within the withdrawal area using the WIPP incident commander for fire-management activities. The DOI will provide firefighting support if requested. In addition, the MOU provides for responsibilities concerning cultural resources, grazing, wildlife, mining, gas and oil production, realty/lands/rights-of-way, and reclamation.

- A mutual-aid firefighting agreement between the Eddy County Commission and the DOE provides for the assistance of the Otis and Joel Fire Departments (a volunteer fire district created under the Eddy County Commission and the New Mexico State Fire Marshall's Office), including equipment and personnel, at any location within the WIPP Fire Protection Area upon request by an authorized representative of the WIPP Project. These responsibilities are reciprocal.

- A mutual-aid agreement between the City of Hobbs and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Hobbs during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A mutual-aid agreement between the City of Carlsbad and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Carlsbad during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A MOU between the DOE and the New Mexico Department of Public Safety (**DPS**) concerning Mutual Assistance and Emergency Management applies to any actual or potential emergency or incident that: 1) involves a significant threat to employees of the Permittees or general public; 2) involves property under the control or jurisdiction of either the DOE or the State; 3) involves a threat to the environment which is reportable to an off-site agency; 4) requires the combined resources of the DOE and the state; 5) requires a resource that the DOE has which the State does not have, or a resource the State has which DOE does not have; or 6) involves any other incident for which a joint determination has been made by the DOE and the State that the provisions of this MOU will apply. The MOU provides that the DPS shall permit qualified and security cleared DOE Emergency Management members into the State EOC for the purpose of: a) coordinating communications functions; b) evaluating and maintaining communications capabilities; c) participating in exercises; d) link the State's High Frequency radio communications network with the DOE; and e) assisting the State during radioactive materials accidents that require joint operations or the use of the DOE Radiological Assistance Program team. The DOE shall permit qualified and security cleared members the State Emergency Management community into the DOE's EOCs for the purposes of coordinating communications and activities. Additional duties for each participant are specified for assistance in incidents or emergencies.

D-7 Evacuation Plan

If it becomes necessary to evacuate the WIPP facility, the assigned on-site and off-site staging areas have been established. The off-site staging areas are outside the security fence. The WIPP facility has implementation procedures for both surface and underground evacuations. Drills are performed on these procedures at the WIPP facility at least once annually. The following sections describe the evacuation plan for the WIPP facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.52(f)).

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D-7a Surface Evacuation On-site and Off-site Staging Areas

Figure D-8 shows the surface staging areas. Personnel report to their Office Wardens at designated staging areas where accountability is conducted. If site evacuation is necessary, the RCRA Emergency Coordinator will decide which staging areas are to be used and will advise Office Wardens of the selections. The RCRA Emergency Coordinator will communicate the locations to Office Wardens via office warden pager, radio, plectron, WIPP Security, or telephone, as appropriate. Office Wardens will direct personnel to the selected staging area outside the security fence. Personnel who are working in a contaminated area when site evacuation is announced, will assemble at specific staging areas to minimize contact with other personnel during the evacuation (Figure D-8).

Office Wardens conduct accountability of personnel assigned to their specific areas. For complete surface accountability, the Office Wardens report to their ACOW, who reports to the COW. When the COW has reports from all ACOWs, surface accountability is reported to the CMRO, who then notifies the RCRA Emergency Coordinator of the accountability.

The COW and all ACOWs have radios for communication between them and the CMRO. The Office Wardens, Assistant Office Wardens, ACOWs, and COW also have pagers with which they are notified of evacuations. At the staging areas Office Wardens report directly to their ACOW.

There are three off-site staging areas identified on Figure D-8. The RCRA Emergency Coordinator determines which staging area will be used. Security officers remain at the primary staging area gate 24 hours a day, and the vehicle trap is opened for personnel during emergency evacuations. The north gate has a single person gate and large gate which can be opened, similar to the main gates for the primary staging area. The east gate is a turnstile gate. Upon notification by the RCRA Emergency Coordinator, Security will respond, open gates, and facilitate egress for evacuation.

The on-site staging areas are identified in Figure D-8. These are used for building or area evacuations as determined by the RCRA Emergency Coordinator.

D-7b Underground Assembly Areas and Egress Hoist Stations

In the event of an underground or surface event, the RCRA Emergency Coordinator can call for underground personnel to report to assembly areas (Figure D-9). Underground personnel are also trained to immediately report to assembly areas under specific circumstances (i.e. loss of underground power or ventilation). If accountability is required, the underground will be evacuated. The Underground Controller is responsible for underground accountability by comparing the brass numbers with the brass tags signed out in the lamproom. Each assembly area contains a Mine Page Phone, miner's aid station, and evacuation maps.

In accordance with 30 CFR §57.11, the mine maintains two escapeways. These escapeways are designated as Egress Hoist Stations. When an underground evacuation is called for, all underground personnel report to the Egress Hoist Stations.

Decontamination of underground personnel will be conducted the same way as described for surface decontamination. Contaminated personnel are trained to remain segregated from other personnel until RC personnel can respond to the incident at the underground location.

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D-7c Plan for Surface Evacuation

Surface evacuation notification is initiated by the RCRA Emergency Coordinator directing the CMRO to sound the surface evacuation alarm. The Office Wardens assist personnel in evacuation from their areas. Evacuation routes and instructions are posted throughout the site.

If the EST/FPT notifies the ERT members by pager to respond to an identified area, these members will not depart the site during an evacuation, but will report to the EST/FPT for instructions and accountability. The EST/FPT notifies the COW of response members present. These personnel will not evacuate until released by the RCRA Emergency Coordinator.

D-7d Plan for Underground Evacuation

Notification for underground evacuation will be made using the underground evacuation alarm and strobe light signals.

Personnel will evacuate to the nearest egress hoist station. Primary underground evacuation routes (identified by green reflectors on the rib) will be used, if possible. Secondary underground evacuation routes (identified by red reflectors on the rib) will be used if necessary (Figure D-5). Brass tags will be collected from personnel at the hoist collar on the surface, and taken to the Underground Controller, who functions as an Office Warden. When all brass tags are accounted for, underground accountability is reported to the RCRA Emergency Coordinator.

Upon reaching the surface, personnel will report to their on-site staging area to receive further instructions.

Members of the FLIRT and the MRT who may be underground, will evacuate the underground when an underground evacuation is called for. A reentry by the MRT will be performed according to 30 CFR 49 and MSHA regulations for reentry into a mine. The two MRTs are trained in compliance with 30 CFR 49 in mine mapping, mine gases, ventilation, exploration, mine fires, rescue, and recovery.

D-7e Further Site Evacuation

In the event of an evacuation involving the need to transport employees, the following transportation will be available:

- Buses/vans—WIPP facility buses/vans will be available for evacuation of personnel. The buses/vans are stationed in the employee parking lot.

- Privately Owned Vehicles—Because many employees drive to work in their own vehicles, these vehicles may be utilized in an emergency. Personnel may be directed as to routes to be taken when leaving the facility.

These vehicles may be used to transport personnel who have been released from the site by the RCRA Emergency Coordinator.

D-8 Required Reports

The RCRA Emergency Coordinator, on behalf of the Permittees, will note in the operating record the time, date, and details of any incident that requires implementing this Contingency Plan. This notation will be in the facility log maintained by the CMRO. In compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)), within 15 days after the incident, the Permittees will ensure that a written report on the incident will be submitted to the EPA Region VI Administrator and to the Secretary of the NMED. The report will include:

- The name, address, and telephone number of the Owner/Operator
- The name, address, and telephone number of the facility
- The date, time, and type of incident (e.g., fire, explosion or release)
- The name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where this is applicable
- The estimated quantity and disposition of recovered material that resulted from the incident

In addition to the above report, the Permittees will ensure that the ES&H Manager, or designee, submits reports to the appropriate agencies as listed in Tables D-8 and D-9.

In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), the Permittees will notify the Secretary of the NMED and EPA Region VI Administrator that the WIPP facility is in compliance with requirements for the cleanup of areas affected by the emergency and that emergency equipment used in the emergency response has been cleaned, repaired, or replaced and is fit for its intended use prior to the resumption of waste management operations in affected areas. The means the WIPP facility will use to meet these requirements are described in Sections D-4e, D-4f, D-4g, and D-4h.

The WIPP requires the EST/FPT to initiate the "WIPP Hazardous Materials Incident Report" if the Contingency Plan is implemented. A form is attached as Figure D-12. The form is initiated by the EST/FPT. The RCRA Emergency Coordinator, CMRO, and Environmental Compliance representatives complete their respective sections.

D-9 Location of the Contingency Plan and Plan Revision

The owner/operator of the WIPP facility will ensure that copies of this Contingency Plan are available through the WIPP electronic controlled-document distribution system or in appropriate controlled-document locations throughout the facility, and the alternate Emergency Operations Center and the Joint Information Center at the Skeen Whitlock Building, and are, consequently, available to all emergency personnel and organizations described in Section D-2. In addition, the owner/operator will make copies available to the following outside agencies:

- Intrepid Potash NM LLC and Mosaic Potash Carlsbad Inc.
- Carlsbad Fire Department, Carlsbad
- Carlsbad Medical Center, Carlsbad
- Lea Regional Medical Center, Hobbs
- Otis Fire Department, Otis
- Hobbs Fire Department, Hobbs
- Joel Fire Department, Carlsbad
- BLM, Carlsbad
- New Mexico State Police

The owner/operator of the WIPP facility will ensure that this plan is reviewed annually and amended whenever:

- Applicable regulations are revised
- The RCRA Part B permit for the WIPP facility is revised in any way that would affect the Contingency Plan
- This plan fails in an emergency
- The WIPP facility design, construction, operation, maintenance, or other circumstances change in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents or change the response necessary in an emergency
- The list of RCRA Emergency Coordinators change
- The list of WIPP facility emergency equipment changes.

References

U.S. Environmental Protection Agency, "A Method for Determining the Compatibility of Hazardous Waste," EPA-600/2-80-076, 1980.

U.S. Department of Transportation, Emergency Response Guidebook, U.S. Government Printing Office, 1993.

Westinghouse Electric Corporation, 1994, "Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling," WP 02-EM1, Westinghouse Electric Corporation, Carlsbad, New Mexico.

U. S. Department of Energy, "WIPP Safety Analysis Report," DOE/WIPP-95-2065, Rev. 2

U. S. Department of Energy, "WP 12-5, WIPP Radiation Safety Manual".

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TABLES

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Table D-1
Hazardous Substances in Large Enough Quantities to Constitute a Level II Incident

Chemical Description	Building Location	Hazard Category
Ethylene Glycol Solution - 35%	Buildings 411; 412; 451; 452; 486; 463; 474C; FAC 414	Immediate (acute) Delayed (chronic)
Gasoline, Unleaded GASC0001	FAC 480	Fire Immediate (acute) Delayed (chronic)
No. 1 Diesel Fuel Oil GASC0210	Oil Depot U/G; FACs 480, 255.1 & 255.2; Transport Tank; Building 456 Trailer 911F	Fire Immediate (acute) Delayed (chronic)
Multiple containers of TRU Waste as described in Permit Section 3.3.1	WHB Waste Shaft U/G	Delayed (chronic)
Hazardous materials in quantities that exceed 5 times the Reportable Quantity (Per DOE O 151.1) values as defined in 40 CFR 302	It should be noted that WIPP is not expected to possess such quantities.	Fire Immediate (acute) Delayed (chronic)

Table D-2
Resource Conservation and Recovery Act Emergency Coordinators

Name	Address*	Office Phone	Personal Phone*
R. C. (Russ) Stroble (primary)[1]		234-8276 or ~~234-~~8554	
J. E. (Joseph) Bealler[2]		234-8276 or ~~234-~~8916	
M. G. (Mike) Proctor[2]		234-8276 or 234-8143	
G. L. (Gary) Kessler[2]		234-8326	
A. E. (Alvy) Williams[1] (primary)		234-8276 or 234-8216	
P. J. (Paul) Paneral[1] (primary)		234-8498	
J. R. (Joel) Howard[2]		234-8325	
M. L. (Mark) Long[1] (primary)		234-8170	
A.C (Andy) Cooper[2]		~~234-~~8197	

* NOTE: Personal information (home addresses and personal phone numbers) has been removed from informational copies of this Permit.

1 The on-duty Facility Shift Manager is the primary RCRA Emergency Coordinator pursuant to 20.4.1.500 NMAC (incorporating 40 CFR §264.52), and is designated to serve as the RCRA Emergency Coordinator.

2 The on-duty Facility Operations Engineer is the alternate RCRA Emergency Coordinator and is available as needed.

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Table D-3
Planning Guide for Determining Incident Levels and Response

Incident Condition	Incident Level		
	I	II *	III *
Product identifications	Placard not required, NFPA 0 or 1 all categories, all Other Regulated Materials A, B, C, and D.	DOT placarded, NFPA 2 for any categories, PCBs without fire, EPA regulated waste. SITE SPECIFIC: Table D-1 and TRU mixed waste AND	Poison A (gas), explosive A/B, organic peroxide, flammable, solid, materials dangerous when wet, chlorine, fluorine, anhydrous ammonia, radioactive materials, NFPA 3 and 4 for any categories including special hazards, PCBs and fire including special hazards, PCBs and fire DOT inhalation hazard, EPA extremely hazardous substances, and cryogenics.
Container size	Container size does not impact this incident level.	Involves multiple packages.	Tank truck.
Fire/explosion potential	Under control.	May spread/may be explosive.	May spread/may be explosive.
Leak severity	No release or small release contained or confined with readily available resources.	Release may not be controllable without special resources.	Release may not be controllable even with special resources.
Life safety	No life-threatening situation from materials involved.	Localized area, limited evacuation area.	Localized area, limited evacuation area.
Environmental impact (Potential)	None.	Limited to incident boundaries	Contained within the Hazardous waste Management Units.
Container integrity	Not damaged.	Damaged but able to contain the contents to allow handling or transfer of product.	Damaged to such an extent that catastrophic rupture is possible.

* Contingency Plan is implemented

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Table D-4
Physical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Absorption	Yes	No	Yes	No
Covering	Yes	Yes	Yes	Yes
Dikes, diversions	Yes	Yes	Yes	Yes
Overpack	Yes	Yes	Yes	Yes
Plug/patch	Yes	Yes	Yes	Yes
Transfer	Yes	Yes	Yes	Yes
Vapor suppression	Yes	Yes	No	No

Table D-5
Chemical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Neutralization	Yes	Yes(1)	No	No
Solidification	Yes	No	Yes(2)	No

(1) When solid neutralizing agents are used, they will be used simultaneously with water.
(2) This method could be utilized for mitigation of firewater involving TRU-waste.

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Table D-6
Emergency Equipment Maintained at the Waste Isolation Pilot Plant

Equipment	Description and Capabilities	Location
	Communications	
Building Fire Alarms	Manual pull stations and automatic devices (sprinkler system flow, and smoke and thermal detectors) trigger fire alarm; locally visible and audible; visual display and alarm in Central Monitoring Room (CMR)	Guard and Security Building, Pumphouse, Warehouse/Shops, Exhaust Filter Building, Support Building, CMR/ Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, SH Hoisthouse, Maintenance Shops, Guard Shack*, Auxiliary Warehouse, Core Storage Building, Engineering Building, Training Facility, Safety Building, Maintenance Shop, Hazardous Waste Storage (non-TRU) Area (Facility 474) *local alarms; not connected to the CMR
Underground Fire Alarms	Automatic/Manual; have priority over other paging channel signals but not override intercom channels; alarms sound in the general area of the control panel and are connected to the underground evacuation alarms; they also interface with the CMR.	Fire detection and control panel locations: Waste Shaft Underground Station, SH Shaft Underground Station, Between E-140 and E-300 in S-2180 Drift, E-O/N-1200, Fuel Station
Site-wide Evacuation Alarm	Transmitted over paging channel of the public address system, overriding its normal use; manually initiated according to procedures requiring evacuation; audible alarm produced by tone generator at 10 decibels above ambient noise level (or at least 75 decibels); flashing strobe lights; radios and/or pagers are used to notify facility personnel outside alarm range. Monthly test are performed on the PA, site notification alarms, and plectrons.	Site-wide
Vehicle Siren	Manual; oscillating; emergency services/surface response vehicles, is mechanical and electronic.	WIPP surface emergency vehicles
Public Address System	Includes intercom phones; handset stations and loudspeaker assemblies, each with own amplifiers; multichannel, one for public address and pages, and others for independent party lines.	Surface and underground
Intraplant Phones	Private automatic branch exchange; direct dial; provide communication link between surface and underground operations	Throughout surface and underground

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Equipment	Description and Capabilities	Location
Mine Page Phones	Battery-operated paging system	CMR, Mine Rescue Room, EOC, lamproom, underground at S550/W30, S100/W30, S1950/E140, SH Shaft Collar and Underground Station, Waste Shaft Collar and Underground Station, FSM desk.
Emergency Pagers	Manual; , intermittent alarm signals	Issued to appropriate emergency personnel
Plectrons	Tone-alert radio receivers placed in areas not accessible by the public address system	Site-wide
Portable Radios	Two-way, portable; transmits and monitors information to/from other transmitters	Issued to individuals
Plant Base Radios	Two-way, stationary, VHF-FM; linked to Eddy County Sheriff Department, NM State Police, and Otis Fire Department), and WIPP Channels 1-18 (Communication with the Lea County Sheriff's Department, the Hobbs Fire Department, Carlsbad Medical Center and Lea Regional Hospital is available via the Eddy County dispatcher) (Site Security, Site Operations and Site Emergency, maintenance, repeater to Carlsbad). Wireless communications such as cellular phones may be used to contact the Eddy County emergency responders.	Various site locations
Mobile Phones	Provide communications link between WIPP Security and key personnel	Issued to individuals plus emergency vehicles,
Spill Response		
SPILL-X-S Guns and Recharge Powder	Containment; (1)SPILL-X model SC-30-C(Gun) (1)SPILL-X model XC-30-S(Gun) (1)SPILL-X model SC-30-A(Gun); (1) A-Acid, 5 gallon bucket (Recharge Powder) (1)S-Solvent, 5 gallon bucket (Recharge Powder) (1)C-Caustic, 5 gallon bucket (Recharge Powder)	HAZMAT trailer
Absorbent Sheets	Containment or cleanup; (1) 3' x 100' Sheet	HAZMAT trailer
Absorbents	Grab and Go container; spill control bucket; (1) for solvents and neutralizing absorbents; 5 gallon bucket (1) for acids/caustics; 5 gallon bucket	HAZMAT trailer
Absorbent Material	Containment or cleanup; (1) 100 ft. rolled or equivalent socks "Pig" for general liquid (1) 100 ft. rolled or equivalent socks "Pig" for oil	HAZMAT trailer

02622

Equipment	Description and Capabilities	Location
Air Bag System	Extrication, Stabilization, Cribbing (1) bag system with tank kit and the following bag sizes: (1)12-ton, (1) 21.8-ton, (1)17-ton	Surface rescue truck
Air Chisel	Extrication (1) Capable of cutting 3/16" steel	Surface rescue truck
Drum Transfer Pumps and Drum Opener	Containment or cleanup; (1) unit for chemical transfer (1) hand operated pump for petroleum transfer (1) drum opener	HAZMAT trailer
Floor Squeegee	Containment or cleanup; (1) straight rubber blade, nonwood handle	HAZMAT trailer
Foam Concentrate	AFFF 6% (4) 5-gallon pail	Fire truck # 1
Gas Cylinder Leak Control Kit	(1)Series A Hazardous Material Response Kit; contains nonsparking equipment to control and plug leaks	HAZMAT trailer
Portable Generator	(1)Backup power; 5,000 watt; 120 or 240 volt	Surface rescue truck

Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
Medical Resources		
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
Fire Detection and Fire Suppression Equipment		
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

02625

Equipment	Description and Capabilities	Location
Water Tanks, Hydrants	Fire suppression water supply; one 180,000-gallon capacity tank, plus a second tank with 100,000 gallon reserve	Tanks are at southwestern edge of WIPP facility; pipelines and hydrants are throughout the surface
Fire Water Pumps	Fire suppression water supply; 125 pounds per square inch, 1,500 gallons per minute centrifugal pump, one with electric motor drive, the other with diesel engine; pressure maintenance pump	Pumphouse
Personal Protection Equipment		
Headlamps	Mounted on hard hat; battery operated	Each person underground
Underground Self-Rescuer Units	Short-term rebreathers; approximately 300	Each person underground
Self-Contained Self-Rescuer	At least 60 minutes of oxygen available. Approximately 400 units cached throughout the underground	Cached throughout the underground
Self-Contained Breathing Apparatus (SCBA)	Oxygen supply; 4-hour units; approximately 14 Mine Rescue Team Draeger units	Mine Rescue Training Room
Chemical and Chemical-Supported Gloves	Body protection; (12 pair) inner-cloth, (12 pair) outer-pvc, (5 pair) outer-viton	HAZMAT trailer
Suit, Acid	Body protection; (4) acid	HAZMAT trailer
Suit, Fully Encapsulated	Body protection; used with SCBAs; full outerboot; (4) Level A; (4) Level B	HAZMAT trailer
Emergency Medical Equipment		
Antishock Trousers	Shock treatment; (2) inflatable, one on each ambulance	Ambulance # 1 and # 2
Zoll 1600 Heart Monitor and Defibrillator	Heart Monitor/defibrillator	Ambulance # 1 and # 2
Oxygen	Patient care; Size D: (2) Ambulance #1 (1) Underground Ambulance (1) Health Services Size E: (1) Rescue Truck (2) Underground Ambulance Size M: (1) Ambulance #1	Ambulance # 1 and # 2, surface rescue truck

Equipment	Description and Capabilities	Location
Resuscitators (Bag)	Disposable bag resuscitation Ambulance #1: (2) adult size (1) child size Underground Ambulance: (2) adult size	Ambulance # 1, Ambulance # 2
Splints	Immobilize limbs; (1) Adult traction splint, lower extremity, with limb-supporting slings, padded ankle hitch and traction device per ambulance. (2) Rigid splinting devices or equivalents, suitable for immobilization of upper extremities per ambulance. (2) Rigid splinting devices or equivalents, suitable for the immobilization of lower extremities. (1) Set of Airsplints: 6 assorted splints; hand/wrist, half arm, full arm, foot/ankle, half leg, and full leg per miner's aid stations.	Ambulance # 1 and # 2, Miner's Aid Stations
Stretchers	Patient transport; (2) Spine Boards, one short and one long, with nylon straps per ambulance. (also used to perform cardiopulmonary resuscitation) (2) Emergency Stretchers or scoops, or combination per ambulance (1) All-purpose multi-level ambulance stretch (gurney), with 3 safety straps and locking mechanism per ambulance. (1) Stretcher in each miner's aid station.	Various combinations in Ambulance # 1 and # 2, Miner's Aid Station
Suctions	For medical emergencies: Portable (1) Suction unit, capable of delivering at least 300 mm. HG on each ambulance.	Ambulances #1 and #2
Trauma Kits	(1) adult blood pressure cuff and stethoscope (4) soft-roller bandages (3) triangular bandages (1) pkg. band-aids (2) trauma dressings (25) 4X4 sponges (1) roll adhesive tape (1) bite stick (1) penlight (1) sterile burn sheet (1) oropharyngeal airway (1) glucose substance (2) sterile gauze dressings	(1) kit in each: Ambulances #1 and #2, surface rescue truck

02527

Equipment	Description and Capabilities	Location
Miner's Aid Station	For First Aid Stations in the Underground (1) Stretcher--as referenced above per station (1) Set of airsplints--as referenced above per station (1) Blanket per station (1) Box of latex gloves (50) per station (5) Pathogen Wipes per station (1) First Aid Kit (24) per station; includes, (3) Band-Aid Combo Paks (2) Swabs, PVP (1) Antibiotic Ointment (1) Sting-Kill Swab (2) Dressing, compresses (2) Roller Bandages (2) Tape (2) Triangle Bandage (1) Eyedressing Pak (1) Burn Dressing (1) Ammonia Inhalants (1) User Log Sheet	Miner's Aid Stations - Various Underground Locations
First Aid Supplies	According to General Order #35 (12) bandages, soft roller, self-adhering type--4" or 6" x 5 yards. (6) triangular bandages, 40" (1) box band-aids (1) 1 pair bandage shears (6) Trauma dressings, 30" x 10" (6) Trauma dressings, 5" x 7" (50) 4" x 4" sponges, individually wrapped and sterile (2) rolls adhesive tape (1) penlight (2) sterile burn sheets (2) oropharyngeal airways -- adult (2) oropharyngeal airways -- child (Ambulance #1 only) (2) oropharyngeal airways -- infant (Ambulance #1 only) (1) Glucose substance (3) Occlusive dressings (1) Roll aluminum foil (6) Rigid cervical collars--2 each small, medium and large sizes (4) Cold packs (4) Heat packs (2) Bite sticks	Ambulance #1
First Aid Supplies	(2) Transfer sheets (2) Blankets	Ambulances #1 and #2

Equipment	Description and Capabilities	Location
First Aid Supplies	(2) #16g angiosets (2) #18g angiosets (2) #20g angiosets (1) 1000cc LR IV fluid (1) 500cc NS IV fluid	Ambulances #1 and #2, surface rescue truck
General Plant Emergency Equipment		
Emergency Lighting	For employee rescue and evacuation, and fire/spill containment; linked to main power supply, and selectively linked to back up diesel power supply and/or battery-backed power supply	Surface and underground
Backup Power Sources	Two diesel generators, and battery-powered uninterruptible power supply (UPS); use limited to essential loads; manual or remote starting 1,100-kilowatt diesel generators with on-site fuel for 62% load for 3 days for selected loads; 30-minute battery capacity for essential loads	Generators are east of Safety and Emergency Services Building; UPS is located at the essential loads
Hoists	Hoists in Waste Shaft, Air Intake Shaft, and SH Shaft	Waste Shaft, Air Intake Shaft, SH Shaft
Radiation Monitoring Equipment	(5) Portable alpha and beta survey meters, portable air samplers, and portable continuous air monitors	Building 412
Emergency Shower	For emergency flushing of contaminated individual	Surface
Eye Wash Fountains	For emergency flushing of affected eyes	Various locations on surface and in the underground
Decon Shower Equipment	Self-contained decon shower trailer, portable decon shower unit, disposable decon shower	Surface
Overpack containers	14-85 Gallon drums 4-SWBs 1-TDOP	Building 481 Building 481 Building 481
HEPA Vacuums	2 HEPA Vacuums to be utilized for removal of contamination.	Building 481
Aquaset or Cement	100 lbs. of aquaset or cement material for solidification of liquid waste generated as a result of fire fighting water or decontamination solutions.	Building 481
Polyvinyl Alcohol or Paint	1 - 5 gallon bucket of approved fixative to be used during recovery.	Building 481
TDOP Upender	Upender facilitates overpacking standard waste boxes	Building 481
Non hazardous Decontaminating Agents	4-1 Gallon bottles for decontamination of surfaces, equipment, and personnel	Building 481

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Table D-7
Types of Fire Suppression Systems by Location

Location	AS	AD	MPS	PFE
Waste Handling Building	*		*	*
Support Building	*		*	*
Exhaust Filter Building	*		*	*
Water Pumphouse	*		*	*
Underground Support Areas (also has rescue truck) (as illustrated in Figure D-5)		*	*	*
Station A Effluent Monitoring Shed			*	*
Station B Effluent Monitoring Shed			*	*

(1) Symbols for WIPP fire-protection systems:

AS = Automatic Wet Pipe Sprinkler System
AD = Automatic Dry Chemical Extinguishing System
MPS = Manual Pull Stations
PFE = Portable Fire Extinguishers

(2) The Waste Handling Building and the Support Building contain the following:

- Automatic wet pipe sprinklers
- Fire detection in the heating, ventilation, and air conditioning instrumentation (Support Building, only)
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Safety and Emergency Services Building contains the following:

- Automatic wet pipe sprinklers
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Core Storage Building contains the following:

- Automatic wet pipe sprinklers
- Portable fire extinguishers

(3) The Exhaust Filter Building, Underground Facilities, Warehouse/Shops Building, Water Pumphouse, and Salt Handling Hoist house also have portable fire extinguishers, manual pull stations, and automatic detectors.

02630

Table D-8
Hazardous Release Reporting, Federal

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA) (40 CFR Part 302)	"Reportable quantities" of CERCLA/SARA "hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Chemical identification; 2) what hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g., evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA). EPA may request a written report.
Emergency Planning and Community Right-to-Know Act (SARA Title III) (40 CFR Parts 302 and 355)	SARA Title III "extremely hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581.	1) Chemical identification; 2) what extremely hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g. evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA) for an address if a written report is requested by EPA.
Resource Conservation and Recovery Act (RCRA), 40 CFR §§264.56(a) and 265.56(a)	Any imminent or actual emergency situation.	State or local agencies with designated response roles, if their help is needed: Carlsbad Police Department: 885-2111; Carlsbad Fire Department: 885-2111; Eddy County Sheriff: 887-7551.	What assistance is required.	Not Applicable (NA)

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
RCRA, 40 CFR §§264.56(d), 264.56(i), 265.56(d), and 265.56(i)	RCRA "hazardous waste" release, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802 and State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response).	(1) Name and telephone number of reporter; (2) name and telephone number of facility; (3) time and type of incident; (4) name and quantity of materials involved; (5) extent of injuries, if any; and (6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: (1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and (2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
RCRA, 40 CFR §§264.56(i), 264.56(j), 265.56(i), and 265.56(j)	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	NA	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g. fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

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Table D-9
Hazardous Release Reporting, State of New Mexico

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
20.4.1.500 and 600 NMAC	RCRA "hazardous waste" releases, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802; State Emergency Response Commission and (505) 476-9620 (New Mexico State Police, Hazardous Materials Emergency Response)	1) Name and telephone number of reporter; 2) name and telephone number of facility; 3) time and type of incident; 4) name and quantity of material involved; 5) extent of injuries, if any; and 6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
20.4.1.500 and .600 NMAC	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	1) Name and telephone number of reporter; 2) name and address of facility; 3) name and quantity of materials involved, to extent known; 4) extent of injuries, if any; and 5) possible hazards to human health or the environment, outside the facility.	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g., fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; and 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

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Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Emergency Management Act, Section 74-4B-5	Any accident (spill) involving hazardous materials (including hazardous substances, radioactive substances, or a combination thereof) which may endanger human health or the environment.	New Mexico Environment Department: (505) 827-9329, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Name, address and telephone number of owner or operator; 2) name, address and telephone number of facility; 3) date, time and type of incident; 4) name and quantity of material(s) involved; 5) extent of any injuries; 6) assessment of actual or potential threat to environment or human health; and 7) estimated quantity and disposition of recovered material.	Written submission within one week of time permittees become aware of discharge. Same as oral and description of noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence. Send reports to New Mexico Environment Department, Chief, Ground Water Quality Bureau, P.O. Box 26110, Santa Fe, New Mexico, 87502, New Mexico State Emergency Response Commission Department of Public Safety, Title III Bureau, P.O. Box 1628 Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220.
New Mexico Water Quality Control Commission, Part 1, Section 203	Any discharge from any facility of oil or any other water contaminant in such quantities as may, with reasonable probability, injure or be detrimental to human health, animal or plant life, or property.	Chief, Ground Water Quality Bureau, New Mexico Environment Department, or his counterpart in any constituent agency delegated responsibility for enforcement of the rules as to any facility subject to such delegation (505) 827-2918.	Within 24 hours: 1) the name, address, and telephone number of the person or persons in charge of the facility; 2) the name, address, and telephone number of the owner/operator of the facility; 3) the date, time, location, and duration of the discharge; 4) the source and cause of the discharge; 5) a description of the discharge, including its chemical composition; and 6) the estimated volume of discharge, and immediate damage from the discharge.	Submit within seven days: verification of the prior oral notification, also provide any appropriate additions or corrections to the information contained in the prior oral notification. Within 15 days: submit a written report describing any corrective actions taken and/or to be taken relative to the discharge. Send reports to Chief, Ground Water Quality Bureau, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

02534

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Underground Storage Tank Regulations-2	Any known or suspected release from an Underground Storage Tank (UST) system, any spill or any other emergency situation.	New Mexico Environment Department Petroleum Storage Tank Bureau (505) 984-1741.	Within 24 hours: 1) the name, address, and telephone number of the agent in charge of the site at which the UST system is located, as well as the owner/operator of the system; 2) the name and address of the site and the location of the UST system on that site; 3) the date, time, location, and duration of the spill, release, or suspected release; 4) the source and cause of the spill, release, or suspected release; 5) a description of the spill, release, or suspected release, including its chemical composition; 6) the estimated volume of the spill, release, or suspected release; and 7) action taken to mitigate immediate damage from the spill, release, or suspected release.	Mail or deliver within seven days of the incident, a written notice describing the spill, release, or suspected release and any investigation or follow-up action taken or to be taken. Send reports to Petroleum Storage Tank Bureau, New Mexico Environment Department, 2044 Galisteo Street, Santa Fe, New Mexico, 87504.

FIGURES

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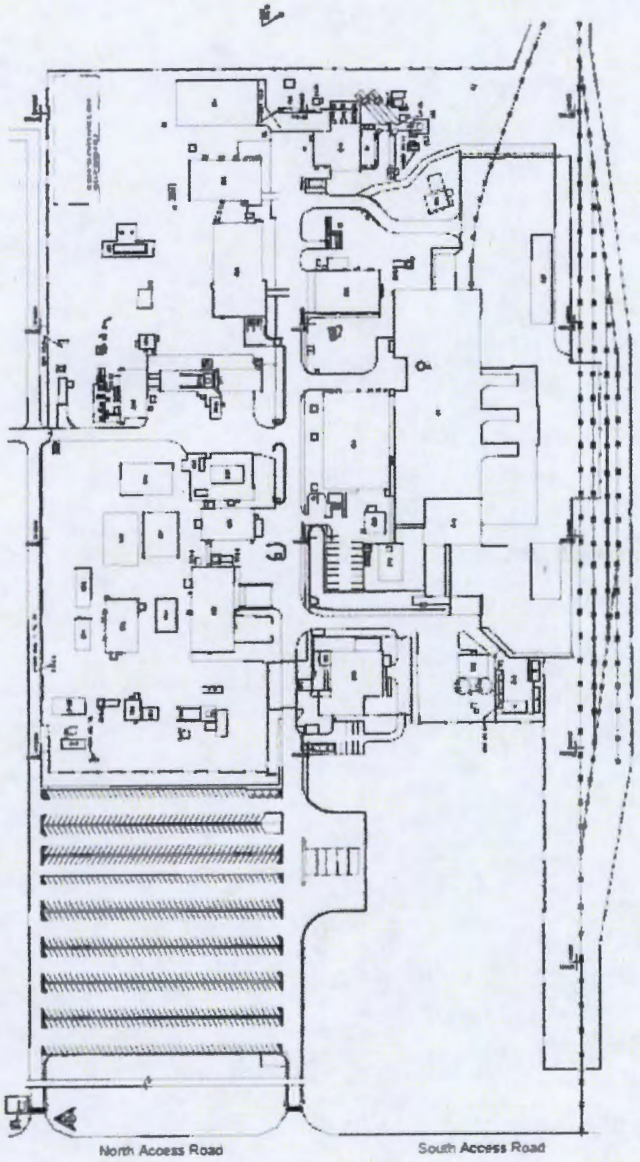

Figure D-1
WIPP Surface Structures

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BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION
#241	EQUIPMENT SHED	#384	SALT HANDLING SHAFT HOISTHOUSE	#475	GATEHOUSE
#242	GUARDSHACK	#384A	MINING OPERATIONS	#480	VEHICLE FUEL STATION
#243	SALT HAULING TRUCKS SHELTER	#411	WASTE HANDLING BUILDING	#481	WAREHOUSE ANNEX
#245	TRUPACT TRAILER SHELTER	#412	TRUPACT MAINTENANCE BUILDING	#482	EXHAUST SHAFT HOIST EQUIP. WAREHOUSE
#246	MgO STORAGE SHELTER	#413	EXHAUST SHAFT FILTER BUILDING	#485	SULLAIR COMPRESSOR BUILDING
#253	13.8 KV SWITCHGEAR 25p-SWG15/1	#413A	MONITORING STATION A	#486	ENGINEERING BUILDING
#254.1	AREA SUBSTATION NO. 1 25P-SW15.1	#413B	MONITORING STATION B	#489	TRAINING BUILDING
#254.2	AREA SUBSTATION NO. 2 25P-SW15.2	#414	WATER CHILLER FACILITY & BLDG	#H-16	SANDIA TEST WELL
#254.3	AREA SUBSTATION NO. 3 25P-SW15.3	#451	SUPPORT BUILDING	#917	AIS MONITORING
#254.4	AREA SUBSTATION NO. 4 25P-SW15.4	#452	SAFETY & EMERGENCY SERVICES FACILITY	#918	VOC TRAILER
#254.5	AREA SUBSTATION NO. 5 25P-SW15.5	#453	WAREHOUSE/SHOPS BUILDING	#918A	VOC AIR MONITORING STATION
#254.6	AREA SUBSTATION NO. 6 25P-SW15.6	#455	AUXILIARY WAREHOUSE BUILDING	#918B	VOC LAB TRAILER
#254.7	AREA SUBSTATION NO. 7 25P-SW15.7	#456	WATER PUMPHOUSE	#950	WORK CONTROL TRAILER
#254.8	AREA SUBSTATION NO. 8 25P-SW15.8	#457N	WATER TANK 25-D-001B	#951	PROCUREMENT/PURCHASING
#254.9	480V SWITCHGEAR (25P-SWGO4/9)	#457S	WATER TANK 25-D-001A	#952	TRAILER
#255.1	BACK-UP DIESEL GENERATOR #1 25-PE 503	#458	GUARD AND SECURITY BUILDING	#953	MODULAR OFFICE COMPLEX
#255.2	BACK-UP DIESEL GENERATOR #2 25-PE 504	#459	CORE STORAGE BUILDING	#971	HUMAN RESOURCES TRAILER
#256.4	SWITCHBOARD #4 (25P-SBD04/4)	#463	COMPRESSOR BUILDING	#986	PUBLICATIONS & PROCEDURES TRAILER
#311	WASTE SHAFT	#465	AUXILIARY AIR INTAKE	SWR NO. 6	SWITCHRACK NO. 6
#351	EXHAUST SHAFT	#466	TELEPHONE HUT	SWR NO. 7	7A, 7B SWITCHRACK NO. 7, 7A, 7B
#361	AIR INTAKE SHAFT	#473	ARMORY BUILDING	SWR NO. 7C	SWITCHRACK NO. 7C
#362	AIR INTAKE SHAFT/HOIST HOUSE	#474	HAZARDOUS WASTE STORAGE FACILITY	SWR NO. 10	SWITCHRACK NO. 10
#363	AIR INTAKE SHAFT/WINCH HOUSE	#474A	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 11	SWITCHRACK NO. 11
#364	EFFLUENT MONITORING INSTRUMENT SHED A	#474B	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 12	SWITCHRACK NO. 12
#365	EFFLUENT MONITORING INSTRUMENT SHED B	#474C	OIL & GREASE STORAGE BUILDING	SWR NO. 15	SWITCHRACK NO. 15
#366	AIR INTAKE SHAFT HEADFRAME	#474D	GAS BOTTLE STORAGE BUILDING		
#371	SALT HANDLING SHAFT	#474E	HAZARD MATERIAL STORAGE BUILDING		
#372	SALT HANDLING SHAFT HEADFRAME	#474F	WASTE OIL RETAINER		

Figure D-1a
Legend to Figure D-1

Field Code Changed

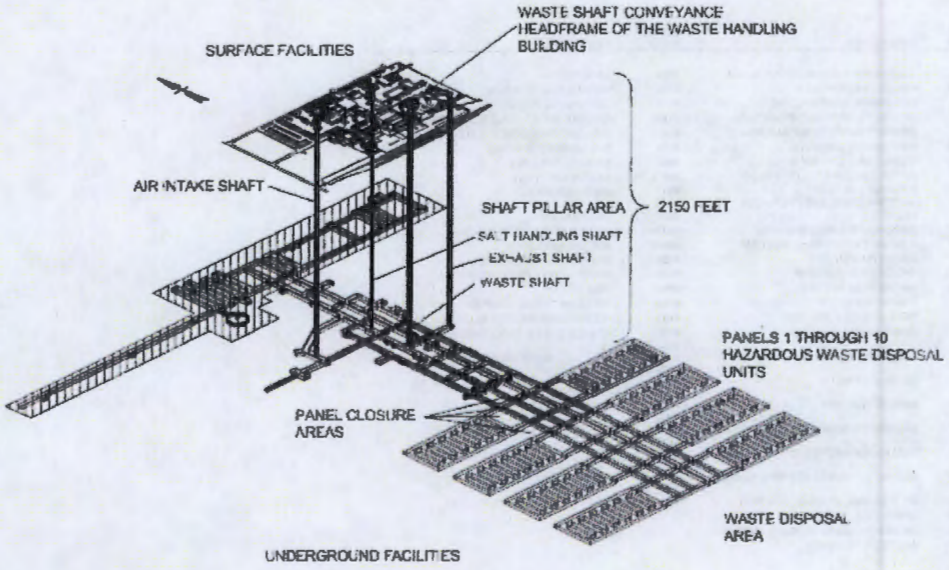

Figure D-2
Spatial View of the WIPP Facility

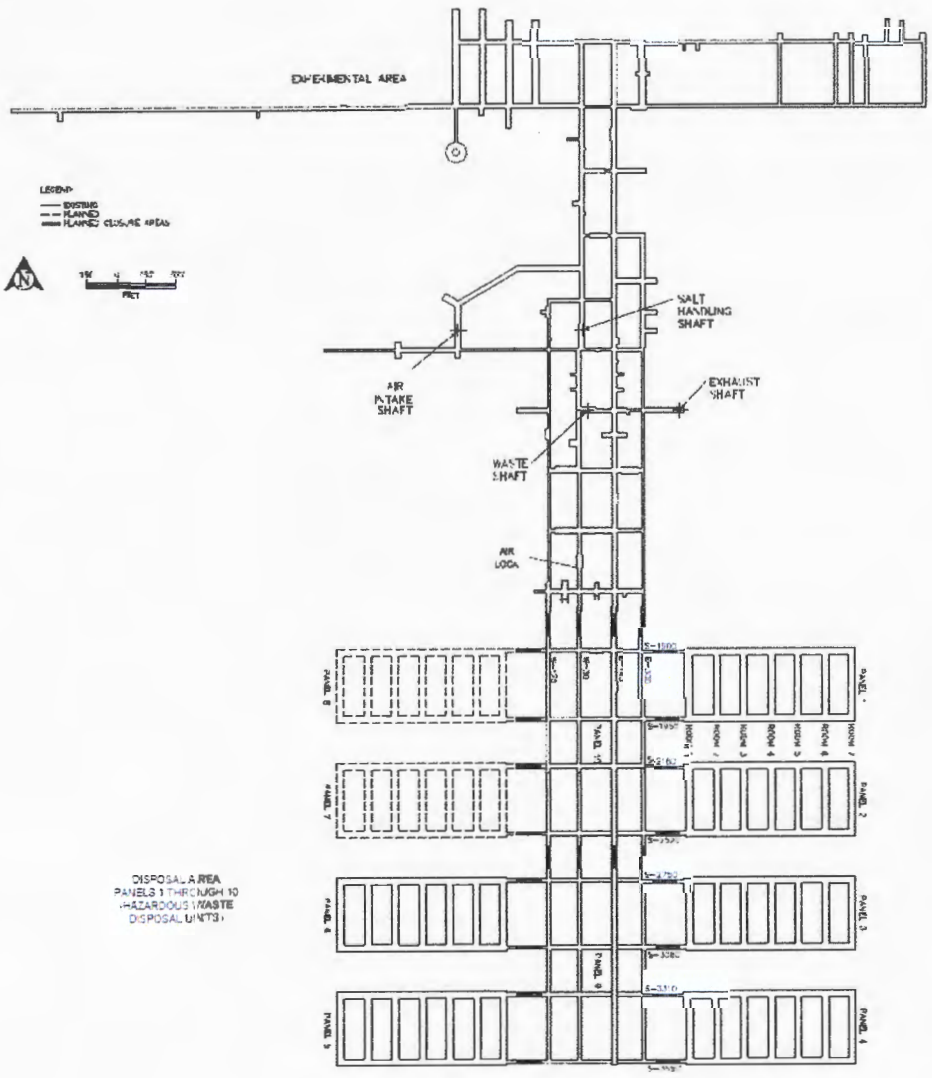

Figure D-3
WIPP Underground Facilities

Field Code Changed

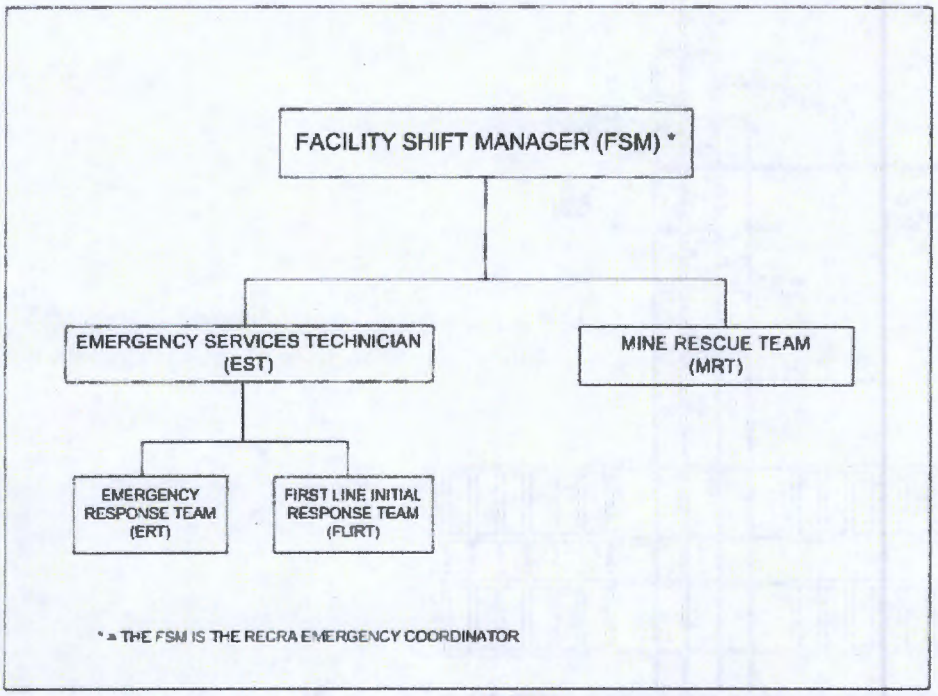

Figure D-4
Direction and Control Under Emergency Conditions in Which the Plan Has Been Implemented

Field Code Changed

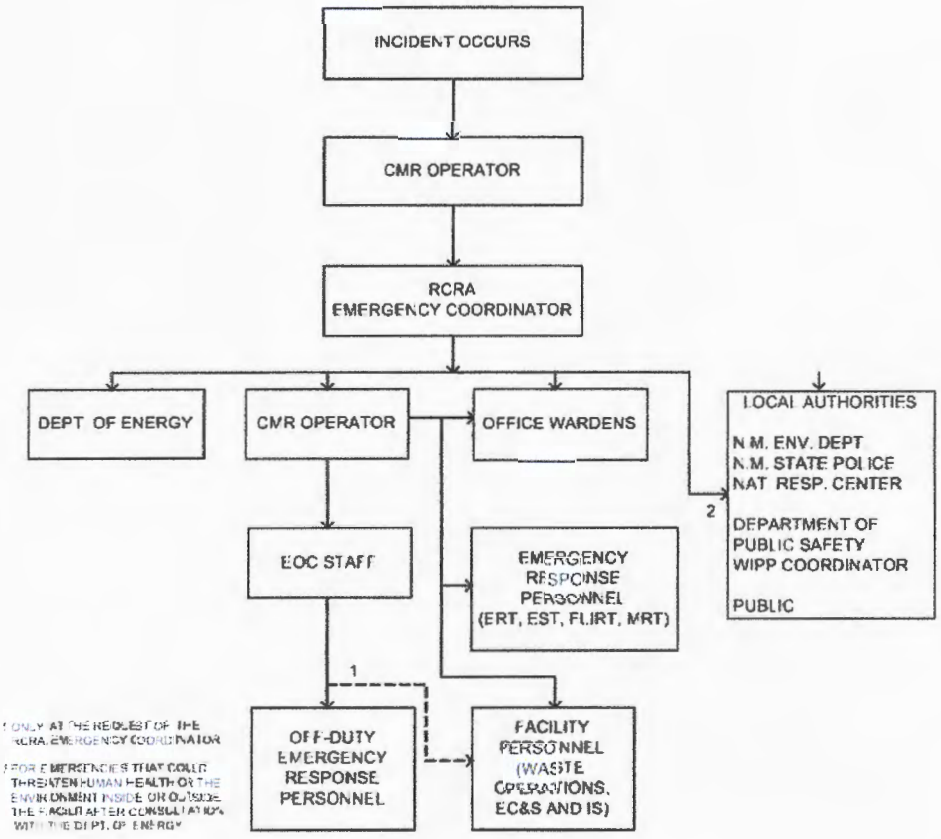

Figure D-4a
WIPP Facility Emergency Notifications

Field Code Changed

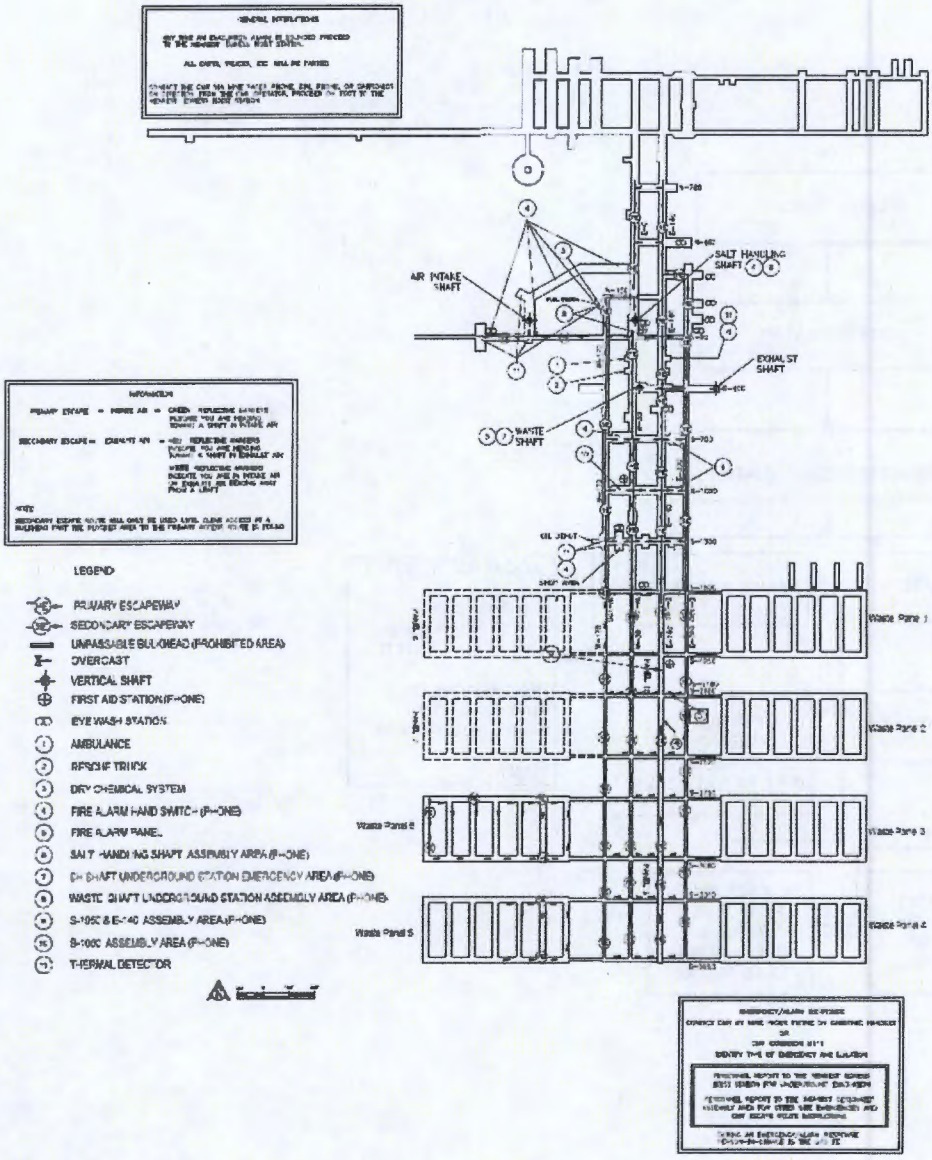

Figure D-5
Underground Emergency Equipment Locations and Underground Evacuation Routes

Field Code Changed

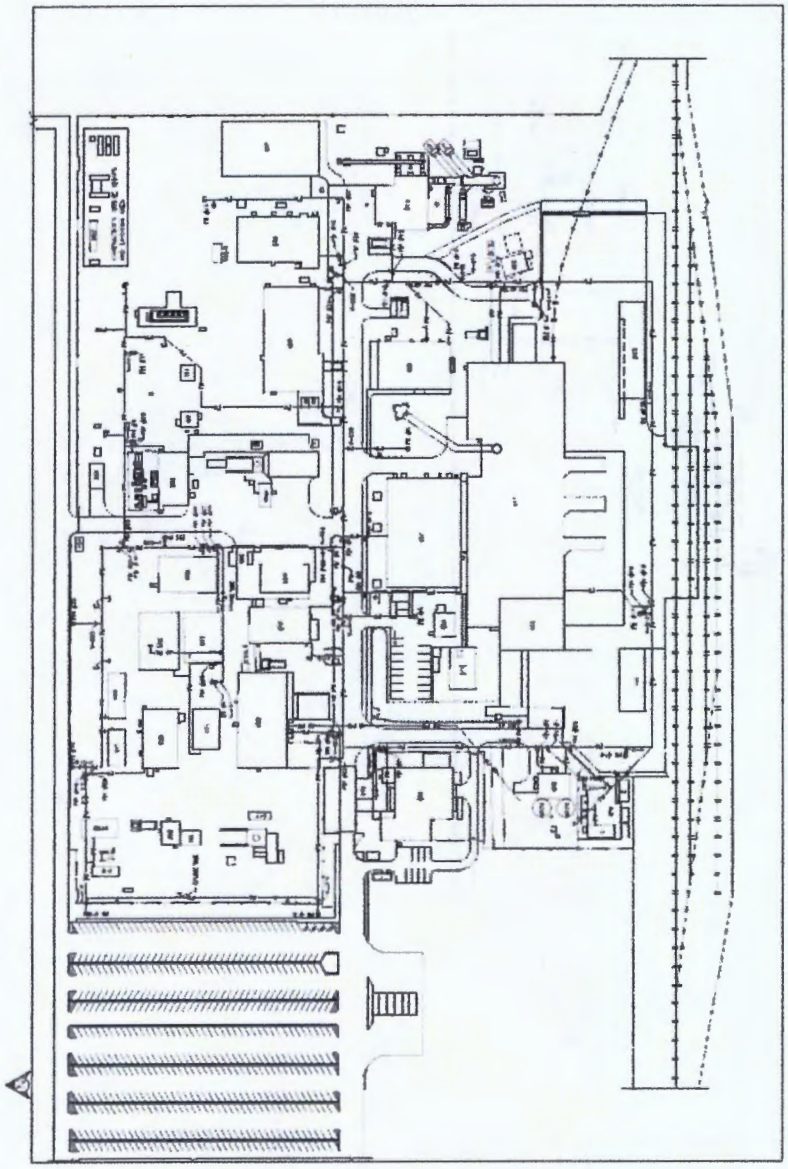

Figure D-6
Fire-Water Distribution System

Field Code Changed

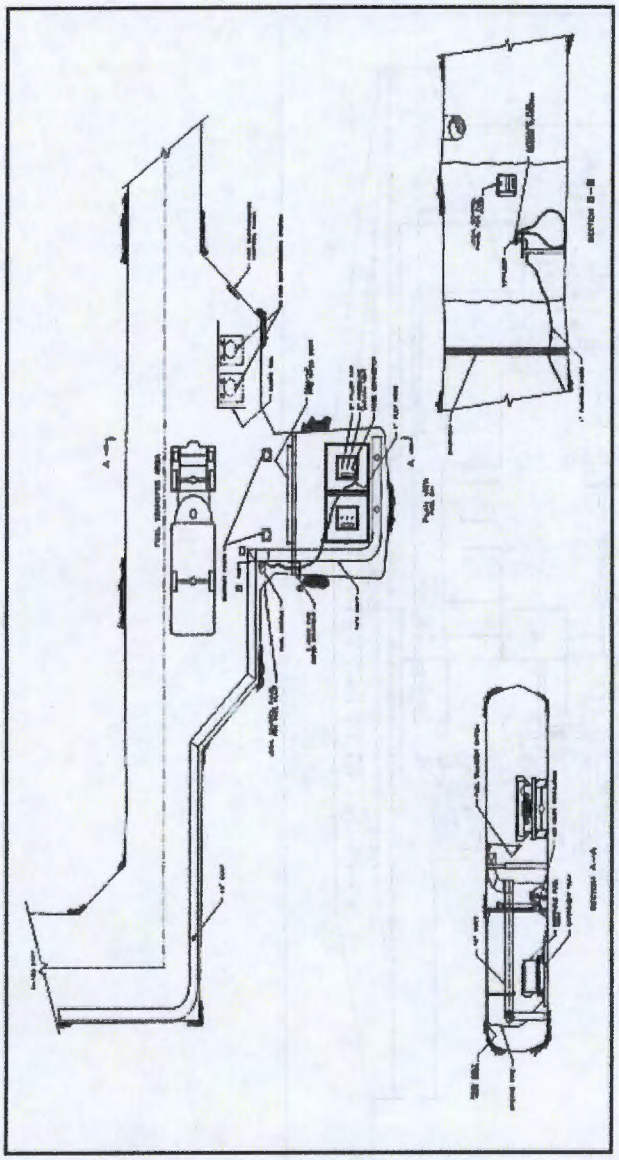

Figure D-7
Underground Diesel Fuel-Station Area Fire-Protection System

Field Code Changed

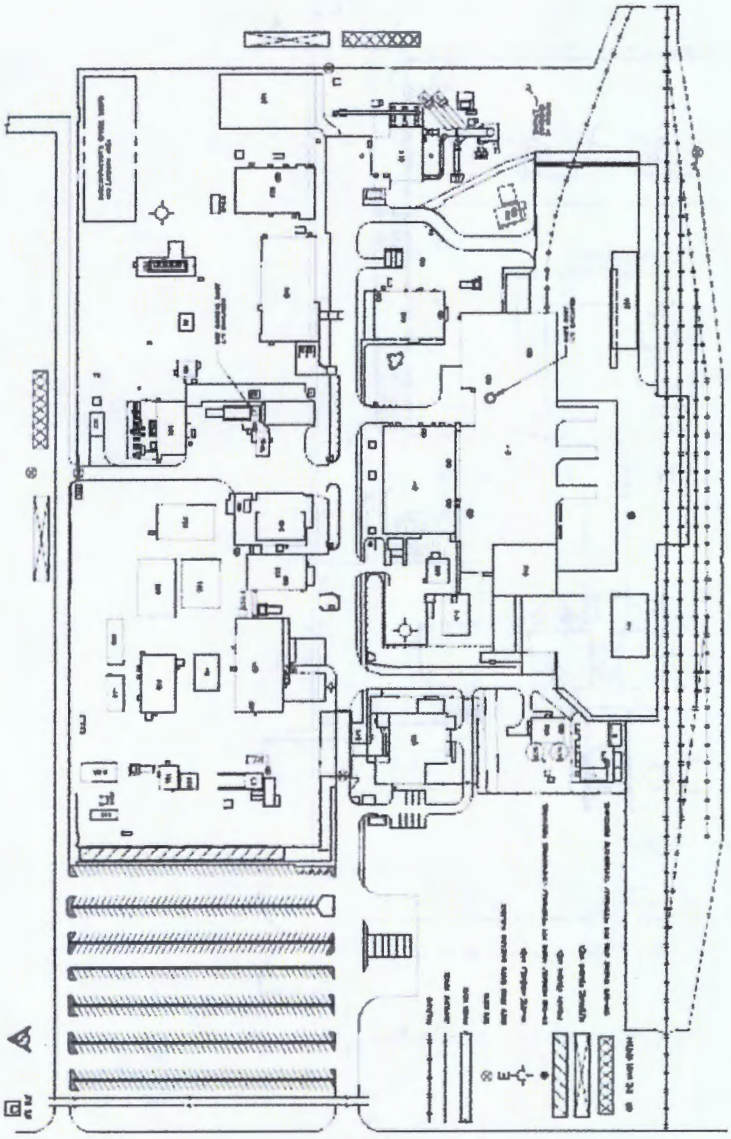

Figure D-8
WIPP On-Site Assembly Areas and WIPP Staging Areas

Field Code Changed

02647

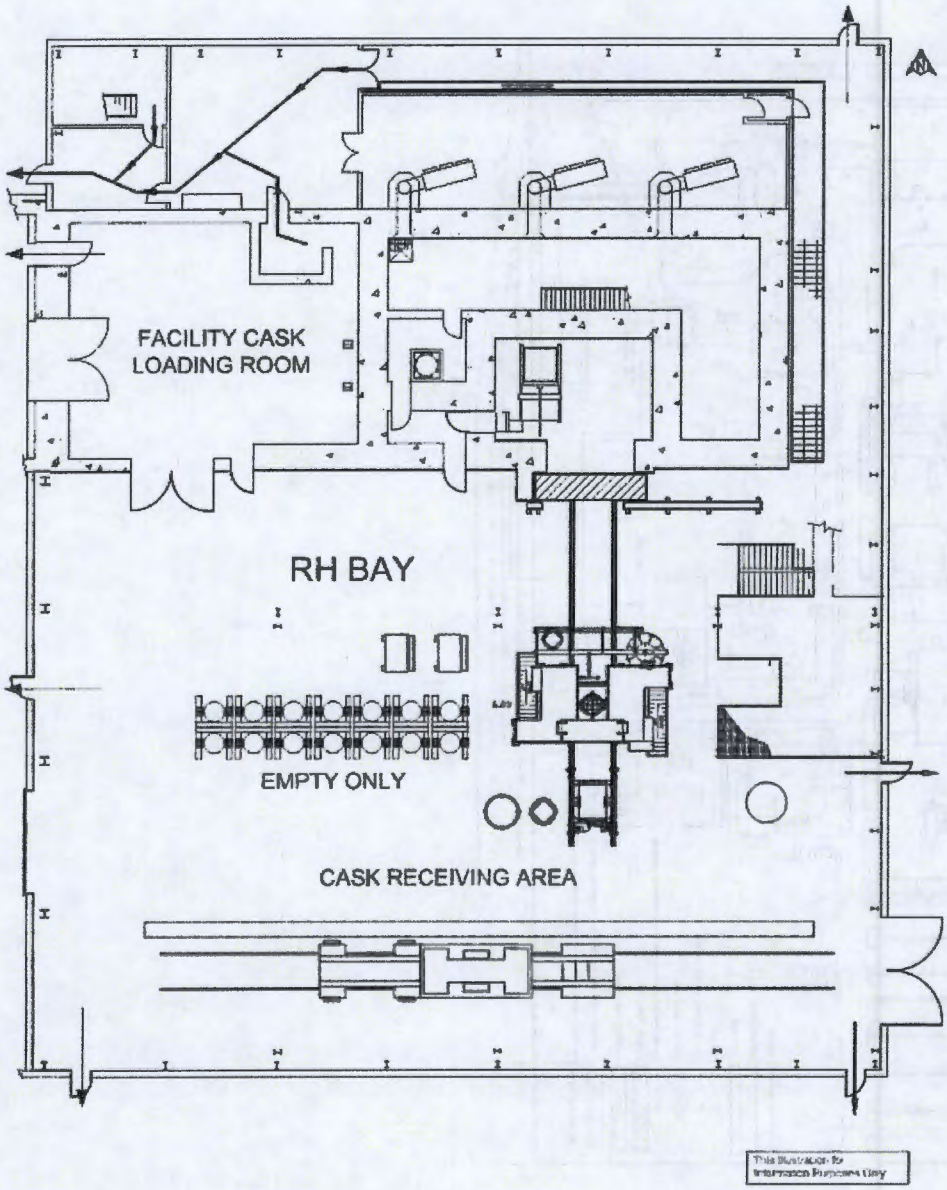

Figure D-8a
RH Bay Evacuation Routes

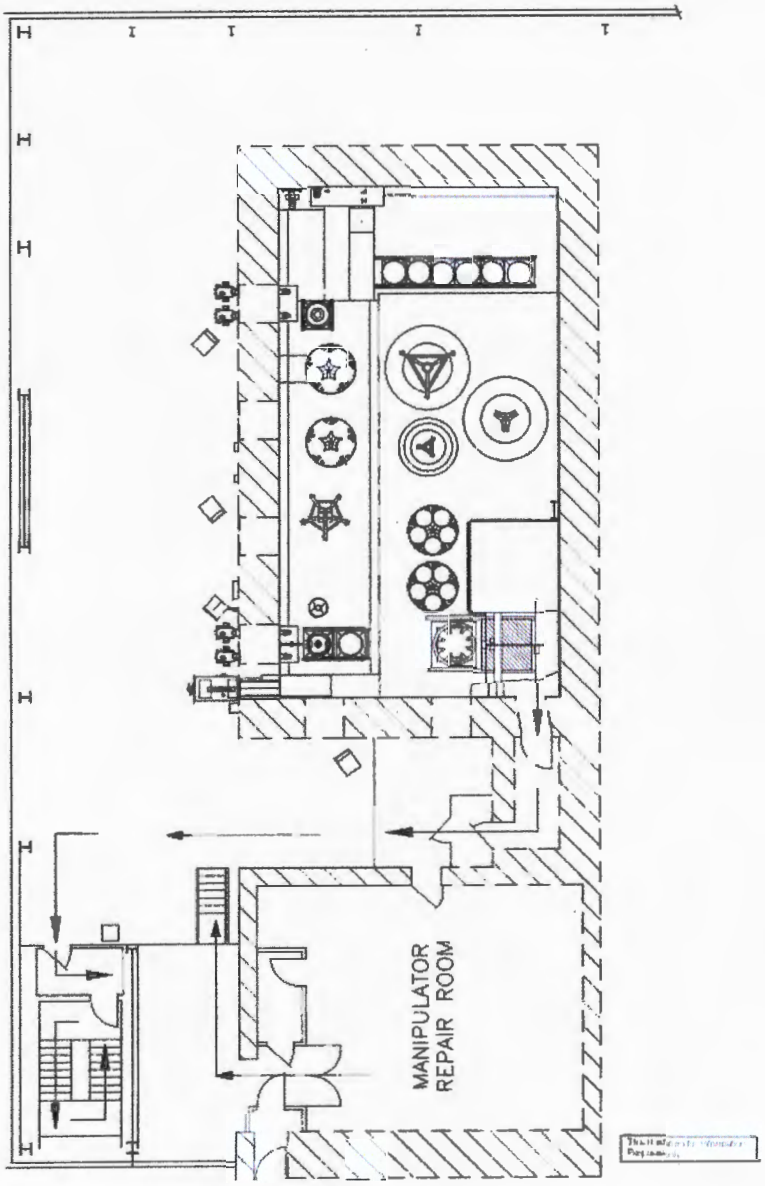

Figure D-8b
RH Bay Hot Cell Evacuation Route

Field Code Changed

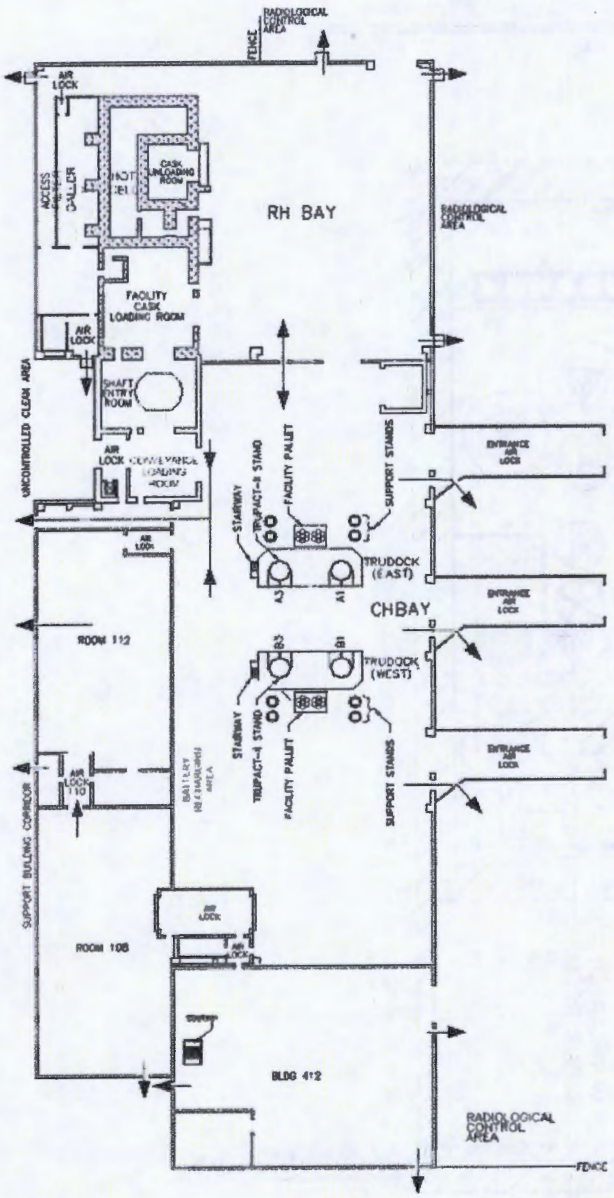

Figure D-8c
Evacuation Routes in the Waste Handling Building

Field Code Changed

02650

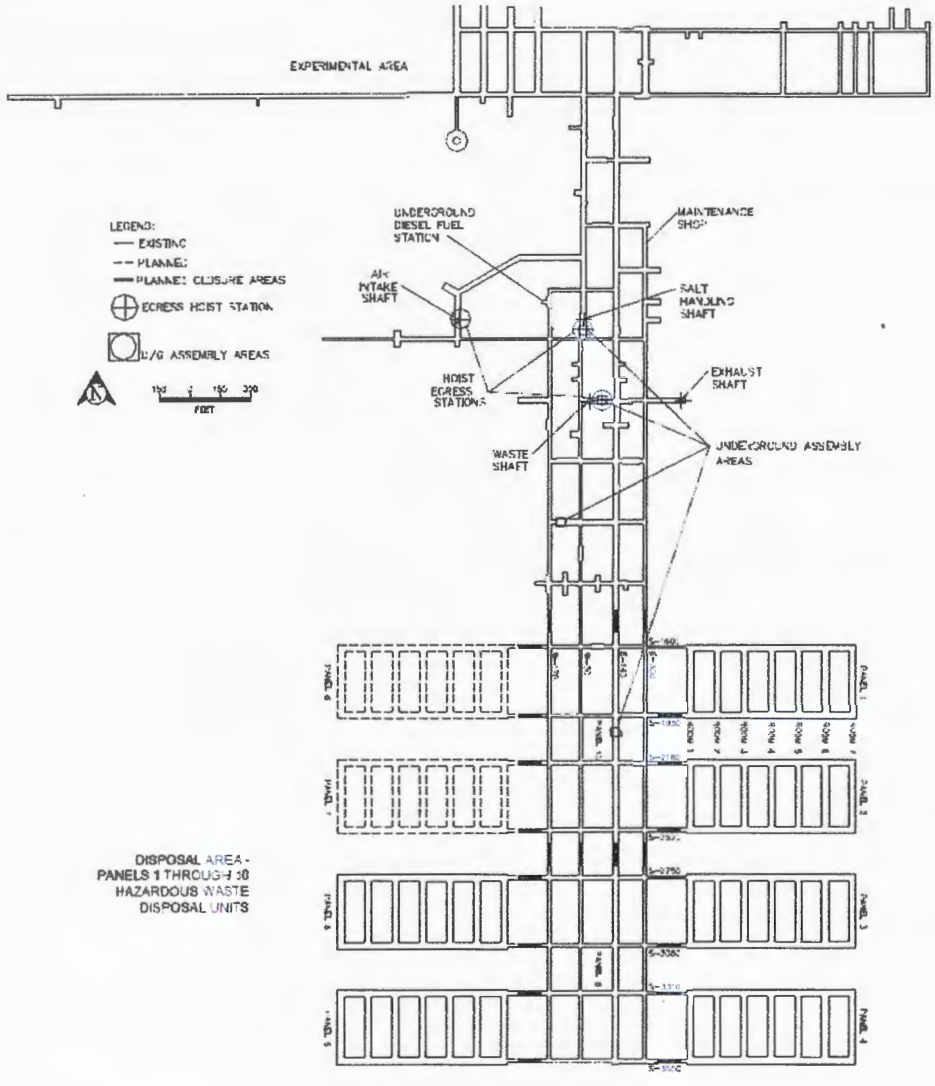

Figure D-9
Designated Underground Assembly Areas

Field Code Changed

02351

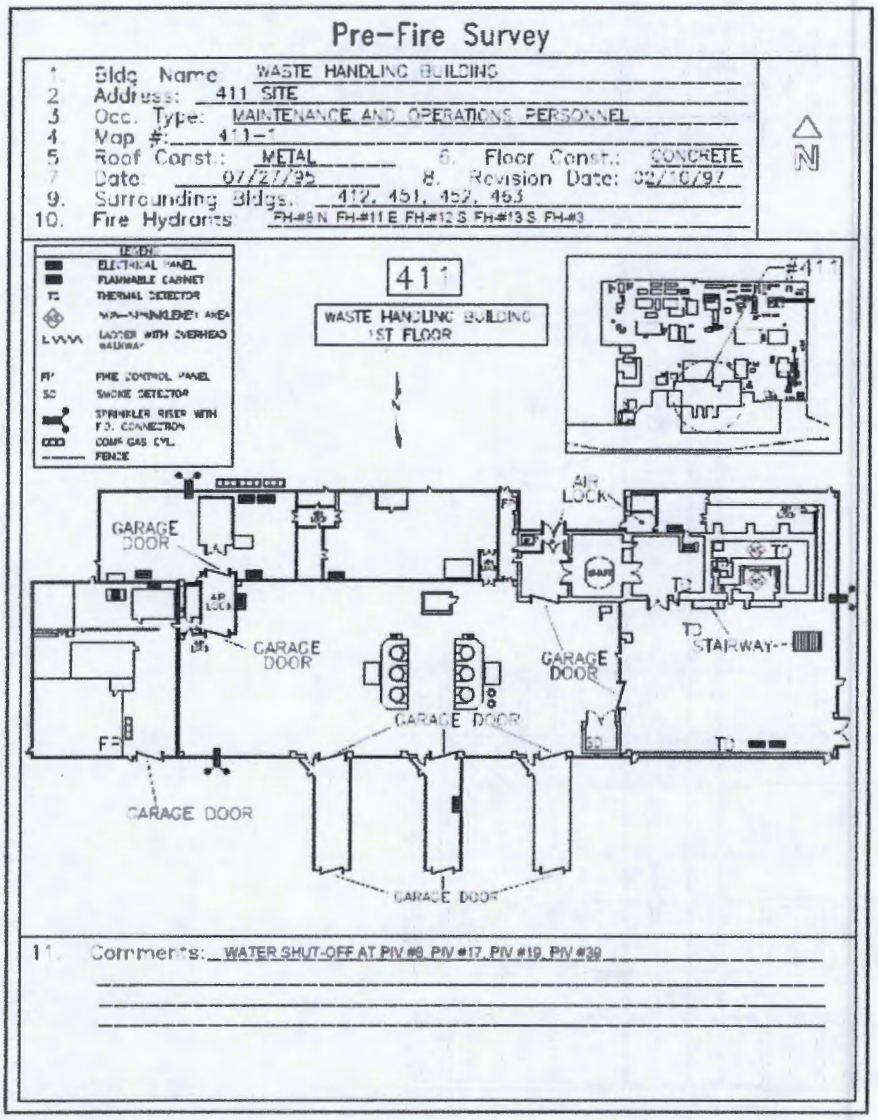

Figure D-10
Waste Handling Building Pre-Fire Survey (First Floor)

Field Code Changed

Pre-Fire Survey Cont.

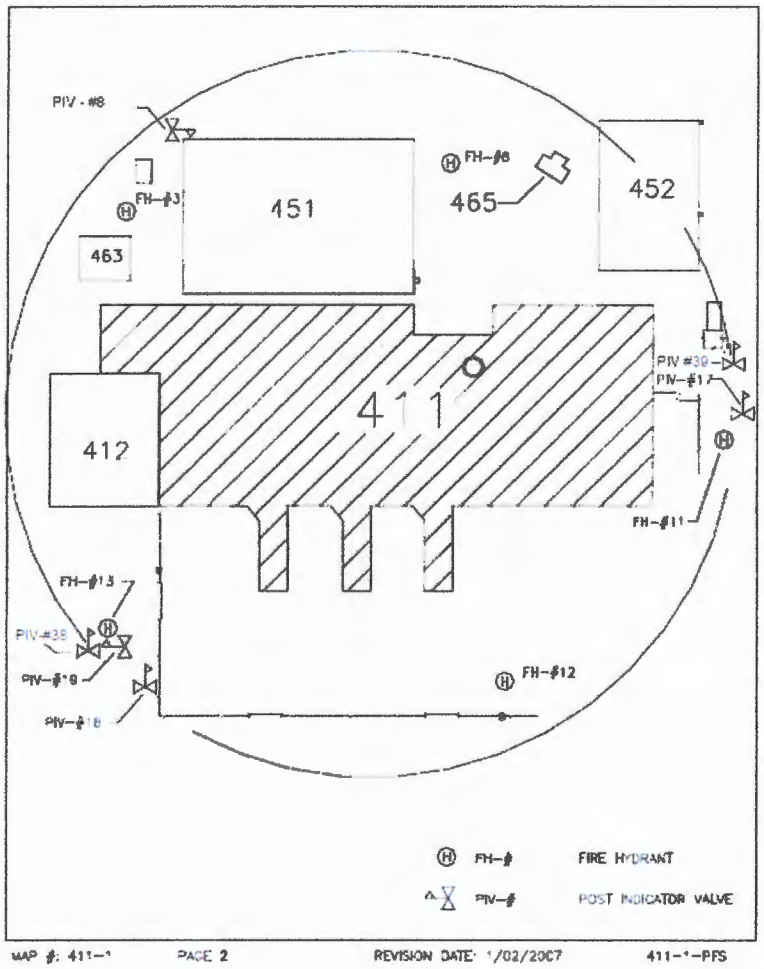

Figure D-10a
Waste Handling Building Pre-Fire Survey
(First Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

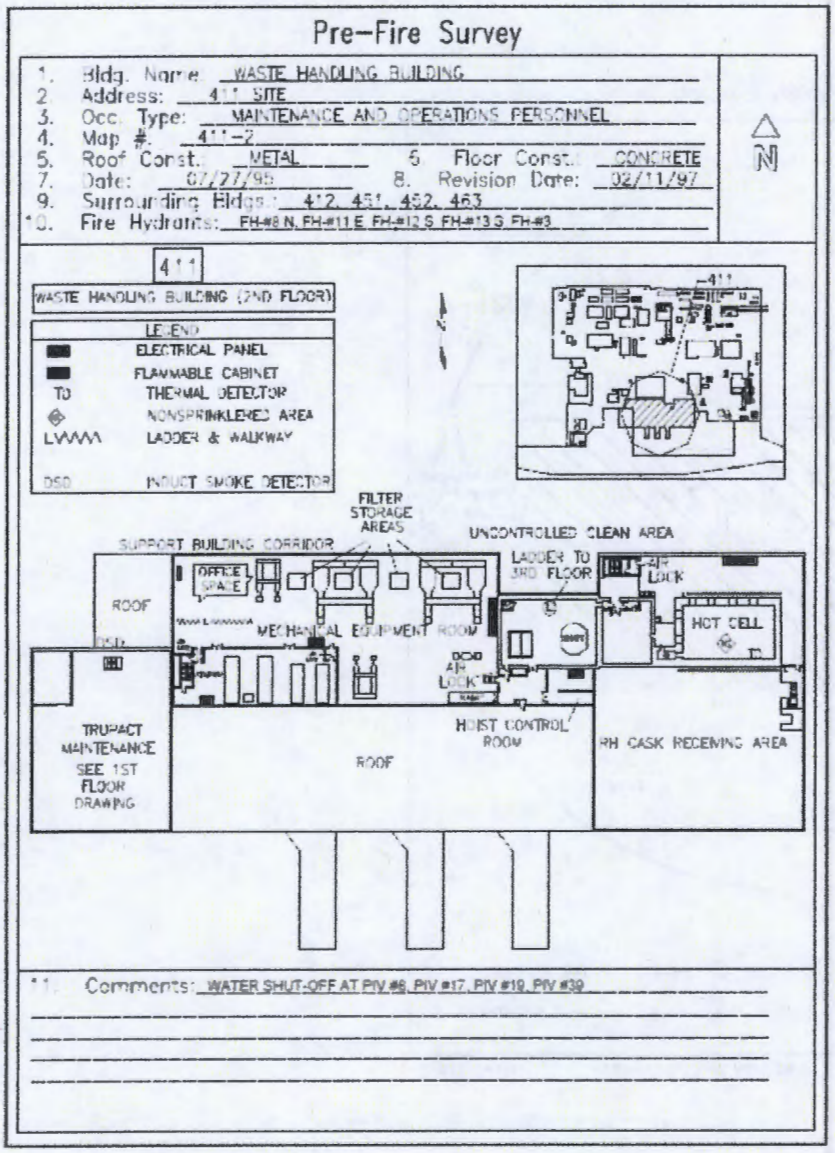

Figure D-11
Waste Handling Building Pre-Fire Survey (Second Floor)

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02554

Pre-Fire Survey Cont.

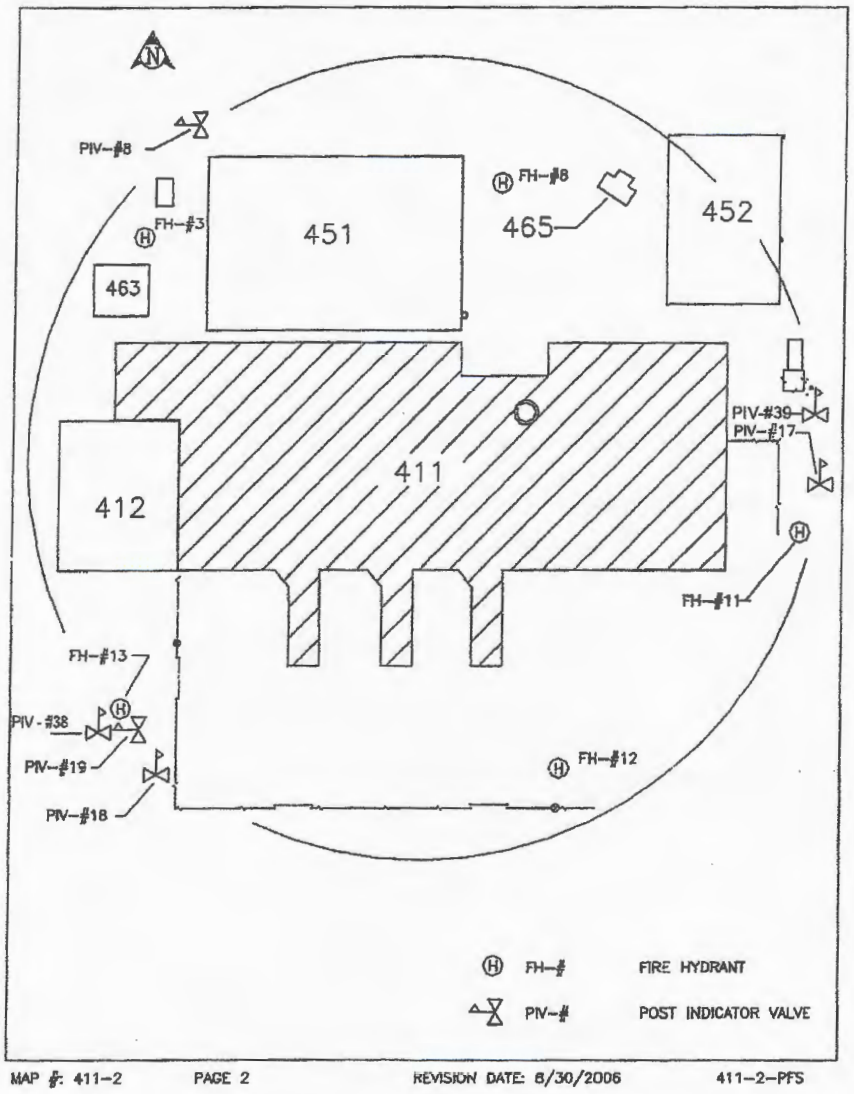

Figure D-11a
Waste Handling Building Pre-Fire Survey
(Second Floor - Fire Hydrant/Post Indicator Location)

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

I. INITIAL INFORMATION DATE:_____ TIME:_____
EST:_____ REPORTED LOCATION:_____
REPORTED BY:_____DEPT.:_____
INITIALLY REPORTED TO:_____DEPT.:_____
RESPONSIBLE MANAGER:_____DEPT.:_____

II. WEATHER CONDITIONS WIND DIRECTION_____WIND SPEED:_____mph TEMP.:_____F
CONDITIONS (i.e.., icy, snowing, raining, cloudy, sunny):_____

III. TYPE OF INCIDENT (SPILL, LEAK, ETC.):_____Fire involved: [ ]YES [ ]NO
(If fire is involved attach a copy of the fire report)

MATERIALS INVOLVED	UN/NA NO.	QUANTITY	HAZARD CLASS	NFPA CLASS

IV. PERSONNEL INVOLVED IN CLEAN-UP ACTIVITIES

PERSONNEL/DEPT	DECON METHOD/MEDICAL TREATMENT

V. PERSONNEL CONTAMINATED NOT INVOLVED IN THE CLEANUP ACTIVITIES

PERSONNEL/DEPT.	MATERIAL CONTACTED	DECON/MEDICAL TREATMENT

Figure D-12
WIPP Hazardous Materials Incident Report, Page 1 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

VI. EQUIPMENT USED FOR CLEAN-UP AND CONTROL MEASURES

EQUIPMENT/MATERIAL/PPE	QUANTITY	DISPOSITION (decon or replacement)

VII. DESCRIPTION OF INCIDENT AND RESPONSE (including containment and control)

_____

VIII. ENVIRONMENTAL COMPLIANCE

Date:_____ Time:_____of evaluation.

Waste Category_____

Disposition_____

ORGANIZATION	DATE	TIME

EC Representative:_____
Print name Signature Date

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 2 of 3

Field Code Changed

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

IX. INITIAL NOTIFICATION BY CMRO

DEPARTMENT	PERSON CONTACTED	TIME	NOTIFIED BY
Facility Ops (FSM)			
Emerg. Mgmt (EST)			
EC			
Industrial Safety			
Facility Ops. (FM/FMD)			

CMRO:_____
Print name Signature Date

FSM:_____
Print name Signature Date

X. CONTINGENCY PLAN IMPLEMENTATION

Contingency Plan implemented [ ]YES [ ]NO

FSM:_____
Print name Signature Date

XI. REVIEWS

Report submitted by:_____
Print name Signature Date

Emergency Management Manger:_____
Print name Signature Date

EC Manager:_____
Print name Signature Date

COMMENTS:_____

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 3 of 3

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DRAWINGS

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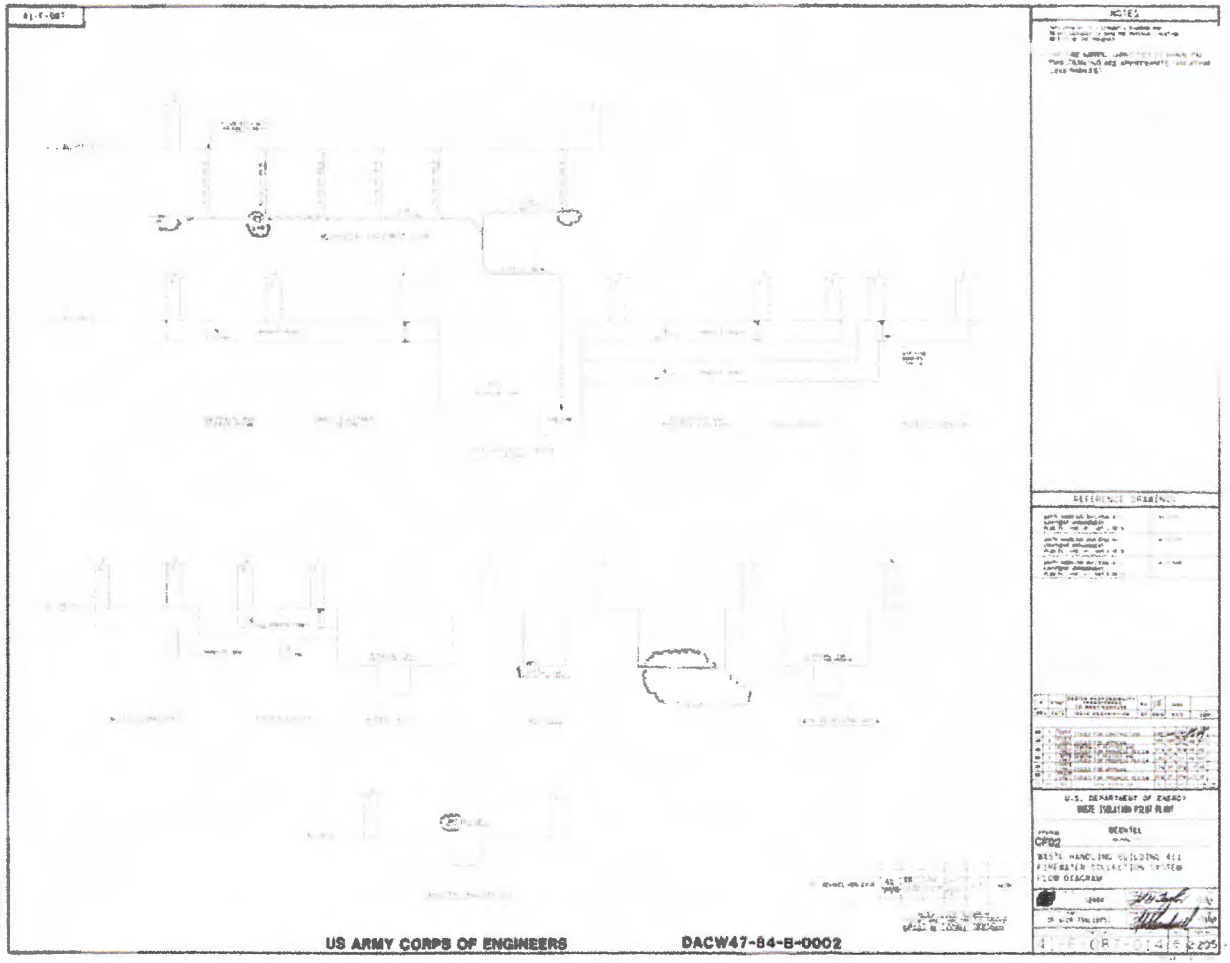

02992

Field Code Changed

ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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Table E-2	Monitoring Schedule

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

Introduction

This Permit Attachment describes the facility inspections (including container inspections) that are conducted to detect malfunctions, deterioration, operator errors, and discharges that may cause or lead to releases of hazardous waste or hazardous waste constituents to the environment or that could be a threat to human health.

E-1 Inspection Schedule

Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as monitoring equipment, safety and emergency equipment, security devices, and operating or structural equipment are inspected. The equipment will be inspected for malfunctions, deterioration, potential for operator errors, and discharges which could lead to a release of hazardous waste constituents to the environment or pose a threat to human health.

The WIPP facility has developed and will maintain a series of written procedures that include all the detailed inspection procedures and forms necessary to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)), during the Disposal Phase. Tables E-1 and E-1a list each item or system requiring inspection under these regulations, the inspection frequency, the organization responsible for the inspection, the applicable inspection procedure, and what to look for during the inspection. 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(b), 264.174, and 264.602) list requirements that are applicable to the WIPP facility.

Operational procedures detailing the inspections required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(a) and (b)), are maintained in electronic format on the WIPP computer network, in the Operating Record and, as appropriate, in controlled document locations at the WIPP facility. Frequency of inspections is discussed in detail in Section E-1a(2). Inspections are conducted often enough to identify problems in time to correct them before they pose a threat to human health or the environment and are based on regulatory requirements. The operational procedures assign responsibility for conducting the inspection, the frequency of each inspection, the types of problems to be watched for, what to do if items fail inspection, directions on record keeping, and inspector signature, date, and time. The operational procedures are maintained at the WIPP facility. Tables E-1 and E-1a summarize inspections, frequencies, responsible organizations, personnel making the inspection (by job title), and the types of anticipated problems as well as the references for the operational procedures. Inspection records are maintained at the WIPP site for three years. Beginning with the effective date of this Permit, records that are over the three year retention period are either maintained at the WIPP site or transferred to the WIPP Records Archive located in Carlsbad, NM until closure. The records maintained at the WIPP Records Archive are stored in facilities that are temperature and humidity controlled especially for the long term storage of records and readily retrievable and available for inspection.

Waste handling equipment and area inspections are typically controlled through established procedures and the results are recorded in logbooks or on data sheets. Operators are trained to consult the logbook to identify the status of any piece of waste handling equipment prior to its

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use. Once a piece of equipment is identified to be operable, a preoperational inspection is initiated in accordance with the appropriate inspection procedure in Tables E-1, E-1a, or in operational procedures. Inspection results as described below are entered in the applicable logbook.

Inspections include identifying malfunctions or deteriorating equipment and structures. Inspection results and data, including deficiencies, discrepancies, or needed repairs are recorded. A negative inspection result does not necessarily lead to a repair. A deficiency, such as low fluid level, may be corrected by the inspector immediately. A discrepancy, such as an increasing trend of a data point, may necessitate additional inspection prior to the next scheduled frequency. The actions taken (corrected, additional inspection, or Action Request (**AR**) for repair submitted) are recorded on the inspection form, the WIPP automated Maintenance Management tracking program (**CHAMPS**) work order sheet, or the equipment logbook, whichever is applicable.

Items that are operational with restrictions are tagged with those restrictions. Items that are not operational are tagged and locked to prevent their use. Tagged and locked items are listed on the Tagout/Lockout Index. Once a scheduled repair or replacement is accomplished in accordance with the work authorization procedures, the tag or lock is removed from the item in accordance with the equipment tagout/lockout procedures. Normally, the individual inspecting the equipment/system is not qualified to make repairs and consequently, prepares an AR if repairs are needed. The AR is tracked by the CHAMPS system through the work control process. When parts are received and work instructions are completed, the work order can be scheduled on the Plan of the Day (**POD**). The POD is held daily to ensure facility configuration can support scheduled work items and to allocate and coordinate the resources necessary to complete the items.

Work orders are released for work by the responsible organization. When repairs are complete the responsible organization tests the equipment to ensure the repairs corrected the problem, then closes out the work order, to return the equipment to an operational status for normal operations to resume. Implementation of these procedures constitutes compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

Requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)), are met by the inspections for each item or system included in Tables E-1 and E-1a. Beginning with the effective date of this Permit, the results of the inspections are maintained in the operating record for three years and are then transferred to the WIPP Records Archive where they are maintained until closure. The inspection logs or summary records include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions. Major pieces of waste handling equipment are inspected using proceduralized inspections. Current copies of inspection forms are maintained in the Operating Record. Non-administrative changes (i.e., changes that affect the frequency or content of inspections) to inspection forms must be submitted to the NMED in accordance with the appropriate portions of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42). The status of these pieces of equipment is maintained in an equipment logbook that is separate from the checklist. The logbook contains information regarding the condition of the equipment. Equipment operators are required, by the inspection checklist, to consult the logbook as the first activity in the inspection procedure. This logbook is maintained in the operating record. CH transuranic (**TRU**) mixed waste equipment that is controlled by a logbook includes the waste handling forklifts, all waste handling cranes, the adjustable center of gravity lift fixture, the CH

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TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and emplacement equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

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E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site waste that will be managed and stored as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), in standard large box 2s (**SLB2s**) or shielded containers as (3)-packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

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As described in Permit Attachment A1, Section A1-1d(3), off-site waste that will be managed and stored as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Off-site waste that will be managed and stored as RH TRU mixed waste is managed and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity

of the shipping containers and the spacing between trailers carrying the Contact-Handled or Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Container inspections will be included as part of the surface TRU mixed waste handling areas (i.e. Parking Area Unit and WHB Unit) inspections described in Tables E-1 and E-1a. These inspections will also include the Derived Waste Storage Areas of the WHB Unit. The Derived Waste Storage Areas will consist of containers of 55 or 85-gallon drums or SWBs for CH TRU mixed waste and 55-gallon drums for RH TRU mixed waste. A Satellite accumulation area (**SAA**) may be required in an area adjacent to the TRUDOCKs for CH TRU mixed waste. A SAA may also be required in the RH Bay and Hot Cell for RH TRU mixed waste. These SAAs will be set up on an as needed basis at or near the point of generation and the derived waste will be discarded into the active derived waste container. All SAAs will be inspected in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34).

E-1b(2) Miscellaneous Unit Inspection

20.4.1.500 NMAC (incorporating 40 CFR §264.602), requires that inspections required in 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33), as well as any additional requirements needed to protect human health and the environment, be met. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33) are discussed in Section E-1 of this Permit Attachment, along with how the WIPP facility complies with those requirements for standard types of inspections. Inspection frequencies for geomechanical monitoring equipment are provided in Table E-1. The monitoring schedule for geomechanical instrumentation is given in Table E-2.

References

DOE, 1999. "WIPP Safety Analysis Report," DOE/WIPP-95-2065. Rev. 4, U.S. Department of Energy. Washington, D.C.

DOE, 2000. "WIPP Remote-Handled Waste Preliminary Safety Analysis" (RH PSAR), U.S. Department of Energy. Washington, D.C.

: 02672

FIGURES

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TYPICAL EQUIPMENT
WEEKLY CHECK LIST

_√_ OK **_X_ Adjustment Made** **_O_ Repairs Required**

AR Written [ ] Yes [ ] No AR # _____

(check or complete appropriate information)

ITEM INSPECTED	Condition	Comments/Corrective Action
Mechanical Checks: (examples)		
Oil level		
Radiator fluid level		
Automatic transmission fluid level		
Operate all valves/check gauges		
Emergency brake		
Fuel level (> ¾ full)		
Oil pressure (at warm idle)		
Tire Pressure		
Sirens, horn, & back-up alarm		
Deterioration Checks: (examples)		
Fan belts		
Battery (terminals, cables)		
Run generator 5 min.		
Hose, nozzles & valves		
Leaks/Spills Checks: (examples)		
Leaks around pump		
Foam tank level		
Required Equipment: (examples)		
Inspect SCBAs (> 4050 psi)		
Hand tools & equipment		
Trauma Kit		

Inspected by: _____
Print Name Signature Time/Date

Inspected by: _____
Print Name Signature Time/Date

Reviewed by: _____
Print Name Signature Time/Date

Comments: _____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-1
Typical Inspection Checklist

: 02675

HOUR METER READING _____ EQUIPMENT NO. _____

DEFICIENCIES NOTED: _____

_____

_____

_____

_____

PRE OPS COMPLETED PER __{Procedure Number}__ SAT _____ **PROBLEMS NOTED** _____

CORRECTIVE ACTIONS TAKEN: _____

_____

_____

_____

_____

_____

_____

OPERATOR SIGNATURE	**DATE**	**TIME**	**SUPERVISOR SIGNATURE/DATE**
_____	_____	_____	_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-2
Typical Logbook Entry

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TABLES

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Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	12-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[l]	Emergency Services	Monthly See List 11	12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[l] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030 and 12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[s] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

1

Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
Senior Mining Technician *
Continuous Mining Specialist *
Senior Mining Specialist *
Mine OPS Supervisor *
b. Waste Hoist Operator
Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
Shaft Technician *
d. Operations Engineer
Supervisor U/G Services*
Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
Senior Safety Technician *
Safety Specialist *
Safety Engineer *
Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

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Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

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Table E-1a
RH TRU Mixed Waste Inspection Schedule/Procedures

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Transfer Car(s)	Waste Operations	Pre-evolution [c,d,e] See List 1	WP05-WH1701 PM041187 (Semi-Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
RH Bay Overhead Bridge Crane	Waste Operations	Preoperational [c,d,e,] See List 1	WP05-WH1741 PM041232 (Quarterly) PM041117 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1713 PM041201 (Annual) PM041203 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical PM.
RH Bay Cask Lifting Yoke	Waste Operations	Preoperational [c,d,e,] See List 1	WP05-WH1741 PM041169 (Annual)	Yes	NA	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask Transfer Car	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1704 PM041186 (Quarterly) PM041195 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Cask Rotating Device	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1713 PM041175 (Annual) PM041176 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Grapple	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1721 PM041172 (Quarterly) PM041177 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear. Non-Destructive Examination
6.25-Ton Grapple Hoist	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1721 PM041173 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Transfer Cell Shuttle Car	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1705 PM041184 (Semi-Annual) PM041222 (Annual)	Yes	Yes	Pre-evolution Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection.

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System/ Equipment Name	Responsible Organization [J]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Unloading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell	Waste Operations	Preoperational [c,d,e,f,g,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell Overhead Powered Manipulator	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1743 PM041215 (Annual) PM041216 (Annual) IC411037 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration
Hot Cell Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1742 PM041217 (Annual) PM041209 (Annual) IC411038 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.
Transfer Cell	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Facility Cask Loading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Closed Circuit Television Camera	Waste Operations	Preoperational [c,i] See List 1	WP05-WH1757	NA	NA	Operability
Radiation Monitoring Equipment	Radiation Control	Preoperational [c,d,e] See List 2	WP12-HP1245 IC240010 WP12-HP1307 IC240007 WP12-HP1314 (Annual)	Yes	NA	Operability Checks, Functional Checks, Instrument calibrations, Flow Calibration, Efficiency Checks.
Cask Unloading Room Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1719 PM041190 (Quarterly) PM041191 (Annual) PM041192 (Annual) IC411035 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.

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System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1700 PM052010 (Semi-Annual) [k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [i] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

1

Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer

Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

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2

Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts, and concrete walls.

[b] Deterioration includes: visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Pre-evolution" signifies that inspections are required prior to equipment use in the waste handling process. (An evolution is considered to be from the receipt of a cask into the RH Bay through canister emplacement in the underground.) For an area, preoperational inspection includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that functional components and emergency equipment are present and operational. When the equipment is not in use, no inspections are required.

[d] When equipment needs to be inspected while handling waste (i.e., during waste unloading or transfer operations), general cleanliness and functional components will be inspected to detect any problem that may harm human health or the environment. The inspection will verify that emergency equipment is present.

[e] Inspection of RH TRU mixed waste equipment and areas in the RH Complex applies only after RH TRU mixed waste receipt begins.

[f] The inspection/maintenance activities associated with these pieces of equipment are performed when the RH Complex is empty of RH TRU mixed waste. If contamination is present, a radiation work permit may be needed.

[g] For the Hot Cell and Transfer Cell, if RH TRU mixed waste is present, camera inspections will be performed in lieu of physical inspection.

[h] The integrity of the floor coating will be inspected weekly if RH TRU mixed waste is present.

[i] "Preoperational" signifies that inspections are required prior to the first use in a calendar day.

[j] Responsible organizations refers to the organization that owns the equipment. Preventive Maintenance (PM) procedures are conducted by either mine maintenance or surface operations maintenance personnel and Instrument Calibration (IC) procedures are conducted by instrument and calibration maintenance personnel.

[k] Inspection will be performed after 250 evolutions (actual and training emplacements), if such usage occurs prior to the semi-annual inspection.

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Table E-2
Monitoring Schedule

System/Equipment Name	Responsible Organization	Monitoring Frequency	Purpose
Geomechanical [b]	Geotechnical Engineering	Monthly	To evaluate the geotechnical performance of the underground facility and to detect ground conditions that could affect operational safety
Central Monitoring System	Facility Operations	System Dependent	Monitor and provide status for the following facility parameters: Electrical Power Status [d] Fire Alarm System [e] Ventilation System Status [f] Meteorological Data System [g] Facility Systems (compressors [g], pumps [h], water tank levels [i], waste hoists [j])

[b] Equipment is listed as Underground-Geomechanical Instrumentation System (GIS) in Table E-1.
[d] Equipment listed as Backup Power Supply Diesel Generator in Table E-1.
[e] Equipment listed as Fire Detection and Alarm System in Table E-1.
[f] Equipment listed as Ventilation Exhaust in Table E-1.
[g] Not RCRA equipment.
[h] Equipment listed as Fire Pumps in Table E-1.
[i] Equipment listed as Water Tank Level in Table E-1.
[j] Equipment listed as Waste Hoist in Table E-1.

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Field Code Changed

ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

Introduction

This Permit Attachment describes the facility inspections (including container inspections) that are conducted to detect malfunctions, deterioration, operator errors, and discharges that may cause or lead to releases of hazardous waste or hazardous waste constituents to the environment or that could be a threat to human health.

E-1 Inspection Schedule

Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as monitoring equipment, safety and emergency equipment, security devices, and operating or structural equipment are inspected. The equipment will be inspected for malfunctions, deterioration, potential for operator errors, and discharges which could lead to a release of hazardous waste constituents to the environment or pose a threat to human health.

The WIPP facility has developed and will maintain a series of written procedures that include all the detailed inspection procedures and forms necessary to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)), during the Disposal Phase. Tables E-1 and E-1a list each item or system requiring inspection under these regulations, the inspection frequency, the organization responsible for the inspection, the applicable inspection procedure, and what to look for during the inspection. 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(b), 264.174, and 264.602) list requirements that are applicable to the WIPP facility.

Operational procedures detailing the inspections required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(a) and (b)), are maintained in electronic format on the WIPP computer network, in the Operating Record and, as appropriate, in controlled document locations at the WIPP facility. Frequency of inspections is discussed in detail in Section E-1a(2). Inspections are conducted often enough to identify problems in time to correct them before they pose a threat to human health or the environment and are based on regulatory requirements. The operational procedures assign responsibility for conducting the inspection, the frequency of each inspection, the types of problems to be watched for, what to do if items fail inspection, directions on record keeping, and inspector signature, date, and time. The operational procedures are maintained at the WIPP facility. Tables E-1 and E-1a summarize inspections, frequencies, responsible organizations, personnel making the inspection (by job title), and the types of anticipated problems as well as the references for the operational procedures. Inspection records are maintained at the WIPP site for three years. Beginning with the effective date of this Permit, records that are over the three year retention period are either maintained at the WIPP site or transferred to the WIPP Records Archive located in Carlsbad, NM until closure. The records maintained at the WIPP Records Archive are stored in facilities that are temperature and humidity controlled especially for the long term storage of records and readily retrievable and available for inspection.

Waste handling equipment and area inspections are typically controlled through established procedures and the results are recorded in logbooks or on data sheets. Operators are trained to consult the logbook to identify the status of any piece of waste handling equipment prior to its

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use. Once a piece of equipment is identified to be operable, a preoperational inspection is initiated in accordance with the appropriate inspection procedure in Tables E-1, E-1a, or in operational procedures. Inspection results as described below are entered in the applicable logbook.

Inspections include identifying malfunctions or deteriorating equipment and structures. Inspection results and data, including deficiencies, discrepancies, or needed repairs are recorded. A negative inspection result does not necessarily lead to a repair. A deficiency, such as low fluid level, may be corrected by the inspector immediately. A discrepancy, such as an increasing trend of a data point, may necessitate additional inspection prior to the next scheduled frequency. The actions taken (corrected, additional inspection, or Action Request (**AR**) for repair submitted) are recorded on the inspection form, the WIPP automated Maintenance Management tracking program (**CHAMPS**) work order sheet, or the equipment logbook, whichever is applicable.

Items that are operational with restrictions are tagged with those restrictions. Items that are not operational are tagged and locked to prevent their use. Tagged and locked items are listed on the Tagout/Lockout Index. Once a scheduled repair or replacement is accomplished in accordance with the work authorization procedures, the tag or lock is removed from the item in accordance with the equipment tagout/lockout procedures. Normally, the individual inspecting the equipment/system is not qualified to make repairs and consequently, prepares an AR if repairs are needed. The AR is tracked by the CHAMPS system through the work control process. When parts are received and work instructions are completed, the work order can be scheduled on the Plan of the Day (**POD**). The POD is held daily to ensure facility configuration can support scheduled work items and to allocate and coordinate the resources necessary to complete the items.

Work orders are released for work by the responsible organization. When repairs are complete the responsible organization tests the equipment to ensure the repairs corrected the problem, then closes out the work order, to return the equipment to an operational status for normal operations to resume. Implementation of these procedures constitutes compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

Requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)), are met by the inspections for each item or system included in Tables E-1 and E-1a. Beginning with the effective date of this Permit, the results of the inspections are maintained in the operating record for three years and are then transferred to the WIPP Records Archive where they are maintained until closure. The inspection logs or summary records include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions. Major pieces of waste handling equipment are inspected using proceduralized inspections. Current copies of inspection forms are maintained in the Operating Record. Non-administrative changes (i.e., changes that affect the frequency or content of inspections) to inspection forms must be submitted to the NMED in accordance with the appropriate portions of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42). The status of these pieces of equipment is maintained in an equipment logbook that is separate from the checklist. The logbook contains information regarding the condition of the equipment. Equipment operators are required, by the inspection checklist, to consult the logbook as the first activity in the inspection procedure. This logbook is maintained in the operating record. CH transuranic (**TRU**) mixed waste equipment that is controlled by a logbook includes the waste handling forklifts, all waste handling cranes, the adjustable center of gravity lift fixture, the CH

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TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and emplacement equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site ~~CH TRU mixed~~ waste that will be managed and stored as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), ~~or~~ in standard large box 2s (**SLB2s**) or shielded containers as (3)-packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

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As described in Permit Attachment A1, Section A1-1d(3), off-site waste that will be managed and stored as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Off-site waste that will be managed and stored as RH TRU mixed waste is ~~handled~~ managed and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity

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of the shipping containers and the spacing between trailers carrying the Contact-Handled or Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Container inspections will be included as part of the surface TRU mixed waste handling areas (i.e. Parking Area Unit and WHB Unit) inspections described in Tables E-1 and E-1a. These inspections will also include the Derived Waste Storage Areas of the WHB Unit. The Derived Waste Storage Areas will consist of containers of 55 or 85-gallon drums or SWBs for CH TRU mixed waste and 55-gallon drums for RH TRU mixed waste. A Satellite accumulation area (**SAA**) may be required in an area adjacent to the TRUDOCKs for CH TRU mixed waste. A SAA may also be required in the RH Bay and Hot Cell for RH TRU mixed waste. These SAAs will be set up on an as needed basis at or near the point of generation and the derived waste will be discarded into the active derived waste container. All SAAs will be inspected in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34).

E-1b(2) Miscellaneous Unit Inspection

20.4.1.500 NMAC (incorporating 40 CFR §264.602), requires that inspections required in 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33), as well as any additional requirements needed to protect human health and the environment, be met. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33) are discussed in Section E-1 of this Permit Attachment, along with how the WIPP facility complies with those requirements for standard types of inspections. Inspection frequencies for geomechanical monitoring equipment are provided in Table E-1. The monitoring schedule for geomechanical instrumentation is given in Table E-2.

References

DOE, 1999. "WIPP Safety Analysis Report," DOE/WIPP-95-2065. Rev. 4, U.S. Department of Energy. Washington, D.C.

DOE, 2000. "WIPP Remote-Handled Waste Preliminary Safety Analysis" (RH PSAR), U.S. Department of Energy. Washington, D.C.

FIGURES

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TYPICAL EQUIPMENT
WEEKLY CHECK LIST

_√_ OK _X_ Adjustment Made _O_ Repairs Required

AR Written [ ] Yes [ ] No AR # _____

(check or complete appropriate information)

ITEM INSPECTED	Condition	Comments/Corrective Action
Mechanical Checks: (examples)		
Oil level		
Radiator fluid level		
Automatic transmission fluid level		
Operate all valves/check gauges		
Emergency brake		
Fuel level (> ¾ full)		
Oil pressure (at warm idle)		
Tire Pressure		
Sirens, horn, & back-up alarm		
Deterioration Checks: (examples)		
Fan belts		
Battery (terminals, cables)		
Run generator 5 min.		
Hose, nozzles & valves		
Leaks/Spills Checks: (examples)		
Leaks around pump		
Foam tank level		
Required Equipment: (examples)		
Inspect SCBAs (> 4050 psi)		
Hand tools & equipment		
Trauma Kit		

Inspected by: _____
Print Name Signature Time/Date

Inspected by: _____
Print Name Signature Time/Date

Reviewed by: _____
Print Name Signature Time/Date

Comments: _____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-1
Typical Inspection Checklist

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HOUR METER READING _____ EQUIPMENT NO. _____

DEFICIENCIES NOTED: _____

_____

_____

_____

_____

PRE OPS COMPLETED PER {Procedure Number} SAT _____ **PROBLEMS NOTED** _____

CORRECTIVE ACTIONS TAKEN: _____

_____

_____

_____

_____

_____

_____

OPERATOR SIGNATURE	**DATE**	**TIME**	**SUPERVISOR SIGNATURE/DATE**
_____	_____	_____	_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-2
Typical Logbook Entry

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TABLES

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Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	12-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[j]	Emergency Services	Monthly See List 11	12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[l] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030 and 12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

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Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
Senior Mining Technician *
Continuous Mining Specialist *
Senior Mining Specialist *
Mine OPS Supervisor *
b. Waste Hoist Operator
Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
Shaft Technician *
d. Operations Engineer
Supervisor U/G Services*
Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
Senior Safety Technician *
Safety Specialist *
Safety Engineer *
Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

Table E-1a
RH TRU Mixed Waste Inspection Schedule/Procedures

System/ Equipment Name	Responsible Organization [J]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration[b]	Leaks/ spills	Other
Cask Transfer Car(s)	Waste Operations	Pre-evolution [c,d,e] See List 1	WP05-WH1701 PM041187 (Semi-Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
RH Bay Overhead Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041232 (Quarterly) PM041117 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041201 (Annual) PM041203 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical PM.
RH Bay Cask Lifting Yoke	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041169 (Annual)	Yes	NA	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask Transfer Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1704 PM041186 (Quarterly) PM041195 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Cask Rotating Device	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1713 PM041175 (Annual) PM041176 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Grapple	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041172 (Quarterly) PM041177 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear. Non-Destructive Examination
6.25-Ton Grapple Hoist	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1721 PM041173 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Transfer Cell Shuttle Car	Waste Operations	Pre-evolution [c,d,e,i] See List 1	WP05-WH1705 PM041184 (Semi-Annual) PM041222 (Annual)	Yes	Yes	Pre-evolution Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection.

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System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Unloading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell	Waste Operations	Preoperational [c,d,e,f,g,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell Overhead Powered Manipulator	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1743 PM041215 (Annual) PM041216 (Annual) IC411037 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration
Hot Cell Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1742 PM041217 (Annual) PM041209 (Annual) IC411038 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.
Transfer Cell	Waste Operations	Preoperational [c,d,e,i,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Facility Cask Loading Room	Waste Operations	Preoperational [c,d,e,i,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Closed Circuit Television Camera	Waste Operations	Preoperational [c,i] See List 1	WP05-WH1757	NA	NA	Operability
Radiation Monitoring Equipment	Radiation Control	Preoperational [c,d,e] See List 2	WP12-HP1245 IC240010 WP12-HP1307 IC240007 WP12-HP1314 (Annual)	Yes	NA	Operability Checks, Functional Checks, Instrument calibrations, Flow Calibration, Efficiency Checks.
Cask Unloading Room Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1719 PM041190 (Quarterly) PM041191 (Annual) PM041192 (Annual) IC411035 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration[b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,l] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,l] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,l] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [f] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer
Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts, and concrete walls.

[b] Deterioration includes: visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Pre-evolution" signifies that inspections are required prior to equipment use in the waste handling process. (An evolution is considered to be from the receipt of a cask into the RH Bay through canister emplacement in the underground.) For an area, preoperational inspection includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that functional components and emergency equipment are present and operational. When the equipment is not in use, no inspections are required.

[d] When equipment needs to be inspected while handling waste (i.e., during waste unloading or transfer operations), general cleanliness and functional components will be inspected to detect any problem that may harm human health or the environment. The inspection will verify that emergency equipment is present.

[e] Inspection of RH TRU mixed waste equipment and areas in the RH Complex applies only after RH TRU mixed waste receipt begins.

[f] The inspection/maintenance activities associated with these pieces of equipment are performed when the RH Complex is empty of RH TRU mixed waste. If contamination is present, a radiation work permit may be needed.

[g] For the Hot Cell and Transfer Cell, if RH TRU mixed waste is present, camera inspections will be performed in lieu of physical inspection.

[h] The integrity of the floor coating will be inspected weekly if RH TRU mixed waste is present.

[i] "Preoperational" signifies that inspections are required prior to the first use in a calendar day.

[j] Responsible organizations refers to the organization that owns the equipment. Preventive Maintenance (PM) procedures are conducted by either mine maintenance or surface operations maintenance personnel and Instrument Calibration (IC) procedures are conducted by instrument and calibration maintenance personnel.

[k] Inspection will be performed after 250 evolutions (actual and training emplacements), if such usage occurs prior to the semi-annual inspection.

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Table E-2
Monitoring Schedule

System/Equipment Name	Responsible Organization	Monitoring Frequency	Purpose
Geomechanical [b]	Geotechnical Engineering	Monthly	To evaluate the geotechnical performance of the underground facility and to detect ground conditions that could affect operational safety
Central Monitoring System	Facility Operations	System Dependent	Monitor and provide status for the following facility parameters: Electrical Power Status [d] Fire Alarm System [e] Ventilation System Status [f] Meteorological Data System [g] Facility Systems (compressors [g], pumps [h], water tank levels [i], waste hoists [j])

[b] Equipment is listed as Underground-Geomechanical Instrumentation System (GIS) in Table E-1.
[d] Equipment listed as Backup Power Supply Diesel Generator in Table E-1.
[e] Equipment listed as Fire Detection and Alarm System in Table E-1.
[f] Equipment listed as Ventilation Exhaust in Table E-1.
[g] Not RCRA equipment.
[h] Equipment listed as Fire Pumps in Table E-1.
[i] Equipment listed as Water Tank Level in Table E-1.
[j] Equipment listed as Waste Hoist in Table E-1.

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Field Code Changed

ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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Table G3-3	Radiological Surveys During RH TRU Mixed Waste Processing

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

G3-1 Purpose

Within the Resource Conservation and Recovery Act (**RCRA**) Permit for the Waste Isolation Pilot Plant (**WIPP**), radiological monitoring is used to determine whether a potential release of hazardous constituents has occurred. This method is used in addition to the visual examinations and container inspections mandated by the RCRA.

G3-2 Definition

This Permit Attachment describes procedures for performing radiological surveys to indicate the potential for hazardous waste releases from containers by virtue of detection of a radioactive constituent release. These procedures assume the potential co-release of hazardous and radioactive materials and applies to all releases except the release of volatile organic compounds (**VOC**) from transuranic (**TRU**) mixed waste containers. Radiological surveys are used to indicate the potential presence or absence of hazardous waste constituents based on the presence or absence of radioactivity. Radiological surveys do not provide any assessment with regard to concentration, since these surveys do not actually detect hazardous waste constituents.

G3-3 Discussion

Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of non-VOC hazardous waste constituents through the use of surface sampling (swipes) and radioactivity counting. This approach depends on the nature of the hazardous waste portion of the TRU mixed waste, the nature of the TRU mixed waste, and the nature of the spills. The sections below discuss each of these factors.

G3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste

Based on the waste codes listed in the Part A (Permit Attachment B) and discussed in the WIPP Waste Analysis Plan (Permit Attachment C), the hazardous waste constituents in WIPP TRU mixed waste consist mainly of EPA F-coded solvents and metals that exhibit the toxicity characteristic. The TRU mixed wastes that are to be shipped to the WIPP facility for disposal have been placed into waste categories based on their physical and chemical properties. Waste category information is summarized in Table G3-1 with emphasis on the process that generated the waste. The waste generating processes can be described in five general categories:

1. Wastes (such as combustible waste) that result from cleaning and decontamination activities in which items such as towels and rags become contaminated simultaneously with hazardous constituents and radioactivity. In these cases, the hazardous constituent and the radioactive constituent are intimately mixed, both on the rag or towel used for cleaning and as residuals on the surface of the object being cleaned. These waste forms are not homogeneous in nature; however, they are generated in a

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fashion that ensures that the hazardous and radioactive contaminants coexist throughout the waste matrix.

2. Wastes generated when materials that contain metals that are believed to exhibit the toxicity characteristic become contaminated with radioactivity as the result of plutonium operations (leaded rubber, some glass, and metal waste are typical examples). These materials may also become contaminated with solvents during decontamination or plutonium recovery activities.

3. A class of processes where objects that are not metals are used in plutonium processes and become contaminated with radioactivity. They are subsequently cleaned with solvents to recover plutonium. Surfaces of these objects (such as graphite, filters, and glass) are contaminated with both radioactive constituents and hazardous constituents.

4. Waste generating processes involving foundry operations where impurities are removed from plutonium. These impurities may result in the deposition of toxicity characteristic metals on the surfaces of objects, such as firebrick, ceramic crucibles, pyrochemical salts, and graphite, which are contaminated with residual quantities of radioactivity.

5. In all of the process waste categories in the second half of the attached table, the hazardous constituent and the radioactivity are physically mixed together as a result of the treatment process. In these wastes, the release of any portion of the waste matrix will involve both the hazardous waste and the radioactive waste components, because the treatment process generates a relatively homogeneous waste form.

Some waste forms only contain radioactive contamination on the surface, because they are not the result of a treatment process or are not porous in form. These include glass, leaded rubber, metals, graphite, ceramics, firebricks, and plastics. In theory, a hazardous waste release could occur if the interiors of these materials became exposed and were involved in a release or spill. Such an occurrence is not likely during operations, because no activities are planned or anticipated that would result in the breaking of these materials to expose fresh surfaces.

Based on the information in the attached table and the discussion above, hazardous constituent releases could potentially occur in only one of two forms: 1) VOC and 2) particulate resulting from the catastrophic failure of a container. Mechanisms that can initiate releases in these forms are discussed subsequently. Regardless of how the release occurs, the nature of the waste and the processes that generated it is such that the radioactive and hazardous components are intimately mixed. A release of one without the other is not likely, except for releases of VOCs from containers.

G3-3b Nature of the TRU Mixed Waste

TRU mixed waste is defined as transuranic waste which is also a hazardous waste. The processes responsible for the radioactivity in the waste are, for the most part, the same processes responsible for making it a hazardous waste. Therefore, the TRU mixed waste forms are described in terms of both classes of waste (radioactive and hazardous). The Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Permit Part 2 places limits on the waste that can be shipped to the WIPP facility based on the

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characteristics of the waste form. According to the TSDF-WAC, certain waste forms with specific characteristics are not allowed at the WIPP facility. Waste with liquid in excess of the TSDF-WAC limits is one waste form that is not allowed. Other limitations include, but are not limited to, a prohibition on pyrophoric materials, corrosive materials, ignitable waste, and compressed gases. Furthermore, TRU waste must contain 100 nanocuries or more of transuranic elements per gram of waste, which means that the radioactive component of the waste will always be present within the waste in significant concentrations. The TSDF-WAC limitations and restrictions are provided to ensure that any waste form received at the WIPP facility is stable and can be managed safely.

One benefit of waste form restrictions, such as no liquid in excess of the TSDF-WAC limits, is that they limit the kinds of releases that could occur to those that would be readily detectable through visual inspection (i.e., large objects that fall out of ruptured containers) or through the use of radiation monitoring either locally or within the adjacent area to detect materials that have escaped from containers.

G3-3c Nature of the Releases

The WIPP facility will handle only sealed containers of waste and derived waste. The practice of handling sealed containers minimizes the opportunity for releases or spills. For the purposes of safety analysis (DOE 1997), it was assumed that releases and spills during operations occur by either of two mechanisms: 1) surface contamination and 2) accidents.

Surface contamination is documented in the WIPP Safety Analysis Report (**SAR**) (DOE 1997) to be the only credible source of contamination external to the containers during normal operations. Surface contamination is assumed to be caused by waste management activities at the generator site that result in the contamination of the outside of a waste container. Contamination would most likely be particulates (dirt or dust) that would be deposited during generator-site handling/loading activities. This contamination may not be detected by visible inspections. Surface contamination is monitored upon arrival at the WIPP facility through the use of swipes and radiation monitoring equipment, as specified in WIPP Procedure WP 12-HP1100, "Radiological Surveys" (DOE, 1995). WP 12-HP1100 is a technical procedure that provides specific methods and guidance for performing surface contamination and dose rate surveys of items, equipment, and areas, but does not cover the monitoring of personnel. Detection using radioactivity is very sensitive and allows for the detection of contamination that may not be visible on the surface of the container. This exceeds the capability required by the RCRA, which is generally limited to inspections that detect only visible evidence of spills or leaks. RCRA-required inspections are specified in Permit Part 3.

Releases due to accidents are modeled in the WIPP SAR. Significant accidents within the waste handling process are assumed to result in the release of radioactive contaminants and VOCs. Radioactive releases are detectable using surface-sampling (swipe) techniques.

G3-4 Application of Radiological Surveys

Radiological surveys apply to many situations calling for sampling or monitoring to indicate the potential for nonvolatile releases. This includes initial sampling for surface radiological contamination upon receipt, sampling for contamination during waste handling activities, sampling for contamination during decommissioning, sampling for contamination during packaging for off-site shipment, and sampling to demonstrate the effectiveness of

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decontamination activities that follow a release or spill and retrieval. Radiation monitoring and sampling are mandated by DOE Orders and provide an immediate indication of a release or spill, even when they are not visibly detectable. A release or spill involving hazardous constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components, as described in Table G3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

G3-4b TRU Mixed Waste Releases

The RCRA Contingency Plan (Permit Attachment D) specifies actions required by the Permittees in the event of spills or leaking or punctured containers of CH and RH TRU mixed waste. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm the removal of hazardous waste constituents.

G3-4c Decontamination Activities at Closure

The Closure Plan (Permit Attachment G, Section G-1e(2)) specifies decontamination activities required by the Permittees at closure. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm removal of hazardous waste constituents.

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TABLES

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Table G3-1
Summary of Waste Generation Processes and Waste Forms

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Combustibles	F001, F002, F003, D008, D019	Cloth and paper wipes are used to clean parts and wash down gloveboxes. Wood and plastic parts are removed from gloveboxes after they are cleaned. Lead may occur as shielding tape or as minor noncombustible waste in this category.	Materials such as metals may retain traces of organics left on surfaces that were cleaned. Waste may remain on the cloth and paper that was used for cleaning or for wiping up spills.
Graphite		Graphite molds, which may contain impurities of metals, are scraped and cleaned with solvents to remove the recoverable plutonium.	Surfaces may retain residual solvents. Lead may be used as shielding or may be an impurity in the graphite.
Filters	F001, F002	Filters are used to capture radioactive particulate in air streams associated with numerous plutonium operations and to filter particulate from aqueous streams.	Filter media may retain organic solvents that were present in the air or liquid streams.
Benelex® and Plexiglas®	F001, F002, D008	Materials are used in gloveboxes as neutron absorbers. The glovebox assembly often includes leaded glass. All surfaces may be wiped down with solvents to remove residual plutonium.	Surfaces may retain residual solvents from wiping operations. Leaded glass may also be present.
Firebrick and Ceramic Crucibles	F001, F002, F005, D006, D007, D008	Firebrick is used to line plutonium processing furnaces. Ceramic crucibles are used in plutonium analytical laboratories. Both may contain metals as surface contaminants.	Metals deposited during plutonium refining or analytical operations could remain as residuals on surfaces. Surfaces may retain residual solvents.
Leaded Rubber	D008	Leaded rubber includes lead oxide impregnated materials such as gloves and aprons.	The leaded rubber could potentially exhibit the toxicity characteristic.
Metal	F001, F002, D008	Metals range from large pieces removed from equipment and structures to nuts, bolts, wire, and small parts. Many times, metal parts will be cleaned with solvents to remove residual plutonium.	Solvents may exist on the surfaces of metal parts. The metals themselves potentially exhibit the toxicity characteristic.
Glass	F001, F002, D006, D007, D008, D009	Glass includes Raschig rings removed from processing tanks, leaded glass removed from gloveboxes, and miscellaneous laboratory glassware.	Solvents may exist as residuals on glass surfaces and in empty containers. The leader glass may exhibit the toxicity characteristic.
Inorganic Wastewater Treatment Sludge	F001-F003, D006-D009, P015	Sludge is vacuum filtered and stabilized with cement or other appropriate sorbent prior to packaging.	Traces of solvents and heavy metals may be contained in the treated sludge which is in the form of a solid dry monolith, highly viscous gel-like material, or dry crumbly solid.

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Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Organic Liquid and Sludge	F001, F003	Organic liquids such as oils, solvents, and lathe coolants are immobilized through the use of various solidification agents or sorbent materials.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Solidified Liquid	F001, F003, D006, D008	Liquids that are not compatible with the primary treatment processes and have to be batched. Typically these liquids are solidified with portland or magnesium cement.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Inorganic Process Solids and Soil	F001, F002, F003, D008	Solids that cannot be reprocessed or process residues from tanks, firebrick fines, ash, grit, salts, metal oxides, and filter sludge. Typically solidified with portland or gypsum-based cements.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Pyrochemical Salts	D007	Molten salt is used to purify plutonium and americium. After the radioactive metals are removed, the salt is discarded.	Residual metals may exist in the salt depending on impurities in the feedstock.
Cation and Anion Exchange Resins	D008	Plutonium is sorbed on resins and is eluted and precipitated.	Feed solutions may contain traces of solvents or metals depending on the preceding process.

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Table G3-2
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-II/HalfPACT)

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Contact Handled Package Outer Containment Assembly (**OCA**) lid interior and top of Inner Containment Vessel (**ICV**) lid	X		X
Contact Handled Package quick connect and vent port	X		
As ICV lid is raised		X	
ICV lid interior and top of payload	X		X
Payload assembly, guide tubes, standard waste box (**SWB**) connecting devices	X		
As payload assembly is raised, including bottom of payload		X	
After placement of payload on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under a Radiation Work Permit (**RWP**). The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-2a
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-III)

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Exterior of TRUPACT-III on arrival at WIPP	X	X	
Interior of Overpack Cover and exterior of Containment Lid	X	X	X
TRUPACT-III Vent Port Tool Assembly quick connect	X		
Interior of Containment Lid and front of SLB2	X	X	X
As SLB2 is removed from TRUPACT-III		X	
After placement of SLB2 on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under an RWP. The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-3
Radiological Surveys During RH TRU Mixed Waste Processing

Step in RH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey
Exterior of cask on arrival at WIPP	X	X
During removal of impact limiters on RH-TRU 72-B cask	X	X
During removal of outer lid closure from RH-TRU 72-B cask	X	X
During removal of inner lid closure from RH-TRU 72-B cask	X	
During removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of the CNS 10-160B cask from the lower impact limiter	X	X
After transfer of the CNS 10-160B cask lid into the Hot Cell	X	
During transfer of waste drum carriages into the Hot Cell	X	
During transfer of waste into the facility canister in the Hot Cell	X	
During transfer of the waste canister from the RH-TRU 72-B cask to the facility cask	X	
Interior of shipping cask inside the RH Bay after unloading of waste canister or drums	X	
Exterior of shield plug subsequent to final canister emplacement		X
Interior of facility cask after completion of waste emplacement	X	

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Field Code Changed

ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

G3-1 Purpose

Within the Resource Conservation and Recovery Act (**RCRA**) Permit for the Waste Isolation Pilot Plant (**WIPP**), radiological monitoring is used to determine whether a potential release of hazardous constituents has occurred. This method is used in addition to the visual examinations and container inspections mandated by the RCRA.

G3-2 Definition

This Permit Attachment describes procedures for performing radiological surveys to indicate the potential for hazardous waste releases from containers by virtue of detection of a radioactive constituent release. These procedures assume the potential co-release of hazardous and radioactive materials and applies to all releases except the release of volatile organic compounds (**VOC**) from transuranic (**TRU**) mixed waste containers. Radiological surveys are used to indicate the potential presence or absence of hazardous waste constituents based on the presence or absence of radioactivity. Radiological surveys do not provide any assessment with regard to concentration, since these surveys do not actually detect hazardous waste constituents.

G3-3 Discussion

Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of non-VOC hazardous waste constituents through the use of surface sampling (swipes) and radioactivity counting. This approach depends on the nature of the hazardous waste portion of the TRU mixed waste, the nature of the TRU mixed waste, and the nature of the spills. The sections below discuss each of these factors.

G3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste

Based on the waste codes listed in the Part A (Permit Attachment B) and discussed in the WIPP Waste Analysis Plan (Permit Attachment C), the hazardous waste constituents in WIPP TRU mixed waste consist mainly of EPA F-coded solvents and metals that exhibit the toxicity characteristic. The TRU mixed wastes that are to be shipped to the WIPP facility for disposal have been placed into waste categories based on their physical and chemical properties. Waste category information is summarized in Table G3-1 with emphasis on the process that generated the waste. The waste generating processes can be described in five general categories:

1. Wastes (such as combustible waste) that result from cleaning and decontamination activities in which items such as towels and rags become contaminated simultaneously with hazardous constituents and radioactivity. In these cases, the hazardous constituent and the radioactive constituent are intimately mixed, both on the rag or towel used for cleaning and as residuals on the surface of the object being cleaned. These waste forms are not homogeneous in nature; however, they are generated in a

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fashion that ensures that the hazardous and radioactive contaminants coexist throughout the waste matrix.

2. Wastes generated when materials that contain metals that are believed to exhibit the toxicity characteristic become contaminated with radioactivity as the result of plutonium operations (leaded rubber, some glass, and metal waste are typical examples). These materials may also become contaminated with solvents during decontamination or plutonium recovery activities.

3. A class of processes where objects that are not metals are used in plutonium processes and become contaminated with radioactivity. They are subsequently cleaned with solvents to recover plutonium. Surfaces of these objects (such as graphite, filters, and glass) are contaminated with both radioactive constituents and hazardous constituents.

4. Waste generating processes involving foundry operations where impurities are removed from plutonium. These impurities may result in the deposition of toxicity characteristic metals on the surfaces of objects, such as firebrick, ceramic crucibles, pyrochemical salts, and graphite, which are contaminated with residual quantities of radioactivity.

5. In all of the process waste categories in the second half of the attached table, the hazardous constituent and the radioactivity are physically mixed together as a result of the treatment process. In these wastes, the release of any portion of the waste matrix will involve both the hazardous waste and the radioactive waste components, because the treatment process generates a relatively homogeneous waste form.

Some waste forms only contain radioactive contamination on the surface, because they are not the result of a treatment process or are not porous in form. These include glass, leaded rubber, metals, graphite, ceramics, firebricks, and plastics. In theory, a hazardous waste release could occur if the interiors of these materials became exposed and were involved in a release or spill. Such an occurrence is not likely during operations, because no activities are planned or anticipated that would result in the breaking of these materials to expose fresh surfaces.

Based on the information in the attached table and the discussion above, hazardous constituent releases could potentially occur in only one of two forms: 1) VOC and 2) particulate resulting from the catastrophic failure of a container. Mechanisms that can initiate releases in these forms are discussed subsequently. Regardless of how the release occurs, the nature of the waste and the processes that generated it is such that the radioactive and hazardous components are intimately mixed. A release of one without the other is not likely, except for releases of VOCs from containers.

G3-3b Nature of the TRU Mixed Waste

TRU mixed waste is defined as transuranic waste which is also a hazardous waste. The processes responsible for the radioactivity in the waste are, for the most part, the same processes responsible for making it a hazardous waste. Therefore, the TRU mixed waste forms are described in terms of both classes of waste (radioactive and hazardous). The Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Permit Part 2 places limits on the waste that can be shipped to the WIPP facility based on the

characteristics of the waste form. According to the TSDF-WAC, certain waste forms with specific characteristics are not allowed at the WIPP facility. Waste with liquid in excess of the TSDF-WAC limits is one waste form that is not allowed. Other limitations include, but are not limited to, a prohibition on pyrophoric materials, corrosive materials, ignitable waste, and compressed gases. Furthermore, TRU waste must contain 100 nanocuries or more of transuranic elements per gram of waste, which means that the radioactive component of the waste will always be present within the waste in significant concentrations. The TSDF-WAC limitations and restrictions are provided to ensure that any waste form received at the WIPP facility is stable and can be managed safely.

One benefit of waste form restrictions, such as no liquid in excess of the TSDF-WAC limits, is that they limit the kinds of releases that could occur to those that would be readily detectable through visual inspection (i.e., large objects that fall out of ruptured containers) or through the use of radiation monitoring either locally or within the adjacent area to detect materials that have escaped from containers.

G3-3c Nature of the Releases

The WIPP facility will handle only sealed containers of waste and derived waste. The practice of handling sealed containers minimizes the opportunity for releases or spills. For the purposes of safety analysis (DOE 1997), it was assumed that releases and spills during operations occur by either of two mechanisms: 1) surface contamination and 2) accidents.

Surface contamination is documented in the WIPP Safety Analysis Report (**SAR**) (DOE 1997) to be the only credible source of contamination external to the containers during normal operations. Surface contamination is assumed to be caused by waste management activities at the generator site that result in the contamination of the outside of a waste container. Contamination would most likely be particulates (dirt or dust) that would be deposited during generator-site handling/loading activities. This contamination may not be detected by visible inspections. Surface contamination is monitored upon arrival at the WIPP facility through the use of swipes and radiation monitoring equipment, as specified in WIPP Procedure WP 12-HP1100, "Radiological Surveys" (DOE, 1995). WP 12-HP1100 is a technical procedure that provides specific methods and guidance for performing surface contamination and dose rate surveys of items, equipment, and areas, but does not cover the monitoring of personnel. Detection using radioactivity is very sensitive and allows for the detection of contamination that may not be visible on the surface of the container. This exceeds the capability required by the RCRA, which is generally limited to inspections that detect only visible evidence of spills or leaks. RCRA-required inspections are specified in Permit Part 3.

Releases due to accidents are modeled in the WIPP SAR. Significant accidents within the waste handling process are assumed to result in the release of radioactive contaminants and VOCs. Radioactive releases are detectable using surface-sampling (swipe) techniques.

G3-4 Application of Radiological Surveys

Radiological surveys apply to many situations calling for sampling or monitoring to indicate the potential for nonvolatile releases. This includes initial sampling for surface radiological contamination upon receipt, sampling for contamination during waste handling activities, sampling for contamination during decommissioning, sampling for contamination during packaging for off-site shipment, and sampling to demonstrate the effectiveness of

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decontamination activities that follow a release or spill and retrieval. Radiation monitoring and sampling are mandated by DOE Orders and provide an immediate indication of a release or spill, even when they are not visibly detectable. A release or spill involving hazardous constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components, as described in Table G3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

G3-4b TRU Mixed Waste Releases

The RCRA Contingency Plan (Permit Attachment D) specifies actions required by the Permittees in the event of spills or leaking or punctured containers of CH and RH TRU mixed waste. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm the removal of hazardous waste constituents.

G3-4c Decontamination Activities at Closure

The Closure Plan (Permit Attachment G, Section G-1e(2)) specifies decontamination activities required by the Permittees at closure. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm removal of hazardous waste constituents.

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TABLES

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Table G3-1
Summary of Waste Generation Processes and Waste Forms

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Combustibles	F001, F002, F003, D008, D019	Cloth and paper wipes are used to clean parts and wash down gloveboxes. Wood and plastic parts are removed from gloveboxes after they are cleaned. Lead may occur as shielding tape or as minor noncombustible waste in this category.	Materials such as metals may retain traces of organics left on surfaces that were cleaned. Waste may remain on the cloth and paper that was used for cleaning or for wiping up spills.
Graphite		Graphite molds, which may contain impurities of metals, are scraped and cleaned with solvents to remove the recoverable plutonium.	Surfaces may retain residual solvents. Lead may be used as shielding or may be an impurity in the graphite.
Filters	F001, F002	Filters are used to capture radioactive particulate in air streams associated with numerous plutonium operations and to filter particulate from aqueous streams.	Filter media may retain organic solvents that were present in the air or liquid streams.
Benelex® and Plexiglas®	F001, F002, D008	Materials are used in gloveboxes as neutron absorbers. The glovebox assembly often includes leaded glass. All surfaces may be wiped down with solvents to remove residual plutonium.	Surfaces may retain residual solvents from wiping operations. Leaded glass may also be present.
Firebrick and Ceramic Crucibles	F001, F002, F005, D006, D007, D008	Firebrick is used to line plutonium processing furnaces. Ceramic crucibles are used in plutonium analytical laboratories. Both may contain metals as surface contaminants.	Metals deposited during plutonium refining or analytical operations could remain as residuals on surfaces. Surfaces may retain residual solvents.
Leaded Rubber	D008	Leaded rubber includes lead oxide impregnated materials such as gloves and aprons.	The leaded rubber could potentially exhibit the toxicity characteristic.
Metal	F001, F002, D008	Metals range from large pieces removed from equipment and structures to nuts, bolts, wire, and small parts. Many times, metal parts will be cleaned with solvents to remove residual plutonium.	Solvents may exist on the surfaces of metal parts. The metals themselves potentially exhibit the toxicity characteristic.
Glass	F001, F002, D006, D007, D008, D009	Glass includes Raschig rings removed from processing tanks, leaded glass removed from gloveboxes, and miscellaneous laboratory glassware.	Solvents may exist as residuals on glass surfaces and in empty containers. The leader glass may exhibit the toxicity characteristic.
Inorganic Wastewater Treatment Sludge	F001-F003, D006-D009, P015	Sludge is vacuum filtered and stabilized with cement or other appropriate sorbent prior to packaging.	Traces of solvents and heavy metals may be contained in the treated sludge which is in the form of a solid dry monolith, highly viscous gel-like material, or dry crumbly solid.

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Organic Liquid and Sludge	F001, F003	Organic liquids such as oils, solvents, and lathe coolants are immobilized through the use of various solidification agents or sorbent materials.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Solidified Liquid	F001, F003, D006, D008	Liquids that are not compatible with the primary treatment processes and have to be batched. Typically these liquids are solidified with portland or magnesium cement.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Inorganic Process Solids and Soil	F001, F002, F003, D008	Solids that cannot be reprocessed or process residues from tanks, firebrick fines, ash, grit, salts, metal oxides, and filter sludge. Typically solidified with portland or gypsum-based cements.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Pyrochemical Salts	D007	Molten salt is used to purify plutonium and americium. After the radioactive metals are removed, the salt is discarded.	Residual metals may exist in the salt depending on impurities in the feedstock.
Cation and Anion Exchange Resins	D008	Plutonium is sorbed on resins and is eluted and precipitated.	Feed solutions may contain traces of solvents or metals depending on the preceding process.

Table G3-2
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-II/HalfPACT)

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Contact Handled Package Outer Containment Assembly (**OCA**) lid interior and top of Inner Containment Vessel (**ICV**) lid	X		X
Contact Handled Package quick connect and vent port	X		
As ICV lid is raised		X	
ICV lid interior and top of payload	X		X
Payload assembly, guide tubes, standard waste box (**SWB**) connecting devices	X		
As payload assembly is raised, including bottom of payload		X	
After placement of payload on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under a Radiation Work Permit (**RWP**). The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-2a
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-III)

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Exterior of TRUPACT-III on arrival at WIPP	X	X	
Interior of Overpack Cover and exterior of Containment Lid	X	X	X
TRUPACT-III Vent Port Tool Assembly quick connect	X		
Interior of Containment Lid and front of SLB2	X	X	X
As SLB2 is removed from TRUPACT-III		X	
After placement of SLB2 on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under an RWP. The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-3
Radiological Surveys During RH TRU Mixed Waste Processing

Step in RH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey
Exterior of cask on arrival at WIPP	X	X
During removal of impact limiters on RH-TRU 72-B cask	X	X
During removal of outer lid closure from RH-TRU 72-B cask	X	X
During removal of inner lid closure from RH-TRU 72-B cask	X	
During removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of the CNS 10-160B cask from the lower impact limiter	X	X
After transfer of the CNS 10-160B cask lid into the Hot Cell	X	
During transfer of waste drum carriages into the Hot Cell	X	
During transfer of waste into the facility canister in the Hot Cell	X	
During transfer of the waste canister from the RH-TRU 72-B cask to the facility cask	X	
Interior of shipping cask inside the RH Bay after unloading of waste canister or drums	X	
Exterior of shield plug subsequent to final canister emplacement		X
Interior of facility cask after completion of waste emplacement	X	

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Field Code Changed

ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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Figure H1-4	Perimeter Fenceline and Roadway

ACRONYMS

CH	contact-handled
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LWA	Land Withdrawal Act
SWB	standard waste box
TRU	transuranic
WIPP	Waste Isolation Pilot Plant

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

Introduction

Under the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b), the following activities identified as active institutional controls during post-closure are incorporated into the Post-Closure Plan.

The post-closure requirements of this permit include 20.4.1.500 NMAC, incorporating:

- 40 CFR §264.117(a)(1), which requires that

  "Post-closure care for each hazardous waste management unit subject to the requirements of §264.117 through 264.120 must begin after completion of closure of the unit and continue for 30 years after that date..."

- 40 CFR §264.601, which requires that

  "A miscellaneous unit must be...maintained and closed in a manner that will ensure protection of human health and the environment..."

- and 40 CFR §264.603, which requires that

  "A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period."

The containment requirements for a disposal system for transuranic (**TRU**) radioactive wastes are defined in Title 40 CFR §191.13 (U.S. Environmental Protection Agency [**EPA**] 1993). 40 CFR §191.14 is titled Assurance Requirements. With regard to the active institutional controls aspect of Assurance Requirements, 40 CFR §191.14 states the following:

> "To provide the confidence needed for long-term compliance with the requirements of §191.13, disposal of spent fuel or high-level or transuranic wastes shall be conducted in accordance with the following provisions... (a) Active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contribution from active institutional controls for more than 100 years after disposal... "

40 CFR §191.12 states the following:

> "Active institutional controls mean:
> 1) controlling access to a disposal site by any means other than passive institutional controls,
> 2) performing maintenance operations or remedial actions at a site,
> 3) controlling or cleaning up releases from a site, or
> 4) monitoring parameters related to disposal system performance."

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Purpose: This Permit Attachment describes the design of a system that the Permittees will implement for compliance with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b)) and 40 CFR §191.14(a) to control access to the Waste Isolation Pilot Plant (**WIPP**) disposal site and implement maintenance and remedial actions pertaining to the site access controls. In addition, this Permit Attachment addresses the scheduling process for control of inspection, maintenance, and periodic reporting related to long-term monitoring. Long-term monitoring addresses the monitoring of disposal system performance, as required by 40 CFR §191.14(b), and environmental monitoring, in accordance with this Permit and the Consultation and Cooperation Agreement between the U.S. Department of Energy (**DOE**) and the state of New Mexico. The scheduling process will also address evaluation of testing activities related to the permanent marker system design contained within the passive institutional controls (not required by this permit).

Implementation of active institutional controls at the WIPP will commence when final facility closure is achieved, as specified in Permit Part 6 and Permit Attachment G. Implementation of active institutional controls marks the transition from the active life of the facility (which ends upon certification of closure) to the post-closure care period, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart G). The Permittees will continue the imposition of active institutional controls under this Permit until NMED approves the post-closure certification specified in Permit Part 7 and Permit Attachment H.

Decommissioning activities include decontamination and site restoration. The decontamination effort will be completed prior to sealing of the shafts to allow disposal of all derived waste (radioactive and/or mixed waste derived from TRU/TRU-mixed waste received at the WIPP) into the repository. The implementation of active institutional controls upon certification of facility closure will prevent human intrusion into the repository. The Permittees' restoration efforts will return the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Necessary exceptions to returning the site to its full pre-WIPP condition include measurements associated with long-term monitoring.

Scope: The active institutional control requirements include a means of controlling access to the site of the repository's surface footprint (the repository area projected to the surface) and maintenance, including corrective actions, for access control system components. Active control of access to the site will be exercised by the Permittees for the duration of the post-closure care period. Although the Permittees are only required to maintain active institutional controls until approval of the post-closure certification by NMED, the Permittees will continue active institutional controls for at least 100 years after final facility closure to satisfy other regulatory requirements. Control of access will prevent intrusion into the disposed waste by deep drilling or mining for natural resources. This Permit Attachment also specifies a process for scheduling activities related to the long-term monitoring of the repository. Some of the activities supporting the monitoring programs will be initiated during the active life of the facility to establish databases. These activities are planned to continue beyond closure through the time after removal of the site structures and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Long-term monitoring requirements will be necessarily integrated with efforts toward returning the land to a stable ecological state.

Background: The WIPP was sited and designed as a research and development facility to demonstrate the safe disposal of radioactive wastes. The wastes are derived from DOE defense-related activities. Specifically, the mission of the WIPP project is to conduct research,

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H1.1.4 Control and Clean-up of Releases

The decontamination process and disposal of the derived waste will be completed prior to sealing the shafts and final facility closure. With the location of the WIPP repository at 2,150 feet (655 meters) below the surface and with panels closed and shafts sealed, the potential for releases of radioactive material or hazardous constituents following the sealing of the shafts is precluded. There will be no credible pathway for releases from the repository other than human intrusion. Routine patrols in accordance with access control requirements will preclude human intrusion into the repository during the post-closure period.

H1.1.5 Groundwater Monitoring

Groundwater monitoring is the only monitoring program required by the Permit that will be conducted throughout the post-closure care period. The post-closure groundwater monitoring requirements are specified in Permit Part 7 and Permit Attachment L.

H1.2 Additional Post-Closure Activities

With the certification of closure of WIPP and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem, continuous occupancy of the site for operational and security purposes will cease. Any additional activities will be imposed through the Post-Closure Care Permit issued by NMED after certification of closure.

H1.3 Quality Assurance

The quality assurance and quality control plan will be applied to the procurement of materials for and the erection of the fencelines enclosing the repository footprint. In particular, quality control inspection of the placement and tensioning of the barbed wire and chain link fabric will be applied and utilized to provide reasonable assurance that the fencing structures will function during the post-closure care period with normal maintenance.

Quality assurance and quality control will also be applied to the sampling and analyses supporting the environmental monitoring program. Contractors collecting samples and laboratories conducting analyses for the Permittees shall be qualified in accordance with guidelines prescribed in the most current edition of the Permittees' quality assurance program document at the time that the contracts are awarded.

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References

EPA (U.S. Environmental Protection Agency). 1993. 40 CFR Part 191 Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste; Final Rule. *Federal Register*, Vol. 58, No. 242, pp. 66398-66416, December 20, 1993. Office of Radiation and Indoor Air, Washington, D.C.

U.S. Congress. 1992. Waste Isolation Pilot Plant Land Withdrawal Act. Public Law 102-579, 106 Stat. 4777, October 1992. 102nd Congress, Washington, D.C.

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FIGURES

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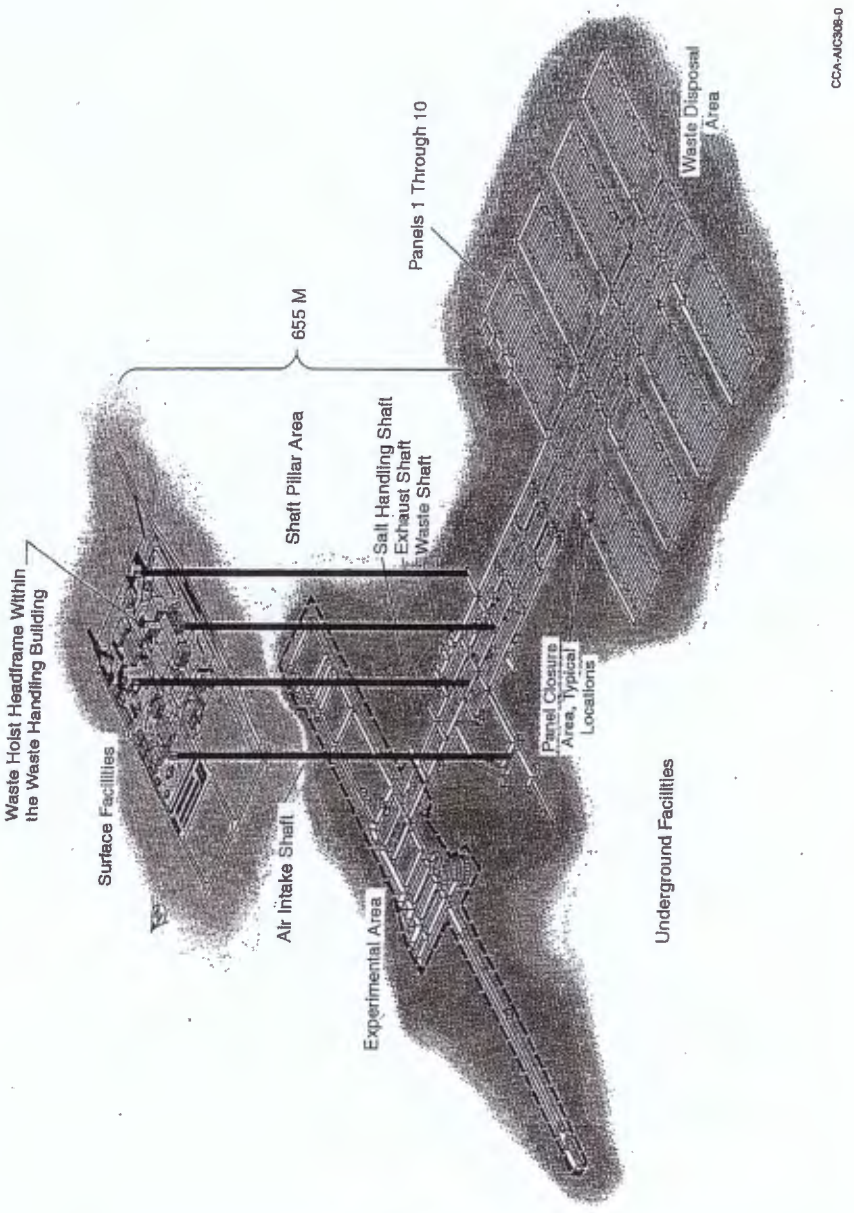

Figure H1-1
Spatial View of WIPP Surface and Underground Facilities

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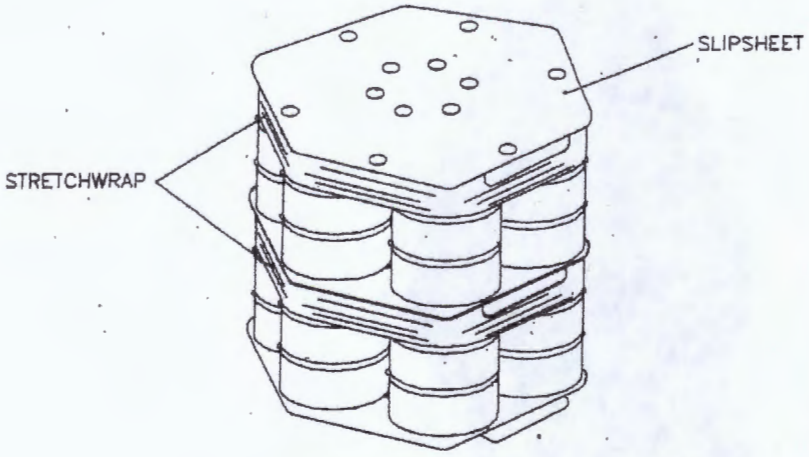
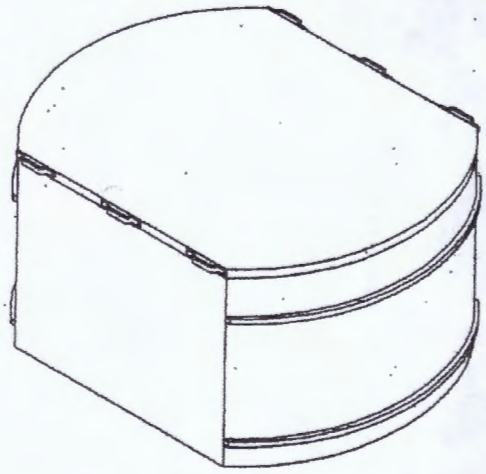


SEVEN–PACKS



STANDARD WASTE BOX

Figure H1-2
Standard Waste Box and Seven-Pack Configuration

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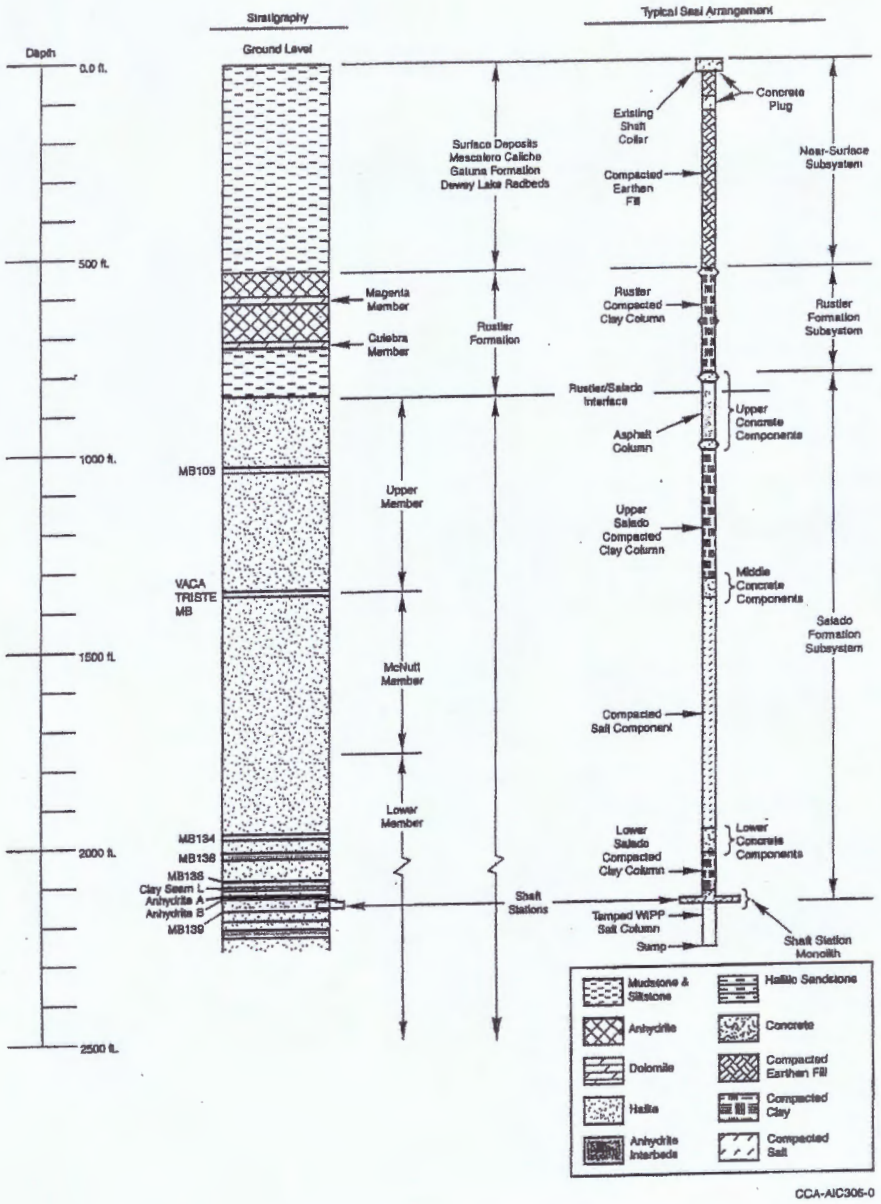

Figure H1-3
Typical Shaft Sealing System

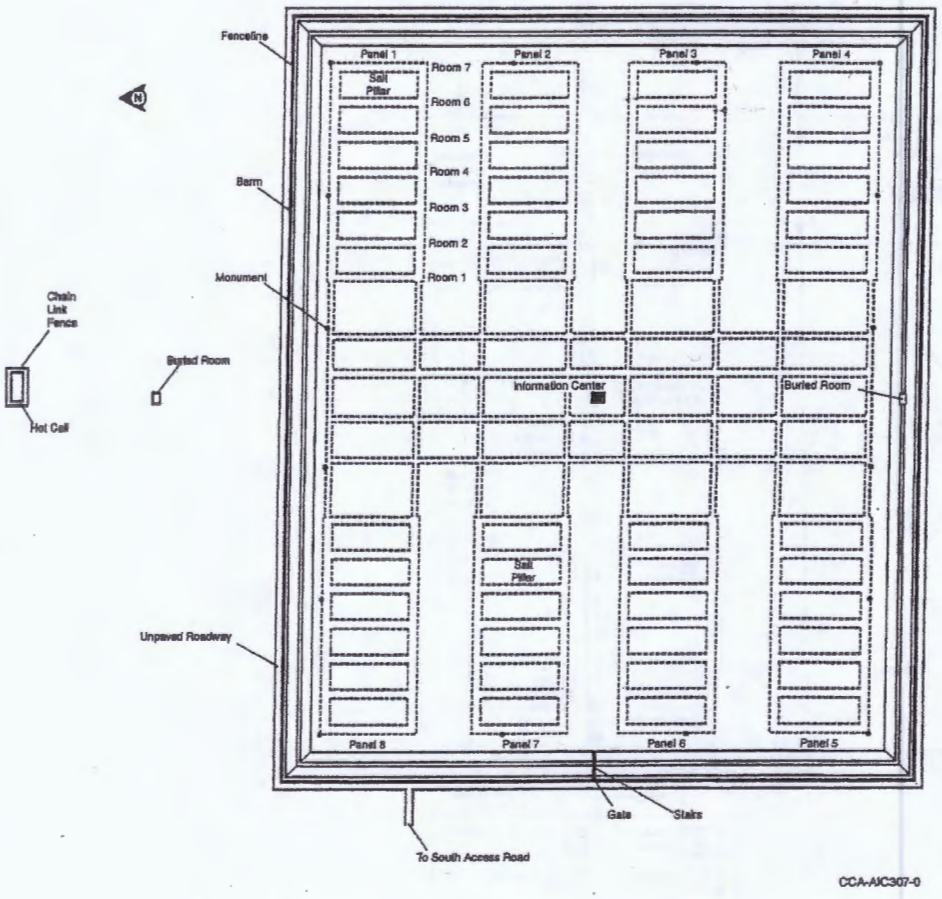

Figure H1-4
Perimeter Fenceline and Roadway

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Field Code Changed

ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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ACRONYMS

CH	contact-handled
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LWA	Land Withdrawal Act
SWB	standard waste box
TRU	transuranic
WIPP	Waste Isolation Pilot Plant

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

Introduction

Under the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b), the following activities identified as active institutional controls during post-closure are incorporated into the Post-Closure Plan.

The post-closure requirements of this permit include 20.4.1.500 NMAC, incorporating:

- 40 CFR §264.117(a)(1), which requires that

  "Post-closure care for each hazardous waste management unit subject to the requirements of §264.117 through 264.120 must begin after completion of closure of the unit and continue for 30 years after that date..."

- 40 CFR §264.601, which requires that

  "A miscellaneous unit must be...maintained and closed in a manner that will ensure protection of human health and the environment..."

- and 40 CFR §264.603, which requires that

  "A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period."

The containment requirements for a disposal system for transuranic (**TRU**) radioactive wastes are defined in Title 40 CFR §191.13 (U.S. Environmental Protection Agency [**EPA**] 1993). 40 CFR §191.14 is titled Assurance Requirements. With regard to the active institutional controls aspect of Assurance Requirements, 40 CFR §191.14 states the following:

> "To provide the confidence needed for long-term compliance with the requirements of §191.13, disposal of spent fuel or high-level or transuranic wastes shall be conducted in accordance with the following provisions... (a) Active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contribution from active institutional controls for more than 100 years after disposal... "

40 CFR §191.12 states the following:

> "Active institutional controls mean:
> 1) controlling access to a disposal site by any means other than passive institutional controls,
> 2) performing maintenance operations or remedial actions at a site,
> 3) controlling or cleaning up releases from a site, or
> 4) monitoring parameters related to disposal system performance."

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Purpose: This Permit Attachment describes the design of a system that the Permittees will implement for compliance with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b)) and 40 CFR §191.14(a) to control access to the Waste Isolation Pilot Plant (**WIPP**) disposal site and implement maintenance and remedial actions pertaining to the site access controls. In addition, this Permit Attachment addresses the scheduling process for control of inspection, maintenance, and periodic reporting related to long-term monitoring. Long-term monitoring addresses the monitoring of disposal system performance, as required by 40 CFR §191.14(b), and environmental monitoring, in accordance with this Permit and the Consultation and Cooperation Agreement between the U.S. Department of Energy (**DOE**) and the state of New Mexico. The scheduling process will also address evaluation of testing activities related to the permanent marker system design contained within the passive institutional controls (not required by this permit).

Implementation of active institutional controls at the WIPP will commence when final facility closure is achieved, as specified in Permit Part 6 and Permit Attachment G. Implementation of active institutional controls marks the transition from the active life of the facility (which ends upon certification of closure) to the post-closure care period, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart G). The Permittees will continue the imposition of active institutional controls under this Permit until NMED approves the post-closure certification specified in Permit Part 7 and Permit Attachment H.

Decommissioning activities include decontamination and site restoration. The decontamination effort will be completed prior to sealing of the shafts to allow disposal of all derived waste (radioactive and/or mixed waste derived from TRU/TRU-mixed waste received at the WIPP) into the repository. The implementation of active institutional controls upon certification of facility closure will prevent human intrusion into the repository. The Permittees' restoration efforts will return the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Necessary exceptions to returning the site to its full pre-WIPP condition include measurements associated with long-term monitoring.

Scope: The active institutional control requirements include a means of controlling access to the site of the repository's surface footprint (the repository area projected to the surface) and maintenance, including corrective actions, for access control system components. Active control of access to the site will be exercised by the Permittees for the duration of the post-closure care period. Although the Permittees are only required to maintain active institutional controls until approval of the post-closure certification by NMED, the Permittees will continue active institutional controls for at least 100 years after final facility closure to satisfy other regulatory requirements. Control of access will prevent intrusion into the disposed waste by deep drilling or mining for natural resources. This Permit Attachment also specifies a process for scheduling activities related to the long-term monitoring of the repository. Some of the activities supporting the monitoring programs will be initiated during the active life of the facility to establish databases. These activities are planned to continue beyond closure through the time after removal of the site structures and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Long-term monitoring requirements will be necessarily integrated with efforts toward returning the land to a stable ecological state.

Background: The WIPP was sited and designed as a research and development facility to demonstrate the safe disposal of radioactive wastes. The wastes are derived from DOE defense-related activities. Specifically, the mission of the WIPP project is to conduct research,

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demonstration, and siting studies relevant to the permanent disposal of TRU wastes. Most of these wastes will be contaminated with hazardous constituents, making them mixed wastes.

The LWA addresses the disposal phase of the WIPP project, the period following closure of the site, and the removal of the surface facilities. The LWA set aside 10,240 acres (4,144 hectares) located in Eddy County, 26 miles (42 kilometers) east of Carlsbad, New Mexico, as the WIPP site. A 277-acre (112-hectare) portion within the 10,240 acres (4,144 hectares) is bounded by a barbed wire fence. This fenced area contains the surface facilities and the mined salt piles for the WIPP site. Figure H1-1 is a cutaway illustrating the spatial relationship of the surface facilities and the underground repository.

Upon receipt of the necessary certifications and permits from the EPA and the New Mexico Environment Department, the Permittees will begin disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU and TRU mixed waste in the WIPP. This waste emplacement and disposal phase will continue until the regulated capacity of the repository of 6,200,000 cubic feet (175,588 cubic meters) of TRU and TRU mixed waste has been reached, and as long as the Permittees comply with the requirements of the Permit. For the purposes of this Permit Attachment, this time period is assumed to be 25 years. The waste will be shipped from DOE facilities across the country in specially designed transportation containers certified by the Nuclear Regulatory Commission. The transportation routes from these facilities to the WIPP have been predetermined. The CH TRU mixed waste will be packaged in 55-gallon (208-liter), 85-gallon (322-liter), 100-gallon (379-liter) steel drums, standard waste boxes (**SWBs**), ten drum overpacks (**TDOPs**), and/or standard large box 2s (**SLB2s**). An SWB is a steel container having a free volume of 66.3 cubic feet (1.88 cubic meters). Figure H1-2 shows the general arrangement of a seven-pack of drums and an SWB as received in a Contact-Handled Package. RH TRU mixed waste inside a Remote-Handled Package is contained in one or more of the allowable containers described in Permit Attachment A1. Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1.

Upon receipt and inspection of the waste containers in the waste handling building, the containers will be moved into the repository 2,150 feet (655 meters) below the surface. The containers will then be transported to a disposal room. (See Figure H1-1 for room and panel arrangement.) The initial seven disposal rooms are in Panel 1. Panel 1 is the first of eight panels planned to be excavated. Special supports and ground control corrective actions have been implemented in Panel 1 to ensure its stability. Upon filling an entire panel, that panel will be closed to isolate it from the rest of the repository and the ventilation system. During the period of time it takes to fill a given panel, an additional panel will be excavated. Sequential excavation of Panels 2 through 8 will ensure that these individual panels remain stable during the entire time a panel is being filled with waste. Ground control maintenance and evaluation with appropriate corrective action will be required to ensure that Panels 9 and 10 (ventilation and access drifts in the repository) remain stable.

Decontamination of the WIPP facility will commence with a detailed radiation survey of the entire site. Contaminated areas and equipment will be evaluated and decontaminated in accordance with applicable requirements. Where decontamination efforts identify areas that meet clean closure standards for permitted container storage units and are below radiological release criteria, routine dismantling and salvaging practices will determine the disposition of the material or equipment involved. Material and equipment that do not meet these standards and criteria will be emplaced in the access entries (Panels 9 and/or 10). Upon completion of emplacement of the contaminated facility material, the entries will be closed and the repository

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shafts will be sealed. Final repository closure includes sealing the shafts leading to the repository. Figure H1-3 illustrates the shaft sealing arrangement. Certification of closure will end disposal operations and initiate the post-closure care period for implementation of active institutional controls.

H1.1 Active Institutional Controls

Active institutional controls during post-closure consist of three elements:

- controlling access to a disposal site,
- performing maintenance operations or remedial actions at a site, and
- controlling or cleaning up releases from a site.

The LWA has removed the WIPP site from public use as a site for mining and other types of mineral resource extraction. Since any type of exploration activity would require authorization, the issuance of approval to intrude upon the repository is precluded by the LWA. The existence of the LWA as law permits meeting the requirements of the first element above by implementing low technology barriers. These barriers include a posted fence and active surveillance at a frequency that denies sufficient time for an individual or organization to intrude into the repository undetected using today's drilling technology. Maintenance and remedial actions at the WIPP site will be conducted by the Permittees at the time of implementing the access controls for the site. The control or cleanup of releases from the site will be conducted as part of the operational program prior to sealing of the shafts. This is necessary to ensure that all derived waste is disposed of within the repository prior to shaft sealing.

The Permittees shall maintain the access controls. This requirement includes the maintenance and corrective actions necessary to ensure that the fence and patrol requirements (surveillance) are met. The active institutional controls to be implemented by the Permittees after final closure are the following:

1. A fence line will be established to control access to the repository footprint area on the surface. A standard four-strand (three barbed and one unbarbed, in accordance with the Bureau of Land Management specifications) wire fence will be erected along the perimeter of the repository surface footprint. To provide access to the repository footprint during construction of the berm (which may be built in multiple sections simultaneously), the fence will have gates placed approximately midway along each of the four sides. these gates will remain locked with access controlled by the Permittees. The western gate will be 20 feet (6 meters) wide. The remaining three gates will each be 16 feet (4.9 meters) wide. Additional fencing will be constructed where appropriate for remote locations that are used for disposal system monitoring. Such fences will meet the same construction specifications as the repository footprint perimeter fence.

2. Unpaved roadways 16 feet (4.9 meters) wide will be established along the perimeter of the barbed wire fence as well as along the WIPP site boundary. These roadways will be constructed so as to provide ready vehicle access to any point around the fenced perimeter and the site boundary. These roadways will facilitate inspection and maintenance of the fenceline and will allow visual observation of the repository footprint and the site boundary to the extent permitted by the lay of the land. These roadways will connect to the paved south access road. Roads to remote sites will also be constructed and maintained where appropriate.

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3. The fence line will be posted with signs having, as a minimum, a legend reading "Danger—Unauthorized Personnel Keep Out" (20.4.1.500 NMAC (incorporating 40 CFR §264.14[c])) and warning against entering the area without specific permission of the Permittees. The legend must be written in English and Spanish. The signs must be legible from a distance of at least 25 feet (7.6 meters). The size of the visual warning and the spacing of the warning signs will be sufficiently large and close to ensure that one or more of the signs can be seen from any approach prior to an individual actually making contact with the fence line. In no case will the spacing be greater than 300 feet (91.5 meters).

4. The Permittees will ensure that periodic inspection and expedited corrective maintenance are conducted on the fence line, its associated warning signs, and roadways.

5. The Permittees will provide for routine periodic patrols and surveillance of all areas controlled by or under the authority of the Permittees by personnel trained in security surveillance and investigation.

6. The Permittees will implement the periodic monitoring requirements of the long-term monitoring system.

7. The Permittees will submit a Permit modification request for any proposed modifications to the active institutional controls appropriate for access control, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

8. The Permittees will immediately take appropriate action to address abnormal conditions identified during periodic surveillance and inspections. Abnormal conditions include any natural or human-caused conditions which would affect the integrity of the active institutional controls.

9. Reports addressing activities associated with the performance of the active access controls after final closure will be prepared periodically according to applicable requirements by the Permittees for submittal to the appropriate regulatory and legislative authorities.

H1.1.1 Repository Footprint Fencing

Access to an area approximately 2,780 feet by 2,360 feet (875 meters by 720 meters) will be controlled by a four-strand barbed wire fence. A single gate will be included along each side of the fence for access. These gates will remain locked with access controlled by the Permittees. Around the perimeter of the fence, an unpaved roadway 16 feet (4.9 meters) wide will be cut to allow for patrolling of the perimeter. Figure H1-4 is an illustration of the fence line in relation to the repository footprint. Patrolling of the perimeter is based upon the need to ensure that no mining or well drilling activity is initiated that could threaten the integrity of the repository.

Fencing off an area larger than the disposal area footprint would not significantly reduce the risk of intrusion but would interfere with cattle grazing established prior to the LWA. The LWA states that the Secretary of Energy can allow grazing to continue where it was established prior to enactment of the LWA. Based upon current drilling technologies, discussions with local well drilling organizations, and observation of well drilling activities in the WIPP vicinity, it typically requires at least two to three days for a driller to set up a deep drilling rig and commence actual

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drilling operations. Attaining the 2,150-foot (655-meter) depth that would approach the repository horizon takes at least another week to 10 days. Based upon current drilling practices, patrolling the fenced area two to three times weekly would identify any potential drilling activity well before any breach of the repository could occur. Therefore, the perimeter fence will be patrolled three times weekly after final closure.

Construction of access control systems using higher technology than described is not required. Likewise, continuous surveillance whether human or electronic is not required.

H1.1.2 Surveillance Monitoring

The Permittees will conduct periodic surveillance of the site and the repository footprint during the post-closure period. Unpaved roadways around the WIPP site boundary and around the repository footprint will facilitate such surveillance. Contractual arrangements with a local organization such as the Eddy County Sheriff's Department may be established which would provide some distinct advantages. Among the advantages are the following:

- deputies are trained in patrol and surveillance activities,
- deputies are authorized to arrest members of the general public who are found to be violating trespassing laws,
- the liability associated with apprehension, attempted apprehension, or circumstances arising from attempts would remain with the Sheriff's Department, and
- the general area to be patrolled is already a part of the Sheriff's area of responsibility.

Surveillance will consist of drive-by patrolling around the fenced perimeter a minimum of three times per week. In the course of the patrol, particular note will be taken of the fence integrity. In addition, the locked condition of each gate will be checked to ensure that gate integrity is maintained and there is no evidence of tampering. Surveillance will also include visual observation of the entire enclosed area for any signs of human activity. Additionally, surveillance patrols will be conducted around the site boundary's perimeter for signs of unauthorized human activities. A routine summary of each month's surveillance activity will be prepared documenting the date and time of each patrol and any unusual circumstances that may have been observed. This surveillance routine will continue throughout the post-closure care period.

H1.1.3 Maintenance and Remedial Actions

Anticipated maintenance and remedial action issues during the post-closure care period are minimal and should encompass such issues as

- fence and road maintenance,
- repair of any damage that occurs,
- response to evidence of potential erection of drilling equipment, and
- response to unauthorized entry into prohibited areas.

The Permittees will provide maintenance services within a reasonable time after the need is identified during routine patrolling activity. Any observed vandalism or unauthorized entry will be investigated and action will be taken as the circumstances warrant.

H1.1.4 Control and Clean-up of Releases

The decontamination process and disposal of the derived waste will be completed prior to sealing the shafts and final facility closure. With the location of the WIPP repository at 2,150 feet (655 meters) below the surface and with panels closed and shafts sealed, the potential for releases of radioactive material or hazardous constituents following the sealing of the shafts is precluded. There will be no credible pathway for releases from the repository other than human intrusion. Routine patrols in accordance with access control requirements will preclude human intrusion into the repository during the post-closure period.

H1.1.5 Groundwater Monitoring

Groundwater monitoring is the only monitoring program required by the Permit that will be conducted throughout the post-closure care period. The post-closure groundwater monitoring requirements are specified in Permit Part 7 and Permit Attachment L.

H1.2 Additional Post-Closure Activities

With the certification of closure of WIPP and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem, continuous occupancy of the site for operational and security purposes will cease. Any additional activities will be imposed through the Post-Closure Care Permit issued by NMED after certification of closure.

H1.3 Quality Assurance

The quality assurance and quality control plan will be applied to the procurement of materials for and the erection of the fencelines enclosing the repository footprint. In particular, quality control inspection of the placement and tensioning of the barbed wire and chain link fabric will be applied and utilized to provide reasonable assurance that the fencing structures will function during the post-closure care period with normal maintenance.

Quality assurance and quality control will also be applied to the sampling and analyses supporting the environmental monitoring program. Contractors collecting samples and laboratories conducting analyses for the Permittees shall be qualified in accordance with guidelines prescribed in the most current edition of the Permittees' quality assurance program document at the time that the contracts are awarded.

: 02781

References

EPA (U.S. Environmental Protection Agency). 1993. 40 CFR Part 191 Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste; Final Rule. *Federal Register*, Vol. 58, No. 242, pp. 66398-66416, December 20, 1993. Office of Radiation and Indoor Air, Washington, D.C.

U.S. Congress. 1992. Waste Isolation Pilot Plant Land Withdrawal Act. Public Law 102-579, 106 Stat. 4777, October 1992. 102nd Congress, Washington, D.C.

FIGURES

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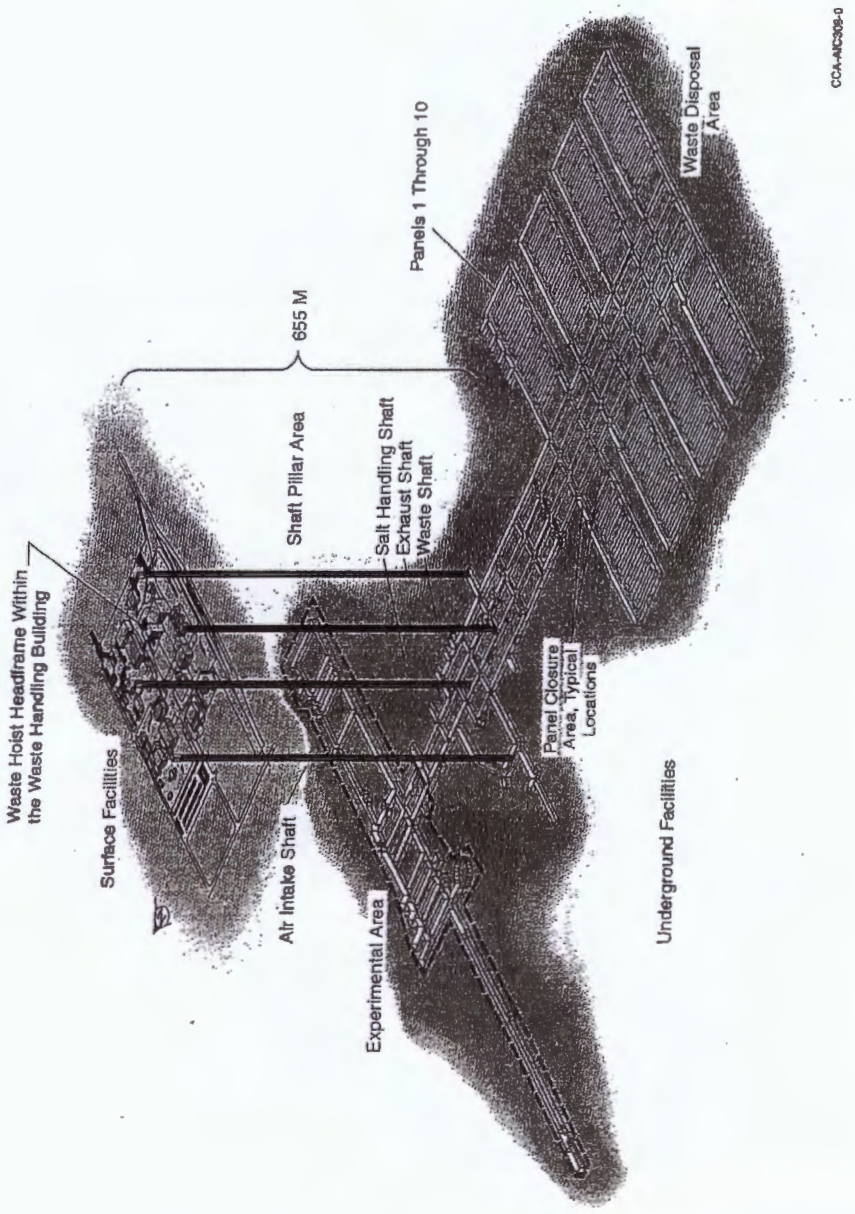
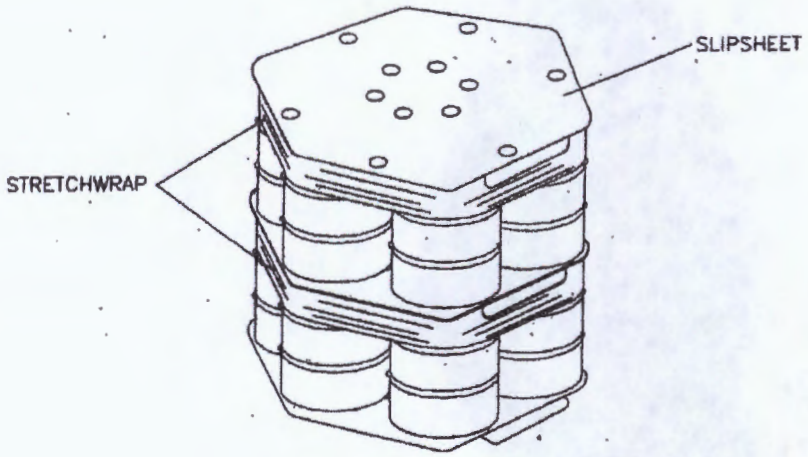


Figure H1-1
Spatial View of WIPP Surface and Underground Facilities



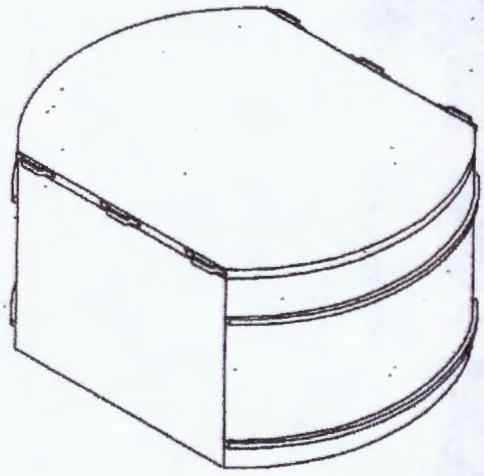


Figure H1-2
Standard Waste Box and Seven-Pack Configuration

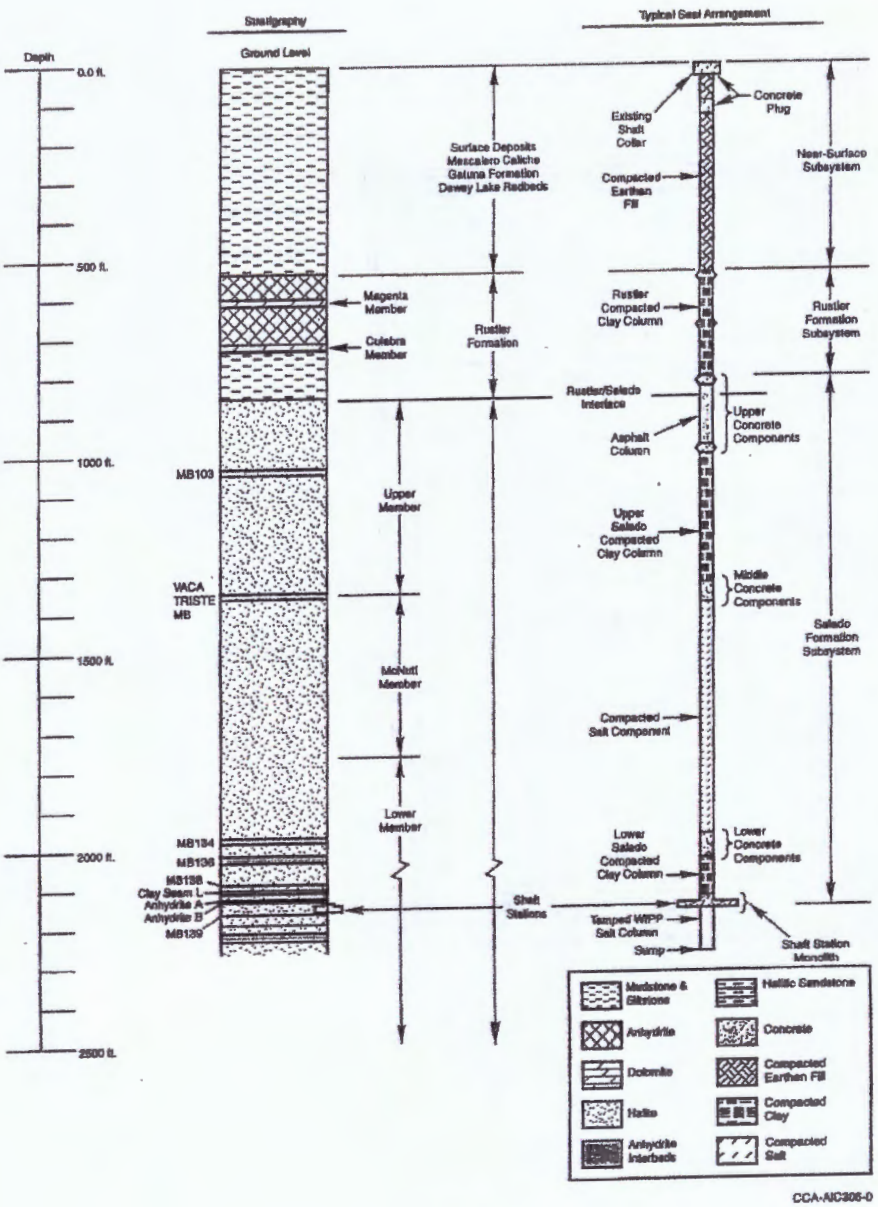


Figure H1-3
Typical Shaft Sealing System

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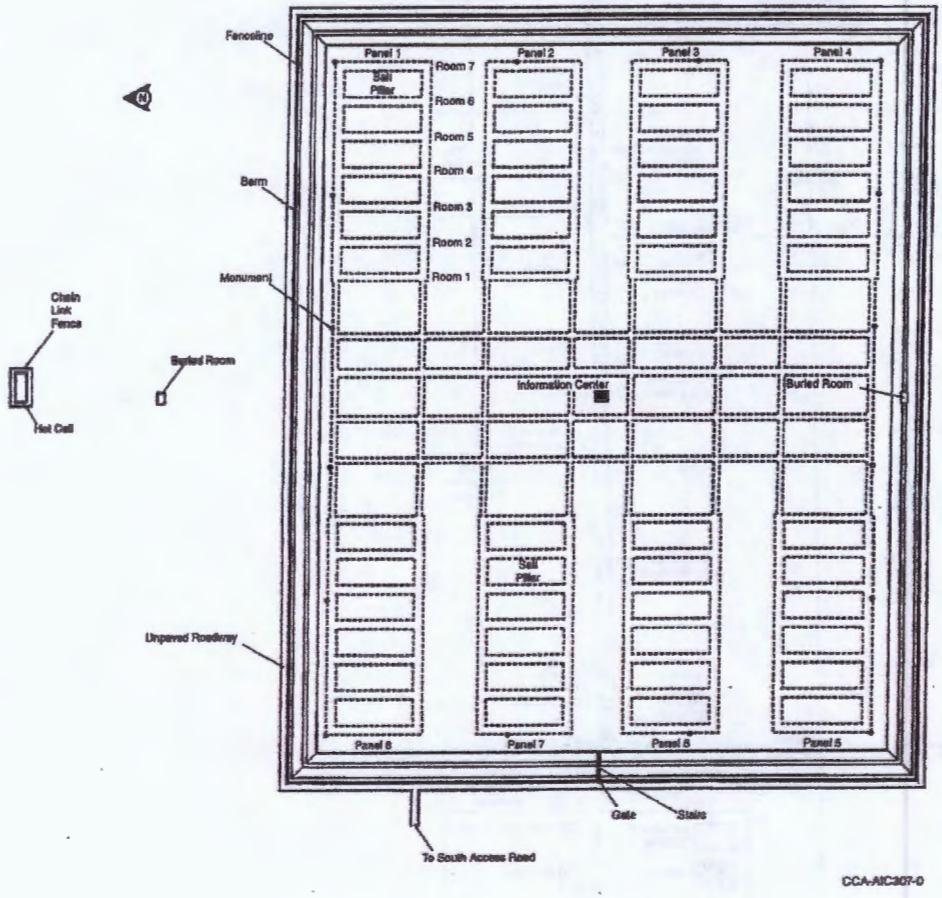

Figure H1-4
Perimeter Fenceline and Roadway

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: 02788

From: Winchester, Jim, NMENV
Sent: Thursday, November 01, 2012 1:47 PM
To: Winchester, Jim, NMENV
Subject: WIPP Permit Modification
Attachments: PR110112 WIPP Permit Modification.pdf

NEW MEXICO ENVIRONMENT DEPARTMENT

November 1, 2012
For Immediate Release

Contact: Jim Winchester
Communications Director
(505) 231-8800

NEW MEXICO ENVIRONMENT DEPARTMENT ISSUES MODIFICATION TO WASTE ISOLATION PILOT PLANT PERMIT

Santa Fe - On November 1, 2012, the New Mexico Environment Department (NMED) took final administrative action on a Class 2 permit modification request (PMR) to the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit by approving the modification with changes. The Department of Energy Carlsbad Field Office and Nuclear Waste Partnership LLC formerly Washington TRU Solutions LLC (the Permittees) submitted this PMR to the NMED Hazardous Waste Bureau on July 5, 2012 seeking to add the shielded container as a shipping package, add descriptions of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked and related changes to waste handling descriptions.

NMED did an extensive review of the comments submitted during the 60 day public comment period, which began July 12, 2012 and ended September 10, 2012, and ultimately determined the majority of concerns expressed in these comments are outside of NMED's regulatory authority. The waste that is emplaced at WIPP contains both radioactive and hazardous components and is therefore referred to as mixed waste. As a result, mixed wastes are regulated by both the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). NMED has regulatory authority over the chemical components of the waste at WIPP through RCRA. The United States Environmental Protection Agency (EPA) regulates the radioactive components. EPA approved the use of shielded containers on August 8, 2011 and found that DOE had fulfilled all documentation requirements set forth by the Agency and had demonstrated that use of shielded containers in the repository would not affect facility compliance with either 40 CFR

191 or 40 CFR 194.

The NMED WIPP group mission is to protect human health and the environment by providing high quality and responsive regulatory oversight and technical guidance to the WIPP facility and to ensure compliance with applicable federal and state regulations ultimately achieving the safe disposal of transuranic mixed waste. NMED is dedicated to applying the regulations in a fair, rigorous and consistent manner while facing many inherent challenges. Input from the public that falls within the scope of its authority is welcome and valued. NMED firmly believes public input plays an important role and assists in accomplishing its mission and considers all comments received. However, NMED decisions are restricted to issues over which NMED has regulatory authority.

The final permit and the response to comments can be found at: http://www.nmenv.state.nm.us/wipp/.

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DAVE MARTIN
Secretary
BUTCH TONGATE
Deputy Secretary

November 1, 2012
For Immediate Release

Contact: Jim Winchester
Communications Director
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NEW MEXICO ENVIRONMENT DEPARTMENT ISSUES MODIFICATION TO WASTE ISOLATION PILOT PLANT PERMIT

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###

From:	Maestas, Ricardo, NMENV
To:	Kliphuis, Trais, NMENV
Cc:	Maestas, Ricardo, NMENV
Bcc:	"mkblackmon1940@att.net"; "pblair108@hotmail.com"; "mezcal69@gmail.com"; "conway_patty@yahoo.com"; "tinymachine@gmail.com"; "jeffreytaos@yahoo.com"; "spiritsong@q.com"; "rosemount@newmexico.com"; "rhardy@cemrc.org"; "mholland48@gmail.com"; "piper@ieee.org"; "solserenity@gmail.com"; "kmarksteiner@yahoo.com"; "lesleyweinstock@yahoo.com"; "Don Hancock"
Subject:	NMED Response to Public Comment
Date:	Thursday, November 01, 2012 2:04:37 PM
Attachments:	Commenter Letter 11-1-2012.docx.docx

Dear Commenter;

Please see attached correspondence.

Thank you.

Ricardo Maestas

>><<<>>><<<>>><<<>>><<

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Director
Resource Protection Division

November 1, 2012

RE: SPECIFIC RESPONSE TO COMMENTS, CLASS 2 MODIFICATION REQUEST
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Commenter:

On November 1, 2012, the New Mexico Environment Department (**NMED**) took final administrative action on a Class 2 permit modification request (**PMR**) to the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit. The Department of Energy Carlsbad Field Office and Nuclear Waste Partnership LLC formerly Washington TRU Solutions LLC (**the Permittees**) submitted this PMR to the Hazardous Waste Bureau on July 5, 2012 seeking to:

- Add the shielded container as a shipping package;
- Add descriptions of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked;
- Add related changes to waste handling descriptions.

NMED approved the modification with changes. This Class 2 PMR was evaluated and processed in accordance with the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)). It was subject to a 60-day public comment period. You are receiving this mailing because you provided public comment on this modification. NMED's specific response to all comments as well as further information on this administrative action may be found on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/>.

NMED appreciates your participation by submitting comments on these permit modification requests. Please contact Trais Kliphuis at (505) 476-6051 or via e-mail at <trais.kliphuis@state.nm.us> if you have further questions or need additional information.

Sincerely,

John E. Kieling
Bureau Chief
Hazardous Waste Bureau

cc: Trais Kliphuis, NMED HWB
Laurie King, EPA Region 6
Jose Franco, DOE/CBFO
M. Farok Sharif, Nuclear Waste Partnership LLC

02794

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JAMES H. DAVIS, Ph.D.
Director
Resource Protection Division

November 1, 2012

RE: FINAL PERMIT DECISION AND RESPONSE TO COMMENTS, CLASS 2 MODIFICATION REQUEST -WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Interested Person:

On November 1, 2012, the New Mexico Environment Department (**NMED**) took final administrative action on a Class 2 permit modification request (**PMR**) to the Waste Isolation Pilot Plant (**WIPP**) Hazardous Waste Facility Permit by approving the PMR. The Department of Energy Carlsbad Field Office and Nuclear Waste Partnership LLC (formally Washington TRU Solutions LLC) submitted this PMR to the Hazardous Waste Bureau on July 5, 2012. This Class 2 modification included the following items:

- Add the shielded container as a shipping package
- Add description of how the volume of RH TRU mixed waste which is disposed in shielded containers will be tracked
- Add related changes to waste handling descriptions

This Class 2 PMR was evaluated and processed in accordance with the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)). It was subject to a 60-day public comment period.

Further information on this administrative action, including response to comments, may be found on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/>.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: Trais Kliphuis, HWB

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

November 27, 2012

Jose Franco, Manager
Carlsbad Field Office
Department of Energy
P.O. Box 3090
Carlsbad, New Mexico 88221-3090

Farok Sharif, Project Manager
Nuclear Waste Partnership LLC
P.O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: CLARIFICATION OF WIPP PERMIT CONDITION 3.3.1.8
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088

Dear Messrs. Franco and Sharif:

On November 1, 2012 The New Mexico Environment Department (**NMED**) approved the shielded container permit modification request. NMED inadvertently left out the phrase "but will be counted towards the volume limits associated with RH TRU mixed waste" at the end of the third sentence in Condition 3.3.1.8. This letter serves as notification that the permit has been corrected and now reads "For the purpose of this Permit, shielded containers will be managed stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste."

If you have any questions regarding this matter, please contact Trais Kliphuis of my staff at (505) 476-6051.

Sincerely,

James H. Davis, Ph.D.
Director
Resource Protection Division

cc: J. Kieling, NMED HWB
T. Kliphuis, NMED HWB
T. Skibitski, NMED DOE-OB
T. Kesterson, NMED DOE-OB/WIPP
L. King, EPA Region 6
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File: Red WIPP '12

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JAMES H. DAVIS, Ph.D.
Director
Resource Protection Division

November 27, 2012

RE: CLARIFICATION OF WIPP PERMIT CONDITION 3.3.1.8
WIPP HAZARDOUS WASTE FACILITY PERMIT

EPA I.D. NUMBER NM4890139088

Dear Interested Person:

On November 1, 2012 The New Mexico Environment Department (**NMED**) approved the shielded container permit modification request. NMED inadvertently left out the phrase "but will be counted towards the volume limits associated with RH TRU mixed waste" at the end of the third sentence in Condition 3.3.1.8. This letter serves as notification that the permit has been corrected and now reads "For the purpose of this Permit, shielded containers will be managed stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste."

Further information on this administrative action, including response to comments, may be found on the NMED WIPP Information Page at <http://www.nmenv.state.nm.us/wipp/>.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: Trais Kliphuis, NMED HWB

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PART 1 - GENERAL PERMIT CONDITIONS

1.1. AUTHORITY

This Permit is issued pursuant to the authority of the Secretary of the New Mexico Environment Department (**Secretary**) under the New Mexico Hazardous Waste Act (**HWA**), NMSA 1978, §§74-4-1 through 74-4-14, in accordance with the New Mexico Hazardous Waste Management Regulations (**HWMR**), 20.4.1 NMAC.

Pursuant to the Resource Conservation and Recovery Act (**RCRA**), 42 U.S.C. §§6901 to 6992k, and 40 CFR Part 271 and Part 272 Subpart GG, the State of New Mexico, through the Secretary, is authorized to administer and enforce the state hazardous waste management program under the HWA in lieu of the federal program.

This Permit contains terms and conditions that the Secretary has determined are necessary to protect human health and the environment, pursuant to 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)).

Any violation of a condition in this Permit may subject the Permittees or their officers, employees, successors, and assigns to:

1) A compliance order under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a));

2) An injunction under §74-4-10 of the HWA or §3008(a) of RCRA (42 U.S.C. §6928(a)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

3) Civil penalties under §§74-4-10 and 74-4-10.1 of the HWA or §§3008(a) and (g) of RCRA (42 U.S.C. §§6928(a) and (g)), or §7002(a) of RCRA (42 U.S.C. §6972(a));

4) Criminal penalties under §74-4-11 of the HWA or §§3008(d), (e), and (f) of RCRA (42 U.S.C. §§6928(d), (e), and (f)); or

5) Some combination of the foregoing.

The list of authorities in this paragraph is not exhaustive and the Secretary reserves the right to take any action authorized by law to enforce the requirements of this Permit.

1.2. EFFECT OF PERMIT

The Secretary issues this Permit to the United States Department of Energy (**DOE**), the owner and co-operator of the Waste Isolation Pilot Plant (**WIPP**) (EPA I.D. Number NM4890139088), and Nuclear Waste Partnership LLC, Management and Operating Contractor (**MOC**), the co-operator of WIPP. This Permit authorizes DOE and MOC (**the Permittees**) to manage, store, and dispose contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste at WIPP, and establishes the general and specific standards for these activities, pursuant to the HWA and HWMR.

As to those activities specifically authorized or otherwise specifically addressed under this Permit, compliance with this Permit during its term shall constitute compliance, for purposes of enforcement, with Subtitle C of RCRA and the HWA, and the implementing regulations at 40 CFR Parts 264, 266, and 268 except for those requirements that become effective by statute after the Permit has been issued [20 4.1.900 NMAC (incorporating 40 CFR §270.4)]

Compliance with this Permit shall not constitute a defense to any order issued or any action brought under Sections 74-4-10.E or 74-4-13 of the HWA; Sections 3008(a), 3008(h), 3013, or 7003 of RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. §9601 et seq., commonly known as CERCLA) Sections 106(a), 104, or 107; or any other federal, state, or local law providing for protection of public health or the environment. This Permit does not convey any property rights of any sort or any exclusive privilege, nor authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local laws or regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.4, 270.30(g), and 270.32(b)(1))]

1.3. PERMIT ACTIONS

1.3.1. Permit Modification, Suspension, and Revocation

This Permit may be modified, suspended, and/or revoked for cause as specified in Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §§270.41, 270.42, and 270.43). The filing of a request by the Permittees for a permit modification, suspension, or revocation, or the notification of planned changes or anticipated noncompliance, shall not stay any permit condition. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(f))]

1.3.2. Permit Renewal

The Permittees may renew this Permit by submitting an application for a new Permit at least 180 calendar days before the expiration date of this Permit. In reviewing any application for a Permit renewal, the Secretary shall consider improvements in the state of control and measurement technology and changes in applicable regulations. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h) and 270.30(b))]

1.3.3. Permit Review

The Secretary shall review this Permit no later than five (5) years after the effective date of this Permit, and shall modify this Permit as necessary pursuant to Section 74-4-4.2 of the HWA and 20.4.1.900 NMAC (incorporating 40 CFR §270.41). Such modification(s) shall not extend the effective term of this Permit specified in Permit Section 1.7.2. [20.4.1.900 NMAC (incorporating 40 CFR §§270.41 and 270.50(b) and (d))]

1.4. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to

other circumstances and the remainder of this Permit shall not be affected thereby. [40 CFR §124.16(a)(1) and (2)]

1.5. DEFINITIONS

Unless otherwise expressly provided herein, the terms used in this Permit shall have the meaning set forth in RCRA, HWA, and/or their implementing regulations.

1.5.1. Contact-handled Transuranic Mixed Waste

"Contact-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate not greater than 200 millirem per hour. [Pub. L. 102-579 (1992)]

1.5.2. Remote-handled Transuranic Mixed Waste

"Remote-handled transuranic mixed waste" means transuranic mixed waste with a surface dose rate of 200 millirem per hour or greater. For WIPP, the surface dose rate shall not exceed 1,000 rems per hour. [Pub. L. 102-579 (1992)]

1.5.3. Facility

"Facility" or "permitted facility" means the Waste Isolation Pilot Plant (**WIPP**) owned by the DOE and located approximately twenty six (26) miles east of Carlsbad, New Mexico, EPA I.D. Number NM4890139088. The WIPP facility comprises the entire complex within the WIPP Site Boundary as specified in the WIPP Land Withdrawal Act of 1992, Pub. L. 102-579 (1992), including all contiguous land, and structures, other appurtenances, and improvements on the Permittees' land, used for management, storage, or disposal of TRU mixed waste.

1.5.4. Permittees

"Permittees" means the United States Department of Energy (**DOE**), an agency of the Federal government, and the owner and co-operator of the WIPP facility; and Nuclear Waste Partnership LLC, Management and Operating Contractor (**MOC**), the co-operator of the WIPP facility. References to actions taken by "the Permittees" indicate actions that may be taken by either co-Permittee.

1.5.5. Secretary

"Secretary" means the Secretary of the New Mexico Environment Department (**NMED**), or designee.

1.5.6. TRU Waste

"TRU Waste" means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (A) high-level radioactive waste; (B) waste that the DOE Secretary has determined, with the

concurrence of the EPA Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations. [Pub. L. 102-579 (1992)]

1.5.7. TRU Mixed Waste

"TRU Mixed Waste" means TRU waste that is also a hazardous waste as defined by the HWA and 20.4.1.200 NMAC (incorporating 40 CFR §261.3).

1.5.8. Contact Handled Packages

"Contact Handled Packages" means TRUPACT-II, HalfPACT, and TRUPACT-III shipping containers and their contents.

1.5.9. Remote-Handled Packages

"Remote-Handled Packages" means both CNS 10-160B and RH-TRU 72-B shipping containers and their contents.

1.5.10. Containment Pallet

"Containment pallet" means a device capable of holding a minimum of one 55-gallon drum, or 85-gallon drum, or 100-gallon drum or a standard waste box, or a ten-drum overpack and that has internal containment for up to ten percent of the volume of the containers on the containment pallet.

1.5.11. Waste Characterization

"Waste characterization" or "characterization" means the activities performed by or on behalf of the waste generator/storage sites (**sites**) to obtain information used by the Permittees to satisfy the general waste analysis requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)). Characterization occurs before waste containers have been certified for disposal at WIPP.

1.5.12. Waste Confirmation

"Waste confirmation" or "confirmation" means the activities performed by the Permittees or the co-Permittee DOE, pursuant to Permit Attachment C7 (TRU Waste Confirmation), to satisfy the requirements specified in Section 310 of Pub. L. 108-447. Confirmation occurs after waste containers have been certified for disposal at WIPP.

1.5.13. Substantial Barrier

"Substantial barrier" means salt or other non-combustible material installed between the waste face and the bulkhead to protect the waste from events such as ground movement or

vehicle impacts. The substantial barrier incorporates the chain link and brattice cloth room closure specified in Permit Attachment A2.

1.5.14. Bulkhead

"Bulkhead" means a steel structure, with flexible flashing, that is used to block ventilation as specified in Permit Attachment A2 (Geologic Repository).

1.5.15. Explosion-Isolation Wall

"Explosion-isolation wall" means the 12-foot wall intended as an explosion isolation device that is part of the approved panel-closure system specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System).

1.5.16. Filled Panel

"Filled panel" means an Underground Hazardous Waste Disposal Unit specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.17. Internal Container

"Internal container" means a container inside the outermost container examined during radiography or visual examination (**VE**). Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not designed to hold liquid at the time of original waste packaging are not internal containers.

1.5.18. Observable Liquid

"Observable liquid" means liquid that is observable using radiography or VE as specified in Permit Attachment C (Waste Analysis Plan).

1.5.19. Filled Room

"Filled Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.20. Active Room

"Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.

1.6. EFFECT OF INACCURACIES IN PERMIT APPLICATION

This Permit is based on the assumption that all information contained in the permit application and the administrative record is accurate and that the Facility will be constructed and operated as specified in the application. The permit application consists of information submitted in September 2009 and supplementary technical documents.

Any inaccuracies found in the submitted information may be grounds for the termination or modification of this Permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.41, §270.42, and §270.43) and for potential enforcement action.

1.7. DUTIES AND REQUIREMENTS

1.7.1. Duty to Comply

The Permittees shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized in an emergency permit specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.61). Any Permit noncompliance, except under the terms of an emergency permit, constitutes a violation of RCRA and/or HWA and is grounds for enforcement action; for Permit modification, suspension, or revocation; or for denial of a Permit modification or renewal application. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(a))]

1.7.2. Permit Term

This Permit shall be effective for a fixed term not to exceed ten years from the effective date. The effective date of this Permit shall be 30 days after notice of the Secretary's decision has been served on the Permittees or such later time as the Secretary may specify. [20.4.1.900 NMAC (incorporating 40 CFR §270.50(a))]

1.7.3. Duty to Reapply

If the Permittees wish to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittees shall apply for and obtain a new Permit. The Permittees shall submit an application for a new Permit at least 180 calendar days before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §§270.10(h), 270.30(b))]

1.7.4. Continuation of Expiring Permits

If the Permittees have submitted a timely and complete application for renewal of this Permit as specified in 20.4.1.900 NMAC (incorporating 40 CFR §§270.10, 270.13 through 270.29), this Permit shall remain in effect until the effective date of the new Permit if, through no fault of the Permittees, the Secretary has not issued a new Permit on or before the expiration date of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.51)]

1.7.5. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for the Permittees in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(c))]

1.7.6. Duty to Mitigate

In the event of noncompliance with this Permit, the Permittees shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(d))]

1.7.7. Proper Operation and Maintenance

The Permittees shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this Permit. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(e))]

1.7.8. Duty to Provide Information

The Permittees shall furnish to the Secretary, within a reasonable time frame as specified by the Secretary, any relevant information which the Secretary may request to determine whether cause exists for modifying, suspending, or revoking this Permit, or to determine compliance with this Permit. The Permittees shall also furnish to the Secretary, upon request, copies of records required to be kept by this Permit. Information and records requested by the Secretary pursuant to this condition shall be provided in a paper or an electronic format acceptable to the Secretary. [20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.74(a) and 270.30(h))]

1.7.9. Inspection and Entry

The Permittees shall allow the Secretary, or authorized representatives, upon the presentation of credentials and other documents as may be required by law and at reasonable times, the following inspection and entry privileges specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(i)):

1.7.9.1. Entrance to Premises

To enter upon the Permittees' premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

1.7.9.2. Access to Records

To have access to and copy any records that must be kept under the conditions of this Permit;

1.7.9.3. Inspection

To have access to, inspect, and obtain photographs of any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

1.7.9.4. Sampling

To sample or monitor, for the purposes of assuring Permit compliance or as otherwise authorized by RCRA and/or HWA, any substances or parameters at any location. If the Secretary obtains any sample, prior to leaving the premises the Secretary shall give the Permittees a receipt describing the sample obtained and, if requested, a portion of each sample of equal weight or volume to the portion retained. If any analysis is made of the sample, the Secretary shall promptly furnish a copy of the results of the analysis to the Permittees.

Permit Section 1.7.9 shall not be construed to limit, in any manner, the Secretary's authority under Section 74-4-4.3 of the HWA.

1.7.10. Monitoring and Records

1.7.10.1. Representative Sampling

For the purposes of monitoring, the Permittees shall take samples and measurements representative of the monitored activity. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(1))]

1.7.10.2. Record Retention

Beginning with the effective date of this Permit, the Permittees shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, and copies of all reports and records required by this Permit until closure. If original strip chart recordings are more than three years old, copies are acceptable. The Permittees shall retain the waste minimization certification required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(9)), and records of all data used to complete the application for this Permit for a period of at least 3 years from the date of certification or application. The Secretary may extend these periods at any time, and these periods shall be automatically extended during the course of any unresolved enforcement action

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regarding this facility. The Permittees shall maintain records from all ground-water monitoring wells and associated ground-water surface elevations, during the active life of the facility and the post-closure period. [20.4.1.500 NMAC (incorporating 40 CFR §264.74(b)), 20.4.1.501 NMAC, and 20.4.1.900 (incorporating §270.30(j)(2))]

1.7.10.3. Monitoring Records Contents

As specified by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(j)(3)), records of monitoring information shall include:

i. The dates, exact place, and times of sampling or measurements;

ii. The individuals who performed the sampling or measurements;

iii. The dates analyses were performed;

iv. The individuals who performed the analyses;

v. The analytical techniques or methods used; and

vi. The results of such analyses.

1.7.11. Reporting Requirements

1.7.11.1. Reporting Planned Changes

The Permittees shall give notice to the Secretary, as soon as possible, of any planned physical alterations or additions to the permitted facility. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(1))]

1.7.11.2. Reporting Anticipated Noncompliance

The Permittees shall give advance notice to the Secretary of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The Permittees shall post a link to the planned change notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall not store or dispose TRU mixed waste in any modified portion of the facility (except as provided in 20.4.1.900 NMAC (incorporating 40 CFR §270.42)) until the following conditions specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(2)) are satisfied:

i. The Permittees have submitted to the Secretary, by certified mail or hand delivery, a letter signed by the Permittees and a New Mexico registered professional engineer stating that the facility has been constructed or modified in compliance with this Permit, and:

ii. The Secretary has either inspected the modified portion of the facility and finds it is in compliance with the conditions of this Permit; or waived the inspection or, within 15 calendar days of the date of submission of the letter required above, has not notified the Permittees of his intent to inspect.

1.7.12. Transfer of Permits

The Permittees shall not transfer this Permit to any person, unless the Secretary has approved a permit modification request for such transfer in writing. The Secretary shall require modification or revocation and reissuance of this Permit as specified by 20.4.1.900 NMAC (incorporating 40 CFR §§270.40 and 270.41(b)(2)) to identify the new Permittees and incorporate other applicable requirements under the HWA, RCRA, and their implementing regulations. The prospective new Permittee shall file a disclosure statement with the Secretary, if applicable and as specified at §74-4-4.7 of the HWA, prior to modification or revocation and re-issuance of the Permit.

Before transferring ownership or operation of the facility during its active life or post-closure care period, the Permittees shall notify the new owner or operator in writing as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.12(c) and 270.30(l)(3)).

1.7.13. 24 Hour and Subsequent Reporting

1.7.13.1. Oral Report

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(i)), within 24 hours from the time the Permittees become aware of the circumstances, the Permittees shall report orally to the Secretary any noncompliance which may endanger human health or the environment, including:

i. Information concerning release of any TRU mixed or hazardous waste that may cause an endangerment to public drinking water supplies; and

ii. Any information of a release or discharge of TRU mixed or hazardous waste, or of a fire or explosion from the facility, which could threaten the environment or human health outside the facility.

The oral report shall be made by calling the Hazardous Waste Bureau's main telephone number during regular business hours, or by calling the New Mexico Department of Public Safety dispatch telephone number during non-business hours, and requesting that the report be forwarded to the NMED spill number.

1.7.13.2. Description of Occurrence

The description of the occurrence and its cause shall include:

i. Name, address, and telephone number of the Permittees;

ii. Name, address, and telephone number of the facility;

iii. Date, time, and type of incident;

iv. Name and quantity of materials involved;

v. The extent of injuries, if any;

vi. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and

vii. Estimated quantity and disposition of recovered material that resulted from the incident. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(ii))]

1.7.13.3. Written Notice

As required by 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(6)(iii)), the Permittees shall submit a written notice within five calendar days of the time the Permittees become aware of the circumstances. The written notice shall contain the information required in Permit Section 1.7.13.2 and the following information:

i. A description of the noncompliance and its cause;

ii. The period(s) of the noncompliance including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and

iii. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

The Secretary may waive the five-day written notice requirement in favor of a written report within 15 calendar days if justifiable cause is provided in advance. The Permittees shall post a link to the written notice or report

transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

1.7.13.4. Contingency Plan Implementation

If the Contingency Plan is implemented, the Permittees shall comply with the reporting requirements specified in Permit Attachment D (RCRA Contingency Plan). [20.4.1.500 NMAC (incorporating 40 CFR §264.56(j))]

1.7.14. Other Noncompliance

The Permittees shall report to the Secretary all other instances of noncompliance not otherwise required to be reported above, in Permit Sections 1.7.10 through 1.7.13, at the time monitoring reports are submitted annually in October. The reports shall contain the information specified in Permit Section 1.7.13 and 20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(10)).

1.7.15. Other Information

Whenever the Permittees become aware that they failed to submit any relevant facts in the Permit application, or submitted incorrect information in the Permit application or in any report to the Secretary, the Permittees shall promptly submit such facts or information in writing to the Secretary. The Permittees shall post a link to the transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(l)(11))]

1.8. ADMISSIBILITY OF DATA

The Permittees waive any objection to the admissibility as evidence of any data required by this Permit in any administrative or judicial action to enforce a condition of this Permit.

1.9. SIGNATORY REQUIREMENT

The Permittees shall sign and certify, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.11) all applications, reports required by this Permit, or information submitted to or requested by the Secretary. [20.4.1.900 NMAC (incorporating 40 CFR §270.30(k))]

1.10. SUBMITTAL OF REPORTS, NOTIFICATIONS, AND INFORMATION TO THE SECRETARY

1.10.1. Information Submittal

The Permittees shall submit, by certified mail or hand delivery or by electronic transmittal with a subsequent hard copy, all reports, notifications, or other submissions which are submitted to or requested by the Secretary or required by this Permit, to:

Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Telephone Number: (505) 476-6000
Facsimile Number: (505) 476-6060

1.10.2. Approval of Submittals

All documents prepared by the Permittees under the terms of this Permit and submitted to the Secretary that are subject to the provisions of 20.4.2 NMAC shall be subject to the procedures set forth therein. Documents requiring the Secretary's approval that are not subject to the provisions of 20.4.2 NMAC may be reviewed and approved, approved with modifications or directions, disapproved, denied, or rejected by the Secretary.

Submittals and associated schedules, upon the Secretary's written approval, shall become enforceable as part of this Permit in accordance with the terms of the Secretary's written approval, and such documents, as approved, shall control over any contrary or conflicting requirements of this Permit. This provision does not affect any public process that is otherwise required by this Permit, the HWA, or its implementing regulations, including 40 CFR §270.42 and 20.4.1.901 NMAC.

1.10.3. Extension of Time

The Permittees may seek an extension of time in which to perform a requirement of this Permit, for good cause, by sending a written request for extension of time and proposed revised schedule to the Secretary. The request shall state the length of the requested extension and describe the basis for the request. The Secretary will respond in writing to any request for extension following receipt of the request. If the Secretary denies the request for extension, reasons for the denial will be stated.

1.11. PUBLIC E-MAIL NOTIFICATION LIST

The Permittees shall develop and maintain an e-mail list to notify members of the public concerning actions identified in this Permit requiring e-mail notification. The Permittees shall send e-mail notifications required by this Permit to the e-mail list within seven days of the submittal date to the Secretary and shall include in the e-mail a direct link to the specific document to which it relates. The Permittees shall provide a link on the WIPP Home Page <http://www.wipp.energy.gov> whereby members of the public may review the actions requiring e-mail notification and submit a request to be placed on this list.

1.12. CONFIDENTIAL INFORMATION

The Permittees may claim confidentiality for any information submitted to or requested by the Secretary or required by this Permit. Any such claim must be asserted at the time of submittal in the manner prescribed on the application form, or in the case of other submittals, by stamping the words

"confidential business information" on each page containing such information. If no claim is made, the Secretary may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information), to the extent authorized by Section 74-4-4.3(D) and (F) of the HWA and 20.4.1.100 and .900 NMAC (incorporating 40 CFR §260.2 and §270.12).

1.13. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The Permittees shall comply with the recordkeeping and reporting requirements specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.73(a)) and elsewhere in this Permit.

The Permittees shall maintain at the facility, until closed as specified in Part 6, the following documents and all amendments, revisions and modifications to these documents:

1. Waste Analysis Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(b)) and this Permit, and records and results of waste analyses performed as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.13).

2. Inspection schedules, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(2)) and this Permit, and records and results of inspections as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

3. Personnel training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d)) and this Permit.

4. Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53(a)) and this Permit, including summary reports and details of all incidents that require implementation of the contingency plan as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)).

5. Operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73) and this Permit.

6. Closure Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.112(a)) and this Permit.

7. Post-Closure Plan as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(a)) and this Permit.

8. Procedures for limiting air emissions, as required by 20.4.1.500 and .900 NMAC (incorporating 40 CFR §§264.601(c) and 270.23(a)(2)) and this Permit.

9. All other documents required by Part 1, Permit Section 1.7.10, and Part 2.

1.14. INFORMATION REPOSITORY

1.14.1. Requirement for Information Repository

The Permittees shall establish and maintain an electronic Information Repository (**IR**) in accordance with the requirements of 20.4.1.1102 NMAC (incorporating 40 CFR §§124.33(c) through (f)) and 20.4.1.900 NMAC (incorporating 40 §270.30(m)). The documents contained in the IR shall be accessible to the public from the WIPP Home Page.

The Permittees shall establish the IR no later than the effective date of this Permit.

1.14.2. Contents of Information Repository

The Permittees shall ensure that the IR contains the following documents:

1. The Permittees' Part A and Part B Permit Applications associated with the permit renewal;
2. A complete copy of this Permit, as it may be modified;
3. Permit modification notifications and requests associated with this Permit submitted pursuant to 20.4.1. 900 NMAC (incorporating 40 CFR §270.42) and any associated responses from the Secretary;
4. The Waste Minimization Report submitted pursuant to Permit Section 2.4;
5. Requests for extensions of time submitted pursuant to Permit Section 1.10.3;
6. Corrective action documents submitted pursuant to Permit Part 8;
7. Each report submitted pursuant to Permit Sections 1.7.11 and 1.7.13 if such report is required to be submitted in writing;
8. Notices of deficiency or disapproval (**NODs**), NOD responses, final approval letters, and directives from the Secretary associated with the documents identified in paragraphs 1, 3, and 6 above;
9. Notices of violation, administrative compliance orders, responses to these documents required by the Secretary, and directives from the Secretary associated with the Permit;
10. Biennial Report submitted pursuant to Permit Section 2.14.2.

1.14.3. Index of Information Repository

The Permittees shall ensure that the IR includes an index of the documents contained in the IR identifying all document titles, publications dates, and authors. This index shall be

accessible on the internet through the WIPP Home Page. The Permittees shall ensure that all documents are searchable and printable.

The Permittees shall add new documents to the IR within ten days after the new documents are submitted to, or received from, the Secretary.

1.14.4. Notification to Public of Information Repository

The Permittees shall inform the public of the existence of the IR and how it may be accessed by the following methods:

1. Written notice to all individuals on the facility mailing list 30 days after the IR becomes operational;

2. Public notice in area newspapers, including the Carlsbad Current-Argus, Albuquerque Journal, and Santa Fe New Mexican, when the IR becomes operational;

3. Continuous notice on the WIPP Home Page of the existence of the IR; and

4. In the public notice related to any permit modification notification or request submitted by the Permittees, including permit renewals.

1.15. COMMUNITY RELATIONS PLAN

1.15.1. Requirement for Community Relations Plan

The Permittees shall establish and implement a Community Relations Plan (**CRP**) to describe how the Permittees will keep communities and interested members of the public informed of Permit-related activities, including waste management, closure, post-closure, and corrective action, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.32(b)(2)). The CRP shall explain how communities and interested members of the public can participate in Permit-related activities.

The Permittees shall implement and post the CRP on the WIPP Home Page within 180 days of the effective date of this Permit. The Permittees shall maintain the CRP until the termination of this Permit.

1.15.2. Contents of Community Relations Plan

The CRP must describe how the Permittees will accomplish the following elements:

1. Identify and establish an open working relationship with communities and interested members of the public;

2. Establish a productive government-to-government relationship between the Permittee DOE and affected tribes and pueblos;

3. Keep communities and interested members of the public informed of permit actions of interest (e.g., implementation of the Contingency Plan, Permit modification requests, Permit compliance issues);

4. Minimize disputes and resolve differences with communities and interested members of the public;

5. Provide a mechanism for the timely dissemination of information in response to individual requests; and

6. Provide a mechanism for communities and interested members of the public to provide feedback and input to the Permittees.

1.15.3. Government to Government Consultation

DOE shall consult on a government-to-government basis with affected tribes and pueblos in New Mexico when developing the CRP in an effort to ensure the program is responsive to their needs. DOE shall document in the operating record of this Permit and post on the WIPP Home Page all consultations, communications, agreements, and disagreements between DOE and affected tribes and pueblos in New Mexico only with the express approval of those entities, regarding the development of the CRP. The CRP shall specify how DOE will consult on a government-to-government basis with affected tribes and pueblos annually concerning how they may be made better informed of the issues related to this Permit.

1.15.4. Initial Consultation on Community Relations Plan

The Permittees shall communicate with and solicit comments from communities and interested members of the public when developing the CRP in an effort to ensure the program is responsive to their needs. The Permittees shall document in the operating record of this Permit all consultations, communications, agreements, and disagreements between the Permittees and all participating entities, with the approval of those entities, regarding the development of the CRP.

1.15.5. Annual Compilation of Comments on Community Relations Plan

The CRP shall specify how the Permittees will solicit comments from communities and interested members of the public annually concerning how they may be made better informed of the issues related to this Permit. The CRP shall specify that the Permittees will annually post on the WIPP Home Page a compilation of all such comments, including any statements of disagreement, with the approval of those entities in a manner set forth in the CRP.

1.16. DISPUTE RESOLUTION

1.16.1. Applicability

In the event DOE disagrees, in whole or in part, with either an action on a final audit report by NMED (as specified in Permit Section 2.3.2.4) or an evaluation by NMED of DOE's provisional approval of an AK Sufficiency Determination Request for a particular waste stream (as specified in Permit Attachment C), DOE may seek dispute resolution. The dispute resolution procedure in this Permit Section shall be the exclusive mechanism for resolving disputes related to NMED's final audit report action or a determination that DOE's provisional approval for a particular waste stream is inadequate.

1.16.2. Notice to NMED

To invoke dispute resolution, DOE shall notify NMED in writing within seven calendar days of receipt of the action or determination in dispute. Such notice shall be sent to the Hazardous Waste Bureau Chief and must set forth the specific matters in dispute, the position DOE asserts should be adopted, a detailed explanation for DOE's position, and any other matters considered necessary for the dispute resolution. For AK Sufficiency Determination disputes, DOE shall also submit all factual data, analysis, opinion, and other documentation upon which they relied for their provisional approval, and any other information that supports their position. NMED shall acknowledge receipt of notification by e-mail sent to DOE's representative as designated in their written notification.

1.16.3. Tier I - Informal Negotiations

DOE and NMED shall make all reasonable, good faith efforts to informally resolve disputes related to NMED's determination. DOE and NMED shall meet or teleconference within 15 calendar days from NMED's receipt of notice to commence negotiations to resolve the dispute. DOE and NMED shall have 30 calendar days from NMED's receipt of notice to resolve the dispute. If an agreement is reached, NMED shall promptly inform DOE of the terms of the agreement in writing. DOE shall comply with the terms of such agreement or, if appropriate, submit a revised submittal and implement the same in accordance with such agreement. If an agreement is not reached, NMED shall promptly inform DOE in writing that an agreement has not been reached.

1.16.4. Tier II - Final Decision of the Secretary

In the event agreement is not reached within the 30 calendar day period, DOE may submit a written Request for Final Decision to the Secretary. The Request must be submitted within seven calendar days after receipt of notification from NMED that an agreement under Tier I was not reached. The Secretary will notify the Permittees in writing of the decision on the dispute, and the Permittees shall comply with the terms and conditions of the decision. Such decision shall be the final resolution of the dispute and shall be enforceable under this Permit.

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1.16.5. Actions Not Affected by Dispute

With the exception of those matters under dispute, the Permittees shall proceed to take any action required by those portions of the submission and of this Permit that NMED determines are not affected by the dispute.

1.16.6. E-Mail Notifications

If DOE submits a notice to NMED pursuant to Permit Section 1.16.2, the Permittees shall post a link to the notice on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. After receipt of NMED's letter concerning the conclusion of any Tier I negotiations, the Permittees shall post a link to the NMED letter on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. If a Tier I agreement is not reached and DOE submits a Tier II request for final decision to the Secretary, the Permittees shall post a link to the request on the WIPP Home Page, and shall inform those on the e-mail notification list as specified in Permit Section 1.11. After receiving notice of the final action by the Secretary, the Permittees shall post a link to the final action on the WIPP Home Page and shall inform those on the e-mail notification list as specified in Permit Section 1.11.

PERMIT ATTACHMENTS

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" - Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter B).

Permit Attachment C7 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Permittee Level TRU Waste Confirmation Processes" - Appendix B7).

Permit Attachment D (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Contingency Plan" - Chapter F).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1)

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PART 2 - GENERAL FACILITY CONDITIONS

2.1. DESIGN AND OPERATION OF FACILITY

The Permittees shall design, construct, maintain, and operate WIPP to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of transuranic (**TRU**) mixed waste or mixed waste constituents to air, soil, groundwater, or surface water which could threaten human health or the environment, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.31).

2.2. WASTE SOURCES

2.2.1. Off-site Wastes

The Permittees may receive off-site TRU mixed waste in compliance with the requirements and conditions specified in this Permit. The Permittees may only receive TRU mixed waste from those sites which comply with the applicable requirements of the Waste Analysis Plan (**WAP**) specified in Permit Section 2.3.1 and Permit Attachment C, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)) and as verified through the Audit and Surveillance Program specified in Permit Section 2.3.2.

2.2.2. Required Notification to Off-Site Sources

Before the Permittees receive TRU mixed waste from an off-site source for the first time, they shall inform the generator/storage site in writing that they have the appropriate Permits for, and will accept, the waste the generator/storage site is shipping. The Permittees shall keep a copy of this written notice as part of the operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.12(b)).

2.3. GENERAL WASTE ANALYSIS

2.3.1. Waste Analysis Plan

The Permittees shall not manage, store, or dispose TRU mixed waste at WIPP which fails to meet the characterization requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13), as specified by this Permit.

The Permittees' WAP, as specified in Permit Attachment C, is approved subject to the following conditions:

2.3.1.1. Implementation of Requirements

i. The Permittees shall require that generator/storage sites implement applicable waste characterization requirements of the WAP, specified in Permit Attachment C, prior to the Permittees' receipt of TRU mixed waste at WIPP.

ii. The Permittees or the co-Permittee DOE shall implement applicable waste confirmation requirements of the WAP, pursuant to Permit Attachment C7 (TRU Waste Confirmation), prior to shipment of TRU mixed waste from generator/storage sites to WIPP.

2.3.1.2. Waste Characterization Sampling and Analytical Methods

The Permittees shall require that generator/storage sites and DOE approved laboratories comply with the applicable method requirements, quality control, equipment testing, inspection, maintenance, and equipment calibration and frequency standards for the procedures specified in Permit Attachment C1 (Waste Characterization Sampling Methods). For all analytical methods for waste analysis not otherwise specified in Permit Attachment C1, the Permittees shall require the generator/storage sites and DOE approved laboratories to use "*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*", EPA Publication SW-846. Updates to EPA Publication SW-846 shall be incorporated into this permit by reference. Sites may use these new or revised methods once they have demonstrated that the results from the new methods will be at least equivalent to the results from the currently used methods.

2.3.1.3. Statistical Methods used in Sampling and Analysis

The Permittees shall require that generator/storage sites use the methods for statistically selecting retrievably stored and newly-generated TRU mixed waste containers for volatile organic compounds (**VOCs**), semivolatile organic compounds (**SVOCs**), and total metals analysis, and establishing upper confidence limits, as specified in Permit Attachment C2 (Statistical Methods Used in Sampling and Analysis).

2.3.1.4. Quality Assurance Objectives

The Permittees shall require that all waste characterization activities used by generator/storage sites and DOE approved laboratories comply with the appropriate quality assurance objectives (**QAOs**) specified in Permit Attachment C3 (Quality Assurance Objectives and Data Validation Techniques for Waste Characterization Sampling and Analytical Methods). The Permittees shall require generator/storage sites to review, validate, and verify all analytical data; reconcile analytical results with data quality objectives (**DQOs**); satisfy data reporting requirements; and identify, document, and report all nonconformances and operational variances in compliance with Permit Attachment C3.

2.3.1.5. Acceptable Knowledge

The Permittees shall require generator/storage sites to assemble acceptable knowledge documentation and re-evaluate acceptable knowledge determinations, and shall audit (as specified in Permit Section 2.3.2) all aspects of the acceptable knowledge waste characterization process as specified in Permit Attachment C4 (TRU Mixed Waste Characterization Using Acceptable Knowledge).

2.3.1.6. Quality Assurance

The Permittees shall require each generator/storage site and DOE approved laboratory to develop and implement a quality assurance project plan (**QAPjP**) which demonstrates compliance with, and implementation of, applicable requirements of the WAP, Permit Attachment C, as specified in Permit Attachment C5 (Quality Assurance Project Plan Requirements).

2.3.1.7. WIPP Waste Information System (**WWIS**) Database

The Permittees shall provide the Secretary access to the WWIS database as necessary to determine compliance with the WAP. The WWIS shall meet all requirements presented in Section C-5a(1) of the WAP, Permit Attachment C, prior to acceptance of TRU mixed waste. The Secretary's access to the WWIS shall be direct, read-only (via modem or Internet) to all query and reporting functions of the Characterization, Certification, Shipping, and Inventory modules of the WWIS database.

Beginning on December 31, 2005, the Permittees instituted a public database containing certain information from the WWIS. The Permittees shall continue to provide such public access through the WIPP Home Page at <http://www.wipp.energy.gov>.

2.3.2. Audit and Surveillance Program

The Permittees shall not manage, store, or dispose TRU mixed waste at WIPP from a generator/storage site until the following conditions have been met as necessary for the Secretary to determine that the applicable characterization requirements of Permit Section 2.3.1 have been implemented:

2.3.2.1. Requirement to Audit

DOE shall demonstrate to the Secretary that the generator/storage sites and DOE approved laboratories have implemented and comply with applicable requirements of the WAP by conducting audits as specified in Permit Attachment C, Section C-5a(3), and Permit Attachment C6 (Audit

and Surveillance Program), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.13).

2.3.2.2. Observation of Audit

The Secretary may observe such audits as necessary to validate the implementation of and compliance with applicable WAP requirements at each generator/storage site and DOE approved laboratory. DOE shall provide the Secretary with a current audit schedule on a monthly basis and notify the Secretary no later than 30 calendar days prior to each audit.

2.3.2.3. Final Audit Report

DOE shall provide the Secretary a final audit report as specified in Permit Attachment C6, and post a link to the final audit report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. The final audit report shall include all information specified in Permit Attachment C6, Section C6-4, and:

i. A detailed description of all corrective actions and the resolution of any corrective action applicable to WAP requirements, including re-audits if required;

ii. All documentation necessary for the Secretary to determine if the corrective action was resolved.

2.3.2.4. Secretary Notification of Approval

The Secretary shall approve DOE's final audit report by written notification to DOE that the applicable characterization requirements of the WAP at a generator/storage site and or DOE approved laboratory have been implemented.

2.3.3. Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**)

The Permittees shall not accept TRU mixed wastes at WIPP for storage, management, or disposal which fail to meet the treatment, storage, and disposal facility waste acceptance criteria as presented in Permit Sections 2.3.3.1 through 2.3.3.10 of this Permit.

2.3.3.1. Liquid

Liquid waste is not acceptable at WIPP. Liquid in the quantities delineated below is acceptable.

- Observable liquid shall be no more than 1 percent by volume of the outermost container at the time of radiography or visual examination.

- Internal containers with more than 60 milliliters or 3 percent by volume observable liquid, whichever is greater, are prohibited.

- Containers with Hazardous Waste Number U134 (hydrofluoric acid) assigned shall have no observable liquid.

- Overpacking the outermost container that was examined during radiography or visual examination or redistributing untreated liquid within the container shall not be used to meet the liquid volume limits.

2.3.3.2. Pyrophoric Materials

Non-radionuclide pyrophoric materials, such as elemental potassium, are not acceptable at WIPP.

2.3.3.3. Non-mixed Hazardous Wastes

Hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes) are not acceptable at WIPP.

2.3.3.4. Chemical Incompatibility

Wastes incompatible with backfill, seal and panel closures materials, container and packaging materials, shipping container materials, or other wastes are not acceptable at WIPP.

2.3.3.5. Explosives and Compressed Gases

Wastes containing explosives or compressed gases are not acceptable at WIPP.

2.3.3.6. PCB Waste

Wastes with polychlorinated biphenyls (**PCBs**) not authorized under an EPA PCB waste disposal authorization are not acceptable at WIPP.

2.3.3.7. Ignitable, Corrosive, and Reactive Wastes

Wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003) are not acceptable at WIPP.

2.3.3.8. Excluded Waste

TRU mixed waste that has ever been managed as high-level waste and waste from tanks specified in Permit Attachment C are not acceptable at

WIPP unless specifically approved through a Class 3 permit modification. Such wastes are listed in Table 2.3.3.8 below.

Table 2.3.3.8 - Additional Approved Waste Streams

Date Class 3 Permit Modification Request Approved	Description of Waste Stream

2.3.3.9. Unconfirmed Waste

Any waste container that has not been subject to confirmation pursuant to Permit Attachment C7 is not acceptable at WIPP. This prohibition shall not apply to waste containers accepted before confirmation activities were required by this Permit.

2.3.3.10. Waste Stream Profiles

Any waste container from a waste stream which has not been preceded by an appropriate, certified Waste Stream Profile Form (Attachment C, Figure C-1) is not acceptable at WIPP.

2.3.4. Permitted TRU Mixed Wastes

The Permittees shall accept containers which contain only those TRU mixed wastes listed in Permit Attachment B (Hazardous Waste Permit Application Part A). Allowable TRU mixed wastes are specified in Table 2.3.4 below. Some of the waste may also be identified by unique state hazardous waste codes. These wastes are acceptable at WIPP as long as the TSDF-WAC are met:

Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
F001	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Trichloroethylene	79-01-6
	Methylene chloride	75-09-2
	1,1,1-Trichloroethane	71-55-6
	Carbon tetrachloride	56-23-5
	Chlorinated fluorocarbons	NA
F002	Spent halogenated solvents:	
	Tetrachloroethylene	127-18-4
	Methylene chloride	75-09-2
	Trichloroethylene	79-01-6
	1,1,1-Trichloroethane	71-55-6
	Chlorobenzene	108-90-7
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1
	Ortho-dichlorobenzene	95-50-1
	Trichlorofluoromethane	75-69-4
	1,1,2-Trichloroethane	79-00-5
F003	Spent non-halogenated solvents:	
	Xylene	1330-20-7
	Acetone	67-64-1
	Ethyl acetate	141-78-6
	Ethyl benzene	100-41-4
	Ethyl ether	60-29-7
	Methyl isobutyl ketone	108-10-1
	n-Butyl alcohol	71-36-3
	Cyclohexanone	108-94-1
	Methanol	67-56-1
F004	Spent non-halogenated solvents:	
	Cresols and cresylic acid	1319-77-3
	Nitrobenzene	98-95-3

Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
F005	Spent non-halogenated solvents:	
	Toluene	108-88-3
	Methyl ethyl ketone	78-93-3
	Carbon disulfide	75-15-0
	Isobutanol	78-83-1
	Pyridine	110-86-1
	Benzene	71-43-2
	2-Ethoxyethanol	110-80-5
	2-Nitropropane	79-46-9
F006	Wastewater treatment sludges from electroplating operations:	
	Cadmium	7440-43-9
	Chromium	7440-47-3
	Cyanide	57-12-5
	Lead	7439-92-1
	Nickel	7440-02-0
	Silver	7440-22-4
F007	Spent cyanide plating bath solutions from electroplating operations:	
	See F006	
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process:	
	See F006	
D004	Arsenic	7440-38-2
D005	Barium	7440-39-3
D006	Cadmium	7440-43-9
D007	Chromium	7440-47-3
D008	Lead	7439-92-1
D009	Mercury	7439-97-6
D010	Selenium	7782-49-2
D011	Silver	7440-22-4
D018	Benzene	71-43-2

Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
D019	Carbon Tetrachloride	56-23-5
D021	Chlorobenzene	108-90-7
D022	Chloroform	67-66-3
D026	Cresol	1319-77-3
D027	1,4-Dichlorobenzene	106-46-7
D028	1,2-Dichloroethane	107-06-2
D029	1,1-Dichloroethylene	75-35-4
D030	2,4-Dinitrotoluene	121-14-2
D032	Hexachlorobenzene	118-74-1
D033	Hexachlorobutadiene	87-68-3
D034	Hexachloroethane	67-72-1
D035	Methyl ethyl ketone	78-93-3
D036	Nitrobenzene	98-95-3
D037	Pentachlorophenol	87-86-5
D038	Pyridine	110-86-1
D039	Tetrachloroethylene	127-18-4
D040	Trichloroethylene	79-01-6
D043	Vinyl chloride	75-01-4
P015	Beryllium powder (H)	7440-41-7
P030	Cyanides (soluble cyanide salts), not otherwise specified (H)	N/A
P098	Potassium Cyanide (H)	151-50-8
P099	Potassium Silver Cyanide (H)	506-61-6
P106	Sodium Cyanide (H)	143-33-9
P120	Vanadium Pentoxide (H)	1314-62-1
U002	Acetone (I)	67-64-1
U003	Acetonitrile (I,T)	75-05-8

Table 2.3.4 – Permitted TRU Mixed Wastes		
EPA Hazardous Waste Number	**Hazardous Waste[1]**	**Chemical Abstracts Service (CAS) Registry Number**
U019	Benzene (I,T)	71-43-2
U037	Chlorobenzene (T)	108-90-7
U043	Vinyl Chloride (T)	75-01-4
U044	Chloroform (T)	67-66-3
U052	Cresol (T)	1319-77-3
U070	1,2-Dichlorobenzene (T)	95-50-1
U072	1,4-Dichlorobenzene (T)	106-46-7
U078	1,1-Dichloroethylene (T)	75-35-4
U079	1,2-Dichloroethylene (T)	156-60-5
U103	Dimethyl Sulfate (T)	77-78-1
U105	2,4-Dinitrotoluene (T)	121-14-2
U108	1,4-Dioxane (T)	123-91-1
U122	Formaldehyde (T)	50-00-0
U133	Hydrazine (R,T)	302-01-2
U134	Hydrofluoric Acid (C,T)	7664-39-3
U151	Mercury (T)	7439-97-6
U154	Methanol (I)	67-56-1
U159	Methyl Ethyl Ketone (I,T)	78-93-3
U196	Pyridine (T)	110-86-1
U209	1,1,2,2-Tetrachloroethane (T)	79-34-5
U210	Tetrachloroethylene (T)	127-18-4
U220	Toluene (T)	108-88-3
U226	1,1,1-Trichloroethane (T)	71-55-6
U228	Trichloroethylene (T)	79-01-6
U239	Xylene (I,T)	1330-20-7

[1] Designations in parentheses for P- and U-coded wastes reflect the basis for the listing and are as follows:

H - acute toxicity

T - toxicity

R - reactivity

I - ignitability

C - corrosivity

Acceptance of U-coded wastes listed for reactivity, ignitability, or corrosivity characteristics is contingent upon a demonstration that the wastes meet the requirements specified in Permit Section 2.3.3.7.

2.3.5. Derived Waste

Any WIPP-generated waste derived from adequately characterized, WIPP-accepted TRU mixed waste generated at an off-site facility (*derived waste*) does not need to be additionally characterized for hazardous waste components if the Permittees use the generator's characterization data and knowledge of the processes at the WIPP facility to identify and characterize derived waste. Derived waste containers shall be managed according to Permit Attachment A1 (Container Storage), Section A1-1d(1), and meet all TSDF waste acceptance criteria in Permit Section 2.3.3 prior to disposal at WIPP.

2.4. WASTE MINIMIZATION PROGRAM

The Permittees shall implement and maintain a waste minimization program to reduce the volume and toxicity of hazardous and mixed wastes generated at the facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(9)). The waste minimization program shall include proposed, practicable methods of treatment and storage currently available to the Permittees to minimize the present and future threat to human health and the environment. The waste minimization program shall include the following items:

1. Written policies or statements that outline goals, objectives, and methods for source reduction and recycling of hazardous and mixed waste at the facility;

2. Employee training or incentive programs designed to identify and implement source reduction and recycling opportunities for all hazardous and mixed wastes;

3. Source reduction or recycling measures implemented in the last five years or planned for the next federal fiscal year;

4. Estimated dollar amounts of capital expenditures and operating costs devoted to source reduction and recycling of hazardous and mixed waste;

5. Factors which have prevented implementation of source reduction or recycling;

6. Summary of additional waste minimization efforts that could be implemented at the facility that analyzes the potential ~~for~~ reducing the quantity and toxicity of each waste stream through production process changes, production reformulations, recycling, and all other appropriate means including an assessment of the technical feasibility, cost, and potential waste reduction for each option;

7. Flow charts and/or tables summarizing all hazardous and mixed waste streams produced by the facility by quantity, type, building or area, and program; and

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8. Demonstration of the need to use those processes which produce a particular hazardous or mixed waste due to a lack of alternative processes, available technology, or available alternative processes that would produce less volume or less toxic waste.

The Permittees shall submit to the Secretary a report regarding progress made in the waste minimization program in the previous year. The report shall address items 1 – 8 above, shall show changes from the previous report, and shall be submitted annually by December 1 for the year ending the previous September 30th.

2.5. DUST SUPPRESSION

The Permittees shall not use waste, used oil, or any other material which is contaminated with dioxin, polychlorinated biphenyls (**PCBs**), or any other hazardous waste (other than a waste identified solely on the basis of ignitability), for dust suppression or road treatment, as specified in 20.4.1.700 NMAC (incorporating 40 CFR §266.23(b)).

2.6. SECURITY

In order to prevent the unknowing entry, and minimize the possibility of unauthorized entry, of persons or livestock onto the active portion of the facility, the Permittees shall comply with the following security provisions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.14).

2.6.1. 24-Hour Surveillance System

The Permittees shall maintain a 24-hour surveillance system comprised of security officers that provide protection 24 hours per day, every day. Security officers shall continuously monitor and control personnel, vehicle, and material access/egress to the active portion of the facility, known as the Property Protection Area (**PPA**), in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(1)).

During non-operational hours, security officers shall conduct documented security patrols outside of the PPA, at a minimum rate of two per 12-hour shift. Whenever scheduled security patrols cannot be made, the reason for missing the patrol shall be documented in the security logbook.

2.6.2. Barrier

The PPA shall be enclosed by a permanent seven ft high chain-link fence topped by three strands of barbed wire, for a total height of eight ft. The fence shall completely surround all major surface structures on the active portion of the facility and shall also be inspected as specified in Permit Attachment E to ensure it remains in good repair, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(2)(i)).

2.6.3. Means to Control Entry

The Permittees shall control entry to the active portion of the facility at all times, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(b)(2)(ii)). Entry into the

PPA, whether by personnel or vehicles, shall be through controlled gates and doors. Only properly identified and authorized persons, vehicles, and property shall be allowed entrance to and exit from the active portion of the facility. Security shall require employees to identify themselves with an identification badge when entering or leaving the premises, and shall require visitors to show proper authorization prior to allowing them to enter the active portion of the facility. Visitors shall be required to wear an approved badge and may require an authorized escort.

For the purposes of entry control to areas where wastes are managed, stored, or disposed, these areas shall be posted as Controlled Areas, and access shall be limited to trained and qualified individuals and visitors escorted by trained and qualified individuals.

2.6.4. Warning Signs

The Permittees shall post "No Trespassing" signs and "Danger: Authorized Personnel Only" signs in English and Spanish at approximately 50 ft intervals on the permanent chain-link fence surrounding the PPA. The signs shall be legible from a distance of 25 ft and shall be visible from any approach to the facility. These same signs, plus security and traffic signs, shall also be located on the controlled gates, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(c)).

2.7. GENERAL INSPECTION REQUIREMENTS

2.7.1. Inspection Schedule

The Permittees shall implement the inspection schedule specified in Permit Attachment E (Inspection Schedule, Process and Forms) to detect any malfunctions and deteriorations, operator errors, and discharges, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.2. Inspection Log Forms

The Permittees shall use the inspection logbooks and forms as specified in Permit Attachment E. Original copies of these completed forms are maintained in the Operating Record. The Permittees shall record the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

2.7.3. Inspection Frequency

The Permittees shall inspect monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment at the frequency specified in Tables E-1 and E-2 of Permit Attachment E, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.4. Inspection Remediation

The Permittees shall remedy any deterioration or malfunction of equipment or structures which an inspection reveals, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

2.7.5. Inspection Records

Beginning with the effective date of this Permit, the Permittees shall maintain inspection logbooks and forms in the operating record until closure, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(d) and 264.73(b)(5)).

2.8. PERSONNEL TRAINING

The Permittees shall conduct personnel training, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.1. Personnel Training Content

The personnel training program shall include the requirements specified in Permit Attachment F (Personnel Training) and Permit Attachment F2 (Training Course and Qualification Card Outlines), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.2. Personnel Training Requirements

The Permittees shall train all persons involved in the management of mixed and hazardous waste in procedures relevant to the positions in which they are employed, as specified in Permit Attachment F1 (RCRA Hazardous Waste Management Job Titles and Descriptions), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.3. Personnel Training Records

The Permittees shall maintain training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d) and (e)).

2.8.4. Continuing Training

Unless otherwise specified by this Permit, continuing training required by this Permit on an annual or biennial basis shall be completed by the end of the month of the anniversary date when the training was previously completed.

2.9. GENERAL REQUIREMENTS FOR HANDLING IGNITABLE, CORROSIVE, REACTIVE, OR INCOMPATIBLE WASTES

The Permittees shall not manage, store or dispose of ignitable, corrosive, reactive, or incompatible wastes, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §§261.21, 261.22, and 261.23) and 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix V) within the permitted units. The Permittees shall comply with the procedures to prevent acceptance of ignitable, corrosive, reactive, and incompatible waste specified in Permit Sections 2.3.1 and 2.3.3.

2.10. PREPAREDNESS AND PREVENTION

2.10.1. Required Equipment

The Permittees shall maintain at the facility the equipment specified in the Contingency Plan, Permit Attachment D (RCRA Contingency Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32).

2.10.1.1. Internal Communications

The Permittees shall have an internal communications or alarm system capable of providing immediate emergency instruction (voice or signal) to facility personnel, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(a)). The internal communication systems shall include two-way communication by the public address (**PA**) system and its intercom phones and paging channels, an internal telephone system, mine phones, pagers and plectrons, and portable two-way radios. The alarm system shall include local and facility-wide alarm systems.

2.10.1.2. External Communications

The Permittees shall have a communications device or system capable of summoning outside agencies for emergency assistance, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(b)). The external communication systems shall include the commercial telephone system and two-way radios.

2.10.1.3. Emergency Equipment

The Permittees shall have portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment as described in Permit Attachment D (RCRA Contingency Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(c)).

2.10.1.4. Water for Fire Control

The Permittees shall have water at adequate volume and pressure to supply water-hose streams, foam-producing equipment, automatic

sprinklers, or water-spray systems, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.32(d)). The WIPP facility water system shall consist of water furnished by the City of Carlsbad capable of providing water at a rate of 6,000 gallons per minute; two water storage tanks, one 180,000-gallon capacity tank for use by the fire-water system and a second tank with a 100,000-gallon reserve; dedicated fire-water pumps rated at 1,500 gallons per minute at 125 pounds per square inch; and a wet-pipe sprinkler system connected to surface buildings as described in Permit Attachment D (RCRA Contingency Plan).

2.10.1.5. Electrical Backup

In case of loss of AC power input to the UPS units, the dedicated batteries were designed to supply power to a fully loaded UPS for 30 minutes. It is expected that the AC power input to the UPS will be restored within 30 minutes, either from the off-site electric utility or from the site back-up power generator system.

The RH Complex is included in the WHB. The Central UPS supplies power to the WHB which includes the RH Complex. The RH Bay, Hot Cell and Transfer Cell equipment are serviced by dual 1,300 KW diesel powered generators located between the exhaust shaft and the WHB. The generators provide backup power to both CH and RH waste handling operations. The RH waste handling equipment is designed to stop as a result of loss of power in a fail-safe condition. Power from the back-up generators may be utilized to place RH TRU mixed waste containers in process into a safe configuration. During a total power outage condition selected RH loads can be powered by the Central UPS. Within a short time selected RH loads at 480 volts and below can be powered by the Backup Diesel Generators. The backup central UPS for the WHB would also supply backup power to the RH Complex.

Human health and the environment are protected during a loss of off-site power by a combination of factors:

i. The underground filtration system fails in the "filter" mode so that no releases of contaminated particulates will occur

ii. The UPS maintains all monitoring systems and alarms in waste handling areas so that fires or pressure loss will be detected and an appropriate response initiated

iii. Generators are brought on line within 30 minutes, at which time hoisting can be initiated so that personnel do not have to stay underground for extended lengths of time.

iv. Decisions to evacuate underground personnel will be made in accordance with the requirements of the Mine Safety and Health Administration (MSHA)

v. The waste hoist brakes set automatically so that loads do not fall

vi. Cranes retain their loads so that spills do not occur from dropped containers

vii. Communication systems are maintained

viii. The emergency operations center is powered if it is needed

2.10.2. Testing and Maintenance of Equipment

The Permittees shall test and maintain the equipment specified in Permit Section 2.10.1, as necessary, to assure its proper operation in time of emergency, as specified in Permit Attachment E and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.33).

2.10.3. Access to Communications or Alarm System

The Permittees shall maintain access to the communications and alarm systems specified in Permit Section 2.10.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.34).

2.10.4. Required Aisle Space

The Permittees shall maintain aisle space in the WHB Unit and Parking Area Unit (Part 3) to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation in an emergency, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.35).

2.10.5. Arrangements with Local Authorities

2.10.5.1. Parties to Arrangements

The Permittees shall maintain preparedness and prevention arrangements with state and local authorities, other mining operations, contractors, and other governmental agencies specified in Permit Attachment D, Section D-6, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.37(a) and 264.52(c)). If state or local authorities, other mining operations, contractors, or other governmental agencies decline to enter into preparedness and prevention arrangements with the Permittees, the Permittees shall document this refusal in the operating record, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37(b)).

2.10.5.2. Coordination Agreements

As specified in Section D-6 of Permit Attachment D, these arrangements shall be either Memoranda of Understanding (**MOU**) or Mutual Aid Agreements (**MAA**) between the Permittees and the off-site cooperating agencies, and shall include the elements required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37(a)). Copies and descriptions of these MOUs and agreements shall be maintained at the facility in the operating record.

2.11. HAZARDS PREVENTION

The Permittees shall operate the WIPP facility to fully meet each of the requirements of 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(8)), to prevent hazards associated with unloading operations, prevent runoff from hazardous waste handling areas, prevent contamination of water supplies, mitigate the effects of equipment and power failures, prevent undue exposure of personnel to hazardous waste, and prevent releases to the atmosphere, as specified in Permit Attachments A (General Facility Description and Process Information), A1 (Container Storage), and A2 (Geologic Repository).

2.12. CONTINGENCY PLAN

2.12.1. Implementation of Plan

The Permittees shall immediately implement the Contingency Plan as specified in Permit Attachment D whenever there is a fire, explosion, or release of mixed or hazardous waste or hazardous waste constituents which could threaten human health or the environment, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)).

2.12.2. Copies of Plan

The Permittees shall maintain copies of the Contingency Plan and all revisions and amendments to the Contingency Plan as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53). The Permittees shall provide copies of the current Contingency Plan to the Secretary and all entities with which the Permittees have emergency MOUs or MAAs, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.53(b)). The Permittees shall maintain at least one current paper copy of the Contingency Plan at the facility in a location readily accessible to the Emergency Coordinator specified in Permit Section 2.12.4.

2.12.3. Amendments to Plan

The Permittees shall review and immediately amend, if necessary, the Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.54).

2.12.4. Emergency Coordinator

An Emergency Coordinator as specified in Table D-2 of Permit Attachment D shall be available at all times in case of an emergency. The Emergency Coordinator shall be thoroughly familiar with the Contingency Plan and shall have the authority to commit the resources needed to implement the Contingency Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55). In the event of an imminent or actual emergency, the Emergency Coordinator shall implement the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.56).

2.13. MANIFEST SYSTEM

The Permittees shall comply with the manifest requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.71 and 264.72). The Permittees shall not accept for storage or disposal any mixed waste from an off-site source without an accompanying manifest.

2.14. RECORDKEEPING AND REPORTING

In addition to the recordkeeping and reporting requirements specified elsewhere in this Permit, the Permittees shall comply with the following conditions:

2.14.1. Operating Record

The Permittees shall maintain a written operating record at the facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(a)). The written operating record shall include all information required under 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)) subject to the limitations on the storage of classified information as discussed in Permit Attachment C. Unless specifically prohibited by this Permit, an electronic record that cannot be altered by the user and capable of producing a paper copy shall be deemed to be a written record. The Permittees shall maintain the operating record until closure of the facility.

2.14.2. Biennial Report

The Permittees shall submit to the Secretary a biennial report, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.75).

PERMIT ATTACHMENTS

Permit Attachment A (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "General Facility Description and Process Information" - Chapter A and "Information for Specific Units - Chapter M)

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage - Appendix M1)

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository - Appendix M2)

Permit Attachment B (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Part A Application").

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter B).

Permit Attachment C1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Characterization Sampling Methods" - Appendix B1).

Permit Attachment C2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Statistical Methods Used in Sampling and Analysis" - Appendix B2).

Permit Attachment C3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Quality Assurance Objectives and Data Validation Techniques for Waste Characterization Sampling and Analytical Methods" - Appendix B3).

Permit Attachment C4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "TRU Waste Characterization Using Acceptable Knowledge" - Appendix B4).

Permit Attachment C5 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Quality Assurance Project Plan Requirements" - Appendix B5).

Permit Attachment C6 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Isolation Pilot Plant DOE Audit and Surveillance Program" - Appendix B6).

Permit Attachment C7 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Permittee Level TRU Waste Confirmation Processes" - Appendix B7).

Permit Attachment D (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Contingency Plan" - Chapter F).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment F (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Personnel Training" - Chapter H).

Permit Attachment F1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "RCRA Hazardous Waste Management Job Titles and Descriptions" - Appendix H1).

Permit Attachment F2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Training Course and Qualification Card Outlines" - Appendix H2).

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PART 3 - CONTAINER STORAGE

3.1. DESIGNATED CONTAINER STORAGE UNITS

This Part authorizes the storage and management of transuranic (**TRU**) mixed waste containers in the Waste Handling Building and Parking Area Container Storage Units described below. Specific facility and process information for the storage and management of TRU mixed waste in these Container Storage Units is incorporated in Permit Attachment A1 (Container Storage).

3.1.1. Waste Handling Building Container Storage Unit

The Waste Handling Building Container Storage Unit (**WHB Unit**) is located in the Waste Handling Building (**WHB**) at the WIPP facility. The WHB Unit consists of the WHB contact-handled (**CH**) Bay and the remote-handled (**RH**) Complex. The areas and storage capacities for the WHB unit are defined in Table 3.1.1.

The Permittees may store and manage TRU mixed waste in the WHB Unit, provided the Permittees comply with the following conditions:

3.1.1.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1.

3.1.1.2. Storage Locations and Quantities

The Permittees may store TRU mixed waste containers in the locations in the WHB Unit, as specified in Table 3.1.1 below and depicted in Permit Attachment A1, Figures A1-1 and A1-17a, b, and c. The Permittees may store quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 3.1.1 below.

3.1.1.3. Use of CH Bay Surge Storage

The Permittees may use the CH Bay Surge Storage Area in Table 3.1.1 below only as specified in Permit Attachment A1, Section A1-1c(1).

3.1.1.4. Notification of CH Bay Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the CH Bay Surge Storage Area and provide justification for its use. The Permittees shall post a link to the notice of CH Bay Surge Storage Area use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing CH Bay Surge Storage Area usage.

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Table 3.1.1 - WHB Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
CH Bay Storage Area	32,307ft^2 (3,001 m^2)	4,800 ft^3 (135.9 m^3)	13 loaded facility pallets and 4 CH Packages at the TRUDOCKS
CH Bay Surge Storage Area	included in CH Bay Storage Area	1,600 ft^3 (45.3 m^3)	5 loaded facility pallets
Derived Waste Storage Area	included in CH Bay Storage Area	66.3 ft^3 (1.88 m^3)	1 Standard Waste Box
Total for CH Waste	32,307 ft^2 (3,001 m^2)	**6,466.3 ft^3 183.1 m^3**	
RH Bay	12,552 ft^2 (1,166 m^2)	156 ft^3 (4.4 m^3)	2 loaded casks and 1 drum of derived waste
Cask Unloading Room	382 ft^2 (36 m^2)	74 ft^3 (2.1 m^3)	1 loaded cask
Hot Cell	1,841 ft^2 (171 m^2)	94.9 ft^3 (2.7 m^3)	12 drums and 1 drum of derived waste
Transfer Cell	1,003 ft^2 (93 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Facility Cask Loading Room	1,625 ft^2 (151 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Total for RH Waste	**17,403 ft^2 (1,617 m^2)**	**387.7 ft^3 (11.0 m^3)**	
Facility Total	**49,710 ft^2 (4,618 m^2)**	**6,854 ft^3 (194.1 m^3)**	

3.1.1.5. Storage on Pallets

The Permittees shall store TRU mixed waste containers unloaded from the Contact-Handled Packages (**TRUPACT-II, HalfPACT, or TRUPACT III** shipping containers) on pallets in the WHB Unit, as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.6. Storage of Derived Waste

The Permittees shall store containers of TRU mixed derived waste only in the Derived Waste Storage Area, the RH Bay, and the RH Hot Cell. The

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Permittees shall store the derived waste containers on a pallet that provides secondary containment and elevates the containers at least 6 inches above the floor to protect them from contact with accumulated liquid.

3.1.1.7. CH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a CH TRU mixed waste container in the WHB Unit for more than 60 calendar days, with the exception of the Derived Waste Storage Area, where derived waste may be accumulated and stored until the container is full.

3.1.1.8. Minimum Aisle Space

The Permittees shall maintain a minimum aisle space of 44 inches (1.1 m) between facility pallets in the CH Bay of the WHB Unit. The Permittees shall maintain adequate aisle space of 44 inches (1.1 m) between loaded casks in the RH Bay of the WHB Unit. For other locations within the RH Complex, sufficient aisle space will be maintained to assure that emergency equipment can be accessed or moved to the necessary locations.

3.1.1.9. Storage of RH TRU Mixed Waste Containers

The Permittees shall store RH TRU mixed waste in casks, canisters, or drums in the RH Complex as described in Permit Attachment A1, Section A1-1c(1).

3.1.1.10. RH TRU Mixed Waste Storage Time Limit

The Permittees shall not store a RH TRU mixed waste container in the RH Complex for more than 60 calendar days, with the following exceptions:

i. Derived Waste Storage Areas, where derived waste may be accumulated and stored until the container is full; and

ii. Hot Cell, where 55-gallon drums may be stored for no more than 25 of the 60 calendar days.

3.1.1.11. Hot Cell RH TRU Mixed Waste Processing Capacity

The processing capacity of the Hot Cell is limited to 13,773 ft^3 (390 m^3) of RH TRU mixed waste.

3.1.2. Parking Area Container Storage Unit

The Parking Area Container Storage Unit (**Parking Area Unit**) is an asphalt and concrete surface extending from north of the rail sidings to the WHB, within the Controlled Area. The Parking Area Unit shall be enclosed by chain link fence. The Parking Area Unit shall comprise a surface area of no more than 137,050 ft^2 (12,730 m^2), as depicted in Permit Attachment A1, Figure A1-2.

The Permittees may store and manage TRU mixed waste in the Parking Area Unit, provided the Permittees comply with the following conditions:

3.1.2.1. Storage Containers

The Permittees shall store TRU mixed waste in containers specified in Permit Section 3.3.1. These TRU mixed waste containers shall be stored within the sealed Contact-Handled or Remote-Handled Packages described in Permit Attachment A1.

3.1.2.2. Storage Locations and Quantities

The Permittees shall store TRU mixed waste containers in any location within the Parking Area Unit, as specified in Table 3.1.2 below. The Permittees may store quantities of TRU mixed waste containers within sealed Contact-Handled or Remote-Handled Packages in these locations not to exceed the maximum capacities specified in Table 3.1.2 below.

3.1.2.3. Use of Parking Area Surge Storage

The Permittees may use the Parking Area Surge Storage in Table 3.1.2 below only when the maximum capacity in the Parking Area is reached and as specified in Permit Attachment A1, Section A1-1c(2).

3.1.2.4. Notification of Parking Area Surge Storage Use

The Permittees shall notify the Secretary in writing upon using the Parking Area Surge Storage and provide justification for its use. The Permittees shall post a link to the notice of Parking Area Surge Storage use on the WIPP Home Page, and inform those on the e-mail notification list as specified in Permit Section 1.11. The Permittees shall submit a report to the Secretary by October 27 of each year summarizing Parking Area Surge Storage usage.

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Table 3.1.2 - Parking Area Unit			
Description	**Area**	**Maximum Capacity**	**Container Equivalent**
Parking Area	137,050 ft^2 (12,730 m^2)	6,734 ft^3 (191 m^3)	40 Contact-Handled Packages containing waste and 8 Remote-Handled Packages containing waste. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.
Parking Area Surge Storage	Included in Parking Area	2,129 ft^3 (60 m^3)	12 Contact-Handled Packages and 4 Remote-Handled Packages. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.

3.1.2.5. Prohibition on Opening Shipping Containers

The Permittees shall keep the Contact-Handled or Remote-Handled Packages sealed at all times while in the Parking Area Unit.

3.1.2.6. Storage Time Limit

The Permittees shall not store sealed Contact-Handled or Remote-Handled Packages in the Parking Area Unit for more than 59 days after the date the Inner Containment Vessel (**ICV**) of the Package was sealed at the generator site. Prior to storing a sealed Package, the Permittees shall verify that the ICV Closure Date for each Package is recorded in the WIPP Waste Information System (**WWIS**) database described in Permit Attachment C (Waste Analysis Plan).

3.1.2.7. Minimum Aisle Space

The Permittees shall maintain a minimum spacing of 4 ft (1.2 m) between loaded Contact-Handled or Remote-Handled Packages.

3.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

3.2.1. Permitted Waste

The Permittees may store and manage TRU mixed waste in the WHB Unit and Parking Area Unit, provided the Permittees comply with the following conditions:

3.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

3.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

3.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

3.2.2. Prohibited Waste

The Permittees shall not store or manage any TRU mixed waste that fails to comply with Permit Section 3.2.1.

3.3. CONDITION OF CONTAINERS

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 3.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

3.3.1. Acceptable Storage Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for storage of TRU mixed waste at WIPP. The Permittees are prohibited from storing TRU mixed waste in any container not specified in Permit Attachment A1, Section A1-1b, as set forth below:

3.3.1.1. Standard 55-gallon (208-liter) Drum

Each standard 55-gallon drum has a gross internal volume of 7.4 ft^3 (0.21 m^3).

3.3.1.2. Standard Waste Box (**SWB**)

Each SWB has a gross internal volume of 66.3 ft^3 (1.88 m^3).

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3.3.1.3. Ten-drum Overpack (**TDOP**)

Each TDOP has a gross internal volume of 160 ft^3 (4.5 m^3). TDOPs may be used to contain up to ten standard 55-gallon drums or one SWB. TDOPs may be direct loaded or used to overpack drums or SWBs containing CH TRU mixed waste.

3.3.1.4. 85-gallon (322-liter) Drum

Each 85-gallon drum has a gross internal volume of up to 11.4 ft^3 (0.32 m^3). 85-gallon drums may be direct loaded or used for overpacking 55-gallons drums containing CH TRU mixed waste and for collecting and storing derived waste.

3.3.1.5. 100-gallon (379-liter) Drum

Each 100-gallon drum has a gross internal volume of 13.4 ft^3 (0.38m^3). 100-gallon drums may be direct loaded with CH TRU mixed waste.

3.3.1.6. RH TRU Canister

Each RH TRU canister has a gross internal volume of 31.4 ft^3 (0.89 m^3). RH TRU canisters contain RH TRU mixed waste packaged in small containers (e.g., 55-gallon drums) or waste loaded directly into the canister.

3.3.1.7. Standard Large Box 2 (**SLB2**)

Each SLB2 has a gross internal volume of 261 ft^3 (7.39 m^3). SLB2s may be direct loaded with CH TRU mixed waste.

3.3.1.8. Shielded Container*

Each shielded container contains a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11m^3). Shielded containers contain RH TRU mixed waste, but shielding will allow it to be managed and stored as CH TRU mixed waste. For the purpose of this Permit, shielded containers will be managed, stored, and disposed as CH TRU mixed waste, but will be counted towards the volume limits associated with RH TRU mixed waste. Shielded containers may be overpacked into standard waste box or ten drum overpack.

* "Shielded Container" refers to the container depicted in Figure A1-37.

3.3.2. Derived Waste Containers

The Permittees shall use standard 55-gallon drums, SWBs, or 85-gallon drums to collect, store, and dispose of derived waste.

3.4. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittees shall use containers made of or lined with materials which will not react with, and are otherwise compatible with, the TRU mixed waste to be stored, so that the ability of the container to contain the waste is not impaired, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

3.5. MANAGEMENT OF CONTAINERS

The Permittees shall manage all containers as specified in Permit Attachment A1 and shall keep all containers closed during storage, except when it is necessary to add waste to derived waste containers. The Permittees shall not open, handle, or store containers in a manner which may rupture the container or cause it to leak, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.173).

3.6. CONTAINMENT SYSTEMS

The Permittees shall maintain the secondary containment systems for all containers managed in the WHB Unit and Parking Area Unit as specified in Permit Attachment A1, Section A1-1f, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.175).

3.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the WHB Unit and Parking Area Unit TRU mixed waste container storage and management areas at least weekly, in accordance with Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and Permit Attachment A1, Section A1-1e, to detect leaking containers and deterioration of containers and the containment system caused by corrosion and other factors, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174).

3.7.1. Inspection of 55-Gallon Drum Seven-Packs

The Permittees shall not be required to inspect the center drum of a 55-gallon seven-pack assembly, as depicted in Permit Attachment A2 (Geologic Repository), Figure A2-6.

3.7.2. Inspection of Sealed Contact-Handled or Remote-Handled Packages

The Permittees shall not be required to inspect the contents of sealed Contact-Handled or Remote-Handled Packages stored in compliance with Permit Section 3.1.2 and Permit Attachment A1, Section A1-1e(2). The Permittees shall attach a clearly legible sign to each Contact-Handled and Remote-Handled Package indicating whether the Contact-Handled or Remote-Handled Package contains TRU mixed waste.

3.8. RECORDKEEPING

The Permittees shall place the results of waste analyses in the operating record as specified in Permit Section 2.14 and Permit Attachment C.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment C (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Waste Analysis Plan" - Chapter C).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

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PART 4 - GEOLOGIC REPOSITORY DISPOSAL

4.1. DESIGNATED DISPOSAL UNITS

This Part authorizes the management and disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste containers in the Underground Hazardous Waste Disposal Units (**Underground HWDUs**) identified herein. Specific facility and process information for the management and disposal of CH and RH TRU mixed waste in the Underground HWDUs is incorporated in Permit Attachment A2 (Geologic Repository).

4.1.1. Underground Hazardous Waste Disposal Units

The Underground HWDUs are located at the WIPP facility approximately 2150 feet (665 meters) below the ground surface within the Salado formation. An Underground HWDU is a single excavated panel, consisting of seven rooms and two access drifts, designated for disposal of TRU mixed waste containers.

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.1.1.1. Disposal Containers

The Permittees shall dispose TRU mixed waste in containers specified in Permit Section 4.3.1.

4.1.1.2. Disposal Locations and Quantities

The Permittees shall dispose TRU mixed waste containers in eight Underground HWDUs, as specified in Table 4.1.1 below and depicted in Permit Attachment A2, Figure A2-1. The Permittees may dispose quantities of TRU mixed waste containers in these locations not to exceed the maximum capacities specified in Table 4.1.1 below. The Permittees may increase these capacities subject to the following conditions:

i. The Permittees may submit a Class 1 permit modification requiring prior approval of the Secretary in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(a)) to increase the CH TRU mixed waste capacity by 35,300 ft^3 (1,000 m^3) or less, and the RH TRU mixed waste capacities in Panels 5 and 6 to a maximum of 22,950 ft^3 (650 m^3).

At least 15 calendar days before submittal to NMED, the Permittees shall post a link to the Class 1 permit modification on the WIPP Home Page and inform those on the e-mail notification list.

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ii. Notwithstanding Permit Section 4.1.1.2.i, any Underground HWDU CH TRU waste capacity may be increased by up to 25 percent of the total maximum capacity in Table 4.1.1 by submitting a Class 2 permit modification request in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42(b)).

Table 4.1.1 - Underground HWDUs

Description[1]	Waste Type	Maximum Capacity[2]		Final Waste Volume
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)		370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)		635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)		603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)		503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)		6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)		562,500 ft^3 (15,927m^3)
	RH TRU	15,720 ft^3 (445 m^3)		8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	18,860 ft^3 (534 m^3)		
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**		
	RH TRU	**93,050 ft^3 (2,635 m^3)**		

[1] The area of each panel is approximately 124,150 ft2 (11,533 m2).
[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository

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capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

4.2. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

4.2.1. Permitted Waste

The Permittees may dispose TRU mixed waste in the Underground HWDUs, provided the Permittees comply with the following conditions:

4.2.1.1. Waste Analysis Plan

The TRU mixed waste shall be characterized to comply with the waste analysis plan specified in Permit Section 2.3.1.

4.2.1.2. TSDF Waste Acceptance Criteria

The TRU mixed waste shall comply with the treatment, storage, and disposal facility (**TSDF**) waste acceptance criteria specified in Permit Section 2.3.3.

4.2.1.3. Hazardous Waste Numbers

The TRU mixed waste shall contain only hazardous waste numbers specified in Permit Section 2.3.4.

Derived waste may be disposed in the Underground HWDUs as specified in Permit Section 2.3.5.

4.2.2. Prohibited Waste

4.2.2.1. General Prohibition

The Permittees shall not dispose any TRU mixed waste that fails to comply with Permit Section 4.2.1.

4.2.2.2. Specific Prohibition

After this Permit becomes effective, the Permittees shall not dispose non-mixed TRU waste in any Underground HWDU unless such waste is characterized in accordance with the requirements of the WAP specified in Permit Section 2.3.1. The Permittees shall not dispose TRU mixed waste in any Underground HWDU if the Underground HWDU contains non-mixed TRU waste which was disposed of after this Permit became effective and was not characterized in accordance with the requirements of the WAP.

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4.3. DISPOSAL CONTAINERS

4.3.1. Acceptable Disposal Containers

The Permittees shall use containers that comply with the requirements for U.S. Department of Transportation shipping container regulations (49 CFR §173 - Shippers - General Requirements for Shipment and Packaging, and 49 CFR §178 - Specifications for Packaging) for disposal of TRU mixed waste at WIPP. The Permittees are prohibited from disposing TRU mixed waste in any container not specified in Permit Attachment A1 (Container Storage), Section A1-1b, as set forth below:

4.3.1.1. Standard 55-gallon (208-liter) Drum

Standard 55-gallon drums are configured as a 7-pack or as an individual unit.

4.3.1.2. Standard Waste Box (**SWB**)

An SWB is configured as an individual unit.

4.3.1.3. Ten-drum Overpack (**TDOP**)

A TDOP is configured as an individual unit.

4.3.1.4. 85-gallon (322-liter) Drum

85-gallon drums are configured as a 4-pack or as an individual unit.

4.3.1.5. 100 gallon (379-liter) Drum

100-gallon drums are configured as a 3-pack or as an individual unit.

4.3.1.6. RH TRU Canister

An RH TRU canister is configured as an individual unit.

4.3.1.7. Standard Large Box 2 (**SLB2**)

An SLB2 is configured as an individual unit.

4.3.1.8. Shielded Container

Shielded containers are configured as a three-pack.

4.3.2. Condition of Containers

If a container holding TRU mixed waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak prior to disposal in an Underground HWDU, the Permittees shall manage the TRU mixed waste containers specified in Permit Section 4.3.1 as specified in Permit Attachment A1 and in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.171).

4.4. VOLATILE ORGANIC COMPOUND LIMITS

The Permittees shall limit releases to the air of volatile organic compound waste constituents (**VOCs**) as specified by the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)):

4.4.1. Room-Based Limits

The measured concentration of VOCs in any open (active) room and in each closed room in active panels within an Underground HWDU shall not exceed the limits specified in Table 4.4.1 below:

Table 4.4.1 - VOC Room-Based Limits

Compound	VOC Room-Based Concentration Limit (PPMV)
Carbon Tetrachloride	9625
Chlorobenzene	13000
Chloroform	9930
1,1-Dichloroethylene	5490
1,2-Dichloroethane	2400
Methylene Chloride	100000
1,1,2,2-Tetrachloroethane	2960
Toluene	11000
1,1,1-Trichloroethane	33700

There are no maximum concentration limits for other VOCs.

4.4.2. Determination of VOC Room-Based Limits

The Permittees shall confirm the VOC concentration and emission rate limits identified in Permit Section 4.4.1 using the VOC Monitoring Plan specified in Permit Attachment N

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(Volatile Organic Compound Monitoring Plan). The Permittees shall conduct monitoring of VOCs as specified in Permit Sections 4.6.2 and 4.6.3.

4.4.3. Ongoing Disposal Room VOC Monitoring in Panels 3 Through 8

The Permittees shall continue disposal room VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless the explosion-isolation wall specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System) is installed in the panel.

4.5. DESIGN, CONSTRUCTION, AND OPERATION REQUIREMENTS

The Permittees shall design, construct, and operate the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601):

4.5.1. Repository Design

The Permittees shall construct each Underground HWDU in conformance with the requirements specified in Permit Attachment A2 and Permit Attachment A3 (Drawing Number 51-W-214-W, "Underground Facilities Typical Disposal Panel").

4.5.2. Repository Construction

4.5.2.1. Construction Requirements

Subject to Permit Section 4.5.1, the Permittees may excavate the following Underground HWDUs, as depicted in Permit Attachment A2, Figure A2-1, "Repository Horizon", and specified in Section A2-2a(3), "Subsurface Structures (Underground Hazardous Waste Disposal Units (HWDUs))":

- Panel 10 (Disposal area access drift)
- Panel 2
- Panel 9 (Disposal area access drift)
- Panel 3
- Panel 4
- Panel 5
- Panel 6
- Panel 7
- Panel 8

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.7.11.2.

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4.5.2.2. Notification Requirements

At least 30 calendar days prior to the projected start date of excavation of each Underground HWDU, the Permittees shall provide written notification to the Secretary stating the projected start date of excavation, along with supporting rationale (e.g., projected waste receipt rate, etc.). The Permittees shall post a link to the notification transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room when waste disposal is taking place and workers are present in the room, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

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4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a

link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

4.6.2.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the VOC Monitoring Plan.

4.6.2.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 below.

The Permittees shall post a link to any exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.2.3 - VOC Concentrations of Concern

Compound	Drift E-300 Concentration	
	ug/m3	ppbv
Carbon Tetrachloride	6040	960
Chlorobenzene	1015	220
Chloroform	890	180
1,1-Dichloroethylene	410	100

1,2-Dichloroethane	175	45
Methylene Chloride	6700	1930
1,1,2,2-Tetrachloroethane	350	50
Toluene	715	190
1,1,1-Trichloroethane	3200	590

4.6.2.4. Remedial Action

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3, the Permittees shall cease disposal in the active CH disposal room and install ventilation barriers as specified in Permit Section 4.5.3.3.

If the running annual average concentration for a VOC specified in Table 4.4.1 exceeds the concentration of concern specified in Table 4.6.2.3 for six consecutive months, the Permittees shall close the affected Underground HWDU as specified in Permit Section 4.9.1.

For any remedial action taken under this Permit Section, the Permittees shall submit to the Secretary written quarterly status reports, beginning 30 calendar days after the Permittees submit the initial notification in Permit Section 4.6.2.3 which resulted in the remedial action. The quarterly status report shall analyze the cause of exceedance, describe the implementation and results of the remedial action, and describe measures taken to prevent future exceedances. The Permittees shall submit such reports until the Secretary determines the remedial action has been completed in accordance with all applicable requirements of this Permit.

4.6.3. Disposal Room Volatile Organic Compound Monitoring

4.6.3.1. Implementation of Disposal Room VOC Monitoring

The Permittees shall implement disposal room VOC monitoring as specified in Permit Attachment N and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.3.2. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Table 4.4.1 in any closed room in an active panel or in the immediately adjacent closed room exceeds the action

levels specified in Table 4.6.3.2 below. The Permittees shall post a link to the exceedance notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring

Compound	50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv	95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethylene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the

subject closed room will continue at a frequency of once per week until commencement of panel closure.

4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report to the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

4.6.5.3. Notification Requirements

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of hydrogen or methane in a filled panel exceeds the action levels specified in Table 4.6.5.3 below.

The Permittees shall post a link to the notification letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

Table 4.6.5.3 - Action Levels for Hydrogen and Methane Monitoring

Compound	Action Level 1	Action Level 2
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

4.6.5.4. Remedial Action

Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 1" in Table 4.6.5.3, the sampling frequency in that filled panel will increase to once per week. Upon receiving validated analytical results that indicate at least one compound exceeded "Action Level 2" in Table 4.6.5.3 in two consecutive weekly samples, the Permittees shall install in that panel the explosion-isolation wall specified in Permit Attachment G1.

4.6.5.5. Sampling Line Loss

The Permittees shall notify the Secretary in writing within seven calendar days of the discovery of loss of sampling line(s). The Permittees shall evaluate any loss of sampling lines as described in Permit Attachment N1, Section N1-5b, "Sample Tubing", and shall notify the Secretary in writing within seven calendar days the results of such evaluation. The Permittees shall also post a link to such notification letters on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11

4.7. INSPECTION SCHEDULES AND PROCEDURES

The Permittees shall inspect the Underground HWDUs at least weekly, as specified in Permit Attachment E (Inspection Schedule, Process and Forms), Tables E-1 and E-1a, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15). The Permittees shall perform these inspections to detect malfunctions, signs of deterioration, operator errors, discharges, or any other factors which

have caused or may cause a release of hazardous wastes or hazardous waste constituents to the environment or which may compromise the ability of any Underground HWDU to comply with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

4.8. RECORDKEEPING

4.8.1. Underground HWDU Location Map

The Permittees shall maintain, in the operating record, a map containing the exact location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks.

4.8.2. Disposal Waste Type and Location

The Permittees shall maintain, in the operating record, a record identifying the types and quantities of TRU mixed waste in each Underground HWDU and the disposal location of each container or container assembly (e.g., a 7-pack of standard 55-gallons drums) within each Underground HWDU, using the following fields from the WWIS data dictionary:

1. Panel Number
2. Room Number or Drift Number
3. Row Number (for CH TRU mixed waste) or Borehole Number (for RH TRU mixed waste)
4. Column Number (for CH TRU mixed waste)
5. Column Height (for CH TRU mixed waste)
6. Container Type Code
7. Container Identification Number
8. Manifest Document Number
9. Disposal Date

The Permittees shall also maintain, in the operating record, a map or diagram depicting the location and quantity of each waste. The map or diagram shall include a cross reference to specific manifest document numbers, if the waste was accompanied by a manifest, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(2)).

4.8.3. Ventilation Rates

The Permittees shall maintain, in the operating record, a record identifying any non-conformance to the ventilation rates specified in Permit Section 4.5.3.2.

PERMIT ATTACHMENTS

Permit Attachment A1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Container Storage" – Appendix M1).

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" – Appendix M2).

Permit Attachment A3 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Underground Facilities Typical Disposal Panel" – Drawing Number 51-W-214-W, Appendix M3).

Permit Attachment A4 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Traffic Patterns" – Chapter G).

Permit Attachment E (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Inspection Schedule, Process and Forms" - Chapter D).

Permit Attachment G1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Detailed Design Report for an Operation Phase Panel Closure System" – Appendix I1).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, " Volatile Organic Compound Monitoring Plan" - Chapter N).

Permit Attachment N1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Hydrogen and Methane Monitoring Plan" - Appendix N1)

Permit Attachment O (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Mine Ventilation Rate Monitoring Plan" - Chapter Q).

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PART 5 - GROUNDWATER DETECTION MONITORING

5.1. DETECTION MONITORING PROGRAM

This Part specifies the requirements of the Detection Monitoring Program (**DMP**). The DMP shall establish background groundwater quality and monitor indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the groundwater, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98).

The DMP consists of six Detection Monitoring Wells (**DMWs**) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground Hazardous Waste Disposal Units (**Underground HWDUs**). The DMWs are screened in the Culebra Member of the Rustler Formation.

A DMP is necessary to demonstrate compliance with the environmental performance standard for the Underground HWDUs, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)). This environmental performance standard requires prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the groundwater or subsurface environment.

5.2. IDENTIFICATION OF POINT OF COMPLIANCE

The point of compliance is the vertical surface located perpendicular to the groundwater flow direction at the DMWs that extends to the Culebra Member of the Rustler Formation [20.4.1.500 NMAC (incorporating 40 CFR §§264.95, 264.601, and 264.602)]. The Permittees shall conduct the DMP at DMWs specified in Table 5.3.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.98 and 264.601).

5.3. WELL LOCATION, MAINTENANCE, AND PLUGGING AND ABANDONING

The Permittees shall conduct the DMP according to the requirements of this Permit and 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) for the DMWs in the Culebra Member of the Rustler Formation.

The Permittees shall maintain the DMP in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97), and as specified below:

5.3.1. Well Locations

The Permittees shall maintain the DMWs at the locations specified on the map in Figure L-6 of Permit Attachment L (WIPP Groundwater Detection Monitoring Program Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(a) and §264.98(b)), and as specified in Table 5.3.1 below:

Table 5.3.1 - Well Locations				
Well Name	**State Plane Coordinates**	**Top of Casing Elevation (ft amsl)**	**Screen Interval Depth (ft below ground surface)**	**Sampled Unit**
WQSP-1	663595E, 503784N	3419.2	702 - 727	Culebra
WQSP-2	667580E, 505537N	3463.9	811 - 836	Culebra
WQSP-3	670573E, 503991N	3480.1	844 - 869	Culebra
WQSP-4	670645E, 494986N	3433.1	764 - 789	Culebra
WQSP-5	667165E, 493665N	3384.4	646 - 671	Culebra
WQSP-6	663681E, 494948N	3364.7	581 - 606	Culebra

5.3.2. Well Maintenance

The Permittees shall maintain the DMWs specified in Table 5.3.1 and in Permit Attachment L, Section L-3b and Figures L-7 through L-12, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(c) and §264.98(b)).

5.3.3. Well Plugging and Abandoning

The Permittees may propose to plug and abandon a DMW by submitting a permit modification request to the Secretary in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The Permittees shall plug and abandon any DMW in a manner which eliminates physical hazards, prevents groundwater contamination, conserves hydrostatic head, and prevents intermixing of subsurface water. The Permittees shall submit a report to the Secretary which summarizes and certifies DMW plugging and abandoning methods within 90 calendar days from the date a DMW is removed from the DMP.

5.4. DETECTION MONITORING PROGRAM PARAMETERS AND CONSTITUENTS

The Permittees shall conduct the DMP at the DMWs as specified in Table 5.3.1 for the indicator parameters listed in Table 5.4.a and the hazardous constituents listed in Table 5.4.b below and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(a)):

Table 5.4.a – Indicator Parameters	
pH	Specific conductance
Total organic carbon (**TOC**)	
Total dissolved solids (**TDS**)	Total suspended solids (**TSS**)
Specific Gravity	Calcium
Magnesium	Potassium
Chloride	

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Table 5.4.b – Hazardous Constituents	
Chloroform	1,2-dichloroethane
Carbon tetrachloride	Chlorobenzene
1,1-dichloroethylene	1,1-dichloroethane
Methylene chloride	1,1,2,2-tetrachloroethane
Toluene	1,1,1-trichloroethane
Cresols	1,4-dichlorobenzene
1,2-dichlorobenzene	trans-1,2-dichloroethylene
2,4-dinitrophenol	2,4-dinitrotoluene
Hexachloroethane	Hexachlorobenzene
Isobutanol	Methyl ethyl ketone
	Pentachlorophenol
Pyridine	Tetrachloroethylene
1,1,2-Trichloroethane	Trichloroethylene
Trichlorofluoromethane	Xylenes
Nitrobenzene	Vinyl chloride
Arsenic	Barium
Cadmium	Chromium
Lead	Mercury
Selenium	Silver
Antimony	Beryllium
Nickel	Thallium
Vanadium	

5.5. SAMPLING AND ANALYSIS PROCEDURES

Except as provided in Permit Section 5.6, the Permittees shall use the following techniques and procedures to obtain and analyze DMP samples from the DMWs specified in Table 5.3.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(d) and (e)):

5.5.1. Sample Collection Procedures

The Permittees shall collect one DMP sample and one DMP sample duplicate annually from each DMW using the procedures specified in Permit Attachment L, Section L-4c, as

required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g)(2), 264.98(d), and 264.601(a)).

5.5.2. Sample Preservation and Shipment Procedures

The Permittees shall preserve and ship DMP samples using the procedures specified in Permit Attachment L, Section L-4c(2)(iv).

5.5.3. Analytical Procedures

The Permittees shall analyze DMP samples using the procedures specified in Permit Attachment L, Section L-4c(3).

5.5.4. Chain of Custody Procedures

The Permittees shall track and control DMP samples using the chain of custody procedures specified in Permit Attachment L, Section L-4c(2)(v).

5.6. BACKGROUND GROUNDWATER QUALITY

For those hazardous constituents listed in Table 5.4.b, and for all substances listed in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), the background groundwater quality values specified in Table 5.6 are established as specified in 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g) and 264.98(d)).

Table 5.6 – WQSP Well Background Values

Hazardous Constituent	WQSP-1	WQSP-2	WQSP-3	WQSP-4	WQSP-5	WQSP-6
Chloroform	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,2-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Carbon tetrachloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Chlorobenzene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Methylene chloride	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,1,2,2-tetrachloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Toluene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,1-trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Cresols	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,4-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,2-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
trans-1,2-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L

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Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
2,4-dinitrophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
2,4-dinitrotoluene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachloroethane	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Isobutanol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Methyl ethyl ketone	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pentachlorophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pyridine	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Tetrachloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,2-Trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichlorofluoromethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Xylenes	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Nitrobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Vinyl chloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Arsenic	0.10 mg/L	0.06 mg/L	0.21 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L
Barium	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L
Cadmium	0.20 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.50 mg/L	0.50 mg/L	2.00 mg/L	2.00 mg/L	0.50 mg/L	0.50 mg/L
Lead	0.11 mg/L	0.17 mg/L	0.80 mg/L	0.53 mg/L	0.05 mg/L	0.15 mg/L
Mercury	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L
Selenium	0.15 mg/L	0.15 mg/L	2.00 mg/L	2.00 mg/L	0.10 mg/L	0.10 mg/L
Silver	0.50 mg/L	0.50 mg/L	0.31 mg/L	0.52 mg/L	0.50 mg/L	0.50 mg/L
Antimony	0.33 mg/L	0.50 mg/L	1.00 mg/L	0.80 mg/L	0.07 mg/L	0.14 mg/L
Beryllium	0.02 mg/L	1.00 mg/L	0.10 mg/L	0.25 mg/L	0.02 mg/L	0.02 mg/L
Nickel	0.50 mg/L	0.50 mg/L	5.00 mg/L	5.00 mg/L	0.10 mg/L	0.50 mg/L
Thallium	1.00 mg/L	1.00 mg/L	5.80 mg/L	1.00 mg/L	0.21 mg/L	0.56 mg/L
Vanadium	0.10 mg/L	0.10 mg/L	5.00 mg/L	5.00 mg/L	2.70 mg/L	0.10 mg/L

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5.7. GROUNDWATER SURFACE ELEVATION DETERMINATION

5.7.1. DMP Groundwater Surface Elevation Determination

The Permittees shall determine the groundwater surface elevation at each DMW specified in Table 5.3.1 each time the groundwater is sampled in compliance with Permit Sections 5.5.1 and 5.9.2, using the methods specified in Permit Attachment L, Section L-4c(1), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)).

5.7.2. Regional Groundwater Surface Elevation Determination

The Permittees shall determine the groundwater surface elevation on a monthly basis for each well completed in the Culebra Member of the Rustler Formation in the WIPP Groundwater Level Monitoring Program, as specified in Permit Attachment L, Section L-4c(1).

5.8. GROUNDWATER FLOW DETERMINATION

The Permittees shall determine the groundwater flow rate and direction in the Culebra Member of the Rustler Formation at least annually, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(e)). The Permittees shall use groundwater surface elevation data specified in Permit Section 5.7 to determine groundwater flow.

5.9. DATA EVALUATION

5.9.1. Statistical Procedures

The Permittees shall use the statistical analysis methods specified in Permit Attachment L, Section L-4e, to evaluate DMP data for each hazardous constituent as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)). These statistical analysis methods shall comply with the appropriate performance standards specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.97(i)).

5.9.2. Groundwater Quality Determination

The Permittees shall sample DMWs as specified in Permit Section 5.5.1 and conduct statistical tests to determine whether there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b during the active life of the WIPP facility and post-closure care period as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90(c)).

5.9.3. Data Evaluation

The Permittees shall determine whether there is statistically significant evidence of contamination for any hazardous constituent identified in Table 5.4.b each time the DMWs are sampled as specified in Permit Section 5.9.2. In determining whether statistically significant evidence of contamination exists, the Permittees shall compare the groundwater

quality at each DMW specified in Table 5.3.1 to the background groundwater quality determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.9.4. Data Evaluation Timeframe

The Permittees shall perform the data evaluations specified in Permit Section 5.9.3 within 120 calendar days after completion of DMP sampling, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)(2)).

5.10. RECORDKEEPING AND REPORTING

5.10.1. Operating Record Requirements

The Permittees shall enter all DMP monitoring, testing, and analytical data in the operating record as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(6)). The Permittees shall enter these data, as measured and in a form appropriate for the determination of statistically significant evidence of contamination, into the operating record as specified in Permit Section 5.9.1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(c)).

5.10.2. Submittal of Results

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, in the Annual Culebra Groundwater Report by November 30 of each year as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)).

5.10.2.2. Groundwater Surface Elevation Results

The Permittees shall submit to the Secretary groundwater surface elevation data specified in Permit Section 5.7. This submittal shall include both groundwater surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be reported semiannually by May 31 and November 30. The November water level data report shall be combined with the Annual Culebra Groundwater Report specified in Permit Part 5.10.2.1.

5.10.2.3. Groundwater Flow Results

The Permittees shall submit to the Secretary an evaluation of the groundwater flow data (to include annotated hydrographs) specified in

Permit Section 5.8 in the Annual Culebra Groundwater Report by November 30 of each calendar year.

5.10.3. Determination of Contamination

If the Permittees determine, pursuant to Permit Section 5.9 and 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)), that there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b, the Permittees shall comply with the following:

5.10.3.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days, indicating what hazardous constituents have shown statistically significant evidence of contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(1)).

5.10.3.2. Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the groundwater in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

5.10.3.3. Verification Sampling

As specified by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)), for any substances found in the initial analysis pursuant to Permit Section 5.10.3.2, the Permittees may resample within one month and repeat the analysis for those compounds detected. If the results of the second analysis confirm the initial analysis, these substances shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4. If the Permittees do not resample, the substances found during the initial analysis specified in Permit Section 5.10.3.2 shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4.

5.10.3.4. Submittal of Compliance Monitoring Program

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to establish a compliance monitoring program meeting the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.99). The application shall include the

following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(4)):

i. An identification of the concentration of any hazardous constituent specified in Table 5.4.b or any Appendix IX substance detected in the ground water at each DMW at the compliance point.

ii. Any proposed changes to the DMP necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iii. Any proposed additions or changes to the monitoring frequency, sampling and analysis procedures or methods, or statistical methods used necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iv. For each hazardous constituent detected at the compliance point, a proposed concentration limit or a notice of intent to seek an alternate concentration limit for a hazardous constituent required by 20.4.1.500 NMAC (incorporating 40 CFR §264.94).

5.10.3.5. Submittal of Additional Information

The Permittees shall, within 180 calendar days, submit to the Secretary the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(5)):

i. All data necessary to justify an alternate concentration limit proposed in compliance with Permit Section 5.10.3.4.iv.

ii. An engineering feasibility plan for corrective action required by 20.4.1.500 NMAC (incorporating 40 CFR §264.100), if necessary.

5.10.4. Demonstration of Outside Contamination

If the Permittees determine, pursuant to Permit Section 5.9, that there is a statistically significant difference for hazardous constituents specified in Table 5.4.b at any DMW at the compliance point, they may demonstrate that a source other than a regulated unit caused the increase or that the detection is an artifact caused by an error in sampling, analysis, statistical evaluation, or natural variation in the ground water. In such cases, the Permittees shall comply with the following:

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5.10.4.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days of determining statistically significant evidence of contamination at the compliance point that they intend to make a demonstration of outside contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(i)).

5.10.4.2. Submittal of Demonstration

The Permittees shall, within 90 calendar days, submit a report to the Secretary which demonstrates that a source other than a regulated unit caused the contamination, or that the contamination resulted from error in sampling, analysis, or evaluation, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(ii)).

5.10.4.3. Submittal of Modification Request

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to make any appropriate changes to the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iii)).

5.10.4.4. Continued Monitoring

The Permittees shall continue to monitor in compliance with the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iv)).

5.11. REQUEST FOR PERMIT MODIFICATION

If the Permittees or the Secretary determines that the DMP no longer satisfies the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) and this Permit Part, the Permittees shall, within 90 calendar days of the determination, submit an application for a permit modification to make any appropriate changes to the program in compliance with 20.4.1.500 and .900 NMAC (incorporating 40 CFR §264.98(h) and §270.42).

PERMIT ATTACHMENTS

Permit Attachment L (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Groundwater Detection Monitoring Program Plan" - Chapter L).

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PART 6 – CLOSURE REQUIREMENTS

6.1. OVERVIEW

This Part specifies the closure requirements for the WIPP facility. The Permittees shall close the permitted Container Storage Units and Underground Hazardous Waste Disposal Units (**Underground HWDUs**) in accordance with the requirements in 20.4.1.500 NMAC (incorporating 40 CFR §§264.110 through 264.116 and §264.178), this Permit Part, and the procedures described in Permit Attachment G (Closure Plan).

6.2. PERFORMANCE STANDARD

The Permittees shall close the facility as specified in Permit Attachment G and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.111).

6.3. AMENDMENT TO CLOSURE PLAN

The Permittees shall amend Permit Attachment G, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.112(c)), whenever necessary.

6.4. NOTIFICATION OF CLOSURE

The Permittees shall notify the Secretary in writing at least 60 calendar days prior to the date on which they expect to begin partial closure, i.e., closure of an Underground Hazardous Waste Disposal Unit (**Underground HWDU**), or final closure of the facility as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.112(d) and 264.601). The Permittees shall post a link to the closure notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

6.5. TIME ALLOWED FOR CLOSURE

6.5.1. Partial Closure

Upon completion of disposal operations in an Underground HWDU, the Permittees shall complete partial closure activities as specified in Permit Attachment G, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.113).

6.5.2. Final Facility Closure

After receiving the final volume of TRU mixed waste, the Permittees shall remove from the facility all non-mixed hazardous waste, dispose in the Underground HWDUs all TRU-mixed hazardous waste and derived waste, and complete closure activities as specified in Permit Attachment G and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.113).

6.6. DISPOSAL OR DECONTAMINATION OF EQUIPMENT, STRUCTURES, AND SOILS

The Permittees shall decontaminate or dispose of all contaminated equipment, structures, and soils, as specified in Permit Attachment G and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.114).

6.7. CERTIFICATION OF CLOSURE

Within 60 calendar days of completion of closure of each Underground HWDU, and within 60 calendar days of completion of final closure, the Permittees shall certify in writing to the Secretary that the Underground HWDUs and/or facility have been closed as specified in Permit Attachment G and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.115 and 264.601).

6.8. SURVEY PLAT

No later than the submission of the certification of closure of each Underground HWDU, the Permittees shall submit a survey plat detailing the location and dimensions of each Underground HWDU with respect to permanently surveyed benchmarks, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.116).

6.9. CLOSURE OF PERMITTED CONTAINER STORAGE UNITS

At closure of the WHB Unit and Parking Area Unit, the Permittees shall remove all hazardous waste and hazardous waste residues from the containment system, in accordance with the procedures in Permit Attachment G, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.178).

6.10. CLOSURE OF PERMITTED DISPOSAL UNITS

6.10.1. Panel Closure

Upon completion of disposal in an Underground HWDU, the Permittees shall provide written notification to the Secretary stating the final volume of TRU mixed waste emplaced in the Underground HWDU. The Permittees shall also close the Underground HWDU as specified in Permit Attachment G and Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System). The Permittees shall post a link to the final panel volume notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

6.10.2. Repository Closure

Upon completion of disposal in the repository and closure of all Underground HWDUs, the Permittees shall close the repository as specified in Permit Attachment G and Permit Attachment G2 (Shaft Sealing System Compliance Submittal Design Report).

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6.10.3. Repository Post-Closure

Upon completion of repository closure as specified in Permit Section 6.10.2, the Permittees shall comply with all post-closure requirements as specified in Permit Part 7, Post-Closure Care.

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PERMIT ATTACHMENTS

Permit Attachment G (as modified from WIPP RCRA Part B Permit Application, "Closure Plans, Post-Closure Plans, and Financial Requirements" - Chapter I).

Permit Attachment G1 (as modified from WIPP RCRA Part B Permit Application, "Detailed Design Report for an Operation Phase Panel Closure System" - Appendix I1).

Permit Attachment G2 (as modified from WIPP RCRA Part B Permit Application, "Shaft Sealing System Compliance Submittal Design Report" - Appendix I2).

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PART 7 - POST-CLOSURE CARE PLAN

7.1. OVERVIEW

This Part specifies the post-closure care requirements for the WIPP facility. Post-closure care requirements are applicable to Underground Hazardous Waste Disposal Units (**Underground HWDUs**) and include requirements for routine inspection and maintenance of the closed panel entry drifts, and air monitoring as required. Post-closure care requirements apply immediately after certification of closure of each Underground HWDU and continue for 30 years after final closure of the facility. Post-closure care requires active institutional controls including fencing and warning signs, inspections, maintenance, monitoring of ground water, and control and cleanup of releases.

7.2. UNIT IDENTIFICATION

The Permittees shall provide post-closure care for the closed Underground HWDUs (eight panels and two access drifts), and for the facility after final closure, as specified in Permit Attachment H (Post-Closure Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.110(b)).

7.3. POST-CLOSURE PROCEDURES AND USE OF PROPERTY

The Permittees shall conduct post-closure care after completion of closure of each Underground HWDU identified in Permit Section 7.2 and shall continue post-closure care for thirty (30) years after the date of certification of final closure of the facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(a)(1)). The Permittees may request, at any time during the post-closure care period, a Permit modification to shorten the applicable post-closure care period. The Secretary may shorten the post-closure care period if the Secretary finds the reduced period is sufficient to protect human health and the environment, as provided by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(a)(2)(i)). The Secretary may extend the applicable post-closure care period if the Secretary finds an extension is necessary to protect human health and the environment, as provided by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(a)(2)(ii)).

7.3.1. Post-Closure Plan

The Permittees shall implement the Post-Closure Plan in Permit Attachment H and Permit Attachment H1 (Active Institutional Controls During Post-closure), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(d), §264.118(b) and §264.603).

7.3.2. Post-Closure Care and Monitoring

7.3.2.1. General Monitoring, Inspection, and Maintenance Requirements

The Permittees shall monitor and perform inspections of the Underground HWDU closures, and perform maintenance of the closed Underground HWDU access drifts after construction of each HWDU closure system, as specified in Permit Attachment A2 (Geologic Repository). The Permittees shall monitor and maintain the components, structures and equipment of

the waste containment systems at the facility as specified in Permit Attachments H and H1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(a)(1)(ii)).

7.3.2.2. Air Monitoring Requirements

The Permittees shall maintain ventilation and perform daily monitoring of the mine ventilation air downstream from closed Underground HWDUs at the beginning of days when work is to be performed downstream from the closed Underground HWDUs. The Permittees shall implement the Volatile Organic Compound Monitoring Plan in Permit Attachment N (Volatile Organic Compound Monitoring Plan) during the post-closure care period for closed Underground HWDUs, until six (6) months after the certification of closure of all Underground HWDUs, as specified in Permit Section 4.6.2. [20.4.1.500 NMAC (incorporating 40 CFR §264.117(a), §264.601 and §264.603)]

7.3.2.3. Detection Monitoring Program

The Permittees shall maintain and implement the Detection Monitoring Program during the post-closure care period as specified in Part 5 and Permit Attachment L (WIPP Ground-water Detection Monitoring Program Plan), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F and §264.117(a)(1)).

7.3.3. Security

The Permittees shall comply with the applicable post-closure security requirements as specified in Permit Attachments H and H1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(b)(2)).

7.3.4. Post-Closure Disturbance

The Permittees shall not allow any use of the facility surface area above the Underground HWDUs designated in Permit Section 7.2 which could disturb the integrity of the shaft sealing systems or any components of the waste containment system, or the function of the facility monitoring systems during the post-closure care period, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.117(c)), except as allowed under 20.4.1.500 NMAC (incorporating 40 CFR §264.117(c)(1) or (2)).

7.4. NOTICES AND CERTIFICATION

7.4.1. Disposal Unit Records

No later than 60 calendar days after certification of closure of each Underground HWDU, the Permittees shall submit to the Secretary and the local zoning authority, or the authority with jurisdiction over local land use, a record of the type, location, and quantity of TRU

mixed waste disposed in each Underground HWDU, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.119(a)).

7.4.2. Deed Notice

Within 60 calendar days of certification of closure of the first Underground HWDU and within 60 calendar days of certification of the last Underground HWDU, the Permittees shall comply with the following conditions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.119(b)):

7.4.2.1. Deed Recordation

The Permittees shall record, in accordance with New Mexico law, a notation on the deed to the facility property, or on some other instrument that is normally examined during a title search, that will in perpetuity notify any potential purchaser of the property that:

(i) The land has been used to manage TRU mixed waste; and

(ii) Its use is restricted under 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart G) regulations; and

(iii) The survey plat and record of the type, location, and quantity of TRU mixed waste disposed in each Underground HWDU have been filed with the Secretary and the local zoning authority or the authority with jurisdiction over local land use.

7.4.2.2. Certification

The Permittees shall submit a certification to the Secretary, signed by the Permittees, stating the Permittees have recorded the notation specified in Permit Section 7.4.2.1, including a copy of the document(s) in which the notation has been placed, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.119(b)).

7.4.3. Removal of Wastes or Contaminated Soils

If the Permittees, or any subsequent owner or operator of the land upon which the Underground HWDUs are located, wishes to remove TRU mixed wastes, TRU mixed waste residues, or contaminated soils, they shall request a modification to this permit in accordance with the applicable requirements in 20.4.1.900 NMAC (incorporating 40 CFR Part 270) and 4.1.901. The Permittees or any subsequent owner or operator of the land shall demonstrate the removal of TRU mixed wastes will satisfy the criteria of 20.4.1.500 NMAC (incorporating 40 CFR §264.117(c) and §264.119(c)).

7.4.4. Completion of Post-Closure Care

No later than 60 calendar days after completion of the post-closure care period for each Underground HWDU, the Permittees shall submit to the Secretary, by registered mail, a certification that the post-closure care for the Underground HWDU was performed in accordance with the specifications in the approved Post-Closure Plan, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.120). The Permittees and an independent New Mexico registered professional engineer shall sign the certification. The Permittees shall provide to the Secretary upon request the documentation supporting the professional engineer's certification, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.145(i) and §264.120).

7.5. POST-CLOSURE PERMIT MODIFICATIONS

The Permittees shall submit a written notification of or request for a permit modification to amend the approved Post-Closure Plan at any time during the active life of the facility or during the post-closure care period, as required by 20.4.1.500, .900, and .901 NMAC (incorporating 40 CFR §§264.118(d) and 270). The Permittees shall include a copy of the proposed amended Post-Closure Plan for approval by the Secretary, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(d)).

7.5.1. Changes Requiring a Permit Modification

Changes to the approved Post-Closure Plan which require a permit modification include, but are not limited to, the following circumstances specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.118(d)(2)):

7.5.1.1. Operating Plans

Whenever changes in operating plans or facility design affect the approved Post-Closure Plan; or

7.5.1.2. Timing of Closure

Whenever there is a change in the expected year of final closure; or

7.5.1.3. Other Events

Whenever other events occur during the active life of the facility, including partial or final closure, that affect the approved Post-Closure Plan.

7.5.2. Timing of Permit Modification

The Permittees shall submit a written request for a permit modification at least 60 calendar days prior to the proposed change in facility design or operation, or no later than 60 calendar

days after an unexpected event has occurred which affects the Post-Closure Plan, as required by 20.4.1.500 NMAC (incorporating §264.118(d)(3)).

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PERMIT ATTACHMENTS

Permit Attachment A2 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Geologic Repository" - Appendix M2).

Permit Attachment H (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Post-Closure Plan" - Chapter J).

Permit Attachment H1 (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Active Institutional Controls During Post-Closure" - Appendix J1).

Permit Attachment L (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Ground-water Detection Monitoring Program Plan" – Chapter L).

Permit Attachment N (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "Volatile Organic Compound Monitoring Plan" - Chapter N)

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PART 8 - CORRECTIVE ACTION FOR SWMUS AND AOCS

8.1. APPLICABILITY

The conditions of this Part apply to all Solid Waste Management Units (**SWMUs**) and Areas of Concern (**AOCs**) identified in Permit Attachment K (Solid Waste Management Unit and Area of Concern Tables), any newly identified SWMUs and AOCs identified after the issuance of this Permit, and any releases of hazardous waste or hazardous constituents from SWMUs and AOCs.

8.2. CONTAMINATION BEYOND THE FACILITY BOUNDARY

The Permittees shall implement corrective action beyond the Facility boundary where necessary to protect human health and the environment, unless the Permittees demonstrate to the satisfaction of the Secretary that, despite the Permittees' best efforts, as determined by the Secretary, the Permittees were unable to obtain the necessary permission to undertake such actions. The Permittees are not relieved of all responsibility to cleanup a release that has migrated beyond the Facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis. [20.4.1.500 NMAC (incorporating 40 CFR §264.101(c))]

8.3. CORRECTIVE ACTION ALREADY COMPLETED

Any corrective action tasks required under this Part that the Permittees have already completed may be used to meet the requirements of this Part, in whole or in part, as determined by the Secretary. The Permittees may submit prior work to meet these requirements for the Secretary's approval.

8.4. NOTIFICATION AND ASSESSMENT FOR NEWLY IDENTIFIED SWMUS AND AOCS

The Permittees shall notify the Secretary in writing, within 15 calendar days of discovery, of any newly discovered SWMU or AOC. The notification shall include, at a minimum, the location of the newly discovered SWMU or AOC and all available information pertaining to the site history and nature of the release (e.g., media affected, hazardous waste or hazardous constituents released, magnitude of release). The Secretary may require the Permittees to submit a Release Assessment Report in accordance with Permit Section 8.6.1 to determine the status of the newly discovered SWMU or AOC. Alternatively, the Secretary may require an Investigation Work Plan for the newly discovered SWMU or AOC in accordance with Permit Section 8.8.1 without requiring a Release Assessment. If the Secretary determines that an Investigation Work Plan for a newly discovered SWMU or AOC is required, the Permittees shall modify this Permit to add the SWMU or AOC to Permit Attachment K in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

8.5. NOTIFICATION REQUIREMENTS FOR NEWLY DISCOVERED RELEASES FROM SWMUS OR AOCS

The Permittees shall notify the Secretary in writing, within 15 calendar days of discovery, of any newly discovered release(s) of hazardous waste or hazardous constituents from a SWMU or AOC that explains the location and circumstances of the release.

If the Secretary determines that investigation of the release is needed, the Permittees shall prepare and submit an Investigation Work Plan in accordance with Permit Section 8.8.1.

8.6. RELEASE ASSESSMENT

8.6.1. Release Assessment Report

If required by the Secretary, the Permittees shall submit a Release Assessment Report for newly discovered SWMUs or AOCs under this Permit Section. Any revisions to the Release Assessment Report required by the Secretary shall be submitted within 30 calendar days of receipt of the Secretary's comments on the Release Assessment Report.

The Release Assessment Report shall, at a minimum, include the following information:

1. Location of unit(s) on a topographic map of appropriate scale, as required under 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(19));

2. Designation of type and function of unit(s);

3. General dimensions, capacities and structural description of unit(s) (supply any available plans/drawings);

4. Dates that the unit(s) was operated;

5. All available site history information;

6. Specifications of all wastes that have been managed at/in the unit(s) to the extent available. Include any available data on hazardous waste or hazardous constituents in the wastes; and

7. All available information pertaining to any release of hazardous waste or hazardous constituents from such unit(s) (to include ground water data, soil analyses, air, and surface water data).

8.6.2. Requirement to Proceed

The Secretary will review the Release Assessment Report to determine whether any further investigative action is required. The Secretary will notify the Permittees of the need for confirmatory sampling if necessary, or notify the Permittees that an Investigation Work Plan is required in accordance with the requirements in Permit Section 8.8.1. The Secretary will notify the Permittees of any corrective action complete decision.

8.7. INTERIM MEASURES

8.7.1. Secretary-Initiated Interim Measures

Upon written notification by the Secretary, the Permittees shall prepare and submit an Interim Measures (**IM**) Work Plan at any SWMU or AOC where the Secretary determines

that interim measures are necessary to minimize or prevent the migration of hazardous waste or hazardous constituents and limit actual or potential human and environmental exposure to hazardous waste or hazardous constituents while long term corrective action remedies are evaluated and implemented. The Permittees shall submit its IM Work Plan to the Secretary within 30 calendar days of the Secretary's notification, unless another time period is specified by the Secretary. Such interim measures may be conducted concurrently with any required corrective action. The Permittees shall prepare and submit IM Work Plans in accordance with the work plan format included in Permit Section 8.14.

8.7.2. Permittee-Initiated Interim Measures

The Permittees may initiate interim measures at a SWMU or AOC by notifying the Secretary, in writing, at least 30 calendar days prior to beginning the Interim Measures. The Secretary will approve the Permittee-initiated IM, conditionally approve the IM, or require submittal of an IM work plan for the Secretary's approval prior to implementation of the Interim Measure.

8.7.3. Emergency Interim Measures

The Permittees may determine, during implementation of site investigation activities, that emergency interim measures are necessary to address an immediate threat of harm to human health or the environment. The Permittees shall notify the Secretary within one business day of discovery of the facts giving rise to the threat, and shall propose emergency interim measures to address the threat. If the Secretary approves the emergency interim measures in writing, the Permittees may implement the proposed emergency interim measures without submitting an interim measures work plan. If circumstances arise resulting in an immediate threat to human health or the environment such that initiation of emergency interim measures are necessary prior to obtaining written approval from the Secretary, the Permittees shall notify the Secretary within one business day of taking the emergency interim measure. The notification shall contain a description of the emergency situation, the types and quantities of contaminants involved, the emergency interim measures taken, and contact information for the emergency coordinator who handled the situation. The notification shall also include a written statement justifying the need to take the emergency action without prior written approval from the Secretary. This requirement shall not be construed to conflict with 20.4.1.500 NMAC (incorporating 40 CFR §264.1(g)(8)) or 20.4.1.900 NMAC (incorporating 40 CFR §270.61).

8.7.4. IM Work Plan Requirements

The IM Work Plan shall ensure that the interim measures are designed to mitigate any current or potential threat(s) to human health or the environment and is consistent with, and integrated into, any final corrective measures at the Facility. The IM Work Plan shall include the interim measures objectives, procedures for implementation (including any designs, plans, or specifications), and schedules for implementation.

8.7.5. Interim Measures Implementation

8.7.5.1. Implementation and Completion of Approved IM Work Plan

The Permittees shall implement interim measures required under Permit Section 8.7 in accordance with the Secretary-approved IM Work Plan. The Permittees shall complete interim measures within 180 calendar days of the start of implementation of the interim measure. The Permittees may submit a written request to the Secretary to extend the period for implementation of the interim measure. The request must provide justification for the extension and a proposed schedule for completion of the interim measure. The Secretary will notify the Permittees, in writing, of the approval or disapproval of the request within 30 calendar days of receipt of the IM implementation extension request.

8.7.5.2. Notification of Changes

The Permittees shall give notice to the Secretary as soon as possible of any planned changes, reductions or additions to the IM Work Plan required by the Secretary under Permit Section 8.7.1 or initiated by the Permittees in accordance with Permit Section 8.7.2.

8.7.6. Interim Measures Reports

The Permittees shall submit to the Secretary for review and approval, within 90 calendar days of completion of interim measures, an IM Report for each SWMU or AOC. The IM Report shall contain, at a minimum, the following information:

1. A description of interim measures implemented;
2. Summaries of results;
3. Summaries of all problems encountered during IM investigations;
4. Summaries of accomplishments and/or effectiveness of interim measures; and,
5. Copies of all relevant laboratory/monitoring data, maps, logs, and other related information.

8.8. CORRECTIVE ACTION INVESTIGATIONS

8.8.1. Investigation Work Plan

8.8.1.1. Investigation Work Plan Submittal

The Permittees shall submit to the Secretary Investigation Work Plans for the SWMUs and AOCs identified in Permit Attachment K, Table K-1

"Solid Waste Management Units (SWMUs) & Areas of Concern (AOCs) Requiring Corrective Action."

8.8.1.2. Investigation Work Plan Requirements

Investigation Work Plans shall meet the requirements specified in Permit Section 8.14.1. Investigation Work Plans shall include schedules of implementation and completion of specific actions necessary to determine the nature and extent of contamination and the potential pathways of contaminant releases to the air, soil, surface water, and ground water. The Permittees shall provide sufficient justification and associated documentation that a release is not probable or has already been characterized if a unit or a media/pathway associated with a unit (ground water, surface water, soil, subsurface gas, or air) is not included in an Investigation Work Plan. Such deletions of a unit, medium, or pathway from the work plan(s) are subject to the approval of the Secretary. The Permittees shall provide sufficient written justification for any omissions or deviations from the minimum requirements specified in Permit Section 8.14.1. Such omissions or deviations are subject to the approval of the Secretary. In addition, Investigation Work Plans shall include all investigations necessary to ensure compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.101).

8.8.1.3. Historical Documents

The Permittees shall submit to the Secretary a summary of the historical information and assessment of potential contaminant releases relating to each SWMU or AOC in conjunction with the unit-specific Investigation Work Plan including complete, legible copies of all associated photographic imprints, maps, figures, drawings, tables, attachments, enclosures, appendices and other relevant supporting documentation.

8.8.2. Investigation Work Plan Implementation

The Permittees shall implement Investigation Work Plans as approved by the Secretary. The Permittees shall notify the Secretary at least 30 calendar days prior to any permit or corrective action-related field activity (e.g., drilling, sampling).

8.8.3. Corrective Action Investigation Reports

The Permittees shall prepare and submit to the Secretary Investigation Reports for the investigations conducted in accordance with Investigation Work Plans submitted under Permit Section 8.8.1. The Permittees shall submit the Investigation Reports to the Secretary for review and approval in accordance with the schedules included in its approved Investigation Work Plans.

The Investigation Reports shall include an analysis and summary of all required investigations of SWMUs and AOCs. The summary shall describe the type and extent of contamination at each SWMU and AOC investigated, including sources and migration pathways, identify all hazardous waste or constituents present in all media, and describe actual or potential receptors. The Investigation Report shall also describe the extent of contamination (qualitative and quantitative) in relation to background levels of the area. If the Investigation Report concludes that further work is necessary, the report shall include a schedule for submission of a work plan for the next phase of investigation.

8.8.3.1. Cleanup Levels

The Investigation Reports shall identify the applicable cleanup levels in accordance with Permit Section 8.13 for each hazardous waste or hazardous constituent found at each SWMU and AOC. The Permittees shall propose in the Investigation Report or in a subsequent Risk Assessment or Corrective Measures Evaluation appropriate cleanup levels for those hazardous wastes or hazardous constituents without established cleanup levels based upon human and ecological risk.

8.8.3.2. Requirement to Proceed

Based upon the Secretary's review of the Investigation Report, the Secretary will notify the Permittees of the need for further investigative action, if necessary, and inform the Permittees, if not already notified, of the need for a Corrective Measures Study. The Secretary will notify the Permittees if corrective action is complete. If the Secretary determines that further investigation is necessary, the Secretary will require the Permittees to submit a work plan for approval that includes a proposed schedule for additional investigation(s).

8.9. RISK ASSESSMENT

The Permittees shall attain the cleanup goals outlined in Permit Section 8.13 including, as necessary, performance of risk analysis to establish alternate cleanup goals, at each site for which the Secretary determines, in the format included in Permit Section 8.14, that corrective measures are necessary. The Permittees shall submit to the Secretary for approval a Risk Assessment Report in accordance with this Permit Section for sites where risk analyses are conducted.

8.10. CORRECTIVE MEASURES EVALUATION

8.10.1. General

the Secretary will require corrective measures at a SWMU or AOC if the Secretary determines, based on the Investigation Report and other relevant information available to the Secretary, that there has been a release of contaminants into the environment at the SWMU or AOC and that corrective action is necessary to protect human health or the environment from such a release. Upon making such a determination, the Secretary will notify the

Permittees in writing. The Secretary will specify a date for the submittal of the necessary reports and evaluations in the written notification.

8.10.2. Corrective Measures Evaluation Report

Following written notification from the Secretary that a corrective measures evaluation is required, the Permittees shall submit to the Secretary for approval a Corrective Measures Evaluation Report. The Permittees shall follow the Corrective Measures Evaluation Report format outlined in Permit Section 8.14.5. The corrective measures evaluation shall evaluate potential remedial alternatives and shall recommend a preferred remedy that will be protective of human health and the environment and that will attain the appropriate cleanup goals. The Corrective Measures Evaluation Report shall, at a minimum, comply with Permit Section 8.14.5 and include the following:

1. A description of the location, status, and current use of the site;

2. A description of the history of site operations and the history of releases of contaminants;

3. A description of site surface conditions;

4. A description of site subsurface conditions;

5. A description of on- and off-site contamination in all affected media;

6. An identification and description of all sources of contaminants;

7. An identification and description of contaminant migration pathways;

8. An identification and description of potential receptors;

9. A description of cleanup standards or other applicable regulatory criteria;

10. An identification and description of a range of remedy alternatives;

11. Remedial alternative pilot or bench scale testing results;

12. A detailed evaluation and rating of each of the remedy alternatives, applying the criteria set forth in Permit Section 8.14.5.10;

13. An identification of a proposed preferred remedy or remedies;

14. Design criteria of the selected remedy or remedies; and

15. A proposed schedule for implementation of the preferred remedy.

8.10.3. Cleanup Standards

The Permittees shall select corrective measures that are capable of achieving the cleanup standards and goals outlined in Permit Section 8.13 including, as applicable, approved alternate cleanup goals established by a risk assessment.

8.10.4. Remedy Evaluation Criteria

8.10.4.1. Threshold Criteria

The Permittees shall evaluate each of the remedy alternatives for the following threshold criteria. To be selected, the remedy alternative must:

1. Be protective of human health and the environment;

2. Attain media cleanup standards;

3. Control the source or sources of releases so as to reduce or eliminate, to the extent practicable, further releases of contaminants that may pose a threat to human health and the environment; and

4. Comply with applicable standards for management of wastes.

8.10.4.2. Remedial Alternative Evaluation Criteria

The Permittees shall evaluate each of the remedy alternatives for the factors described in this Permit Section. These factors shall be balanced in proposing a preferred alternative.

a. Long-term Reliability and Effectiveness

The remedy shall be evaluated for long-term reliability and effectiveness. This factor includes consideration of the magnitude of risks that will remain after implementation of the remedy; the extent of long-term monitoring, or other management that will be required after implementation of the remedy; the uncertainties associated with leaving contaminants in place; and the potential for failure of the remedy. Permittees shall give preference to a remedy that reduces risks with little long-term management, and that has proven effective under similar conditions.

b. Reduction of Toxicity, Mobility, or Volume

The remedy shall be evaluated for its reduction in the toxicity, mobility, and volume of contaminants. Permittees shall give preference to remedy that uses treatment to more completely and

permanently reduce the toxicity, mobility, and volume of contaminants.

c. Short-term Effectiveness

The remedy shall be evaluated for its short-term effectiveness. This factor includes consideration of the short-term reduction in existing risks that the remedy would achieve; the time needed to achieve that reduction; and the short-term risks that might be posed to the community, workers, and the environment during implementation of the remedy. The Permittees shall give preference to a remedy that quickly reduces short-term risks, without creating significant additional risks.

d. Implementability

The remedy shall be evaluated for its implementability or the difficulty of implementing the remedy. This factor includes consideration of installation and construction difficulties; operation and maintenance difficulties; difficulties with cleanup technology; permitting and approvals; and the availability of necessary equipment, services, expertise, and storage and disposal capacity. Permittees shall give preference to a remedy that can be implemented quickly and easily, and poses fewer and lesser difficulties.

e. Cost

The remedy shall be evaluated for its cost. This factor includes a consideration of both capital costs, and operation and maintenance costs. Capital costs shall include, without limitation, construction and installation costs; equipment costs; land development costs; and indirect costs including engineering costs, legal fees, permitting fees, startup and shakedown costs, and contingency allowances. Operation and maintenance costs shall include, without limitation, operating labor and materials costs; maintenance labor and materials costs; replacement costs; utilities; monitoring and reporting costs; administrative costs; indirect costs; and contingency allowances. All costs shall be calculated based on their net present value. Permittees shall give preference to a remedy that is less costly, but does not sacrifice protection of health and the environment.

8.10.5. Approval of Corrective Measures Evaluation Report

Subject to the procedures in Permit Section 1.10.2, if the Secretary disapproves the Corrective Measures Evaluation Report, the Secretary will notify the Permittees in writing

of the Corrective Measures Evaluation Report's deficiencies and specify a due date for submission of a revised Corrective Measures Evaluation Report. Upon receipt of such notification of disapproval, the Permittees shall submit to the Secretary, within the specified time, a revised Corrective Measures Evaluation Report that corrects the deficiencies. If the Secretary approves the Corrective Measures Evaluation Report, the Secretary will notify the Permittees in writing.

8.10.6. Relationship to Corrective Action Requirements

The Corrective Measures Evaluation shall serve as a Corrective Measures Study for the purposes of RCRA compliance. *See* 55 Fed. Reg. 30875-77 (July 27, 1990) (proposed 20.4.1.500 NMAC (incorporating 40 CFR §264.520-264.524).

8.10.7. Statement of Basis

Upon approval of the Corrective Measures Evaluation Report, the Secretary will select a remedy or remedies for the SWMU or AOC. The Secretary may choose a different remedy from that recommended by the Permittees. The Secretary will issue a Statement of Basis for selection of the remedy, and will receive public comment on the remedy. The public comment period will extend for at least 45 days from the date of the public notice of the Statement of Basis. The Secretary will provide an opportunity for a public hearing on the remedy, at which all interested persons will be given a reasonable chance to submit data, views or arguments orally or in writing and to examine witnesses testifying at the hearing. The comment period will automatically be extended to the close of the public hearing. The public hearing will follow the hearing requirements specified in 20.4.1.901.F NMAC. The Secretary will select a final remedy and issue a response to public comments to all commenters, after the end of the public comment period. In selecting a remedy, the Secretary will follow the public participation requirements applicable to remedy selection specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41) and 20.4.1.901 NMAC.

The administrative record for the Facility will be made available to the public for review at the Secretary's offices in Santa Fe, New Mexico. All significant written and signed comments, including emailed comments, will be considered by the Secretary prior to approving a final remedy or remedies.

The Secretary's decision on the final remedy or remedies shall follow the requirements specified in 20.4.1.901 NMAC, Secretary's Decision. The Secretary will issue a response to public comments at the time of the Secretary's final decision.

8.11. CORRECTIVE MEASURES IMPLEMENTATION

8.11.1. General

The Permittees shall implement the final remedy selected by the Secretary.

8.11.2. Corrective Measures Implementation Plan

Within 90 days after the Secretary's selection of a final remedy, or as otherwise specified by the schedule contained in the approved Corrective Measure Evaluation Report or as specified by a schedule required by the Secretary in the written approval notification, the Permittees shall submit to the Secretary for approval a Corrective Measures Implementation Plan outlining the design, construction, operation, maintenance, and performance monitoring for the selected remedy, and a schedule for its implementation. The implementation plan shall be submitted to the Secretary for review in accordance with the procedures in Permit Section 1.10. The Corrective Measures Implementation Plan shall, at a minimum, include the following elements:

1. A description of the selected final remedy;

2. A description of the cleanup goals and remediation system objectives;

3. An identification and description of the qualifications of all persons, consultants, and contractors that will be implementing the remedy;

4. Detailed engineering design drawings and systems specifications for all elements of the remedy signed and stamped by a registered New Mexico professional engineer;

5. A construction work plan;

6. An operation and maintenance plan;

7. The results of any remedy pilot tests;

8. A plan for monitoring the performance of the remedy, including sampling and laboratory analysis of all affected media;

9. A waste management plan;

10. A proposed schedule for submission to the Secretary of periodic progress reports; and

11. A proposed schedule for implementation of the remedy.

8.11.3. Health and Safety Plan

The Permittees shall conduct all activities in accordance with a site-specific or Facility-wide Health and Safety Plan during all construction, operation, maintenance, and monitoring activities conducted during corrective measures implementation.

8.11.4. Progress Reports

The Permittees shall submit progress reports to the Secretary in accordance with the schedule approved in the Corrective Measures Implementation Plan. The progress reports shall, at a minimum, include the following information:

1. A description of the remedy work completed during the reporting period;

2. A summary of problems, potential problems, or delays encountered during the reporting period;

3. A description of actions taken to eliminate or mitigate the problems, potential problems, or delays;

4. A discussion of the remedy work projected for the next reporting period, including all sampling events;

5. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the reporting period; and

6. Copies of all waste disposal records generated during the reporting period.

8.11.5. Remedy Completion

8.11.5.1. Remedy Completion Report

Within 90 days after completion of remedy, the Permittees shall submit to the Secretary a Remedy Completion Report. The report shall, at a minimum, include the following items:

1. A summary of the work completed;

2. A statement, signed by a registered professional engineer, that the remedy has been completed in accordance with the Secretary approved work plan for the remedy;

3. As-built drawings and specifications signed and stamped by a registered New Mexico professional engineer;

4. Copies of the results of all monitoring, including sampling and analysis, and other data generated during the remedy implementation, if not already submitted in a progress report;

5. Copies of all waste disposal records, if not already submitted in a progress report; and

6. A certification, signed by a responsible official of facility, stating: "I certify under penalty of law that this document and all

attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

8.12. ACCELERATED CLEANUP PROCESS

If the Permittees identify a corrective action or measure that, if implemented voluntarily, will reduce risks to human health and the environment to levels acceptable to the Secretary, will reduce cost and/or will achieve cleanup of a SWMU or AOC ahead of schedule, the Permittees may implement the corrective measure as provided in this Permit Section, in lieu of the process established in Permit Sections 8.7 through 8.11. The accelerated cleanup process shall be used at sites to implement presumptive remedies at small-scale and relatively simple sites where groundwater contamination is not a component of the accelerated cleanup, where the remedy is considered to be the final remedy for the site, and where the field work will be accomplished within 180 days of the commencement of field activities.

The Permittees shall notify the Secretary of the planned accelerated corrective action or measure a minimum of 30 days prior to the commencement of any accelerated field activity. The notification shall include the submittal of the Plan if not already submitted to the Secretary.

8.12.1. Accelerated Corrective Measures Work Plan

The proposed accelerated cleanup will be documented in an Accelerated Corrective Measure Work Plan, which shall include:

1. A description of the proposed remedial action, including details of the unit or activity that is subject to the requirements of this Permit;

2. An explanation of how the proposed cleanup action is consistent with the overall corrective action objectives and requirements of this Permit,

3. The methods and procedures for characterization and remediation sample collection and analyses, and

4. A schedule for implementation and reporting on the proposed cleanup action.

The Permittees shall obtain the Secretary's approval of an Accelerated Corrective Measures Work Plan prior to implementation. The Permittees shall prepare the Work Plan in general accordance with the requirements of Permit Section 8.14. The Permittees shall include an implementation schedule in the revised Accelerated Corrective Measures Work Plan.

8.12.2. Accelerated Corrective Measures Implementation

Upon approval by the Secretary, the Permittees shall implement the accelerated corrective measures in accordance with the approved Accelerated Corrective Measures Work Plan. Within 90 days of completion of the accelerated corrective measures, the Permittees shall submit to the Secretary for approval a Remedy Completion Report in a format approved by the Department in accordance with Permit Section 8.14. If upon review, the Secretary determines that applicable cleanup levels were not achieved during corrective measures implementation or that there were deficiencies in the accelerated corrective measures implementation or reporting, the Secretary will notify the Permittees in writing.

8.13. CLEANUP LEVELS

The Permittees shall attain the cleanup levels specified below when implementing the closure and corrective action requirements of this Permit.

8.13.1. Ground Water Cleanup Levels

The Permittees shall attain the following cleanup levels for all hazardous waste and hazardous constituents in ground water:

1. For any contaminant for which the Environmental Protection Agency (**EPA**) has adopted a maximum contaminant level (**MCL**) for drinking water under 40 CFR parts 141 and 143, the MCL shall be the cleanup level;

2. For any contaminant for which the New Mexico Water Quality Control Commission (**WQCC**) has adopted numeric standards for ground water listed in 20.6.2.3103 NMAC, the ground water standard shall be the cleanup level; and

3. For any contaminant that the WQCC has identified as a toxic pollutant listed in 20.6.2.7.WW NMAC, the level approved by the New Mexico Environment Department (**NMED**) under paragraph 2 or 3 below shall be the cleanup level.

For any contaminant for which more than one of the cleanup levels set forth in subparagraphs 1, 2, and 3 above would apply, the lowest (or otherwise most protective) level shall be the applicable cleanup level.

If a cleanup level under Item 1 above does not exist for a carcinogenic hazardous waste or hazardous constituent, then the Permittees shall use the most recent version of the EPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (**RSLs**) for tap water and a target excess cancer risk level of 10^{-5} to develop a proposed cleanup level for NMED approval. The Permittees may use other scientific or regulatory information currently available to the public to develop and propose a cleanup level for NMED approval provided that the level is lower (or otherwise more protective) than the RSL.

If a cleanup level under Item 1 above does not exist for a noncarcinogenic hazardous waste or hazardous constituent, then the Permittees shall use the most recent version of the EPA

RSLs for tap water and a Hazard Index (**HI**) of one (1.0) to develop a proposed cleanup level for NMED approval. The Permittees may use other scientific or regulatory information currently available to the public to develop and propose a cleanup level for NMED approval provided that the level is lower (or otherwise more protective) than the RSL.

If perchlorate is detected at concentrations at or greater than 4 μg/L and no ground water standard or MCL has been adopted by the Environmental Improvement Board, WQCC, or EPA, then the Permittees shall use the cleanup goal with a HI of 1.0 to develop the proposed cleanup level for use in their site investigation or corrective measure evaluation.

8.13.2. Soil Cleanup Levels

The Permittees shall attain the following cleanup levels for hazardous waste and hazardous constituents in soil:

1. For all individual contaminants for which NMED has specified a soil screening level in NMED's *Technical Background Document for Development of Soil Screening Levels*, the residential or industrial land use scenario cleanup level shall be the screening level specified in the most recent version of that document. The method for determining cleanup levels for sites with multiple contaminants shall follow NMED's *Technical Background Document for Development of Soil Screening Levels* (as updated) and items 2 and 3 below, as applicable;

2. The Permittees shall propose a soil cleanup level for PCBs based on NMED's *Position Paper Risk-based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites* (March 2000 as updated); and

3. If NMED soil screening level has not been established for a hazardous waste or hazardous constituent, the Permittees shall propose for NMED approval, a cleanup level based on the most recent version of the EPA Region VI HHMSSL (based on a HI of one (1.0) for compounds designated as "n" (noncarcinogen effects), "max" (maximum concentration), and "sat" (soil saturation concentration), or ten times the EPA Region VI HHMSSL for compounds designated "c" (carcinogen effects) (i.e. a target excess cancer risk level of 10^{-5}).

8.13.3. Land Use Determination

All soil cleanup levels shall be based on a residential land use scenario unless NMED determines that an alternate land use is appropriate (e.g. subsistence farming, cultural, or industrial). The Permittees may only propose an alternate land use with less stringent cleanup levels (e.g. industrial) if NMED or EPA can legally and practicably enforce the institutional controls limiting the land use. If an alternate land use for which NMED or EPA has not established soil cleanup levels is determined to be the current and reasonably foreseeable future land use, then the Permittees may propose cleanup levels based on a risk assessment using a target excess cancer risk level of 10^{-5} for carcinogenic hazardous waste or hazardous constituent or, for noncarcinogenic hazardous waste or hazardous constituent, a HI of one (1.0).

8.13.4. Surface Water Cleanup Levels

The Permittees shall comply with the surface water quality standards outlined in the Clean Water Act (33 U.S.C. §§1251 to 1387), the New Mexico WQCC Regulations (20.6.2 NMAC), the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) and the procedures for alternative abatement standards (20.6.2.4103 NMAC).

8.13.5. Ecological Risk Cleanup Levels

The Permittees shall derive cleanup levels for each hazardous waste and hazardous constituent for each ecological zone at the Facility using the methodology in NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening–Level Ecological Risk Assessment* (July 2008, as updated). If the ecological risk evaluation indicates that a lower cleanup level for a hazardous waste or hazardous constituent in ground water, soil, or surface water is necessary to protect environmental receptors, NMED may establish cleanup levels based on ecological risk for hazardous waste or hazardous constituents in ground water, soil, or surface water that are lower than levels that are solely protective of human health.

8.13.6. Background Concentrations

If the naturally occurring (background) concentration of a hazardous waste or hazardous constituent in ground water, soil, or surface water exceeds the standards specified above, then the cleanup level shall be the background concentration. To use background concentration as a cleanup level, the Permittees must obtain a written background determination from NMED.

8.13.7. Variance from Cleanup Levels

The Permittees may seek a variance from a cleanup level for soil or ground water as follows:

8.13.7.1. WQCC Standards

The Permittees may seek a technical infeasibility determination or alternative abatement standard from a WQCC standard in accordance with 20.6.2.4103.E or F NMAC.

8.13.7.2. Soil Standards and Non-WQCC Ground Water Standards

The Permittees may seek a variance from any cleanup level for soil or for ground water (other than a WQCC standard) by submitting a written request to NMED for a determination that attainment of the cleanup level is technically infeasible or otherwise impracticable due to conflict with other environmental laws or requirements for the preservation of cultural resources. If based on technical infeasibility, the request shall include a demonstration of technical or physical impossibility of attaining the

cleanup level using potential corrective action remedies. If based on conflict with other environmental laws or requirements for the preservation of cultural resources, the request shall include documentation showing that Permittees have attempted to resolve the conflict or mitigate the impact on cultural or natural resources and shall explain why mitigating measures cannot resolve the conflict or adequately protect the cultural or natural resource (e.g. consultation and a determination of incidental taking or reasonable and prudent measures to minimize the impact under 16 U.S.C. §1536). All requests shall include a discussion of the effectiveness of potential corrective action remedies, whether the proposed variance will allow a present or future hazard to public health or the environment, and any other information required by the NMED. In addition, the request shall propose alternate cleanup levels for NMED approval, based on the effectiveness of potential corrective action remedies and a site-specific risk assessment based on NMED's guidance, *Technical Background Document for Development of Soil Screening Levels* (August 2009, as updated), *Assessing Human Health Risks Posed by Chemicals: Screening Level Risk Assessment* (March 2000), and *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (July 2008, as updated).

8.14. REPORTING REQUIREMENTS

The purpose of this Permit Section is to provide the reporting requirements and report formats for corrective action activities at all SWMUs, AOCs, and permitted units required under this Permit. This Section is not intended to provide reporting requirements for every potential corrective action conducted at the facility; therefore, the formats for all types of reports are not presented below. The described formats include the general reporting requirements and formats for site-specific investigation work plans, investigation reports, periodic monitoring reports, risk assessment reports, and corrective measures evaluations. The Permittees shall generally consider the reports to be the equivalents of RCRA Facility Investigation (**RFI**) work plans, RFI reports, periodic monitoring reports, risk assessments, Corrective Measures Study (**CMS**) plans, and CMS reports, for the purposes of RCRA compliance. The Permittees shall include detailed, site-specific requirements in all SWMU, AOC, permitted unit and facility-wide investigation work plans, investigation reports, monitoring reports, and corrective measures evaluations. All plans and reports shall be prepared with technical and regulatory input from NMED. All work plans, reports and other documents shall be submitted to NMED in the form of two paper copies and one copy in electronic or other format acceptable to NMED. The Permittees shall submit maps and figures in a format specified by NMED (e.g., *shp, *dwg).

The reporting requirements listed in this Section do not include all sections that may be necessary to complete each type of report listed and may include sections that are not relevant for a specific site action. The Permittees or NMED may determine that additional sections may be needed to address additional site-specific issues or information collected during corrective action or monitoring activities not listed below. However, the Permittees must submit variations of the general report format and the formats for reports not listed in this Section in outline form to NMED for approval

prior to submittal of the reports. All work plans and reports are subject to the requirements in this Permit Part. NMED will approve or disapprove, in writing, the proposed report outline within 90 days of receipt of the outline. If NMED disapproves the report outline, NMED will notify the Permittees, in writing, of the outline's deficiencies and will specify a date for submittal of a revised report outline. All reports submitted by the Permittees shall follow the general approach and limitations for data presentation described in this Section.

8.14.1. Investigation Work Plan

The Permittees shall prepare work plans subject to the requirements of this Permit Part for site investigations or corrective action activities at the facility using the general outline below. The minimum requirements for describing proposed activities within each section are included. All research, locations, depths and methods of exploration, field procedures, analytical results, data collection methods, and schedules shall be included in each work plan. In general, interpretation of data acquired during previous investigations shall be presented only in the background sections of the work plans. The other text sections of the work plans shall be reserved for presentation of anticipated site-specific activities and procedures relevant to the project. The general work plan outline is described below.

8.14.1.1. Title Page

The title page shall include the type of document; facility name; area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible facility representative shall be provided on the title page in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1)).

8.14.1.2. Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose and scope of the investigation to be conducted at the subject site. The facility, SWMU or AOC name, site name, any other unit name, location, and area designation shall be included in the executive summary.

8.14.1.3. Table of Contents

The table of contents shall list all text sections, tables, figures, and appendices or attachments included in the work plan. The corresponding page numbers for the titles of each section of the work plan shall be included in the table of contents.

8.14.1.4. Introduction

The introduction shall include the facility name, area designation, unit location, and unit status (e.g., closed, corrective action). General

information on the current site usage and status shall be included in this section. A brief description of the purpose of the investigation and the type of site investigation to be conducted shall be provided in this section.

8.14.1.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of pertinent subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, unless none exist.

This section shall identify potential receptors, including groundwater, and include a brief summary of the type and characteristics of all waste and all contaminants managed or released at the site, the known and possible sources of contamination, the history of releases or discharges of contamination, and the known extent of contamination. This section shall include brief summaries of results of previous investigations, if conducted, including references to pertinent figures, data summary tables, and text in previous reports. At a minimum, detections of contaminants encountered during previous investigations shall be presented in table format, with an accompanying figure showing sample locations. References to previous reports shall include page, table, and figure numbers for referenced information. Summary data tables and site plans showing relevant investigation locations shall be included in the Tables and Figures sections of the document, respectively.

8.14.1.6. Site Conditions

a. Surface Conditions

A section on surface conditions shall provide a brief detailed description of current site topography, features and structures including a description of topographic drainages, man-made drainages, vegetation, erosional features, and basins. It shall also include a detailed description of current site usage and any current operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant fate and transport shall be included in this section.

b. Subsurface Conditions

A section on subsurface conditions shall provide a brief, detailed description of the site conditions observed during previous subsurface investigations, including relevant soil horizons, stratigraphy, presence of groundwater, and other relevant information. A site plan showing the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the work plan. A brief description of the anticipated stratigraphic units that may be encountered during the investigation may be included in this subsection if no previous investigations have been conducted at the site.

8.14.1.7. Scope of Activities

A section on the scope of activities shall briefly describe a list of all anticipated activities to be performed during the investigation including background information research, health and safety requirements that may affect or limit the completion of tasks, drilling, test pit or other excavations, well construction, field data collection, survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and investigation-derived waste (**IDW**) storage and disposal.

8.14.1.8. Investigation Methods

A section on investigation methods shall provide a description of all anticipated locations and methods for conducting the activities to be performed during the investigation. This section shall include research methods, health and safety practices that may affect the completion of tasks, drilling methods, test pit or other excavation methods, sampling intervals and methods, well construction methods, field data collection methods, geophysical and land survey methods, field screening methods, chemical analytical testing, materials testing, aquifer testing, pilot tests, and other proposed investigation and testing methods. This information may also be summarized in table format, if appropriate.

8.14.1.9. Monitoring and Sampling

A section on monitoring and sampling shall provide a description of the groundwater, ambient air, subsurface vapor, remediation system, engineering controls, and other monitoring and sampling programs currently being implemented at the site.

8.14.1.10. Schedule

A section shall set forth the anticipated schedule for completion of field investigation, pilot testing, and monitoring and sampling activities. In addition, this section shall set forth a schedule for submittal of reports and

data to NMED including a schedule for submitting all status reports and preliminary data.

8.14.1.11. Tables

The following summary tables may be included in the investigation work plans, if previous investigations have been conducted at the site. Data presented in the tables shall include information on dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Summaries of regulatory criteria, background, and applicable cleanup levels (may be included in the analytical data tables instead of as separate tables).

2. Summaries of historical field survey location data.

3. Summaries of historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.

4. Summaries of historical soil, rock, or sediment laboratory analytical data shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.

5. Summaries of historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times measurements were taken.

6. Summaries of historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.

7. Summary of historical surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that could influence interpretation of the data.

8. Summary of historical air sample screening and chemical analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits,

and significant data quality exceptions that could influence interpretation of the data.

9. Summary of historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

8.14.1.12. Figures

The following figures shall be included with each investigation work plan for each site, including presentation of data where previous investigations have been conducted. All figures must include an accurate bar scale and a north arrow. An explanation shall be included on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall contain a date of preparation.

1. A vicinity map showing topography and the general location of the site relative to surrounding features and properties.

2. A site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan, if appropriate. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.

3. Figures showing historical and proposed soil boring or excavation locations and sampling locations.

4. Figures presenting historical soil sample field screening and laboratory analytical data if applicable.

5. Figures presenting the locations of all existing and proposed borings and vapor monitoring well locations.

6. Figures showing all existing and proposed wells and piezometers, presenting historical groundwater elevation data, and indicating groundwater flow directions.

7. Figures presenting historical groundwater laboratory analytical data, if applicable. The chemical analytical data corresponding to each sampling location can be presented in tabular form on the figure or as an isoconcentration map.

8. Figures presenting historical and proposed surface water sample locations and field measurement data, if applicable.

9. Figures presenting historical surface water laboratory analytical data, if applicable.

10. Figures showing historical and proposed air or vapor sampling locations and presenting historical air quality data, if applicable.

11. Figures presenting historical pilot and other testing locations and data, where applicable, including site plans and graphic data presentation.

12. Figures presenting geologic cross-sections, based on outcrop and borehole data acquired during previous investigations, if applicable.

8.14.1.13. Appendices

A description of IDW management shall be included as an appendix to the investigation work plan. The results of historical investigations required in this Permit shall be submitted with the investigation work plan as a separate document. Additional appendices may be necessary to present additional data or documentation not listed above.

8.14.2. Investigation Report

The Permittees shall prepare investigation reports at the facility using the general outline below. The Investigation Report shall be the reporting mechanism for presenting the results of completed Investigation Work Plans. This section describes the minimum requirements for reporting on site investigations. All data collected during each site investigation event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions and recommendations sections of the reports. The other text sections of the reports shall be reserved for presentation of facts and data without interpretation or qualifications. The general report outline is provided below.

8.14.2.1. Title Page

The title page shall include the type of document; facility name; area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible facility representatives shall be provided on the title page in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1)).

8.14.2.2. Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the investigation; site names; location; and area designation. In addition, this section shall include a brief summary of

conclusions included in the Report based on the investigation data collected and recommendations for future investigation, monitoring, remedial action or site closure.

8.14.2.3. Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

8.14.2.4. Introduction

The introduction section shall include the facility name, area designation, unit location, and unit status (e.g., closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the investigation, the type of site investigation conducted, and the type of results presented in the report also shall be provided in this section.

8.14.2.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in the background summary and labeled on the figure, as appropriate. In addition, this section shall include a brief summary of the possible sources of contamination, the history of releases or discharges of contamination, the known extent of contamination, and a general summary of the results of previous investigations including references to previous reports. The references to previous reports shall include page, table, and figure numbers for referenced information. A site plan, showing relevant investigation locations, and summary data tables shall be included in the Figures and Tables sections of the document, respectively.

8.14.2.6. Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the investigation event including background information research, implemented health and safety measures that affected or limited the completion of tasks, drilling, test pit or other excavation methods, well construction methods, field data collection,

survey data collection, chemical analytical testing, aquifer testing, remediation system pilot tests, and IDW storage or disposal.

8.14.2.7. Field Investigation Results

A section shall provide a summary of the procedures used and the results of all field investigation activities conducted at the site including the dates that investigation activities were conducted, the type and purpose of field investigation activities performed, field screening measurements, logging and sampling results, pilot test results, construction details, and conditions observed. Field observations or conditions that altered the planned work or may have influenced the results of sampling, testing, and logging shall be reported in this section. The following sections shall be included.

a. Surface Conditions

A section on surface conditions shall describe current site topography, features, and structures including topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current site uses and any operations at the site. In addition, descriptions of features located in surrounding sites that may have an impact on the subject site regarding sediment transport, surface water runoff, or contaminant transport shall be included in this subsection.

b. Exploratory Drilling or Excavation Investigations

A section shall describe the locations, methods, and depths of subsurface explorations. The description shall include the types of equipment used, the logging procedures, the soil or rock classification system used to describe the observed materials, exploration equipment decontamination procedures, and conditions encountered that may have affected or limited the investigation.

A description of the site conditions observed during subsurface investigation activities shall be included in this section, including soil horizon and stratigraphic information. Site plans showing the locations of all borings and excavations shall be included in the Figures Section of the report. Boring and test pit logs for all exploratory borings and test pits shall be presented in an appendix or attachment to the report.

c. Exploratory and Monitoring Well Boring Geophysical Logging

A section shall describe the methods, dates of measurement, depth intervals measured, and the results of geophysical logging. The relative merits and limitations of each geophysical logging method employed shall be discussed, along with any field conditions or instrument malfunctions that occurred that may have affected the results of the geophysical logging.

d. Subsurface Conditions

A section on subsurface conditions shall describe known subsurface lithology and structures, based on observations made during the current and previous subsurface investigations, including interpretation of geophysical logs and as-built drawings of man-made structures. A description of any known locations of pipelines and utility lines and observed geologic structures shall also be included in this section. A site plan showing boring and excavation locations and the locations of the site's above- and below-ground structures shall be included in the Figures section of the report. In addition, cross-sections shall be constructed, if appropriate, to provide additional visual presentation of site or regional subsurface conditions.

e. Monitoring Well construction and Boring or Excavation Abandonment

A section shall describe the methods and details of monitoring well construction and the methods used to abandon or backfill exploratory borings and excavations. The description shall include the dates of well construction, boring abandonment, or excavation backfilling. In addition, well construction diagrams shall be included in an appendix or attachment with the associated boring logs for monitoring well borings. The Permittees may submit well abandonment reports as an appendix to the investigation report.

f. Groundwater Conditions

A section shall describe groundwater conditions observed beneath the subject site and relate local groundwater conditions to regional groundwater conditions. A description of the depths to water, aquifer thickness, and groundwater flow directions shall be included in this section for alluvial groundwater, shallow perched groundwater, intermediate perched groundwater, and regional groundwater, as appropriate to the investigation. Figures showing well locations, surrounding area, and groundwater elevations and flow directions for each hydrologic zone shall be included in the Figures section of the report.

g. Surface Water Conditions

A section shall describe surface water conditions and include a description of surface water runoff, drainage, surface water sediment transport, and contaminant transport in surface water as suspended load and as a dissolved phase in surface water via natural and man-made drainages, if applicable. A description of contaminant fate and transport shall be included, if appropriate.

h. Surface Air and Subsurface Vapor Conditions

A section shall describe surface air and subsurface vapor monitoring and sampling methods used during the site investigation. It shall also describe observations made during the site investigation regarding subsurface flow pathways and the subsurface air-flow regime.

i. Materials Testing Results

A section shall discuss the materials testing results, such as core permeability testing, grain size analysis, or other materials testing results. Sample collection methods, locations, and depths shall also be included. Corresponding summary tables shall be included in the Tables section of the report.

j. Pilot Testing Results

A section shall discuss the results of any pilot tests. Pilot tests are typically conducted after initial subsurface investigations are completed and the need for additional investigation or remediation has been evaluated. Pilot tests, including aquifer tests and remediation system pilot tests, shall be addressed through separate work plans and pilot test reports. The format for pilot test work plans and reports shall be approved by NMED prior to submittal.

8.14.2.8. Regulatory Criteria

A section shall set forth the cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included if site-specific levels have been established at separate facility sites or units. A table summarizing the applicable cleanup standards or levels or inclusion of applicable cleanup standards or levels in the data tables shall be included as part of the document. The risk assessment, if conducted, shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a NMED-approved risk evaluation are employed, the risk evaluation document shall be

referenced and shall include pertinent page numbers for referenced information.

8.14.2.9. Site Contamination

A section shall provide a description of sampling intervals and methods for detection of surface and subsurface contamination in soils, rock, sediments, groundwater, and surface water, and as vapor-phase contamination. Only factual information shall be included in this section. Interpretation of the data shall be reserved for the summary and conclusions sections of the report. Tables summarizing all sampling, testing, and screening results for detected contaminants shall be prepared in a format approved by NMED. The tables shall be presented in the Tables Section of the report.

a. Soil, Rock, and Sediment Sampling

A section shall describe the sampling of soil, rock, and sediment. It shall include the dates, locations and methods of sample collection; sampling intervals; sample logging methods; screening sample selection methods; and laboratory sample selection methods including the collection depths for samples submitted for laboratory analyses. A site plan showing the sample locations shall be included in the Figures Section of the report.

b. Soil, Rock, and Sediment Sampling Field Screening Results

A section shall describe the field screening methods used during the investigation and the field screening results. Field screening results also shall be presented in summary tables in the Tables section of the document. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this section.

c. Soil, Rock, and Sediment Sampling Analytical Results

A section shall summarize the results of laboratory analysis for soil, rock, and sediment samples. It shall also describe the analytical methods used and provide a comparison of the analytical results to background levels, cleanup standards, or established cleanup levels for the site. The laboratory results also shall be presented in summary tables in the Tables section of the document. Field conditions and sample collection methods that could potentially affect the analytical results shall be described in this section. If appropriate, soil analytical data shall be presented with sample locations on a site plan and included in the Figures section of the report.

d. Groundwater Sampling

A section on groundwater sampling shall describe the dates, locations, depths, and methods of sample collection; methods for sample logging; and methods for screening and laboratory sample selection. A map showing all site and surrounding area well locations shall be included in the Figures section of the report.

e. Groundwater General Chemistry

A section on the general groundwater chemistry shall describe the results of measurement of field purging parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that may have influenced the results of field screening shall be discussed in this section. As determined by the Permittees and NMED, relevant water chemistry concentrations shall be presented as data tables or as isoconcentration contours on a map included in the Figures section of the report.

f. Groundwater Chemical Analytical Results

A section shall summarize the results of groundwater chemical analyses. It shall describe the groundwater chemical analytical methods and analytical results. It shall also provide a comparison of the data to cleanup standards or established cleanup levels for the site. The rationale or purpose for altering or modifying the groundwater sampling program outlined in the site investigation work plan shall also be provided in this section. Field conditions shall be described in this section that may have affected the analytical results during sample collection. Tables summarizing the groundwater laboratory, field, and field sample QA/QC chemical analytical data; applicable cleanup levels; and modifications to the groundwater sampling program shall be provided in the Tables Section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures Section of the report.

g. Surface Water Sampling

A section shall describe the surface water sampling and shall include the dates, times, locations, depths, and methods of sample collection. It shall also describe methods for sample logging,

sample-screening methods, and laboratory sample selection methods. A map showing all surface-water sampling locations shall be included in the Figures section of the report.

h. Surface Water General Chemistry

A section on the surface water general chemistry shall describe the results of measurement of field parameters and field analytical measurements. Field parameter measurements and field analytical results also shall be presented in summary tables in the Tables section of the document. The limitations of field measurement instrumentation and any conditions that influenced the results of field screening shall be discussed in this section. Relevant water chemistry concentrations shall be presented as data tables on a map included in the Figures section of the report.

i. Surface Water Chemical Analytical Results

A section shall summarize the results of surface water chemical analyses. It shall describe the analytical methods and analytical results, and provide a comparison of the data to the cleanup standards or established background or cleanup levels for the site. The rationale or purpose for altering or modifying the surface-water sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the surface water laboratory, field, and analytical field sample QA/QC analytical data; applicable cleanup levels; and modifications to the surface-water sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations or as data tables on a map included in the Figures section of the report.

j. Air and Subsurface Vapor Sampling

A section shall describe the air and subsurface vapor sampling. It shall describe the dates, locations, depths or elevations above ground surface, methods of sample collection, methods for sample logging, and methods for laboratory sample selection. A map showing all air sampling locations shall be provided in the Figures section of the report.

k. Air and Subsurface Vapor Field Screening Results

A section shall describe the air and subsurface vapor field screening results. It shall describe the field screening methods

used for ambient air and subsurface vapors during the investigation. Field screening results shall also be presented in summary tables in the Tables section of the report. The locations of ambient air and subsurface vapor screening sample collection shall be presented on a site plan included in the Figures section of the report. The limitations of field screening instrumentation and any conditions that influenced the results of field screening shall be discussed in this section.

l. Air and subsurface Vapor Laboratory Analytical Results

A section shall describe the results of air and subsurface vapor laboratory analysis. It shall describe the air sampling laboratory analytical methods and analytical results, and provide a comparison of the data to emissions standards or established cleanup or emissions levels for the site. The rationale or purpose for altering or modifying the air monitoring or sampling program outlined in the site investigation work plan also shall be provided in this section. Field conditions that may have affected the analytical results during sample collection shall be described in this section. Tables summarizing the air sample laboratory, field, and analytical field sample QA/QC data; applicable cleanup levels or emissions standards; and modifications to the air sampling program shall be provided in the Tables section of the report. Relevant contaminant concentrations shall be presented as individual analyte concentrations, data tables, or as isoconcentration contours on a map included in the Figures section of the report.

8.14.2.10. Conclusions

A section shall provide a brief summary of the investigation activities and a discussion of the conclusions of the investigation conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup or screening levels, and to relevant historical investigation results and analytical data. Potential receptors, including groundwater, shall be identified and discussed. An explanation shall be provided with regard to data gaps. A risk assessment may be included as an appendix to the investigation report; however, the risk assessment shall be presented in the Risk Assessment format described in Permit Section 8.14.4. References to the risk assessment shall be presented only in the summary and conclusions sections of the Investigation Report.

8.14.2.11. Recommendations

A section shall discuss the need for further investigation, corrective measures, risk assessment and monitoring, or recommendations for corrective action completed, based on the conclusions provided in the Conclusions section. It shall include explanations regarding additional sampling, monitoring, and site closure. A corresponding schedule for further action regarding the site shall also be provided. No action recommendations shall include the anticipated schedule for submittal of a petition for a permit modification.

8.14.2.12. Tables

A section shall provide the following summary tables as applicable. With prior approval from NMED, the Permittees may combine one or more of the tables. Data presented in the tables shall include the current data, dates of data collection, analytical methods, detection limits, and significant data quality exceptions. The summary analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. Tables summarizing regulatory criteria, background levels, and applicable cleanup levels (this information may be included in the analytical data tables instead of as separate tables).

2. Tables summarizing field survey location data. Separate tables shall be prepared for well locations and individual medium sampling locations except where the locations are the same for more than one medium.

3. Tables summarizing field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.

4. A table summarizing soil, rock, and/or sediment laboratory analytical data. It shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

5. A table summarizing the groundwater elevations and depths to groundwater. The table shall include the monitoring well depths and the screened intervals in each well.

6. A table summarizing the groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

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7. A table summarizing the surface water laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

8. A table summarizing the air sample screening and laboratory analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

9. Tables summarizing the pilot test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

10. A table summarizing any materials test data.

8.14.2.13. Figures

A section shall provide the following figures as applicable. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All maps shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features and properties.

2. A site plan that presents any pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and details. Off-site well locations and other relevant features shall be included on the site plan. Additional site plans may be required to present the locations of relevant off-site well locations, structures and features.

3. Figures showing boring or excavation locations and sampling locations.

4. Figures presenting soil sample field screening and laboratory analytical data.

5. Figures displaying the locations of all newly installed and existing wells and borings.

6. Figures presenting monitoring well and piezometer locations, groundwater elevation data, and groundwater flow directions.

7. Figures presenting groundwater laboratory analytical data, including any past data requested by NMED. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.

8. Figures presenting surface water sample locations and field measurement data including any past data requested by NMED.

9. Figures presenting surface water laboratory analytical data including any past data requested by NMED. The laboratory analytical data corresponding to each sampling location may be presented in table form on the figure.

10. Figures showing air sampling locations and presenting air quality. The field screening or laboratory analytical data corresponding to each sampling location may be presented in table form on the figure or as an isoconcentration map.

11. Figures presenting geologic cross-sections based on outcrop and borehole data.

12. Figures presenting pilot test locations and data, where applicable, including site plans or graphic data presentation.

8.14.2.14. Appendices

Each investigation report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

a. Field Methods

An appendix shall provide detailed descriptions of the methods used to acquire field measurements of each medium that was surveyed or tested during the investigation. This appendix shall include exploratory drilling or excavation methods, the methods and types of instruments used to obtain field screening, field analytical or field parameter measurements, instrument calibration procedures, sampling methods for each medium investigated, decontamination procedures, sample handling procedures, documentation procedures, and a description of field conditions that affected procedural or sample testing results. Methods of measuring and sampling during pilot tests shall be reported in this appendix, if applicable. Geophysical logging methods shall be discussed in a separate section of this appendix. IDW storage and disposal methods shall also be discussed in this appendix. Copies

of IDW disposal documentation shall be provided in a separate appendix.

b. Boring/Test Pit Logs and Well Construction Diagrams

An appendix shall provide boring logs, test pit logs, or other excavation logs, and well construction details. In addition, a key to symbols and a soil or rock classification system shall be included in this appendix. Geophysical logs shall be provided in a separate section of this appendix.

c. Analytical Programs

An appendix shall discuss the analytical methods, a summary of data quality objectives, and the data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the field and laboratory analytical data with regard to the investigation and the site status shall be included in this appendix along with references to the case narratives provided in the laboratory reports.

d. Analytical Reports

An appendix shall provide the contract laboratory final analytical data reports generated for the investigation. The reports shall include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The final laboratory reports and data tables shall be provided electronically in a format approved by NMED. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

e. Other Appendices

Other appendices containing additional information shall be included as required by NMED or as otherwise appropriate.

8.14.3. Periodic Monitoring Report

The Permittees shall use the following guidance for preparing periodic monitoring reports. The reports shall present the reporting of periodic groundwater, surface water, vapor, and remediation system monitoring at the facility. The following sections provide a general outline for monitoring reports, and also provide the minimum requirements for reporting for specific facility sites, areas, and regional monitoring. All data collected during each monitoring and sampling event in the reporting period shall be included in the reports. In general, interpretation of data shall be presented only in the background, conclusions, and recommendations sections of the reports. The other text sections of the reports shall be reserved for presentation of facts and data without interpretation or qualifications.

8.14.3.1. Title Page

The title page shall include the type of document; facility name; area designation; SWMU or AOC name, site, watershed, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible facility representatives shall be provided on the title page in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1)).

8.14.3.2. Executive Summary (Abstract)

The executive summary or abstract shall provide a brief summary of the purpose, scope, and results of the monitoring conducted at the subject site during the reporting period. The area (e.g., Plume-front, facility-wide) SWMU, AOC and site name, location, and/or area designation shall be included in the executive summary. In addition, this section shall include a brief summary of conclusions based on the monitoring data collected.

8.14.3.3. Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the report. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

8.14.3.4. Introduction

The introduction section shall include the facility name, area designation physical area and/or, unit location, and unit status as applicable (e.g. closed, corrective action). General information on the site usage and status shall be included in this section. A brief description of the purpose of the monitoring, type of monitoring conducted, and the type of results presented in the report also shall be provided in this section.

8.14.3.5. Scope of Activities

A section on the scope of activities shall briefly describe all activities performed during the monitoring event or reporting period including field data collection, analytical testing, remediation system monitoring, if applicable, and purge/decontamination water storage and disposal.

8.14.3.6. Regulatory Criteria

A section on regulatory criteria shall provide information regarding applicable cleanup standards, risk-based screening levels and risk-based cleanup goals for the subject site. A separate table summarizing the applicable screening levels or standards or inclusion of the applicable

cleanup standards or screening levels in the data tables can be substituted for this section. The appropriate cleanup or screening levels for each site shall be included, if site-specific levels have been established at separate sites. Risk-based evaluation procedures, if used to calculate cleanup or screening levels, must either be included as an attachment or referenced. The specific document and page numbers must be included for all referenced materials.

8.14.3.7. Monitoring Results

A section shall provide a summary of the results of monitoring conducted at the site. This section shall include the dates and times that monitoring was conducted, the measured depths to groundwater, directions of groundwater flow, field air and water quality measurements, contaminant surveys, static pressures, field measurements, and a comparison to previous monitoring results. Field observations or conditions that may influence the results of monitoring shall be reported in this section. Tables summarizing vapor-monitoring parameters, groundwater elevations, depths to groundwater measurements, and other field measurements can be substituted for this section. The tables shall include all information required in Permit Section 8.14.3.11.

8.14.3.8. Analytical Data Results

A section shall discuss the results of the chemical analyses. It shall provide the dates of sampling, the analytical methods, and the analytical results. It shall also provide a comparison of the data to previous results and to background levels, cleanup standards, or established cleanup levels for the site. The rationale or purpose for altering or modifying the monitoring and sampling program shall be provided in this section. A table summarizing the laboratory analytical data, QA/QC data, applicable cleanup levels, and modifications to the sampling program can be substituted for this section. The tables shall include all information required in Permit Section 8.14.3.11.

8.14.3.9. Remediation System Monitoring

A section shall discuss the remediation system monitoring. It shall summarize the remediation system's capabilities and performance. It shall also provide monitoring data, treatment system discharge sampling requirements, and system influent and effluent sample analytical results. The dates of operation, system failures, and modifications made to the remediation system during the reporting period shall also be included in this section. A summary table may be substituted for this section. The tables shall include all information required in Permit Section 8.14.3.11.

8.14.3.10. Summary

A summary section shall provide a discussion and conclusions of the monitoring conducted at the site. In addition, this section shall provide a comparison of the results to applicable cleanup levels, and to relevant historical monitoring and laboratory analytical data. An explanation shall be provided with regard to data gaps. A discussion of remediation system performance, monitoring results, modifications, if applicable, and compliance with discharge requirements shall be provided in this section. Recommendations and explanations regarding future monitoring, remedial actions, or site closure, if applicable, shall also be included in this section.

8.14.3.11. Tables

A section shall provide the following summary tables for the media sampled. With prior approval from NMED, the Permittees may combine one or more of the tables. Data presented in the tables shall include the current sampling and monitoring data plus data from the three previous monitoring events or, if data from less than three monitoring events is available, data acquired during previous investigations. Remediation system monitoring data also shall be presented. The dates of data collection shall be included in the tables. Summary tables may be substituted for portions of the text. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing the regulatory criteria (a Regulatory Criteria text section may be substituted for this table or the applicable cleanup levels may be included in the analytical data tables).

2. A table summarizing groundwater elevations and depths to groundwater data. The table shall include the monitoring well depths, the screened intervals in each well, and the dates and times of measurements.

3. A table summarizing field measurements of surface water quality data.

4. A table summarizing field measurements of vapor monitoring data (must include historical vapor monitoring data as described above).

5. A table summarizing field measurements of groundwater quality data (must include historical water quality data as described above).

6. A table summarizing vapor sample analytical data (must include historical vapor sample analytical data as described above).

7. A table summarizing surface water analytical data (must include historical surface water analytical data as described above).

8. A table summarizing groundwater analytical data (must include historical groundwater analytical data as described above).

9. A table summarizing remediation system monitoring data, if applicable

8.14.3.12. Figures

The section shall include the following figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. A site plan that presents pertinent site features and structures, well and piezometer locations, and remediation system location(s) and features. Off-site well locations and pertinent features shall be included on the site plan, if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.

3. Figures presenting the locations of piezometer, monitoring and other well locations, groundwater elevation data, and groundwater flow directions.

4. Figures presenting groundwater analytical data for the current monitoring event. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.

5. Figures presenting surface water sampling locations and analytical data for the current monitoring period if applicable.

6. Figures presenting vapor sampling locations and analytical data for the current monitoring event if applicable. The analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure or as an isoconcentration map.

7. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.

8.14.3.13. Appendices

Each monitoring report shall include the following appendices. Additional appendices may be necessary to present data or documentation not listed below.

a. Field Methods

An appendix shall include the methods used to acquire field measurements of groundwater elevations, vapor and water quality data, and vapor, surface water and groundwater samples. It shall include the methods and types of instruments used to measure depths to water, air or headspace parameters, flow measurements, and water quality parameters. In addition, decontamination, well purging techniques, well sampling techniques, and sample handling procedures shall be provided in this appendix. Methods of measuring and sampling remediation systems shall be reported in this appendix, if applicable. Purge and decontamination water storage and disposal methods shall also be presented in this appendix. Copies of purge and decontamination water disposal documentation shall be provided in a separate appendix, if applicable.

b. Analytical Programs

An appendix shall discuss the analytical program. It shall include the analytical methods, a summary of data quality objectives, and data quality review procedures. A summary of data quality exceptions and their effect on the acceptability of the analytical data with regard to the monitoring event and the site status shall be included in this appendix along with references to case narratives provided in the laboratory reports.

c. Analytical Reports

An appendix shall provide the analytical reports and shall include the contract laboratory final chemical analytical data reports generated during this reporting period. The reports must include all chain-of-custody records and Level II QA/QC results provided by the laboratory. The laboratory final reports and data tables shall be provided electronically in a format approved by NMED. Paper copies (or electronically scanned in PDF format) of all chain-of-custody records shall be provided with the reports.

8.14.4. Risk Assessment Report

The Permittees shall prepare risk assessment reports for sites requiring corrective action at the facility using the format listed below. This section provides a general outline for risk assessments and also lists the minimum requirements for describing risk assessment elements. In general, interpretation of data shall be presented only in the Background, Conceptual Site Model, and Conclusions and Recommendations Sections of the reports. The other text sections of the Risk Assessment report shall be reserved for presentation of sampling results from all investigations, conceptual and mathematical elements of the risk assessment, and presentations of toxicity information and screening values used in the risk assessment. Permit Section 8.14.4.8 and subsequent sections should be presented in separate sections for the human health and ecological risk assessments, but the general risk assessment outline applicable to both sections is provided below.

8.14.4.1. Title Page

The title page shall include the type of document; facility name; area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible facility representative shall be provided on the title page in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1)).

8.14.4.2. Executive Summary (Abstract)

The executive summary or abstract section shall provide a brief summary of the purpose and scope of the risk assessment of the subject site. The Executive Summary shall also briefly summarize the conclusions of the risk assessment. The facility, SWMU, AOC, and site names; location; and area designation shall be included in the executive summary.

8.14.4.3. Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the risk assessment. The corresponding page numbers for the titles of each unit of the report shall be included in the table of contents.

8.14.4.4. Introduction

The introduction section shall include the facility name, area designation, unit location, and unit status (e.g., closed, corrective action). General information on the current site usage and status shall be included in this section.

8.14.4.5. Background

The background section shall describe relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features.

a. Site Description

A section shall describe current site topography, features and structures including topographic drainages, man-made drainages, erosional features, current site uses, and other data relevant to assessing risk at the site. Depth to groundwater and direction of groundwater flow shall be included in this section. The presence and location of surface water bodies such as any springs or wetlands shall be noted in this section. Photographs of the site may be incorporated into this section. Ecological features of the site shall be described here, including type and amount of vegetative cover, observed and expected wildlife receptors, and level of disturbance of the site. A topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features shall be included in the Figures section of the document.

b. Sampling Results

A section shall discuss the results of the sampling at the site. It shall include a description of the history of releases of contaminants, the known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include summaries of sampling results of all investigations including site plans (included in the Figures section of the report) showing locations of detected contaminants. This section shall reference pertinent figures, data summary tables, and references in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summaries of sampling data shall include for each constituent: the maximum value detected, the detection limit, the 95 percent upper confidence level (**UCL**) of the mean value detected (if applicable to the data set), and whether the 95 percent UCL of the mean was calculated based on a normal or lognormal distribution. Background values used for comparison to inorganic constituents at the site shall be presented here. The table of background values should appear in the Tables section of the

document and include actual values used as well as the origin of the values (e.g. facility-wide, UCL, upper tolerance level (**UTL**)). This section shall also include a discussion of how "non-detect" sample results were handled in the averaging of data.

8.14.4.6. Conceptual Site Model

A section shall present the conceptual site model. It shall include information on the expected fate and transport of contaminants detected at the site. This section shall provide a list of all sources of contamination at the site. Sources that are no longer considered to be ongoing but represent the point of origination for contaminants transported to other locations shall be included. The discussion of fate and transport shall address potential migration of each contaminant in each medium, potential breakdown products and their migration, and anticipated pathways of exposure for human or ecological receptors. Diagrammatic representations of the conceptual site model shall appear in the Figures section of the document.

For human health risk assessments, the conceptual site model shall include the current and reasonably foreseeable future land use and residential land use for all risk assessments. All values for exposure parameters and the source of those values shall be included in table format and presented in the Tables section of the document.

Conceptual site models presented for ecological risk assessments shall identify assessment endpoints and measurement receptors for the site. The discussion of the model shall explain how the measurement receptors for the site are protective of the wildlife receptors identified by the Permittees in the Site Description section (see Permit Section 8.14.4.5.a).

8.14.4.7. Risk Screening Levels

A section shall present the actual screening values used for each contaminant for comparison to all human health and ecological risk screening levels. NMED's Soil Screening Levels (**SSLs**) for residential and industrial soil shall be used to screen soil for human health using EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I, Part A, 1989* as updated. For those contaminants not appearing on NMED's SSL table, the EPA Region 6 soil screening value adjusted to meet NMED's risk goal of 10^{-5} for total risk for carcinogens shall be used to screen the site for human health risks. Screening for ecological risk shall be conducted using EPA's ECO-SSLs, or derive a screening level using the methodology in NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening–Level Ecological Risk Assessment* (July 2008, as updated). If no valid toxicological studies exist for a particular

receptor or contaminant, the contaminant/receptor combination shall be addressed using qualitative methods. If a NMED approved site-specific risk scenario is used for the human health risk assessment, this section shall include all toxicity information and exposure assessment equations used for the site-specific scenario as well as the sources for that information. Other regulatory levels applicable to screening the site, such as drinking water MCLs, shall also be included in this section.

8.14.4.8. Risk Assessment Results

A section shall present all risk values, hazard quotients (**HQs**), and HIs for human health based on current and reasonably foreseeable future land use. Where the current or reasonably foreseeable future land use is not residential, risk values, HQs, and HIs for a residential land use scenario shall also be calculated and reported. The residential scenario shall be used for comparison purposes only, unless the land use becomes residential. This section shall also present the HQ and HI for each contaminant for each ecological receptor.

a. Uncertainty Analysis

A section shall include discussion of qualitative, semi-quantitative, and quantitative uncertainty in the risk assessment and estimate the potential impact of the various uncertainties.

8.14.4.9. Conclusions and Recommendations

A section shall include the interpretation of the results of the risk assessment and any recommendations for future disposition of the site. This section may include additional information and considerations that the Permittees believe are relevant to the analysis of the site.

8.14.4.10. Tables

A section shall provide the following summary tables, as appropriate. With prior approval from NMED, the Permittees may combine one or more of the tables. Data presented in the summary tables shall include information on detection limits and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table presenting background values used for comparison to inorganic constituents at the site. The table shall include actual values used as well as the origin of the values (facility-wide, UCL, UTL, or maximum).

2. A table summarizing sampling data shall include, for each constituent, all detected values above background, the maximum value detected, the 95 percent UCL of the mean value detected (if applicable to the data set), and whether that 95 percent UCL of the mean was calculated based on a normal or lognormal distribution.

3. A table of all screening values used and the sources of those values.

4. A table presenting all risk values, HQs, and HIs under current and reasonably foreseeable future land use for human health.

5. If residential use is not a current or reasonably foreseeable future land use, a table presenting all risk values, HQs, and HIs under a residential land use scenario for human health shall be included for comparison purposes.

6. A table presenting the HQ and HI for each contaminant for each ecological receptor.

7. A table presenting values for exposure parameters and the source of the values.

8.14.4.11. Figures

A section shall present the following figures for each site, as appropriate. With prior approval from NMED, the Permittees may combine one or more of the figures. All figures shall include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. For human health risk assessments, a site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system location(s) and its details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.

3. For ecological risk assessments, a topographical map of the site and vicinity of the site showing habitat types, boundaries of each habitat, and any surface water features.

4. Conceptual site model diagrams for both human health and ecological risk assessments.

8.14.4.12. Appendices

Each risk assessment report shall include appendices containing supporting data. Appendices may include the results of statistical analyses of data sets and comparisons of data, full sets of results of all sampling investigations at the site, or other data as appropriate.

8.14.5. Corrective Measures Evaluation Report

The Permittees shall prepare corrective measures evaluations for sites requiring corrective measures using the format listed below. This section provides a general outline for corrective measures evaluations and also lists the minimum requirements for describing corrective measures when preparing these documents. All investigation summaries, site condition descriptions, corrective action goals, corrective action options, remedial options selection criteria, and schedules shall be included in the corrective measures evaluations. In general, interpretation of historical investigation data and discussions of prior interim activities shall be presented only in the background sections of the corrective measures evaluations. At a minimum, detections of contaminants encountered during previous site investigations shall be presented in the corrective measures evaluations in table format with an accompanying site plan showing sample locations. The other text sections of the corrective measures evaluations shall be reserved for presentation of corrective action-related information regarding anticipated or potential site-specific corrective action options and methods relevant to the project. The general corrective measures evaluation outline is provided below.

8.14.5.1. Title Page

The title page shall include the type of document; facility name; area designation; SWMU or AOC name, site, and any other unit name; and the submittal date. A signature block providing spaces for the name and title of the responsible facility representative shall be provided on the title page in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.11(d)(1)).

8.14.5.2. Executive Summary (Abstract)

This executive summary or abstract shall provide a brief summary of the purpose and scope of the corrective measures evaluation to be conducted at the subject site. The executive summary or abstract shall also briefly summarize the conclusions of the evaluation. The SWMU, AOC, and site names, location, and area designation shall be included in the executive summary.

8.14.5.3. Table of Contents

The table of contents shall list all text sections, subsections, tables, figures, and appendices or attachments included in the corrective measures evaluation. The corresponding page numbers for the titles of each section of the report shall be included in the table of contents.

8.14.5.4. Introduction

The Introduction section shall include the facility name, area designation, site location, and site status (e.g. closed, corrective action). General information on the current site usage and status shall be included in this section. A brief description of the purpose of the corrective measures evaluation and the corrective action objectives for the project also shall be provided in this section.

8.14.5.5. Background

The Background section shall describe the relevant background information. This section shall briefly summarize historical site uses by the U.S. Government and any other entity, including the locations of current and former site structures and features. A labeled figure shall be included in the document showing the locations of current and former site structures and features. The locations of any subsurface features such as pipelines, underground tanks, utility lines, and other subsurface structures shall be included in this section and labeled on the site plan, as appropriate.

This section shall include contaminant and waste characteristics, a brief summary of the history of contaminant releases, known and possible sources of contamination, and the vertical and lateral extent of contamination present in each medium. This section shall include brief summaries of results of previous investigations, including references to pertinent figures, data summary tables, and text in previous reports. References to previous reports shall include page, table, and figure numbers for referenced information. Summary tables and site plans showing relevant investigation locations shall be referenced and included in the Tables and Figures sections of the document, respectively.

8.14.5.6. Site Conditions

a. Surface Conditions

A section on surface conditions shall describe current and historic site topography, features, and structures, including a description of topographic drainages, man-made drainages, vegetation, and erosional features. It shall also include a description of current

uses of the site and any current operations at the site. This section shall also include a description of those features that could potentially influence corrective action option selection or implementation such as archeological sites, wetlands, or other features that may affect remedial activities. In addition, descriptions of features located in surrounding sites that may have an effect on the subject site regarding sediment transport, surface water runoff or contaminant transport shall be included in this section. A site plan displaying the locations of all pertinent surface features and structures shall be included in the Figures section of the corrective measures evaluation.

b. Subsurface Conditions

A section on subsurface conditions shall describe the site conditions observed during previous subsurface investigations. It shall include relevant soil horizon and stratigraphic information, groundwater conditions, fracture data, and subsurface vapor information. A site plan displaying the locations of all borings and excavations advanced during previous investigations shall be included in the Figures section of the corrective measures evaluation. A brief description of the stratigraphic units anticipated to be present beneath the site may be included in this section if stratigraphic information is not available from previous investigations conducted at the site.

8.14.5.7. Potential Receptors

a. Sources

A section shall provide a list of all sources of contamination at the subject site where corrective measures are to be considered or required. Sources that are no longer considered to be releasing contaminants at the site, but may be the point of origination for contaminants transported to other locations, shall be included in this section.

b. Pathways

A section shall describe potential migration pathways that could result in either acute or chronic exposures to contaminants. It shall include such pathways as utility trenches, paleochannels, surface exposures, surface drainages, stratigraphic units, fractures, structures, and other features. The migration pathways for each contaminant and each relevant medium should be tied to the potential receptors for each pathway. A discussion of contaminant

characteristics relating to fate and transport of contaminants through each pathway shall also be included in this section.

c. Receptors

A section shall provide a listing and description of all anticipated potential receptors that could possibly be affected by the contamination present at the site. Potential receptors shall include human and ecological receptors, groundwater, and other features such as pathways that could divert or accelerate the transport of contamination to human receptors, ecological receptors, and groundwater.

8.14.5.8. Regulatory Criteria

A section shall set forth the applicable cleanup standards, risk-based screening levels, and risk-based cleanup goals for each pertinent medium at the subject site. The appropriate cleanup levels for each site shall be included, if site-specific levels have been established at separate sites or units. A table summarizing the applicable cleanup standards or levels, or inclusion of applicable cleanup standards or levels in the summary data tables shall be included in the Tables section of the document. The risk assessment shall be presented in a separate document or in an appendix to this report. If cleanup or screening levels calculated in a risk evaluation are employed, the risk evaluation document shall be referenced including pertinent page numbers for referenced information.

8.14.5.9. Identification of Corrective Measures Options

A section shall identify and describe potential corrective measures for source, pathway, and receptor controls. Corrective measures options shall include the range of available options including, but not limited to, a no action alternative, institutional controls, engineering controls, in-situ and on-site remediation alternatives, complete removal, and any combination of alternatives that would potentially achieve cleanup goals.

8.14.5.10. Evaluation of Corrective Measures Options

A section shall provide an evaluation of the corrective measures options identified in Permit Section 8.14.5.9. The evaluation shall be based on the applicability, technical feasibility, effectiveness, implementability, impacts to human health and the environment, and cost of each option. A table summarizing the corrective measures alternatives and the criteria listed below shall be included in the Tables section of this document. The general basis for evaluation of corrective measures options is defined below.

a. Applicability

Applicability addresses the overall suitability for the corrective action option for containment or remediation of the contaminants in the subject medium for protection of human health and the environment.

b. Technical Practicability

Technical practicability describes the uncertainty in designing, constructing, and operating a specific remedial alternative. The description shall include an evaluation of historical applications of the remedial alternative including performance, reliability, and minimization of hazards.

c. Effectiveness

Effectiveness assesses the ability of the corrective measure to mitigate the measured or potential impact of contamination in a medium under the current and projected site conditions. The assessment also shall include the anticipated duration for the technology to attain regulatory compliance. In general, all corrective measures described above will have the ability to mitigate the impacts of contamination at the site, but not all remedial options will be equally effective at achieving the desired cleanup goals to the degree and within the same time frame as other options. Each remedy shall be evaluated for both short-term and long-term effectiveness.

d. Implementability

Implementability characterizes the degree of difficulty involved during the installation, construction, and operation of the corrective measure. Operation and maintenance of the alternative shall be addressed in this section.

e. Human Health and Ecological Protectiveness

This category evaluates the short-term (remedy installation-related) and long-term (remedy operation-related) hazards to human health and the environment of implementing the corrective measure. The assessment shall include whether the technology will create a hazard or increase existing hazards and the possible methods of hazard reduction.

f. Cost

This section shall discuss the anticipated cost of implementing the corrective measure. The costs shall be divided into: 1) capital costs associated with construction, installation, pilot testing, evaluation, permitting, and reporting of the effectiveness of the alternative; and 2) continuing costs associated with operating, maintaining, monitoring, testing, and reporting on the use and effectiveness of the technology.

8.14.5.11. Selection of Preferred Corrective Measure

The Permittees shall propose the preferred corrective measure(s) at the site and provide a justification for the selection in this section. The proposal shall be based upon the ability of the remedial alternative to: 1) achieve cleanup objectives in a timely manner; 2) protect human and ecological receptors; 3) control or eliminate the sources of contamination; 4) control migration of released contaminants; and 5) manage remediation waste in accordance with State and Federal regulations. The justification shall include the supporting rationale for the remedy selection, based on the factors listed in Permit Section 8.14.5.10 and a discussion of short- and long-term objectives for the site. The benefits and possible hazards of each potential corrective measure alternative shall be included in this section.

8.14.5.12. Design Criteria to Meet Cleanup Objectives

The Permittees shall present descriptions of the preliminary design for the selected corrective measures in this section. The description shall include appropriate preliminary plans and specifications to effectively illustrate the technology and the anticipated implementation of the remedial option at the subject area. The preliminary design shall include a discussion of the design life of the alternative and provide engineering calculations for proposed remediation systems.

8.14.5.13. Schedule

A section shall set forth a proposed schedule for completion of remedy-related activities such as bench tests, pilot tests, construction, installation, remedial excavation, cap construction, installation of monitoring points, and other remedial actions. The anticipated duration of corrective action operations and the schedule for conducting monitoring and sampling activities shall also be presented. In addition, this section shall provide a schedule for submittal of reports and data to NMED, including a schedule for submitting all status reports and preliminary data.

8.14.5.14. Tables

A section shall present the following summary tables, as appropriate. With prior approval of NMED, the Permittees may combine one or more of the tables. Data presented in the summary tables shall include information on dates of sample collection, analytical methods, detection limits, and significant data quality exceptions. The analytical data tables shall include only detected analytes and data quality exceptions that could potentially mask detections.

1. A table summarizing regulatory criteria, background, and/or the applicable cleanup standards.

2. A table summarizing historical field survey location data.

3. Tables summarizing historical field screening and field parameter measurements of soil, rock, sediments, groundwater, surface water, and air quality data.

4. Tables summarizing historical soil, rock, or sediment laboratory analytical data. The summary tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

5. A table summarizing historical groundwater elevation and depth to groundwater data. The table shall include the monitoring well depths and the screened intervals in each well.

6. Tables summarizing historical groundwater laboratory analytical data. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

7. Tables summarizing historical surface water laboratory analytical data if applicable. The analytical data tables shall include the analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

8. Tables summarizing historical air sample screening and analytical data. The data tables shall include the screening instruments used, laboratory analytical methods, detection limits, and significant data quality exceptions that would influence interpretation of the data.

9. Tables summarizing historical pilot or other test data, if applicable, including units of measurement and types of instruments used to obtain measurements.

10. A table summarizing the corrective measures alternatives and evaluation criteria.

11. A table presenting the schedule for installation, construction, implementation, and reporting of selected corrective measures.

8.14.5.15. Figures

A section shall present the following figures for each site, as appropriate. All figures must include an accurate bar scale and a north arrow. An explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers. All figures shall have a date.

1. A vicinity map showing topography and the general location of the subject site relative to surrounding features or properties.

2. A unit site plan that presents pertinent site features and structures, underground utilities, well locations, and remediation system locations and details. Off-site well locations and other relevant features shall be included on the site plan if practical. Additional site plans may be required to present the locations of relevant off-site well locations, structures, and features.

3. Figures showing historical soil boring or excavation locations and sampling locations.

4. Figures presenting historical soil sample field screening and laboratory analytical data, if appropriate.

5. Figures showing all existing wells including vapor monitoring wells and piezometers. The figures shall present historical groundwater elevation data and indicate groundwater flow directions.

6. Figures presenting historical groundwater laboratory analytical data including past data, if applicable. The analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.

7. Figures presenting historical surface water sample locations and analytical data including past data, if applicable. The laboratory analytical data corresponding to each sampling location may be presented as individual concentrations or in table form on the figure.

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8. Figures presenting historical air sampling locations and presenting air quality data. The field screening or laboratory analytical data corresponding to each sampling location may be presented as individual concentrations, in table form on the figure or as an isoconcentration map.

9. Figures presenting historical pilot or other test locations and data, where applicable, including site plans or graphic data presentation.

10. Figures presenting geologic cross-sections based on outcrop and borehole data, if applicable.

11. Figures presenting the locations of existing and proposed remediation systems.

12. Figures presenting existing remedial system design and construction details.

13. Figures presenting preliminary design and construction details for preferred corrective measures.

8.14.5.16. Appendices

Each corrective measures evaluation shall include, as appropriate, as an appendix, the management plan for waste, including investigation derived waste, generated as a result of construction, installation, or operation of remedial systems or activities conducted. Each corrective measures evaluation shall include additional appendices presenting relevant additional data, such as pilot or other test or investigation data, remediation system design specifications, system performance data, or cost analyses as necessary.

8.15. REFERENCES

U.S. Environmental Protection Agency (EPA), *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, http://epa-prgs.ornl.gov/chemicals/index.shtml

U.S. Environmental Protection Agency (EPA) 1989, *Risk Assessment Guidance for Superfund (RAGS), Volume I, Part A, 1989*, http://www.epa.gov/oswer/riskassessment/ragsa/

New Mexico Environment Department (NMED) 2000, *Assessing Human Health Risks Posed by Chemicals: Screening Level Risk Assessment*. Santa Fe, New Mexico.

NMED 2008, *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening–Level Ecological Risk Assessment*. Santa Fe, New Mexico.

NMED 2009, *Technical Background Document for Development of Soil Screening Levels*. Santa Fe, New Mexico.

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ATTACHMENT A

GENERAL FACILITY DESCRIPTION AND PROCESS INFORMATION

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ATTACHMENT A

GENERAL FACILITY DESCRIPTION AND PROCESS INFORMATION

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ATTACHMENT A

GENERAL FACILITY DESCRIPTION AND PROCESS INFORMATION

A-1 Facility Description

Abstract

NAME OF FACILITY:	Waste Isolation Pilot Plant
OWNER and CO-OPERATOR:	U.S. Department of Energy P.O. Box 3090 Carlsbad, NM 88221
CO-OPERATOR:	Nuclear Waste Partnership LLC P.O. Box 2078 Carlsbad, NM 88221
RESPONSIBLE OFFICIALS:	Jose R. Franco Manager, DOE/Carlsbad Field Office Farok Sharif, Project Manager Nuclear Waste Partnership LLC
FACILITY MAILING ADDRESS:	U.S. Department of Energy P.O. Box 3090 Carlsbad, NM 88221
FACILITY LOCATION:	30 miles east of Carlsbad on the Jal Highway, in Eddy County.
TELEPHONE NUMBER:	575/234-7300
U.S. EPA I.D. NUMBER:	NM4890139088
GEOGRAPHIC LOCATION:	32° 22′ 30″ N 103° 47′ 30″ W
DATE OPERATIONS BEGAN:	November 26, 1999

: 02968

A-2 Description of Activities

The Waste Isolation Pilot Plant (**WIPP**) is a facility for the management, storage, and disposal of transuranic (**TRU**) mixed waste subject to regulation under 20.4.1.500 NMAC. Both contact-handled (**CH**) and remote-handled (**RH**) TRU mixed wastes are permitted for storage and disposal at the WIPP facility.

A-3 Property Description

The WIPP property has been divided into functional areas. The Property Protection Area (**PPA**), surrounded by a chain-link security fence, encompasses 34.16 acres and provides security and protection for all major surface structures. The DOE Off Limits Area encloses the PPA, and is approximately 1,454 acres. These areas define the DOE exclusion zone within which certain items and material are prohibited. The final zone is marked by the WIPP Site Boundary (WIPP Land Withdrawal Area), a 16-section Federal land area under the jurisdiction of the DOE.

A-4 Facility Type

There are three basic groups of structures associated with the WIPP facility: surface structures, shafts and underground structures. The surface structures accommodate the personnel, equipment, and support services required for the receipt, preparation, and transfer of TRU mixed waste from the surface to the underground. There are two surface locations where TRU mixed waste is managed and stored. The first area is the Waste Handling Building (**WHB**) Container Storage Unit (**WHB Unit**) for TRU mixed waste management and storage. The WHB Unit consists of the WHB contact-handled (**CH**) Bay and the remote-handled (**RH**) Complex. The second area designated for managing and storing TRU mixed waste is the Parking Area Container Storage Unit (**Parking Area Unit**), an outside container storage area which extends south from the WHB to the rail siding. The Parking Area Unit provides storage space for up to 50 loaded Contact-Handled Packages and 14 loaded Remote-Handled Packages on an asphalt and concrete surface. Part 3 of the permit authorizes the storage and management of CH and RH TRU mixed waste containers in these two surface locations. The technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.170 to 264.178) are applied to the operation of the WHB Unit and the Parking Area Unit. Permit Attachment A1 describes the container storage units, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1.500 NMAC.

Four vertical shafts connect the surface facility to the underground. These are the Waste Shaft, the Salt Handling Shaft, the Exhaust Shaft and the Air Intake Shaft. The Waste Shaft is the only shaft used to transport TRU mixed waste to the underground. The WIPP underground structures are located in a mined salt bed 2,150 feet below the surface.

The WIPP is a geologic repository mined within a bedded salt formation, which is defined in 20.4.1.100 NMAC (incorporating 40 CFR §260.10) as a miscellaneous unit. As such, hazardous waste management units within the repository are subject to permitting according to 20.4.1.900 and .901 NMAC (incorporating 40 CFR §270), and are regulated under 20.4.1.500 NMAC, Miscellaneous Units.

The underground structures include the underground Hazardous Waste Disposal Units (**HWDUs**), an area for future underground HWDUs, the shaft pillar area, interconnecting drifts and other areas unrelated to the Hazardous Waste Facility Permit. The underground HWDUs

are defined as waste panels, each consisting of seven rooms and two access drifts. The WIPP underground area is designated as Panels 1 through 10, although only Panels 1 through 8 will be used under the terms of this permit. Each of the seven rooms is approximately 300 feet long, 33 feet wide and 13 feet high. Part 4 of the permit authorizes the management and disposal of CH and RH TRU mixed waste containers in underground HWDUs. The Disposal Phase consists of receiving CH and RH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the underground HWDUs in the geologic repository, will be met. Permit Attachment A2 describes the underground HWDUs, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1.500 NMAC.

A-5 Waste Description

Wastes destined for WIPP are byproducts of nuclear weapons production and have been identified in terms of waste streams based on the processes that produced them. Each waste stream identified by generators is assigned to a Waste Summary Category to facilitate RCRA waste characterization, and reflect the final waste forms acceptable for WIPP disposal.

These Waste Summary Categories are:

S3000—Homogeneous Solids
Solid process residues defined as solid materials, excluding soil, that do not meet the applicable regulatory criteria for classification as debris [20.4.1.800 NMAC, (incorporating 40 CFR §268.2(g) and (h))]. Solid process residues include inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Waste Summary Category based on the specific waste stream types and final waste form. This category includes wastes that are at least 50 percent by volume solid process residues.

S4000—Soils/Gravel
This waste summary category includes waste streams that are at least 50 percent by volume soil. Soils are further categorized by the amount of debris included in the matrix.

S5000—Debris Wastes
This waste summary category includes waste that is at least 50 percent by volume materials that meet the NMAC criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2)). Debris means solid material exceeding a 2.36 inch (60 millimeter) particle size that is intended for disposal and that is: 1) a manufactured object, 2) plant or animal matter, or 3) natural geologic material.

The S5000 Waste Summary Category includes metal debris, metal debris containing lead, inorganic nonmetal debris, asbestos debris, combustible debris, graphite debris, heterogeneous debris, and composite filters, as well as other minor waste streams. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

If a waste does not include at least 50 percent of any given category by volume, characterization shall be performed using the waste characterization process required for the category constituting the greatest volume of waste for that waste stream.

Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such waste may be generated in either the WHB or the underground. This waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

Non-mixed hazardous wastes generated at the WIPP, through activities where contact with TRU mixed waste does not occur, are characterized, placed in containers, and stored (for periods not exceeding the limits specified in 20.4.1.300 NMAC (incorporating 40 CFR §262.34)) until they are transported off site for treatment and/or disposal at a permitted facility. This waste generation and accumulation activity, when performed in compliance with 20.4.1.300 NMAC (incorporating 40 CFR §262), is not subject to RCRA permitting requirements and, as such, is not addressed in the permit.

A-6 Chronology of Events Relevant to Changes in Ownership or Operational Control

December 19, 1997	NMED received notification of a change of name/ownership from Westinghouse Electric Corporation to CBS Corporation. The WIPP Management and Operating Contractor (**MOC**), Westinghouse Waste Isolation Division (**WID**), became a division of Westinghouse Electric Company, which in turn was a division of CBS Corporation. Notification to NMED was made by the permit applicant in a letter dated December 18, 1997. The permit application was under review, but a draft permit was not yet issued.
September 22, 1998	NMED received notification of a pending transfer of ownership for the MOC, Westinghouse WID, from CBS Corporation to an as-yet-to-be-named limited liability company owned jointly by British Nuclear Fuels, plc and Morrison-Knudsen Corporation. The transfer of ownership was scheduled to occur on or about December 15, 1998. Notification to NMED was made by the permit applicant in a letter dated September 17, 1998. The draft permit had been issued for public comment, but the final permit was not yet issued.
March 9, 1999	NMED again received notification of the pending divestiture of the MOC, Westinghouse WID, by CBS Corporation to the limited liability company owned jointly by British Nuclear Fuels, plc and Morrison-Knudsen Corporation known as MK/BNFL GESCO LLC. The new MOC would be renamed to Westinghouse Government Environmental Services Company LLC. Notification to NMED was made by the permit applicant in a letter dated March 2, 1999. The public hearing on the permit was underway, but the final permit was not yet issued.
March 26, 1999	NMED received official notification of the divestiture of Westinghouse Electric Company by CBS Corporation to MK/BNFL GESCO LLC effective March 22, 1999. The MOC was renamed Westinghouse Government Environmental Services Company LLC (**WGES**), of which

	Westinghouse Waste Isolation Division was a division. This transaction constituted a change of operational control under 20.4.1.900 NMAC (incorporating 40 CFR §270.40). Notification to NMED was made by the permit applicant in a letter dated March 24, 1999. The public hearing on the permit was nearly concluded, but the final permit was not yet issued.
April 28, 1999	NMED received a revised Part A Permit Application in a letter dated April 21, 1999, reflecting that the Westinghouse Waste Isolation Division, co-operator of the WIPP hazardous waste facility, was now a part of WGES. However, the final permit, issued October 27, 1999, did not reflect the change in ownership.
July 25, 2000	NMED received a Class 1 permit modification in a letter dated July 21, 2000, changing the name in the Permit from Westinghouse Electric Corporation to Westinghouse Government Environmental Services Company LLC (**WGES**), Waste Isolation Division (**WID**). However, this notification did not constitute the required permit modification under 20.4.1.900 NMAC (incorporating 40 CFR §270.40) necessary to reflect the transfer of the permit to a new operator.
December 15, 2000	DOE announced that it had awarded a five-year contract for management and operation of WIPP to Westinghouse TRU Solutions LLC, a limited liability company owned jointly by WGES LLC and Roy F. Weston, Inc. The announcement further stated that, following a brief transition period, the new contractor would assume MOC responsibilities on February 1, 2001. This transaction constituted a change of operational control under 20.4.1.900 NMAC (incorporating 40 CFR §270.40) requiring a Class 1 permit modification with prior written approval of NMED.
February 5, 2001	NMED received a Class 1 permit modification in a letter dated February 2, 2001, which notified NMED of an organizational name change of the MOC from Westinghouse Government Environmental Services Company LLC Waste Isolation Division to Westinghouse TRU Solutions LLC. However, this notification did not constitute the required permit modification under 20.4.1.900 NMAC (incorporating 40 CFR §270.40) necessary to reflect the transfer of the permit to a new operator.
December 31, 2002	NMED received a Class 1 permit modification in a letter dated December 27, 2002, which changed the name of the MOC from Westinghouse TRU Solutions LLC to Washington TRU Solutions LLC. Again, this notification did not constitute the required permit modification under 20.4.1.900 NMAC (incorporating 40 CFR §270.40) necessary to reflect the transfer of the permit to a new operator.
February 28, 2003	NMED received a Class 1 permit modification requiring prior agency approval in a letter dated February 28, 2003, to satisfy the requirements specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.40) to reflect the transfer of the permit to a new operator.

September 16, 2004	NMED received a Class 1 permit modification requiring prior agency approval in a letter dated September 16, 2004, describing a change of ownership of Washington TRU Solutions LLC (**WTS**). WTS is owned jointly by WGES, managing member, and Weston Solutions, Inc. WGES had been owned jointly by Washington Group International, Inc. (**WGI**), and BNFL Nuclear Services, Inc. However, WGI has acquired BNFL's prior interest in the former Westinghouse government services businesses, which includes BNFL's prior interest in WGES.
August 6, 2007	NMED received notification in a letter dated August 2, 2007 of the pending acquisition of WGI by URS Corporation at an unknown future date. This acquisition would be related to operational control, because WGI is the sole owner of WGES, managing member of the joint venture, along with Weston Solutions, Inc., that owns WTS, the WIPP MOC. This notification was submitted to assure compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.40(b)).
November 26, 2007	NMED received a Class 1 permit modification requiring prior agency approval in a letter dated November 19, 2007, describing a change of ownership of WTS. On November 15, 2007, WGI was acquired by URS Corporation. WTS is owned jointly by WGES, managing member, and Weston Solutions, Inc. WGES, formerly owned by WGI, is now owned by URS Corporation.
October 1, 2012	NMED received a Class 1 permit modification requiring prior agency approval in a letter dated June 25, 2012 describing a change in the MOC for the WIPP facility. The new MOC for the WIPP facility will be Nuclear Waste Partnership LLC. The new MOC is comprised of URS Energy and Construction, Inc. and Babcock and Wilcox Technical Services Group, Inc.

ATTACHMENT A1

CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

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ATTACHMENT A1

CONTAINER STORAGE

Introduction

Management and storage of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under 20.4.1.500 NMAC. The technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.170 to 264.178 are applied to the operation of the Waste Handling Building Container Storage Unit (**WHB Unit**)(Figure A1-1), and the Parking Area Container Storage Unit (**Parking Area Unit**)(Figure A1-2). This Permit Attachment describes the container storage units, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1 NMAC. The configuration of the WIPP facility consists of completed structures, including all buildings and systems for the operation of the facility.

A1-1 Container Storage

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

A1-1a Containers with Liquid

The Permit Treatment, Storage, and Disposal Facility (**TSDF**) Waste Acceptance Criteria (**WAC**) and the Waste Analysis Plan (Permit Attachment C) prohibit the shipment of waste to the WIPP with liquid in excess of one percent of the volume of the waste container (e.g., drum, standard waste box [**SWB**], or canister). Since the maximum amount of liquid is one percent, calculations made to determine the secondary containment as required by 20.4.1.500 NMAC (incorporating §264.175) are based on ten percent of one percent of the volume of the containers, or one percent of the largest container, whichever is greater.

A1-1b Description of Containers

20.4.1.500 NMAC (incorporating 40 CFR §264.171) requires that containers holding waste be in good condition. Waste containers shall be in good condition prior to shipment from the generator sites, i.e., containers will be of high integrity, intact, and free of surface contamination above DOE limits. The Manager of the DOE Carlsbad Field Office has the authority to suspend a generator's certification to ship TRU mixed waste to the WIPP facility should the generator fail to meet this requirement. The containers will be certified free of surface contamination above DOE limits upon shipment. This condition shall be verified upon receipt of the waste at WIPP. The level of rigor applied in these areas to ensure container integrity and the absence of external contamination on both ends of the transportation process will ensure that waste containers entering the waste management process line at WIPP meet the applicable Resource Conservation and Recovery Act (**RCRA**) requirements for container condition.

A1-1b(1) CH TRU Mixed Waste Containers

Contact handled (**CH**) TRU mixed waste containers will be either 55-gal (208-L) drums singly or arranged into 7-packs, 85-gal (322-L) drums singly or arranged into 4-packs, 100-gal (379 L)

drums singly or arranged into 3-packs, ten-drum overpacks (**TDOP**), standard large box 2s (**SLB2**), or SWBs. A summary description of each CH TRU mixed waste container type is provided below.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (**DOT**) specification 7A regulations.

A standard 55-gal (208-L) drum has a gross internal volume of 7.4 cubic feet (ft^3) (0.21 cubic meters (m^3)). Figure A1-3 shows a standard TRU mixed waste drum. One or more filtered vents (as described in Section A1-1d(1)) will be installed in the drum lid to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

Standard 55-gal (208-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

Standard 55-gal (208-L) drums may be used to collect derived waste.

Standard Waste Boxes

The SWBs meet all the requirements of DOT specification 7A regulations.

One or more filtered vents (as described in Section A1-1d(1)) will be installed in the SWB body and located near the top of the SWB to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. They have an internal volume of 66.3 ft^3 (1.88 m^3). Figure A1-4 shows a SWB.

The SWB is the largest container that may be used to collect derived waste.

Ten-Drum Overpack

The TDOP is a metal container, similar to a SWB, that meets DOT specification 7A and is certified to be noncombustible and to meet all applicable requirements for Type A packaging. The TDOP is a welded-steel, right circular cylinder, approximately 74 inches (in.) (1.9 meters (m)) high and 71 in. (1.8 m) in diameter (Figure A1-5). The maximum loaded weight of a TDOP is 6,700 pounds (lbs) (3,040 kilograms (kg)). A bolted lid on one end is removable; sealing is accomplished by clamping a neoprene gasket between the lid and the body. One or more filter vents are located near the top of the TDOP on the body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization. A TDOP may contain up to ten standard 55-gal (208-L) drums or one SWB. TDOPs may be used to overpack drums or SWBs containing CH TRU mixed waste. The TDOP may also be direct loaded with CH TRU mixed waste. Figure A1-5 shows a TDOP.

Eighty-Five Gallon Drum

The 85-gal (322-L) drums meet the requirements for DOT specification 7A regulations. An 85-gal (322-L) drum has a gross internal volume of 11.4 ft^3 (0.32 m^3). One or more filtered vents

(as described in Section A1-1d(1)) will be installed in the 85-gal drum to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

85-gal (322-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

The 85-gal (322-L) drum, which is shown in Figure A1-6, will be used for overpacking contaminated 55-gal (208 L) drums at the WIPP facility. The 85-gal drum may also be direct loaded with CH TRU mixed waste.

85-gal (322-L) drums may be used to collect derived waste.

100-Gallon Drum

100-gal (379-L) drums meet the requirements for DOT specification 7A regulations.

A 100-gal (379-L) drum has a gross internal volume of 13.4 ft^3 (0.38 m^3). One or more filtered vents (as described in Section A1-1d(1) will be installed in the drum lid or body to prevent the escape of any radioactive particulates and to eliminate any potential of pressurization.

100-gal (379-L) drums are constructed of mild steel and may also contain rigid, molded polyethylene (or other compatible material) liners. These liners are procured to a specification describing the functional requirements of fitting inside the drum, material thickness and tolerances, and quality controls and required testing. A quality assurance surveillance program is applied to all procurements to verify that the liners meet the specification.

100-gal (379-L) drums may be direct loaded.

Standard Large Box 2

The SLB2 meets the requirements of DOT specification 7A requirements. The SLB2 is a welded steel container with a gross internal volume of 261 ft^3 (7.39 m^3).

One or more filtered vents will be installed in the SLB2 body and located near the top of the SLB2 to prevent the escape of radioactive particulates and to prevent internal pressurization. Figure A1-34 shows an SLB2.

A1-1b(2) RH TRU Mixed Waste Containers

Remote-Handled (**RH**) TRU mixed waste containers include RH TRU Canisters, which are received at WIPP loaded singly in an RH-TRU 72-B cask, shielded containers, which are received in HalfPACTs, and 55-gallon drums, which are received in a CNS 10-160B cask.

RH TRU Canister

The RH TRU Canister is a steel single shell container which is constructed to be of high integrity. An example canister is depicted in Figure A1-16a. The RH TRU Canister is vented and

will have a nominal internal volume of 31.4 ft^3 (0.89 m^3) and shall contain waste packaged in small containers (e.g., drums) or waste loaded directly into the canister.

Standard 55-Gallon Drums

Standard 55-gal (208-L) drums meet the requirements for U.S. Department of Transportation (DOT) specification 7A regulations. A detailed description of a standard 55-gallon drum is provided above. Up to ten 55-gallon drums containing RH TRU mixed waste are arranged on two drum carriage units in the CNS 10-160B cask (up to five drums per drum carriage unit). The drums are transferred to an RH TRU mixed waste Facility Canister that will contain three drums.

Shielded Container

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be arranged as three-packs. A summary description of the shielded container is provided below. The shielded container meets the requirements for DOT specification 7A (Figure A1-37).

Shielded containers consist of a 30-gallon inner container with a gross internal volume of 4.0 ft^3 (0.11 m^3). One or more filter vents will be installed in the shielded container lid to prevent the escape of radioactive particulates and to prevent internal pressurization. The shielded container is constructed with approximately one inch of lead shielding on the sides and approximately three inches of steel on the top and bottom of the container and will be used to emplace RH TRU mixed waste. The shielding will allow it to be managed and stored as CH TRU mixed waste.

A1-1b(3) Container Compatibility

All containers will be made of steel, and some will contain rigid, molded polyethylene liners. The compatibility study, documented in Appendix C1 of the WIPP RCRA Part B Permit Application (DOE, 1997a), included container materials to assure containers are compatible with the waste. Therefore, these containers meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.172).

A1-1c Description of the Container Storage Units

A1-1c(1) Waste Handling Building Container Storage Unit (WHB Unit)

The Waste Handling Building (**WHB**) is the surface facility where TRU mixed waste handling activities will take place (Figure A1-1a). The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters (m^2)) of which 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for handling and storage of RH TRU mixed waste, as shown in Figures A1-1, A1-14a, and A1-17a, b, c, and d. These areas are being permitted as the WHB Unit. The concrete floors are sealed with a coating that is sufficiently impervious to the chemicals in TRU mixed waste to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(1)).

CH Bay Surge Storage Area

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the CH Bay Storage Area. The Permittees may use the CH Bay Surge Storage Area as specified in Part 3 (see Figure A1-1) only when the maximum capacities in the CH Bay Storage Area (except for the Shielded Storage Room) and the Parking Area Unit are reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because Parking Area Container Storage Unit Surge Storage is in use; or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.1.4) upon using the CH Bay Surge Storage and provide justification for its use.

CH TRU Mixed Waste

The Contact-Handled Packages used to transport TRU mixed waste containers will be received through one of three air-lock entries to the CH Bay of the WHB Unit. The WHB heating, ventilation and air conditioning (**HVAC**) system maintains the interior of the WHB at a pressure lower than the ambient atmosphere to ensure that air flows into the WHB, preventing the inadvertent release of any hazardous or radioactive constituents contamination as the result of a contamination event. The doors at each end of the air lock are interlocked to prevent both from opening simultaneously and equalizing CH Bay pressure with outside atmospheric pressure.

- TRUPACT-II and HalfPACT Management

  The CH Bay houses two TRUPACT-II Docks (**TRUDOCKs**), each equipped with overhead cranes for opening and unloading Contact-Handled Packages. The TRUDOCKs are within the TRUDOCK Storage Area of the WHB Unit. The cranes are rated to lift the Contact-Handled Packaging lids as well as their contents. The cranes are designed to remain on their tracks and hold their load even in the event of a design-basis earthquake.

  Upon receipt and removal of CH TRU mixed waste containers from the Contact-Handled Packaging, the waste containers are required to be in good condition as provided in Permit Part 3. The waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are good condition prior to storage. Waste containers will also

be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the Contact-Handled Package to a third party contractor. Decontamination activities will not be conducted on containers which are not in good condition, or which are leaking. If local decontamination activities are opted for, the work will be conducted in the WHB Unit on the TRUDOCK. These processes are described in Section A1-1d.

Once unloaded from the Contact-Handled Packaging, CH TRU mixed waste containers (7-packs, 3-packs, 4-packs, SWBs, or TDOPs) are placed in one of two positions on the facility pallet or on a containment pallet. The waste containers are stacked, on the facility pallets (one- or two-high, depending on weight considerations). Waste on containment pallets will be stacked one-high. The use of facility or containment pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage.

In addition, four Contact-Handled Packages, containing up to eight 7-packs, 3-packs, 4-packs, SWBs, or four TDOPs, may occupy positions at the TRUDOCKs. If waste containers are left in this area, they will be in the Contact-Handled Package with or without the shipping container lids removed. The maximum volume of waste in containers in four Contact-Handled Packages is 640 ft^3 (18.1 m^3).

- TRUPACT-III Management

The TRUPACT-III containing one SLB2 will be transferred to a Yard Transfer Vehicle in the Parking Area Unit using a forklift. The Yard Transfer Vehicle then transports the TRUPACT-III into the CH Bay through one of the airlocks and into Room 108 for unloading (Figure A1-1b). The TRUPACT-III is first transported to the bolting station where the overpack cover and closure lid are removed using a bolting robot, or manually as required, and a monorail hoist The TRUPACT-III is then moved to the payload transfer station where the SLB2 is removed from the TRUPACT-III.

The SLB2 will be visually inspected for physical damage in a similar manner as containers removed from a TRUPACT-II or HalfPACT (i.e., severe rusting, apparent structural defects, or signs of pressurization) and for leakage to ensure it is in good condition. The SLB2 will also be checked for external surface contamination. If the SLB2 is not in good condition, the Permittees will repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. The Permittees may initiate local decontamination, return unacceptable containers to a DOE generator site or send the SLB2 to a third-party contractor. If local decontamination activities are opted for, the work will be conducted in the WHB Unit.

Once the SLB2 is unloaded from the TRUPACT-III in Room 108, it will be placed on a facility pallet and moved to a pallet stand or floor storage location in the CH Bay for storage or to the conveyance loading room for waste emplacement.

The CH Bay Storage Area, which is shown in Figure A1-1, will be clearly marked to indicate the lateral limits of the storage area. This CH Bay Storage Area will have a maximum capacity of 13 pallets (4,160 ft^3 [118 m^3]) of TRU mixed waste containers during normal operations.

The Derived Waste Storage Area of the WHB Unit is on the north wall of the CH Bay. This area will contain containers up to the volume of a SWB for collecting derived waste from all TRU mixed waste handling processes in the WHB Unit. The Derived Waste Storage Area is being permitted to allow containers in size up to a SWB to be used to accumulate derived waste. The volume of TRU mixed waste stored in this area will be up to 66.3 ft^3 (1.88 m^3). The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which are polyethylene trays with a grated deck, which will elevate the derived waste containers approximately 6 in. (15 cm) from the floor surface, and provide approximately 50 gal (190 L) of secondary containment capacity.

Aisle space shall be maintained in all WHB Unit TRU mixed waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire-fighting personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space of 44 in. (1.1 m) between facility pallets will be maintained in all WHB Unit TRU mixed waste storage areas. An aisle space of 60 in. (1.5 m) will be maintained between the west wall of the CH Bay and facility pallets.

The WHB has been designed to meet DOE design and associated quality assurance requirements. Table A1-1 summarizes basic design requirements, principal codes, and standards for the WIPP facility. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997a) provided engineering design-basis earthquake and tornado reports. The design-basis earthquake report provides the basis for seismic design of WIPP facility structures, including the WHB foundation. The WIPP design-basis earthquake is 0.1 g. The WIPP design-basis tornado includes a maximum windspeed of 183 mi per hr (mi/hr) (294.5 km/hr), which is the vector sum of all velocity components. It is also limited to a translational velocity of 41 mi/hr (66 km/hr) and a tangential velocity of 124 mi/hr (200 km/hr). Other parameters are a radius of maximum wind of 325 ft (99 m), a pressure drop of 0.5 lb per $in.^2$ (3.4 kilopascals [kPa]), and a rate-of-pressure drop of 0.09 $lb/in.^2/s$ (0.6 kPa/s). A design-basis flood report is not available because flooding is not a credible phenomenon at the WIPP facility. Design calculations for the probable maximum precipitation (**PMP**) event, provided in Appendix D7 of the WIPP RCRA Part B Permit Application (DOE, 1997a), illustrated run-on protection for the WIPP facility.

The WIPP facility does not lie within a 100-year floodplain. There are no major surface-water bodies within 5 mi (8 km) of the site, and the nearest river, the Pecos River, is approximately 12 mi (19 km) away. The general ground elevation in the vicinity of the surface facilities (approximately 3,400 ft [1,036 m] above mean sea level) is about 500 ft (152 m) above the riverbed and 400 ft (122 m) above the 100-year floodplain. Protection from flooding or ponding caused by PMP events is provided by the diversion of water away from the WIPP facility by a system of peripheral interceptor berms and dikes. Additionally, grade elevations of roads and surface facilities are designed so that storm water will not collect within the Property Protection Area under the most severe conditions.

The following are the major pieces of equipment that will be used to manage CH TRU mixed waste in the container storage units. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A1-2.

TRUPACT-II Type B Packaging

The TRUPACT-II (Figure A1-8a) is a double-contained cylindrical shipping container 8 ft (2.4 m) in diameter and 10 ft (3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,265 lbs (3,300 kg) gross weight in up to fourteen 55-gal (208-L) drums, eight 85-gal (322-L) drums, six 100-gal (379-L) drums, two SWBs, or one TDOP.

HalfPACT Type B Packaging

The HalfPACT (Figure A1-8b) is a double-contained right cylindrical shipping container 7.8 ft (2.4 m) in diameter and 7.6 ft (2.3 m) high. It meets NRC Type B shipping container requirements and has successfully completed rigorous container-integrity tests. The payload consists of approximately 7,600 lbs (3,500 kg) gross weight in up to seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums.

TRUPACT-III Type B Packaging

The TRUPACT-III (Figure A1-33) is an NRC-certified Type B package designed to meet the containment and shielding requirements of 10 CFR Part 71. The nominal dimensions for a TRUPACT-III are 14 feet 1 inch long, 8 feet 2 inches wide and 8 feet 8 inches high. The TRUPACT-III is specifically certified to safely transport TRU wastes packaged in an SLB2.

This package, unlike the TRUPACT-II or HalfPACT, is horizontally loaded and will be unloaded horizontally as well.

The TRUPACT-III has a bolted overpack cover that is secured to the TRUPACT-III container.

The maximum weight of a TRUPACT-III is 55,116 lbs (25,000 kg) when loaded with the maximum allowable contents of 11,486 lbs (5,210 kg).

Unloading Docks

Each TRUDOCK is designed to accommodate up to two Contact-Handled Packages. The TRUDOCK functions as a work platform, providing TRU mixed waste handling personnel easy access to the container during unloading operations (see Figure A1-1a) (Also see Drawing 41-M-001-W in Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997a)).

The payload transfer station serves as the unloading dock for TRUPACT-III and can accommodate a single TRUPACT-III package.

Forklifts

Forklifts may be used to transfer the Contact-Handled Packages into the WHB Unit and may be used to transfer palletized CH TRU mixed waste containers to the facility transfer vehicle. Another forklift will be used for general-purpose transfer operations. This forklift has attachments and adapters to handle individual TRU mixed waste containers, if required.

Cranes, Unloading Devices, and Adjustable Center-of-Gravity Lift Fixtures

At each TRUDOCK, an overhead bridge crane is used with a specially designed lift fixture for disassembly of the Contact-Handled Packages. Separate lifting attachments have been specifically designed to accommodate SWBs and TDOPs. The lift fixture, attached to the crane, has built-in level indicators and two counterweights that can be moved to adjust the center of gravity of unbalanced loads and to keep them level.

The TRUPACT-III is unloaded horizontally in Room 108. The Payload Transfer Station, Yard Transfer Vehicle and Facility Transfer Vehicle, or forklift are used to perform the unloading and movement functions. The Payload Transfer Station includes retractable arms that are used to position the SLB2 onto the Facility Transfer Vehicle and facility pallet.

Facility or Containment Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 4-packs, or 3-packs of drums, SWBs, TDOPs, or an SLB2, and has a rated load of 25,000 lbs. (11,430 kg). The facility pallet will accommodate up to four 7-packs, four 3-packs, or four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or an SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A1-10. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. Facility pallets may also be moved by facility transfer vehicles. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Containment pallets are fabricated units having a containment capacity of at least ten percent of the volume of the containers and designed to support a minimum of either a single drum, a single SWB or a single TDOP. The pallets will have a rated load capacity of equal to or greater than the gross weight limit of the container(s) to be supported on the pallet. Loads are secured to the containment pallet during transport. A typical containment pallet is shown in Figure A1-10a. Fork pockets in the side of the pallet allow the containment pallet to be lifted and transferred by forklift. WIPP facility operational documents define the operational load of the containment pallet to assure that the rated load of a containment pallet is not exceeded.

Facility Transfer Vehicle

The facility transfer vehicle is a battery or electric powered automated vehicle that either operates on tracks or has an on-board guidance system that allows the vehicle to operate on the floor of the WHB. It is designed with a flat bed that has adjustable height capability and may transfer waste payloads on facility pallets or off the facility pallet stands in the CH Bay storage area, and on and off the waste shaft conveyance by raising and lowering the bed (see Figure A1-11).

Yard Transfer Vehicle

The Yard Transfer Vehicle (Figure A1-35) transports the TRUPACT-III shipping container from the PAU into the WHB and into Room 108. The Yard Transfer Vehicle is an electric vehicle with a load capacity of 60,000 pounds.

RH TRU Mixed Waste

The RH TRU mixed waste is handled and stored in the RH Complex of the WHB Unit which comprises the following locations: RH Bay (12,552 ft^2 (1,166 m^2)), the Cask Unloading Room (382 ft^2 (36 m^2)), the Hot Cell (1,841 ft^2 (171 m^2)), the Transfer Cell (1,003 ft^2 (93 m^2)) (Figures A1-17a, b and c), and the Facility Cask Loading Room (1,625 ft^2 (151 m^2)) (Figure A1-17d).

The RH Bay (Figure A1-14a) is a high-bay area for receiving casks and subsequent handling operations. The trailer carrying the RH-TRU 72-B or CNS 10-160B shipping cask (Figures A1-18, A1-19, A1-20 and A1-21) enters the RH Bay through a set of double doors on the east side of the WHB. The RH Bay houses the Cask Transfer Car. The RH Bay is served by the RH Bay Overhead Bridge Crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. The storage occurs after the trailer containing the cask is moved into the RH Bay and prior to moving the cask into the Cask Unloading Room to stage the waste for disposal operations. A maximum of two loaded casks and one 55-gallon drum for derived waste (156 ft^3 (4.4 m^3)) may be stored in the RH Bay.

The Cask Unloading Room (Figure A1-17a) provides for transfer of the RH-TRU 72-B cask to the Transfer Cell, or the transfer of drums from the CNS 10-160B cask to the Hot Cell. Storage in the Cask Unloading Room will occur in the RH-TRU 72-B or CNS 10-160B casks. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one cask (74 ft^3 (2.1 m^3)) may be stored in the Cask Unloading Room.

The Hot Cell (Figure A1-17b) is a concrete shielded room in which drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, staged in the Hot Cell, and loaded into a Facility Canister. The loaded Facility Canister is then lowered from the Hot Cell into the Transfer Cell Shuttle Car containing a Shielded Insert. Storage in the Hot Cell occurs in either drums or Facility Canisters. Drums that are stored are either on the drum carriage unit that was removed from the CNS 10-160B cask or in a Facility Canisters. A maximum of 12 55-gallon drums and one 55-gallon drum for derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell.

The Transfer Cell (Figure A1-17c) houses the Transfer Cell Shuttle Car, which moves the RH-TRU 72-B cask or Shielded Insert into position for transferring the canister to the Facility Cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of a waste handling evolution. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in the Transfer Cell Shuttle Car.

The Facility Cask Loading Room (Figure A1-17d) provides for transfer of a canister to the Facility Cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit (**HWDU**). The Facility Cask Loading Room also functions as an air lock between the Waste Shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling operations. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask (Figure A1-23) in the Facility Cask Loading Room.

Following is a description of major pieces of equipment that are used to manage RH TRU mixed waste in the WHB Unit. A summary of equipment capacities, as required by 20.4.1.500 NMAC, is included in Table A1-3.

Casks

The RH-TRU 72-B cask (Figure A1-20) is a cylinder designed to meet U.S. Department of Transportation (**DOT**) Type B shipping container requirements. It consists of a separate inner vessel within a stainless steel, lead-shielded outer cask protected by impact limiters at each end, made of stainless steel skins filled with polyurethane foam. The inner vessel is made of stainless steel and provides an internal containment boundary and a cavity for the payload. Neither the outer cask nor the inner vessel is vented. Payload capacity of each RH-TRU 72-B shipping cask is 8,000 lbs (3,628 kg). The payload consists of a canister of RH TRU mixed waste, which may contain up to 31.4 ft^3 (0.89 m^3) of directly loaded waste or waste in smaller containers.

The CNS 10-160B cask (Figure A1-21) is designed to meet DOT Type B container requirements and consists of two carbon steel shells and a lead shield, welded to a carbon steel bottom plate. A 12-gauge stainless steel thermal shield surrounds the cask outer shell, which is equipped with two steel-encased, rigid polyurethane foam impact limiters attached to the top and bottom of the cask. The CNS 10-160B cask is not vented. Payload capacity of each CNS 10-160B cask is 14,500 lbs (6,577 kg). The payload consists of up to ten 55-gallon drums.

Shielded Insert

The Shielded Insert (Figure A1-30) is specifically designed to be used in the Transfer Cell to hold and transport loaded Facility Canisters from the Hot Cell until loaded into the Facility Cask. The Shielded Insert, designed and constructed similar to the RH-TRU 72-B shipping cask, has a 29 in. inside diameter with an inside length of 130.5 in. to accommodate the Facility Canister, which is 28.5 in. in diameter by 117.5 in. long. The Shielded Insert is installed on and removed from the Transfer Cell Shuttle Car in the same manner as the RH-TRU 72-B shipping cask.

CNS 10-160B Drum Carriage

The CNS 10-160B drum carriage (Figure A1-25) is a steel device used to handle drums in the CNS 10-160B cask. The drum carriages are stacked two high in the CNS 10-160B cask during shipment. They are removed from the cask using a below-the-hook lifting device termed a pentapod. The drum carriage is rated to lift up to five drums with a maximum weight of 1000 pounds each.

RH Bay Overhead Bridge Crane

In the RH Bay, an overhead bridge crane is used to lift the cask from the trailer and place it on the Cask Transfer Car. It is also used to remove the impact limiters from the casks and the outer lid of the RH-TRU 72-B cask.

Cask Lifting Yoke

The lifting yoke is a lifting fixture that attaches to the RH Bay Overhead Bridge Crane and is designed to lift and rotate the RH-TRU 72-B cask onto the Cask Transfer Car.

Cask Transfer Cars

The Cask Transfer Cars (Figures A1-22a and A1-22b) are self-propelled, rail-guided vehicles that transport casks between the RH Bay and the Cask Unloading Room.

6.25 Ton Grapple Hoist

A 6.25 Ton Grapple Hoist is used to hoist the canister from the Transfer Cell Shuttle Car into the Facility Cask.

Facility Canister

The Facility Canister is a cylindrical container designed to hold three 55-gallon drums of either RH TRU waste or dunnage (Figure A1-16).

Facility Cask

The Facility Cask body consists of two concentric steel cylinders. The annulus between the cylinders is filled with lead, and gate shield valves are located at either end. Figure A1-23 provides an outline configuration of the Facility Cask. The canister is placed inside the Facility Cask for shielding during canister transfer from the RH Complex to the Underground HWDU for emplacement.

Facility Cask Transfer Car

The Facility Cask Transfer Car (Figure A1-24) is a self-propelled rail car that is used to move the Facility Cask between the Facility Cask Loading Room and the Shaft Station in the underground.

Hot Cell Bridge Crane

The Hot Cell Bridge Crane, outfitted with a rotating block and the Hot Cell Facility Grapple, will be used to lift the CNS 10-160B lid and the drum carriage units from the cask located in the Cask Unloading Room, into the Hot Cell. The Hot Cell Bridge Crane is also used to lift the empty Facility Canisters into place within the Hot Cell, move loaded drums into the Facility Canister, and lower loaded Facility Canisters into the Transfer Cell.

Overhead Powered Manipulator

The Overhead Powered Manipulator is used in the Hot Cell to lift individual drums from the drum carriage unit and lower each drum into the Facility Canister and support miscellaneous Hot Cell operations.

Manipulators

There is a maximum of two operational sets of fixed Manipulators in the Hot Cell. The Manipulators collect swipes of drums as they are being lifted from the drum carriage unit and transfer the swipes to the Shielded Material Transfer Drawer and support Hot Cell operations.

Shielded Material Transfer Drawer

The Shielded Material Transfer Drawer is used to transfer swipe samples obtained by the fixed Manipulators to the Hot Cell Gallery for radiological counting and transferring small equipment into and out of the Hot Cell.

Closed-Circuit Television Cameras

The Closed-Circuit Television Camera system is used to monitor operations throughout the Hot Cell and Transfer Cell. These cameras are used to perform inspections of waste containers and waste management areas. This camera system is operated from the shielded room in the Facility Cask Loading Room and Hot Cell Gallery. The camera system has a video recording capability as an operational aid.

Transfer Cell Shuttle Car

The Transfer Cell Shuttle Car (Figure A1-31) positions the loaded RH-TRU 72-B cask and Shielded Insert within the Transfer Cell.

Cask Unloading Room Crane

The Cask Unloading Room Crane lifts and suspends the RH-TRU 72-B cask or Shielded Insert from the Transfer Car and lowers the cask or Shielded Insert into the Transfer Cell Shuttle Car.

Facility Cask Rotating Device

The Facility Cask Rotating Device, a floor mounted hydraulically operated structure, is designed to rotate the Facility Cask from the horizontal position to the vertical position for waste canister loading and then back to the horizontal position after the waste canister has been loaded into the Facility Cask (Figure A1-32).

A1-1c(2) Parking Area Container Storage Unit (Parking Area Unit)

The parking area south of the WHB (see Figure A1-2) will be used for storage of waste containers within sealed shipping containers awaiting unloading. The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Unit. The Parking Area Unit provides storage space for up to 6,734 ft^3 (191 m^3) of TRU mixed waste, contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing liquid are provided by the Contact-Handled or Remote-Handled Packaging. Wastes placed in the Parking Area Unit will remain sealed in their Contact-Handled or Remote-Handled Packages, at all times while in this area.

The Nuclear Regulatory Commission (**NRC**) Certificate of Compliance requires that sealed Contact-Handled or Remote-Handled Packages which contain waste be vented every 60 days to avoid unacceptable levels of internal pressure. During normal operations the maximum residence time of any one container in the Parking Area Unit is typically five days. Therefore, during normal waste handling operations, no Contact-Handled or Remote-Handled Packages will require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be handled in accordance with Section A1-1e(2) of this Permit Attachment. Under no circumstances shall a Contact-Handled or Remote-Handled Package be stored in the Parking Area Unit for more than fifty-nine (59) days after the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was sealed at the generator site.

Parking Area Surge Storage

The Permittees will coordinate shipments with the generator/storage sites in an attempt to minimize the use of surge storage. However, there may be circumstances causing shipments to arrive that would exceed the maximum capacity of the Parking Area. The Permittees may use the Parking Area Surge Storage as specified in Part 3 (see Figure A1-2) only when the maximum capacity in the Parking Area is reached and at least one of the following conditions is met:

- Surface or underground waste handling equipment malfunctions prevent the Permittees from moving waste to disposal locations;
- Hoisting or underground ventilation equipment malfunctions prevent the Permittees from moving waste into the underground;
- Power outages cause a suspension of waste emplacement activities;
- Inbound shipment delays are imminent because the Parking Area is full (not applicable to RH TRU waste shipments); or
- Onsite or offsite emergencies cause a suspension of waste emplacement activities.

The Permittees must notify NMED and those on the e-mail notification list (as specified in Permit Sections 1.11 and 3.1.2.4) upon using the Parking Area Surge Storage and provide justification for its use.

A1-1d Container Management Practices

20.4.1.500 NMAC (incorporating 40 CFR §264.173) requires that containers be managed in a manner that does not result in spills or leaks. Containers are required to be closed at all times, unless waste is being placed in the container or removed. Because containers at the WIPP will contain radioactive waste, safety concerns require that containers be continuously vented to obviate the buildup of gases within the container. These gases could result from radiolysis, which is the breakdown of moisture by radiation. The vents, which are nominally 0.75 in. (1.9 centimeters [cm]) in diameter, are generally installed on or near the lids of the containers. These vents are filtered so that gas can escape while particulates are retained.

TRU mixed waste containers, containing off-site waste, are never opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Off-normal events could interrupt normal operations in the waste management process line. These off normal events fall into the following categories:

- Waste management system equipment malfunctions
- Waste shipments with unacceptable levels of surface contamination
- Hazardous Waste Manifest discrepancies that are not immediately resolved
- A suspension of emplacement activities for regulatory reasons

Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

A1-1d(1) Derived Waste

The WIPP facility operational philosophy is to introduce no new hazardous chemical components into TRU mixed waste or TRU mixed waste residues that could be present in the controlled area. This will be accomplished principally through written procedures and the use of Safe Work Permits (**SWP**)[1] and Radiological Work Permits (**RWP**)[2] which govern the activities within a controlled area involving TRU mixed waste. The purpose of this operating philosophy is to avoid generating TRU mixed waste that is compositionally different than the TRU mixed waste shipped to the WIPP facility for disposal.

Some additional TRU mixed waste, such as used personal protective equipment, swipes, and tools, may result from decontamination operations and off-normal events. Such waste will be assumed to be contaminated with RCRA-regulated hazardous constituents in the TRU mixed waste containers from which it was derived. Derived waste may be generated as the result of decontamination activities during the waste handling process. Should decontamination activities be performed, water and a cleaning agent such as those listed in Permit Attachment D will be used. Derived waste will be considered acceptable for management at the WIPP facility, because any TRU mixed waste shipped to the facility will have already been determined to be acceptable and because no new constituents will be added. Data on the derived waste will be entered into the WWIS database. Derived waste will be contained in standard DOT approved Type A containers.

The Safety Analysis Report (DOE 1997b) for packaging requires the lids of TRU mixed waste containers to be vented through high efficiency particulate air (**HEPA**)-grade filters to preclude container pressurization caused by gas generation and to prevent particulate material from escaping. Filtered vents used in CH TRU mixed waste containers (55-gal (208-L) drums, 85-gal (322 L) drums, 100-gal (379-L) drums, TDOPs, and SWBs) have an orifice approximately 0.375-in. (9.53-millimeters) in diameter through which internally generated gas may pass. The filter media can be any material (e.g., composite carbon, sintered metal).

As each derived waste container is filled, it will be closed with a lid containing a HEPA-grade. filter and moved to an Underground Hazardous Waste Disposal Unit (**HWDU**) using the same equipment used for handling TRU mixed waste.

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[1] SWPs are prepared to assure that any hazardous work (not already covered by a procedure) is performed with due precaution. SWPs are issued by the Permittees after a job supervisor completes the proper form detailing the job location, work description, personnel involved, specific hazards involved, and protective requirements. The Permittees review the form, check on the adequacy of the protective measures, and if sufficient, approve the work permit. Conditions of the SWPs must be met while any hazardous work is proceeding. Examples of activities covered by the SWP program include confined space entry, overhead work, and work on energized equipment.

[2] RWPs are used to control entry into and performance of work within a controlled area (**CA**). Managers responsible for work within a CA must generate a work permit that specifies the work scope, limiting conditions, dosimetry, respiratory protection, protective clothing, specific worker qualifications, and radiation safety technician support. RWPs are approved by the Permittees after thorough review. No work can proceed in a CA without a valid RWP.

A1-1d(2) CH TRU Mixed Waste Handling

CH TRU mixed waste containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers (e.g., TRUPACT-IIs, HalfPACTs, or TRUPACT-IIIs) (see Figure A1-12), at which time they will undergo security and radiological checks and shipping documentation reviews. A forklift will remove the Contact-Handled Packages which will be transported by forklift or Yard Transfer Vehicle through an air lock that is designed to maintain differential pressure in the WHB. The forklift will place the shipping containers at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit or the Yard Transfer Vehicle will locate the TRUPACT-III at the bolting station in Room 108. An external survey of the Contact-Handled Package inner vessel (Figure A1-8a and A1-8b) will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the Vent Hood System (**VHS**), and the contents will be surveyed during and after this process is complete. The VHS[3] is attached to the Contact-Handled Package to provide atmospheric control and confinement of headspace gases at their source. It also prevents potential personnel exposure and facility contamination due to the spread of radiologically contaminated airborne dust particles and minimizes personnel exposure to VOCs.

Contamination surveys at the WIPP facility are based in part on radiological surveys used to indicate potential releases of hazardous constituents from containers by virtue of detection of radioactive contamination (see Permit Attachment G3). Radiological surveys may be applicable to most hazardous constituent releases except the release of gaseous VOCs from TRU mixed waste containers. Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of nongaseous hazardous constituents through the use of surface sampling (swipes) and radioactivity counting. Radiological surveys are used in addition to the more conventional techniques such as visual inspection to identify spills.

Under normal operations, it is not expected that the waste containers will be externally contaminated or that removable surface contamination on the shipping package or the waste containers will be in excess of the DOE's free release limits (i.e.; < 20 disintegrations per minute (**dpm**)[4] per 100 cm^2 alpha or < 200 dpm per 100 cm^2 beta/gamma). In such a case, no further decontamination action is needed. The shipping package and waste container will be handled through the normal process. However, should the magnitude of contamination exceed the free release limits, yet still fall within the criteria for small area "spot" decontamination (i.e., less than or equal to 100 times the free release limit and less than or equal to 6 ft^2 [0.56 m^2]), the shipping package or the waste container will be decontaminated. Decontamination activities will not be

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[3] The TRU mixed waste container headspace may contain radiologically contaminated airborne dust particles.

1. Without the VHS, a potential mechanism will exist to spread contamination (if present) in the immediate CH TRU mixed waste handling area, because lid removal will immediately expose headspace gases to prevailing air currents induced by the building ventilation system.
2. With the VHS, a confined and controlled set of prevailing air currents will be induced by the system blower. The VHS will function as a local exhaust system to effectively control radiologically contaminated airborne dust particles (and VOCs) at essentially atmospheric pressure conditions.
   Functionally, the VHS will draw the TRU mixed waste container headspace gases, convey them through a HEPA filter, and ultimately duct them through the WHB exhaust ventilation system. VOCs will pass through the HEPA filter and will be conveyed to the ventilation exhaust duct system. The system principally consists of a functional aggregation of 1) vent hood assembly, 2) HEPA filter assemblies (to capture any airborne radioactive particles), 3) blower (to provide forced airflow), 4) ductwork, and 5) flexible hose.

[4] The unit "dpm" stands for "disintegration per minute" and is the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

conducted on containers which are not in good condition, or containers which are leaking. Containers which are not in good condition, and containers which are leaking, will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. In addition, if during the waste handling process at the WIPP a waste container is breached, it will be overpacked, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. Should WIPP structures or equipment become contaminated, waste handling operations in the affected area will be immediately suspended.

Decontamination activities will use water and cleaning agents (see Permit Attachment D) so as to not generate any waste that cannot be considered derived waste. Items that are radiologically contaminated are also assumed to be contaminated with the hazardous wastes that are in the container involved in the spill or release. A complete listing of these waste components can be obtained from the WIPP Waste Information System (**WWIS**), as described in Permit Attachment C, for the purpose of characterizing derived waste.

It is assumed that the process of decontamination will remove the hazardous waste constituents along with the radioactive waste constituents. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" will be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses becomes documentation of the condition of the container at the time of emplacement. The presence of hazardous waste constituents on a container after decontamination will be at trace levels and will likely not be visible and will not pose a threat to human health or the environment. These containers will be placed in the underground without further action once the radiological contamination is removed unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed which incorporates the guidance of EPA's SW 846 in selecting random samples over large areas. Selection of constituents for sampling analysis will be based on information (in the WWIS) about the waste that was spilled and information on cleanup procedures. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether further cleaning will be beneficial or whether final clean up shall be deferred until closure. For example, if hazardous constituents react with the floor coating and are essentially nonremovable without removing the coating, then clean up will be deferred until closure when the coatings will be stripped. In any case, appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore, measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

Small area decontamination, if needed, will occur in the area in which it is detected for contamination that is less than 6 ft^2 (0.56 m^2) in area and is less than 100 times the free release limit. The free release limit is defined by DOE Orders as alpha contamination less than 20 dpm/100 cm^2 and beta-gamma contamination less than 200 dpm/100 cm^2. Overpacking would occur in the event the WIPP staff damages an otherwise intact container during handling

activities. In such a case, a radiological boundary will be established, inside which all activities are carefully controlled in accordance with the protocols for the cleanup of spills or releases. A plan of recovery will be developed and executed, including overpacking or repairing the damaged container. The overpacked or repaired container will be properly labeled and sent underground for disposal. The area will then be decontaminated and verified to be free of contamination using both radiological and hazardous waste sampling techniques (essentially, this is done with "swipes" of the surface for counting in sensitive radiation detection equipment or, if no radioactivity is present, by analysis for hazardous waste by an offsite laboratory).

In the event a large area contamination is discovered within a Contact-Handled Package during unloading, the waste will be left in the Contact-Handled Package and the shipping container will be resealed. The DOE considers such contamination problems the responsibility of the shipping site. Therefore, the shipper will have several options for disposition. These are as follows:

- The Contact-Handled Package can be returned to the shipper for decontamination and repackaging of the waste. Such waste would have to be re-approved prior to shipment to the WIPP.

- Shipment to another DOE site for management in the event the original shipper does not have suitable facilities for decontamination. If the repairing site wishes to return the waste to WIPP, the site will have to meet the characterization requirements of the WAP.

- The waste could go to a third (non-DOE) party for decontamination. In such cases, the repaired shipment would go to the original shipper and be recertified prior to shipment to the WIPP.

Written procedures specify materials, protocols, and steps needed to put an object into a safe configuration for decontamination of surfaces. A RWP will always be prepared prior to decontamination activities. TRU mixed waste products from decontamination will be managed as derived waste.[5]

The TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. A HalfPACT may hold seven 55-gal (208-L) drums, one SWB, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. An overhead bridge crane or Facility Transfer Vehicle will be used to remove the contents of the Contact-Handled Package and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

[5] Note that the DOE had previously proposed use of an Overpack and Repair Room to deal with major decontamination and overpacking activities. The DOE has eliminated the need for this area by: 1) limiting the size of contamination events that will be dealt with as described in this section, and 2) by performing overpacking at the point where a need for overpacking is identified instead of moving the waste to another area of the WHB. This strategy minimizes the spread of contamination.

For inventory control purposes, TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved with the generator before TRU mixed waste is emplaced. Discrepancies that are not resolved within 15 days will be reported to the NMED in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Each facility pallet has two recessed pockets to accommodate two sets of 7-packs (see Figure A1-10), two sets of 4-packs, two sets of 3-packs, or two SWBs stacked two-high, two TDOPs, or any combination thereof. Each facility pallet will accommodate one SLB2. Each stack of waste containers will be secured prior to transport underground. A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room located adjacent to the Waste Shaft. The conveyance loading room serves as an air lock between the CH Bay and the Waste Shaft, preventing excessive air flow between the two areas. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379-L) drums, and TDOPs) can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the Underground HWDUs. Figure A1-13 is a flow diagram of the CH TRU mixed waste handling process.

A1-1d(3) RH TRU Mixed Waste Handling

The RH TRU mixed waste that is not in a shielded container will be received in the RH-TRU 72-B cask or CNS 10-160B cask loaded on a trailer, as illustrated in process flow diagrams in Figures A1-26 and A1-27, respectively. These are shown schematically in Figures A1-28 and A1-29. Remote-Handled TRU mixed waste received in shielded containers will be managed and stored as CH TRU mixed waste. Upon arrival at the gate, external radiological surveys, security checks, shipping documentation reviews are performed and the Uniform Hazardous Waste Manifest is signed. The generator's copy of the Uniform Hazardous Waste Manifest is returned to the generator. Should the results of the contamination survey exceed acceptable levels, the shipping cask and transport trailer remain outside the WHB in the Parking Area Unit, and the appropriate radiological boundaries (i.e., ropes, placards) are erected around the shipping cask and transport trailer. A determination will be made whether to return the cask to the originating site or to decontaminate the cask.

Following cask inspections, the shipping cask and trailer are moved into the RH Bay or held in the Parking Area Unit. The waste handling process begins in the RH Bay where the impact limiter(s) are removed from the shipping cask while it is on the trailer. Additional radiological surveys are conducted on the end of the cask previously protected by the impact limiter(s) to verify the absence of contamination. The cask is unloaded from the trailer using the RH Bay Overhead Bridge Crane and placed on a Cask Transfer Car.

Differential air pressure between the RH TRU mixed waste handling locations in the RH Complex protects workers and prevents potential spread of contamination during handling of RH TRU mixed waste. Airflow between key rooms in the WHB is controlled by maintaining differential pressures between the rooms. The CH Receiving Bay is maintained with a negative pressure relative to outside atmosphere. The RH Receiving Bay is maintained with a requirement to be positive pressure relative to the CH Receiving Bay. The RH Hot Cell is

maintained with a negative differential pressure relative to the RH Receiving Bay. The Hot Cell ventilation is exhausted through high-efficiency particulate air filters prior to venting through the WHB filtered exhaust.

RH-TRU 72-B Cask Unloading

The Cask Transfer Car then moves the RH-TRU 72-B cask to a work stand in the RH Bay. The work stand allows access to the head area of the RH-TRU 72-B cask for conducting radiological surveys, performing physical inspections or minor maintenance, and decontamination, if necessary. The outer lid bolts on the RH-TRU 72-B cask are removed, and the outer lid is removed to provide access to the lid of the cask inner containment vessel. The RH-TRU 72-B cask is moved into the Cask Unloading Room by a Cask Transfer Car and is positioned under the Cask Unloading Room Bridge Crane. The Cask Unloading Room Bridge Crane attaches to the RH-TRU 72-B cask and lifts and suspends the RH-TRU 72-B cask to clear the Cask Transfer Car. The RH-TRU 72-B cask is aligned over the Cask Unloading Room port.

The Cask Unloading Room shield valve is opened, and the cask is lowered through the port into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. After the cask is lowered into the Transfer Cell Shuttle Car, the bolts on the lid of the cask inner containment vessel are loosened by a robotic Manipulator. The Transfer Cell Shuttle Car is then aligned directly under the Transfer Cell shield valve in preparation for removing the inner vessel lid and transferring the canister to the Facility Cask. Operations in the Transfer Cell are monitored by closed-circuit video cameras.

Using the remotely-operated fixed 6.25 Ton Grapple Hoist in the Facility Cask Loading Room, the inner vessel lid is lifted clear of the RH-TRU 72-B cask, and the robotic Manipulator takes swipe samples and places them in a swipe delivery system for counting outside the Transfer Cell. If found to be contaminated above acceptable levels, the Permittees have the option to decontaminate or return the RH TRU Canister to the generator/storage site or another site for remediation. If no contamination is found, the Transfer Cell Shuttle Car moves a short distance, and the inner vessel lid is lowered onto a stand on the Transfer Cell Shuttle Car. The canister is transferred to the Facility Cask as described below.

CNS 10-160B Cask Unloading

After the lid bolts are removed, the CNS 10-160B cask is moved using the Cask Transfer Car from the RH Bay into the Cask Unloading Room and centered beneath the Hot Cell shield plug port. The Cask Unloading Room shield door is closed, and the inner and outer Hot Cell shield plugs are removed simultaneously and set aside on the floor of the Hot Cell using the remotely operated Hot Cell Bridge Crane. The Hot Cell Bridge Crane is then lowered through the Hot Cell port and is connected to the CNS 10-160B cask lid rigging or lifting device. The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid through the Hot Cell port and sets the lid aside on the Hot Cell floor.

Operations in the Hot Cell are monitored by closed-circuit television cameras. The drum carriage unit lifting fixture (hereafter referred to as lifting fixture) is attached to the Hot Cell Bridge Crane and lowered through the Hot Cell port. The lifting fixture is connected to the upper drum carriage unit contained in the CNS 10-160B cask. The Hot Cell Bridge Crane lifts the upper drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets

it near the Hot Cell inspection station. The Hot Cell Bridge Crane again lowers the lifting fixture through the Hot Cell port and connects to the lower drum carriage unit. The Hot Cell Bridge Crane lifts the lower drum carriage unit from the CNS 10-160B cask through the port into the Hot Cell and sets it near the upper drum carriage unit.

The Hot Cell Bridge Crane lifts the CNS 10-160B cask lid from the Hot Cell floor, lowers it through the Hot Cell port and onto the top of the CNS 10-160B cask. The inner and outer Hot Cell shield plugs are replaced simultaneously. The Cask Unloading Room shield door is opened, and the CNS 10-160B cask is moved into the RH Bay using the Cask Transfer Car. The CNS 10-160B cask is inspected and surveyed, the lid and impact limiter are reinstalled on the CNS 10-160B cask, and it is prepared for transportation off-site.

The Hot Cell Bridge Crane connects to an empty Facility Canister, places it into a sleeve at the inspection station, and removes the canister lid. The Overhead Powered Manipulator or Hot Cell Crane lifts one drum from the drum carriage unit. The Hot Cell Manipulators collect swipe samples from the drum and transfer the swipes via the Transfer Drawer to the Hot Cell Gallery for counting. If the 55-gallon drums are contaminated, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. The drum identification number is recorded, and the recorded numbers are verified against the WWIS. If there are any discrepancies, the drum(s) in question are stored within the Hot Cell, and the generator/storage site is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72).

Either the Overhead Powered Manipulator or Hot Cell Bridge Crane lowers the drum into the Facility Canister. This process is repeated to place three drums in the Facility Canister. The Hot Cell Bridge Crane or powered Manipulator lifts the canister lid and places it onto the Facility Canister. The lid is locked in place using a Manipulator. Each CNS 10-160B cask shipment will contain up to ten drums. Drums will be managed in sets of three. If there is a tenth drum, it will be placed in a Facility Canister or stored until WIPP receipt of the next CNS 10-160B cask shipment. The Hot Cell Bridge Crane lifts the Facility Canister and lowers it into the Transfer Cell.

To prepare to transfer a loaded Facility Canister from the Hot Cell to the Transfer Cell, a Shielded Insert is placed onto a Cask Transfer Car in the RH Bay. The Cask Transfer Car is then moved into the Cask Unloading Room and positioned under the Cask Unloading Room Bridge Crane. The Bridge Crane attaches to the Shielded Insert. The Cask Unloading Room Bridge Crane lifts and suspends the Shielded Insert clear of the Cask Transfer Car. The Shielded Insert is aligned over the Cask Unloading Room port. The floor valve is opened, and the Shielded Insert is lowered into the Transfer Cell Shuttle Car. The Cask Unloading Room Bridge Crane is unhooked and retracted, and the Cask Unloading Room shield valve is closed. The Shielded Insert is positioned under the Hot Cell port.

The Hot Cell Bridge Crane lifts a loaded, closed Facility Canister and positions it over the Hot Cell port. The Hot Cell shield valve is opened, and the crane lowers the Facility Canister through the port into the Shielded Insert positioned in the Transfer Cell Shuttle Car in the Transfer Cell. The Hot Cell Bridge Crane is disconnected from the Facility Canister and raised until the crane hook clears the Hot Cell shield valve. The Hot Cell shield valve is then closed.

Transfer of Disposal Canister into the Facility Cask

The transfer of a canister into the Facility Cask from the Transfer Cell is monitored by closed-circuit television cameras. The Transfer Cell Shuttle Car positions the RH-TRU 72-B cask or Shielded Insert under the Facility Cask Loading Room port and the shield valve is opened. Then the remotely operated 6.25 Ton Grapple Hoist attaches to the canister, and the canister is lifted through the open shield valve into the vertically-oriented Facility Cask located on the Cask Transfer Car in the Facility Cask Loading Room. During this cask-to-cask transfer, the telescoping port shield is in contact with the underside of the Facility Cask to assure shielding continuity, as does the shield bell located above the Facility Cask.

For canisters received at the WIPP from the generator site in a RH-TRU 72-B cask, the identification number is verified using cameras, which also provide images of the canister surfaces during the lifting operation. Identification numbers are verified against the WWIS. If there are any discrepancies, the canister is returned to the RH-TRU 72-B cask, returned to the Parking Area Unit, and the generator is contacted for resolution. Discrepancies that are not resolved within 15 days will be reported to the NMED as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.72). As the canister is being lifted from the RH-TRU 72-B cask into the Facility Cask, additional swipe samples may be taken.

Transfer of the Canister to the Underground

When the canister is fully within the Facility Cask, the lower shield valve is closed. The 6.25 Ton Grapple Hoist detaches from the canister and is raised until the 6.25 Ton Grapple Hoist clears the Facility Cask, at which time the upper shield valve is closed. The 6.25 Ton Grapple Hoist and shield bell are then raised clear of the Facility Cask, and the telescoping port shield is retracted. The Facility Cask Rotating Device rotates the Facility Cask until it is in the horizontal position on the Facility Cask Transfer Car. The shield doors on the Facility Cask Loading Room are opened, and the facility Cask Transfer Car moves onto the waste shaft conveyance and is lowered to the waste Shaft Station underground. At the waste Shaft Station underground, the Facility Cask Transfer Car moves the Facility Cask from the waste shaft conveyance. A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU.

Returning the Empty Cask

The empty RH-TRU 72-B cask or Shielded Insert is returned to the RH Bay by reversing the process. In the RH Bay, swipe samples are collected from inside the empty cask. If necessary, the inside of the cask is decontaminated. The RH-TRU 72-B cask lids are replaced, and the cask is replaced on the trailer using the RH Bay Bridge Crane. The impact limiters are replaced, and the trailer and the RH-TRU 72-B cask are then moved out of the RH Bay. The Shielded Insert is stored in the RH Bay until needed.

A1-1d(4) Handling Waste in Shielded Containers

Remote-Handled TRU mixed waste received at the WIPP facility in shielded containers will be managed, stored, and emplaced as CH TRU mixed waste using the CH TRU mixed waste handling equipment described in this Permit. Shielded containers with RH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed HalfPACTs, at which time they will undergo security and radiological checks and shipping documentation reviews. Consistent with

the handling of HalfPACT shipping packages in Section A1-1d(2), a forklift will remove the HalfPACT and transport it into the WHB and place the HalfPACT at either one of the two TRUDOCKs in the TRUDOCK Storage Area of the WHB Unit.

An external survey of the HalfPACT inner vessel will be performed as the outer containment vessel lid is removed. The inner vessel lid or closure lid will be lifted under the VHS, and the contents will be surveyed during and after this process is complete. A description of the VHS and criteria that are applied if radiological contamination is detected are discussed in Section A1-1d(2).

Shielded containers will be received as three-pack assemblies in HalfPACTs. An overhead bridge crane will be used to remove the contents of the shielded container assembly and place them on a facility pallet. The containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage to ensure they are in good condition prior to storage. Waste containers will also be checked for external surface contamination. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator.

Once the shielded container assembly is on the facility pallet, the TRU mixed waste container identification numbers will be verified against the Uniform Hazardous Waste Manifest and the WWIS. Inconsistencies will be resolved as discussed in Section A1-1d(2). Up to two three-pack assemblies of shielded containers will be placed on a facility pallet. The use of facility pallets will elevate the waste at least 6 in. (15 cm) from the floor surface. Pallets of waste will then be relocated to the CH Bay Storage Area of the WHB Unit for normal storage or will be transported to the conveyance loading room as described in Section A1-1d(2).

A1-1e Inspections

Inspection of containers and container storage area are required by 20.4.1.500 NMAC (incorporating 40 CFR §264.174). These inspections are described in this section.

A1-1e(1) WHB Unit

The waste containers in storage will be inspected visually or by closed-circuit television camera prior to each movement and, at a minimum, weekly, to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. Waste containers will be visually inspected for physical damage (severe rusting, apparent structural defects, signs of pressurization, etc.) and leakage. If a primary waste container is not in good condition, the Permittees will overpack the container, repair/patch the container in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or return the container to the generator. This visual inspection of CH TRU mixed waste containers shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If waste handling operations should stop for any reason with containers located at the TRUDOCK while still in the Contact-Handled Package, primary waste container inspections will not be accomplished until the containers of waste are removed from the Contact-Handled Package. If the lid to the Contact-Handled Package inner container vessel is removed, radiological checks (swipes of Contact-Handled Package inner surfaces) will be used to determine if there is contamination within the Contact-Handled Package. Such contamination could indicate a waste container leak or spill. Using radiological surveys, a

detected spill or leak of a radioactive contamination from a waste container will also be assumed to be a hazardous waste spill or release.

Waste containers residing within a Contact-Handled Package are not inspected, as described in the first bullet in Section A1-1e(2).

Waste containers will be inspected prior to reentering the waste management process line for downloading to the underground. Waste containers stored in this area will be inspected at least once weekly.

Loaded RH-TRU 72-B and CNS 10-160B casks will be inspected when present in the RH Bay. Physical or closed-circuit television camera inspections of the RH Complex are conducted as described in Table D-1a. Canisters loaded in an RH-TRU 72-B cask are inspected in the Transfer Cell during transfer from the cask to the Facility Cask. Waste containers received in CNS 10-160B casks are inspected in the Hot Cell during transfer from the cask to the Facility Canister by camera and/or visual inspection (through shield windows).

A1-1e(2) Parking Area Unit

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded, stored Contact-Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit (Figure A1-2). Inspections of the Contact-Handled or Remote-Handled Packages stored in the Parking Area Unit will focus on the inventory and integrity of the shipping containers and the spacing between Contact-Handled and Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Contact-Handled and Remote-Handled Packages located in the Parking Area Unit will be inspected weekly during use and prior to each reuse.

Inspection of waste containers is not possible when the containers are in their shipping container (e.g., casks, TRUPACT-II or HalfPACTs). Inspections can be accomplished by bringing the shipping containers into the WHB Unit and opening them and lifting the waste containers out for inspection. The DOE, however, believes that removing containers strictly for the purposes of inspection results in unnecessary worker exposures and subjects the waste to additional handling. The DOE has proposed that waste containers need not be inspected at all until they are ready to be removed from the shipping container for emplacement underground. Because shipping containers are sealed and are of robust design, no harm can come to the waste while in the shipping containers and the waste cannot leak or otherwise be released to the environment. Contact-Handled or Remote-Handled Packages shall be opened every 60 days for the purposes of venting, so that the longest waste would be uninspected would be for 60 days from the date that the inner containment vessel of the Contact-Handled or Remote-Handled Package was closed at the generator site. Venting the Contact-Handled or Remote-Handled Packages involves removing the outer lid and installing a tool in the port of the inner lid.

The following strategy will be used for inspecting waste containers that will be retained within their shipping containers for an extended period of time:

- If the reason for retaining the TRU mixed waste containers in the shipping container is due to an unresolved manifest discrepancy, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period or within 30 days after receipt at the WIPP, whichever comes sooner. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers in the Contact-Handled or Remote-Handled Package is due to an equipment malfunction that prevents unloading the waste in the WHB Unit, the DOE will return the shipment to the generator prior to the expiration of the 60 day NRC venting period. In this case, the DOE would have to ship the TRU mixed waste containers back with sufficient time for the generator to vent the shipment within the 60 day limit. In this case, no inspections of the internal containers will be performed. The stored Contact-Handled or Remote-Handled Package will be inspected weekly as described above.

- If the reason for retaining the TRU mixed waste containers is due to an equipment malfunction that prevents the timely movement of the waste containers into the underground, the waste containers will be kept in the Contact-Handled or Remote-Handled Package until day 30 (after receipt at the WIPP) or the expiration of the 60 day limit, whichever comes sooner. At that time the Contact-Handled or Remote-Handled Package will be moved into the WHB. Contact-Handled TRU mixed waste containers will be removed and placed in one of the permitted storage areas in the WHB Unit. The Remote-Handled Package will be vented, however, the containers will not be removed from the shipping package. If there is no additional space within the permitted storage areas of the WHB Unit, the DOE will discuss an emergency permit with the NMED for the purposes of storing the waste elsewhere in the WHB Unit. Waste containers will be inspected when removed from the Contact-Handled Packaging and weekly while in storage in the WHB Unit. Contact-Handled or Remote-Handled Packages will be inspected weekly while they contain TRU mixed waste containers as discussed above.

The DOE believes that this strategy minimizes both the amount of shipping that is necessary and the amount of waste handling, while maintaining a reasonable inspection schedule. The DOE will stop shipments of waste for any equipment outage that will extend beyond three days.

A1-1f Containment

The WHB Unit has concrete floors, which are sealed with a coating that is designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor. The floor coating consists of Carboline® 1340 clear primer-sealer on top of prepared concrete, Carboline® 191 primer epoxy, and Carboline® 195 surface epoxy. The manufacturer's chemical resistance guide shows "Very Good" for acids and "Excellent" for alkalies, solvents, salt, and water. Uses are indicated for nuclear power plants, industrial equipment and components, chemical processing plants, and pulp and paper mills for protection of structural steel and concrete. During the Disposal Phase, should the floors need to be re-coated, any floor coating used in the WHB Unit TRU mixed waste handling areas will be compatible with the TRU mixed waste constituents and will have

chemical resistance at least equivalent to the Carboline® products. Figure A1-1 shows where TRU mixed waste handling activities discussed in this section occur.

During normal operations, the floor of the storage areas within the WHB Unit shall be visually inspected on a weekly ~~b~~asis to verify that it is in good condition and free of obvious cracks and gaps. Floor areas of the WHB Unit in use during off-normal events will be inspected prior to use and weekly thereafter. All TRU mixed waste containers located in the permitted storage areas shall be elevated at least 6 in. (15 cm) from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packaging shall be stored at a designated storage area inside the WHB Unit so as to preclude exposure to the elements.

Secondary containment at the CH Bay Storage Area inside the WHB Unit shall be provided by the WHB Unit floor (See Figure A1-1). The WHB Unit is engineered such that during normal operations, the floor capacity is sufficient to contain liquids upon release. Secondary Containment at the Derived Waste Storage Area of the WHB Unit will be provided by a polyethylene standard drum pallet. The Parking Area Unit and TRUDOCK Storage Area of the WHB Unit require no engineered secondary containment since no waste is to be stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging.

Calculations to determine the floor surface area required to provide secondary containment in the event of a release are based on the maximum quantity of liquid which could be present within ten percent of one percent of the volume of all the containers or one percent of the capacity of the largest single container, whichever is greater.

Secondary containment at storage locations inside the RH Bay and Cask Unloading Room is provided by the cask. Secondary containment at storage locations inside the Transfer Cell is provided by the RH-TRU 72-B cask or Shielded Insert. Secondary containment at storage locations in the Facility Cask Loading Room is provided by the Facility Cask. In the Hot Cell, waste containers are stored in either the drum carriage unit or in canister sleeves. The Lower Hot Cell provides secondary containment as described in section A1-f(2). In addition, the RH Bay, Hot Cell, and Transfer Cell contain 220-gallon (833-L) (Hot Cell), 11,400-gallon (43,152-L) (RH Bay), and 220-gallon (833-L) (Transfer Cell) sumps, respectively, to collect any liquids.

A1-1f(1) Secondary Containment Requirements for the WHB Unit

The maximum volume of TRU mixed waste on facility pallets that will be stored in the CH Bay Storage and Surge Storage Areas of the WHB is 18 facility pallets @ 2 TDOPs per pallet = 36 TDOPs of waste. 36 TDOPs @ 1,200 gal (4,540 L) per TDOP = 43,200 gal (163,440L) waste container capacity. 43,200 gal (163,440 L) x ten percent of the total volume = 4,320 gal (16,344 L) of waste. Since 4,320 gal (16,344 L) is greater than 1,200 gal (4,540 L), the configuration of possible TDOPs in the storage area is used for the calculation of secondary containment requirements. 4,320 gal (16,344 L) of liquid x one percent liquids = 43.2 gal (163.4 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Derived Waste Storage Area of the WHB Unit is one SWB. 1 SWBs @ 496 gal (1,878 L) per SWB = 496 gal (1,878 L) waste container capacity. Since the maximum storage volume of 496 gal (1,878 L) is equal to the volume of the largest single container, the volume of the a single SWB is used for the

calculation of secondary containment requirements. 496 gal (1,878 L) of liquid x one percent liquids = 4.96 gal (18.8 L) of liquid for which secondary containment is needed.

The maximum volume of TRU mixed waste that will be stored in the Hot Cell is 13 RH TRU drums @ 55 gal (210 L) per drum = 715 (2,730 L) of waste in drums. 715 gal (2,730 L) of waste x ten percent of total volume = 71.5 gal (273 L) of waste. Secondary containment for liquids will need to have a capacity of 71.5 gal (273 L). Since 71.5 gal (273 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

The maximum volume of TRU mixed waste that will be stored in the Transfer Cell is one RH-TRU 72-B Canister or one Facility Canister @ 235 gal (890 L) per canister x ten percent of total volume = 23.5 gal (8.90 L) of waste. Since 23.5 gal (8.90 L) is less than the volume of the single container of 235 gal (890 L) therefore, the larger volume is used for determining the secondary containment requirements. 235 gal (890 L) of waste x one percent liquids = 2.35 gal (8.9 L) of liquid needed for secondary containment.

A1-1f(2) Secondary Containment Description

The following is a calculation of the surface area the quantities of liquid would cover. Using a conversion factor of 0.1337 ft^3/gal (0.001 m^3/L) and assuming the spill is 0.0033 ft (0.001 m) thick, the following calculation can be used:

gallons × cubic feet per gallon ÷ thickness in feet = area covered in square feet

CH Bay Storage Area

43.2 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 1,750 ft^2 (162.7 m^2)

Hot Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

Transfer Cell

2.35 gal × 0.1337 ft^3/gal ÷ 0.0033 ft = 95 ft^2 (8.8 m^2)

The WHB Unit has 33,175 ft^2 (3,082 m^2) of floor space, the CH Bay Storage Area has 26,151 ft^2 (2,430 m^2) of floor space. The CH Bay Storage Area requires 1,750 ft^2 (162.7 m^2) for containment, Thus, the floor area of the CH Bay Storage Area of the WHB Unit provide sufficient secondary containment to contain a release of ten percent of one percent of the volume of all of the containers, or one percent of the capacity of the largest container, whichever is greater.

The Hot Cell and Transfer Cell are the only portions of the RH Complex managing RH TRU mixed waste outside of casks or canisters. The Hot Cell has 1,841 ft^2 (171 m^2) of floor space and the Transfer Cell has 1,003 ft^2 (93 m^2) of floor space. The Hot Cell and Transfer Cell require only 95 ft^2 for containment, therefore there is sufficient floor space to contain a release of ten percent of one percent of containers in these storage areas.

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In addition, both the Hot Cell and the Transfer Cell each contain a 220 gal (833 L) sump that will collect any liquids that spill from containers.

Derived Waste Storage Area

The derived waste containers in the Derived Waste Storage Area will be stored on standard drum pallets, which provides approximately 50 gal (190 L) of secondary containment capacity. Thus the secondary containment capacity of the standard drum pallet is sufficient to contain a release of ten percent of one percent of the largest container (4.96 gal or 18.8 L).

Parking Area Unit

Containers of TRU mixed waste to be stored in the Parking Area Unit will be in Contact-Handled or Remote-Handled Packages. There will be no additional requirements for engineered secondary containment systems.

A1-1g Special Requirements for Ignitable, Reactive, and Incompatible Waste

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 264.177). Permit Part 2 precludes ignitable, reactive, or incompatible waste at the WIPP. No additional measures are required.

A1-1h Closure

Clean closure is planned in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.178) for all permitted container storage areas. The applicable areas and the plans for clean closure are detailed in Permit Attachment G.

A1-1i Control of Run On

The WHB Unit is located indoors which prevents run-on from a precipitation event. In addition, the CH TRU containers are stored on facility pallets, containment pallets, or standard drum pallets, which elevate the CH TRU mixed waste containers at least 6 in. (15 cm) off the floor, or in Contact-Handled or Remote-Handled Packages, so that any firewater released in the building will not pool around containers. Within the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room, waste containers are stored in casks or Shielded Inserts and protected from any potential run on. Any firewater released in the building will not pool around the waste containers as they are stored in casks, or Shielded Inserts. Within the Hot Cell, there is no source of water during operations. However, control of run-on is provided by the Lower Hot Cell, which lies below a sloped floor surrounded by a grating and canister sleeves in the Hot Cell above.

In the Parking Area Unit, the containers of TRU mixed waste are always in Contact-Handled or Remote-Handled Packages which protect them from precipitation and run on. Therefore, the WIPP container storage units will comply with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.175(b)(4)).

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References

DOE, 1997a. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Rev. 6.5, 1997.

DOE, 1997b. Waste Isolation Pilot Plant Safety Analysis Report (DOE/WIPP-95-2065, Rev. 1), U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1997.

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TABLES

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Table A1-1
Basic Design Requirements, Principal Codes, and Standards

	Structure/Supports			Liquid and Process Air Handling Processing and storage equipment						Air Hdlg Ducting & Fans	HVAC filters		Mechanical Handling Equipment			Instrumentation and Electrical			Quality Assurance Program	
					Piping & Valves															
	DBE DBT ACI-318 AISC	ANSI A58.1	Site-specific Require-ments	Vessel ASME VIII NFPA[e]	ANSI BBB,1 NFPA[e]	UP	Pumps API-610 NFPA[e]	Storage Tanks API-650 or API-620	Heat Exchgrs ASME VIII TEMA	All Other Equip-ment Mfrs Std	ARI SMACNA AMCA	Pre-filters ASHRAE 52.68	HEPA Filters MIL F 51068C ANSI N 509 ANSI N 510	Crane and Related equipment CMAA	CMAA AISC AWS	All Other Equip-meant Mfrs STD	A-NE	ANSI Sods or Nat'l Elect-trial Code	IA/ Mfrs Std	ANSI/ASME NQA-1 and Supple-ments	Com. and Industry Practices
Design Class I	X		a	X [f]			X	X	X		X [c]	X [c,d]	X [c]	X	X		X	X		X	
Design Class Ii	a,b	X	a	X	X		X	X	X		X [c]	X [c]	X [c]	X	X			X	X	X	
Design Class Iiia	a	X	a	a	X		a			X	X [c]	X [c]	X [c]	a	a	X		X	X	X	
Design Class Iii		X	g		a	X				X	X	X	X			X		X	X		X

X = Minimum Requirements

[a] Requirements to be determined on a case-by-case basis.
[b] Required for structure and supports needed for confinement and control of radioactivity.
[c] Except structures and supports that are designed to withstand a design-basis earthquake (DBE)/design-basis tornado (DBT) when specified in column 1 of this table.
[d] Underwriter's Laboratory (UL) Class I Listed.
[e] For fire-protection systems.
[f] American Society for Mechanical Engineers (ASME) III for other Class I vessels.
[g] Design of underground structures, mining equipment, and facilities are basically governed by the MSHA and experience in local mines.

ACI = American Concrete Institute
AISC = American Institute of Steel Construction
AMCA = Air Moving and Conditioning Association
ANSI = American National Standards Institute
API = American Petroleum Institute
ARI = Air Conditioning and Refrigeration Institute
ASHRAE = American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.
AWS = American Welding Society
CMAA = Crane Manufacturers Association
DBE = Design-basis earthquake
DBT = Design-basis tornado
HEPA = High-efficiency particulate air
HVAC = Heating, Ventilation, and Air-Conditioning
A = Institute of Electronics and Electronic Engineers
IA = Instrument Society of America
MFR = Manufacturer
MIL = Military (specification)
MSHA = Mine Safety and Health Administration
NFPA = National Fire Protection Association
NQA = Nuclear Quality Assurance (Standard)
SMACNA = Sheet Metal and Air Conditioning Contractors National Association, Inc.
STD = Standard
TEMA = Tubular Exchanger Manufacturers Association
UP = Uniform Plumbing Code

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Table A1-2
Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
CH Bay overhead bridge crane	12,000 lbs.
Surface forklifts	26,000 lbs. (CH Bay forklift) 70,000 lbs. (TRUPACT-III Handler forklift)
Facility Pallet	25,000 lbs.
Adjustable center-of-gravity lift fixture	10,000 lbs.
Facility Transfer Vehicle	30,000 lbs.
Yard Transfer Vehicle	60,000 lbs.
MAXIMUM GROSS WEIGHTS OF CONTAINERS	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Adjustable center of gravity lift fixture	2,500 lbs.
Facility pallet	4,120 lbs.

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Table A1-3
RH TRU Mixed Waste Handling Equipment Capacities

CAPACITIES FOR EQUIPMENT	
RH Bay Overhead Bridge Crane	140 tons main hoist 25 tons auxiliary hoist
RH-TRU 72-B Cask Transfer Car	20 tons
CNS 10-160B Cask Transfer Car	35 tons
Transfer Cell Shuttle Car	29 tons
Hot Cell Bridge Crane	15 tons
Overhead Powered Manipulator	2.5 tons
Facility Cask Rotating Device	No specific load rating
Cask Unloading Room Crane	25 tons
6.25 Ton Grapple Hoist	6.25 tons
Facility Cask Transfer Car	40 tons
MAXIMUM GROSS WEIGHTS OF RH TRU CONTAINERS	
RH TRU Canister	8,000 lbs
55-Gallon Drum	1,000 lbs
Facility Canister	10,000 lbs
MAXIMUM NET EMPTY WEIGHTS OF EQUIPMENT	
RH-TRU 72-B Cask	37,000 lbs
CNS 10-160B Cask	57,500 lbs
Facility Cask	67,700 lbs
Shielded Insert	26,300 lbs

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FIGURES

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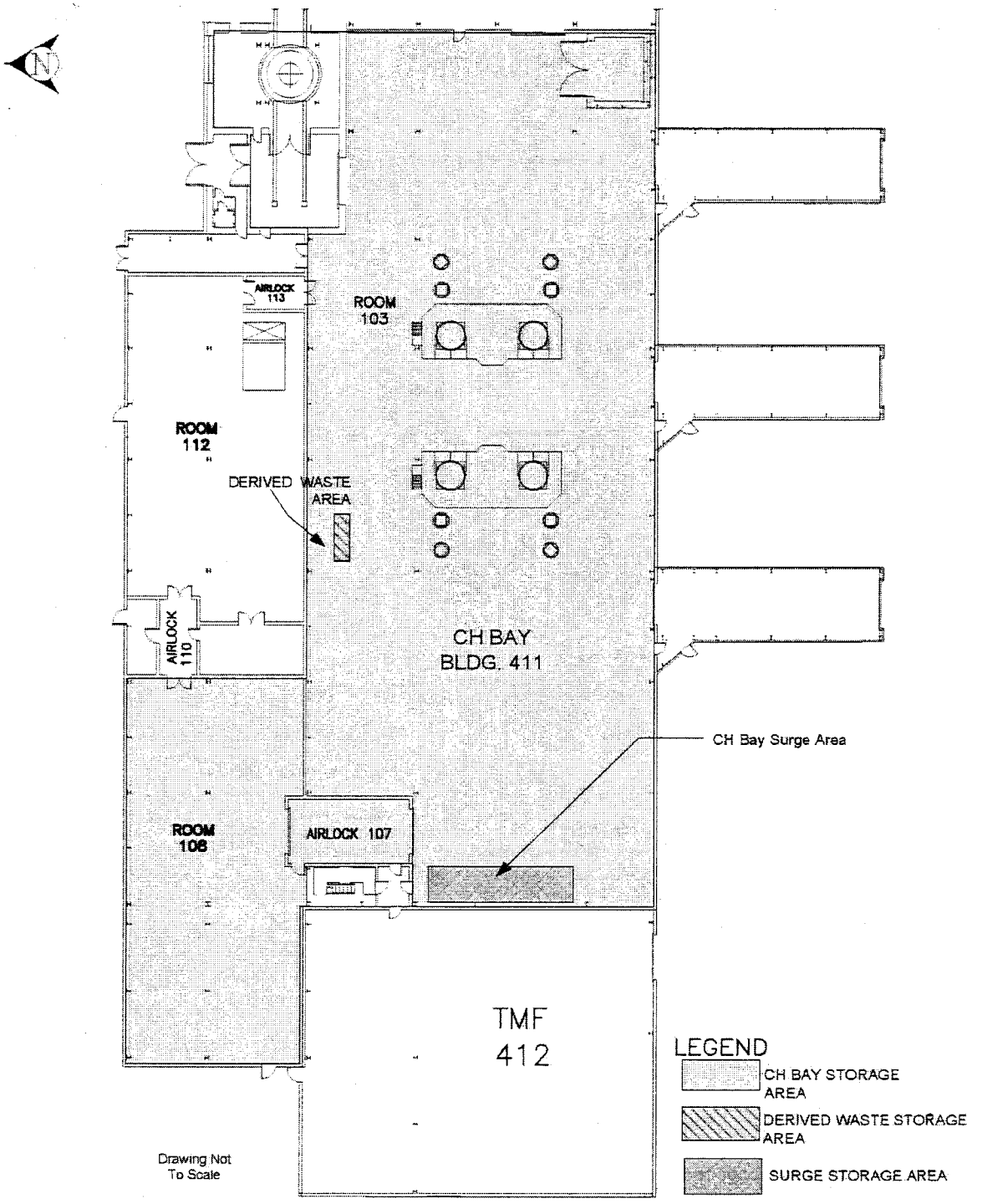

Figure A1-1
Waste Handling Building - CH TRU Mixed Waste Container Storage and Surge Areas

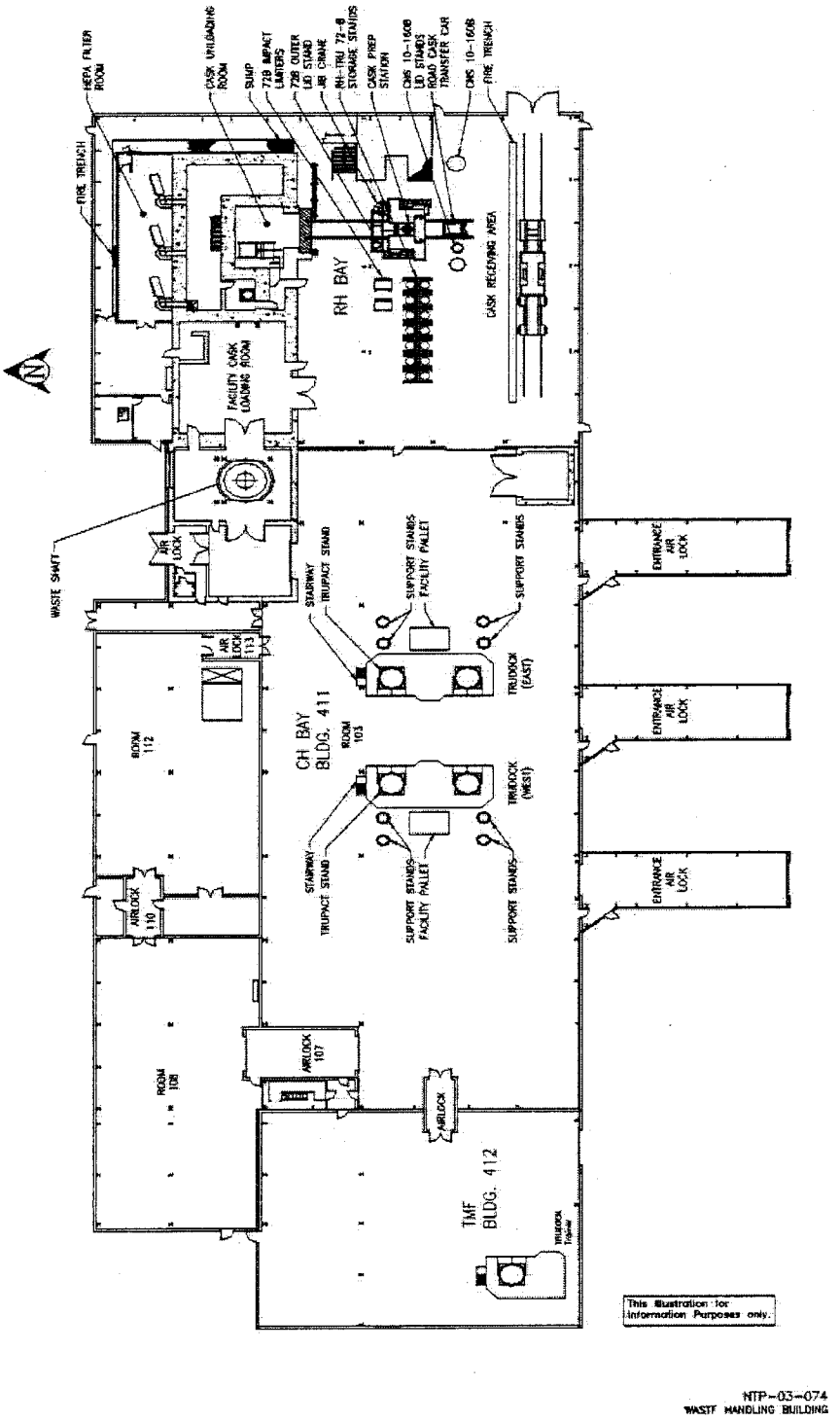

Figure A1-1a
Waste Handling Building Plan (Ground Floor)

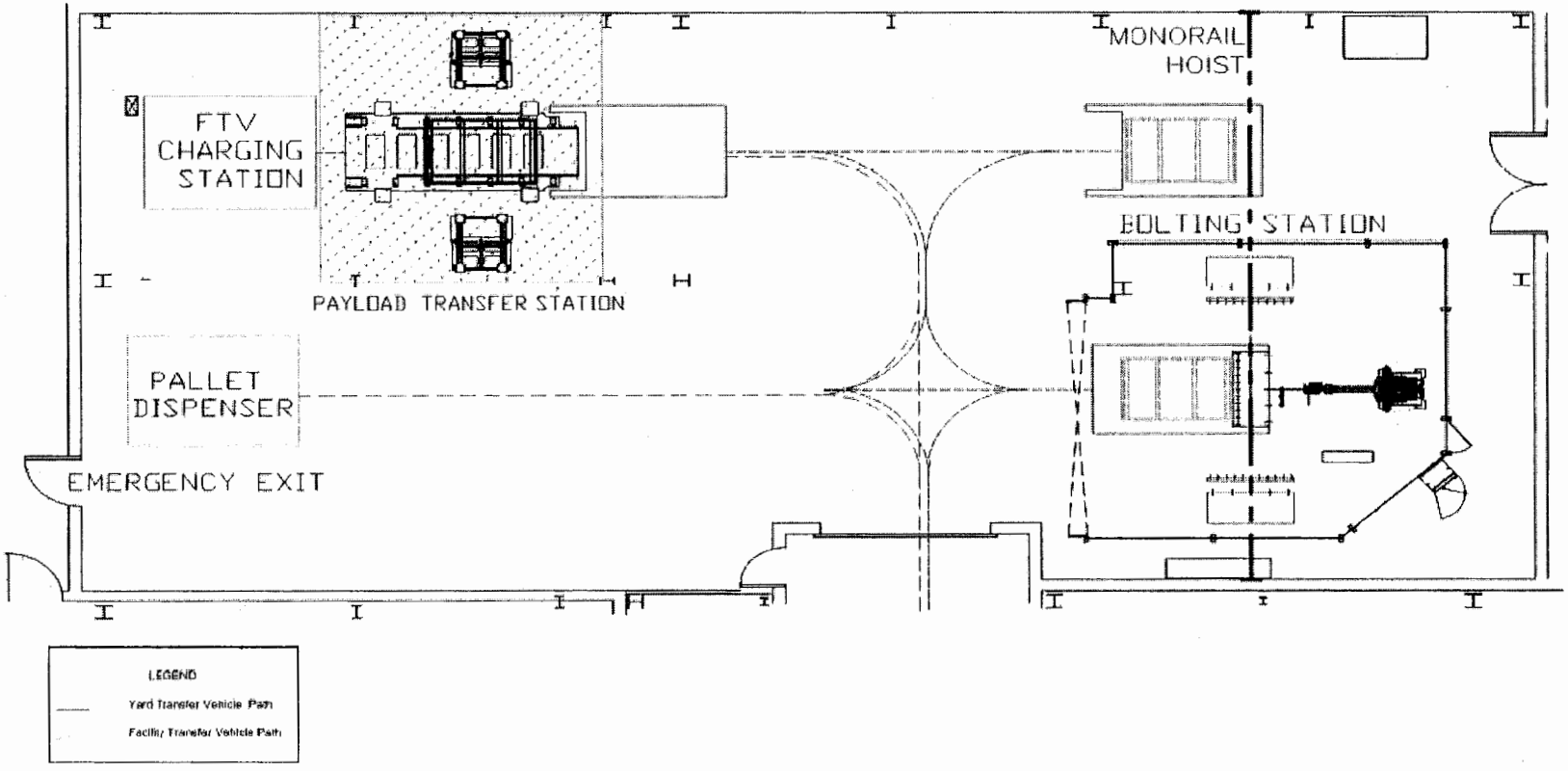

Figure A1-1b
Waste Handling Building Plan (Room 108 Detail)

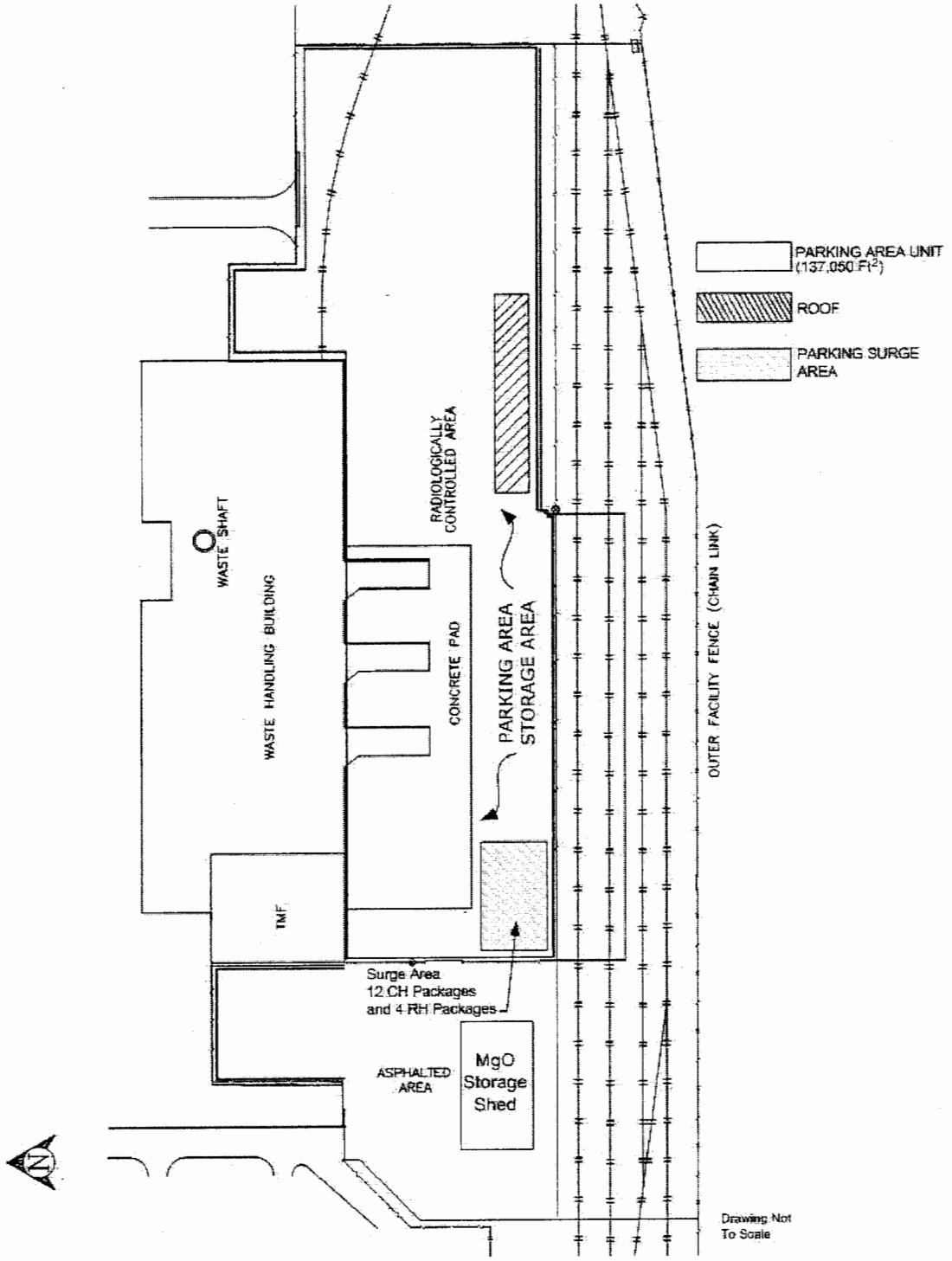

Figure A1-2
Parking Area - Container Storage and Surge Areas

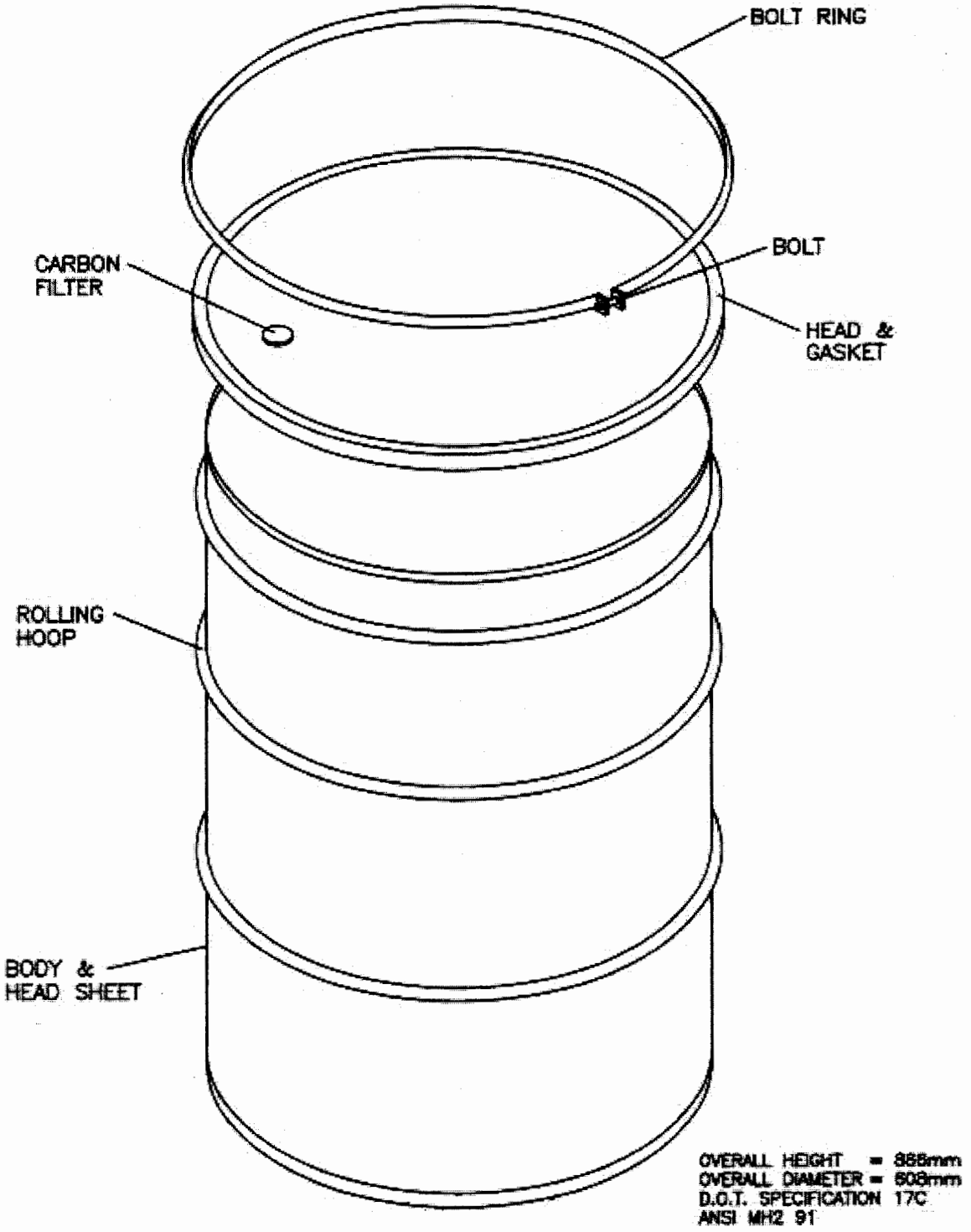

Figure A1-3
Standard 55-Gallon Drum (Typical)

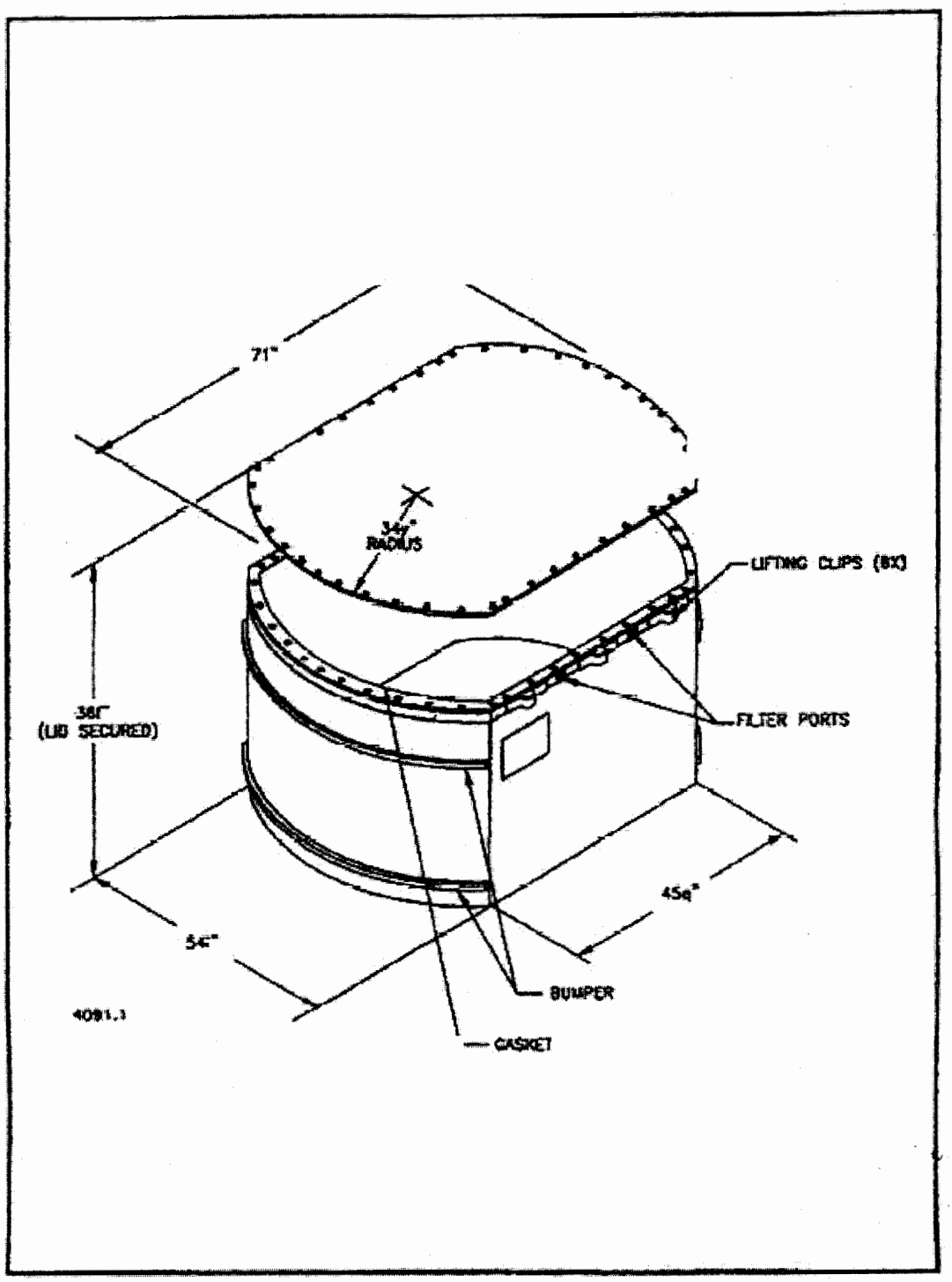

Figure A1-4
Standard Waste Box

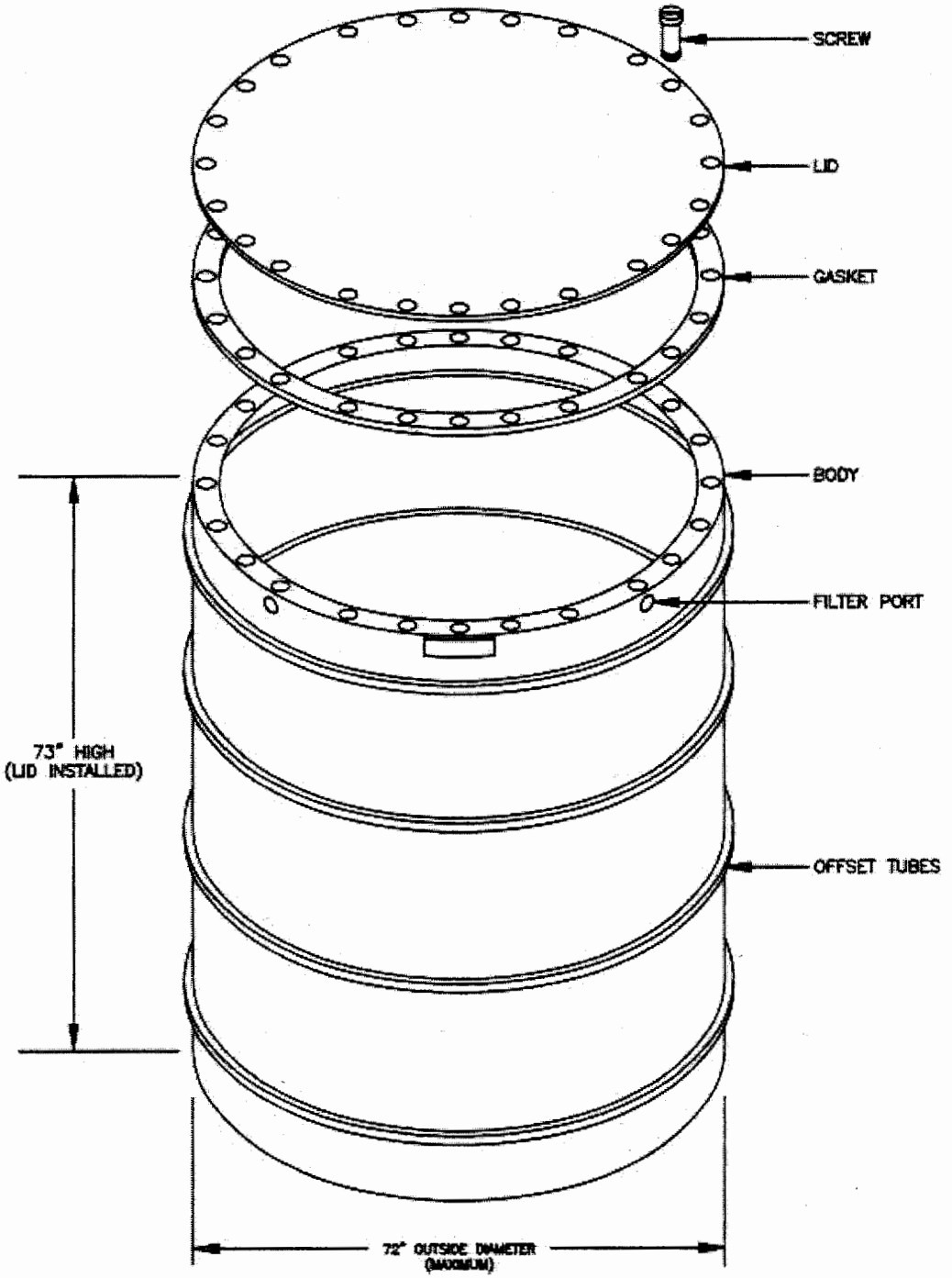

Figure A1-5
Ten-Drum Overpack

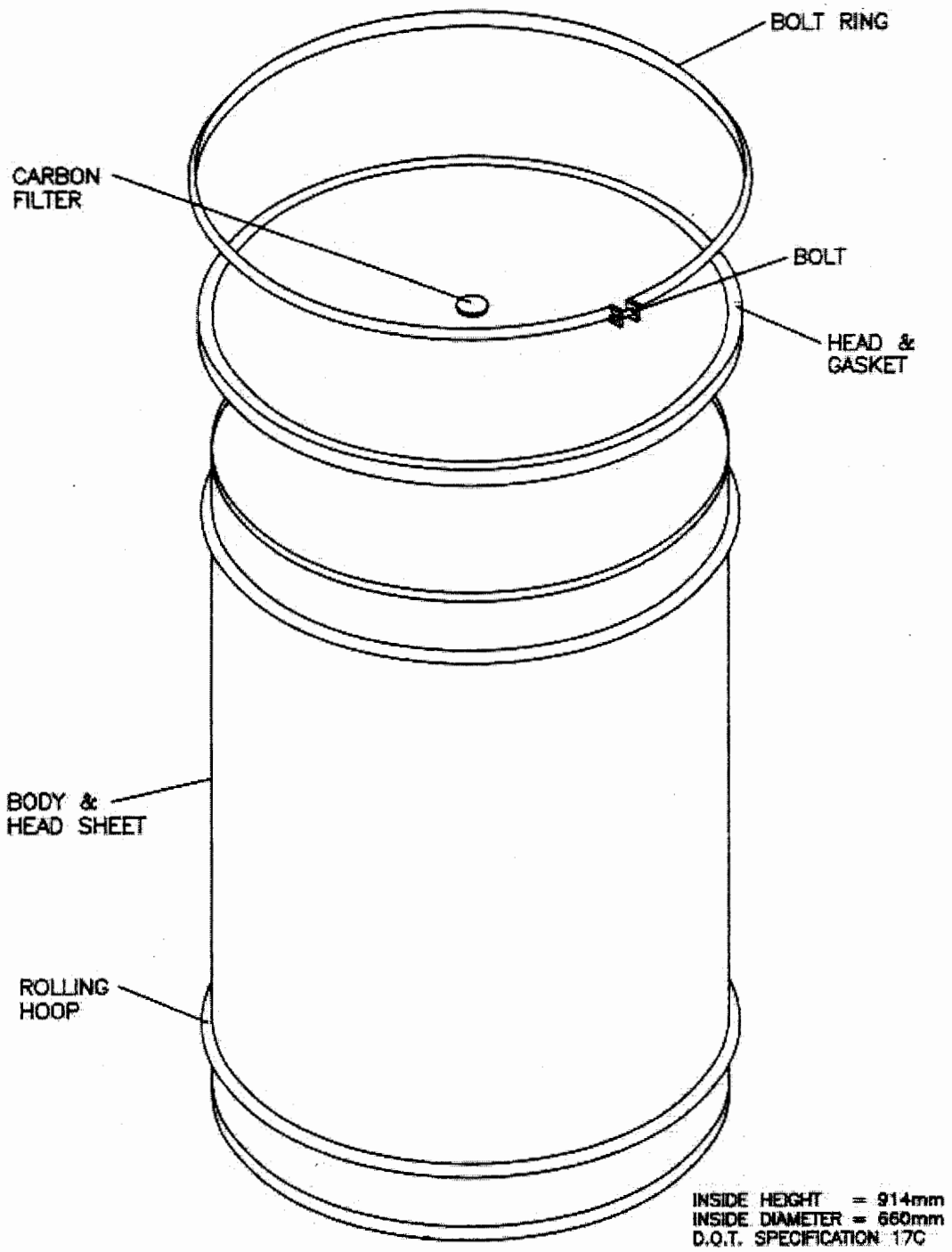

Figure A1-6
85-Gallon Drum

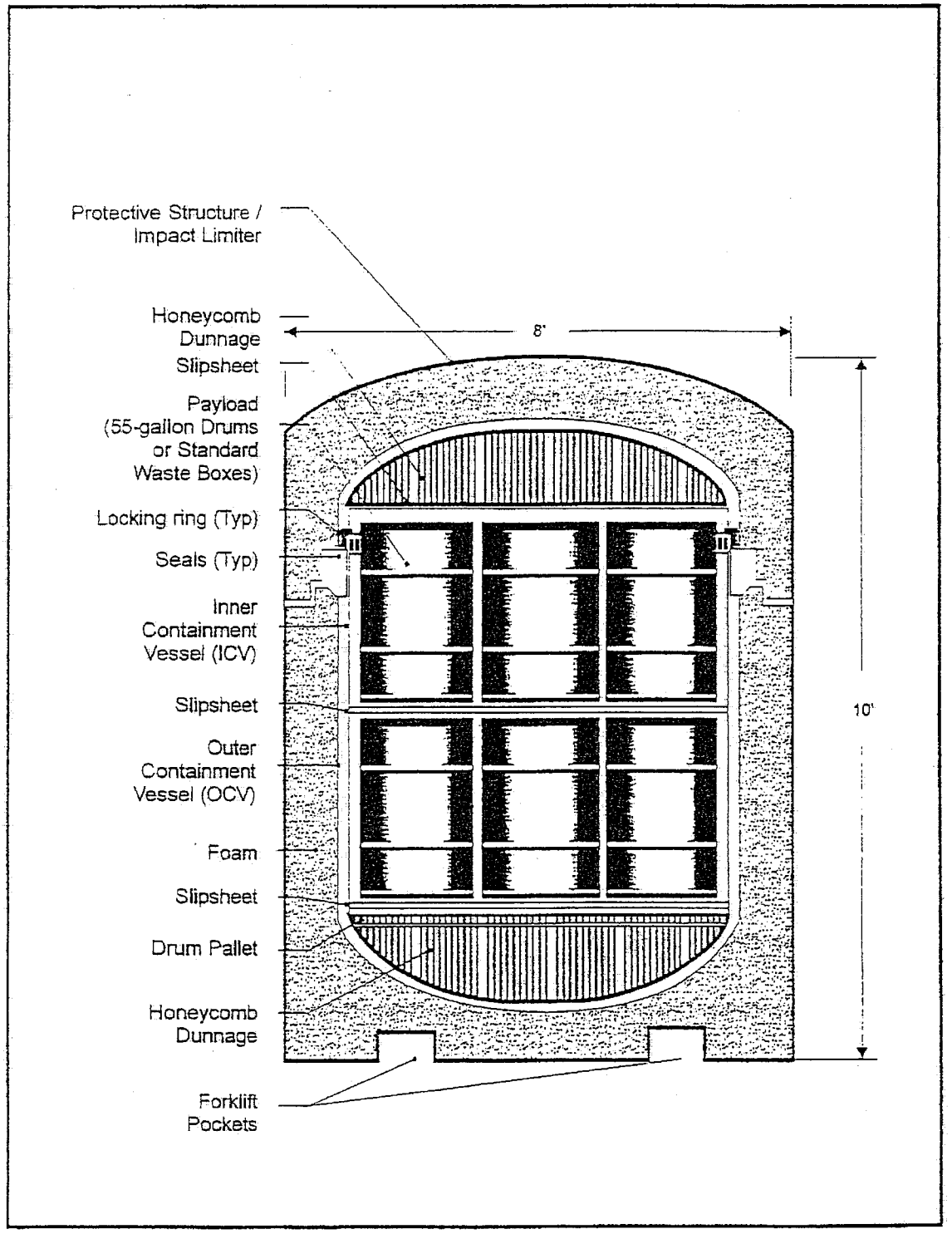

Figure A1-8a
TRUPACT-II Shipping Container for CH Transuranic Mixed Waste (Schematic)

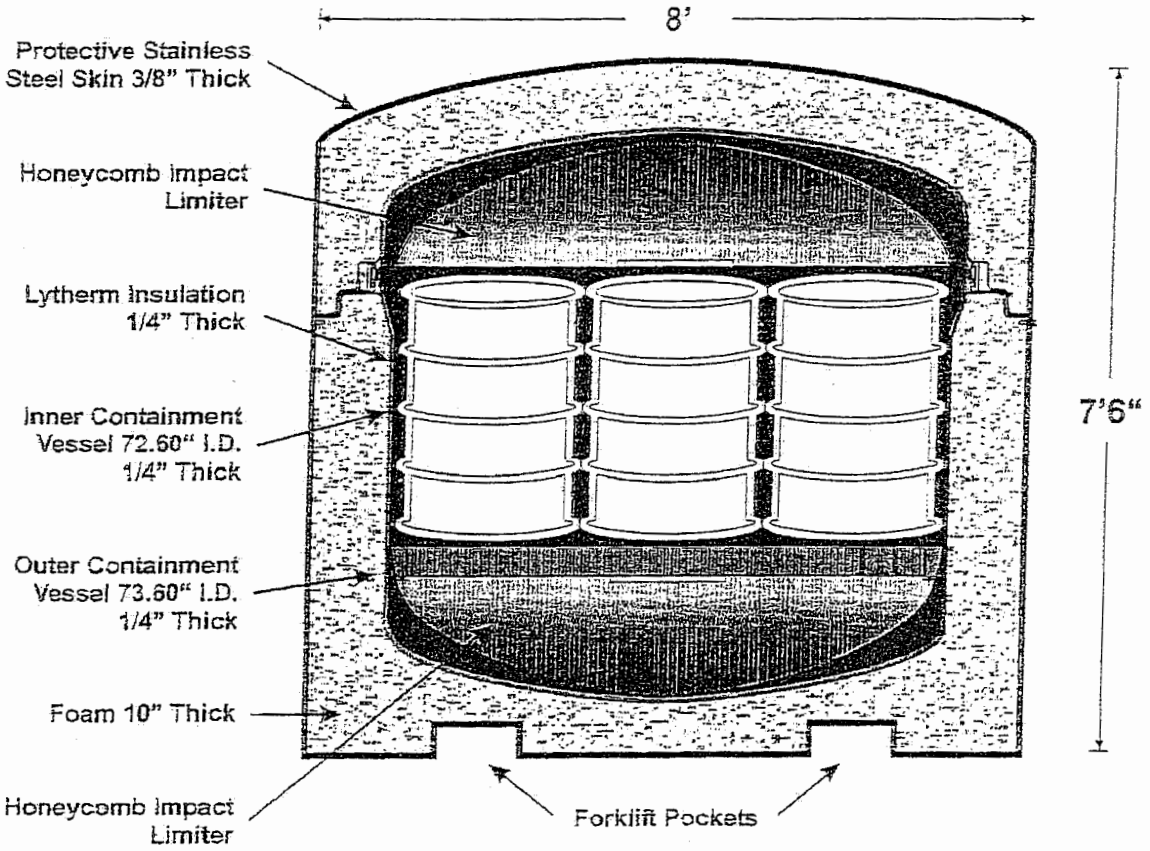

Figure A1-8b
Typical HalfPACT Shipping Container for CH Transuranic Mixed Waste (Schematic)

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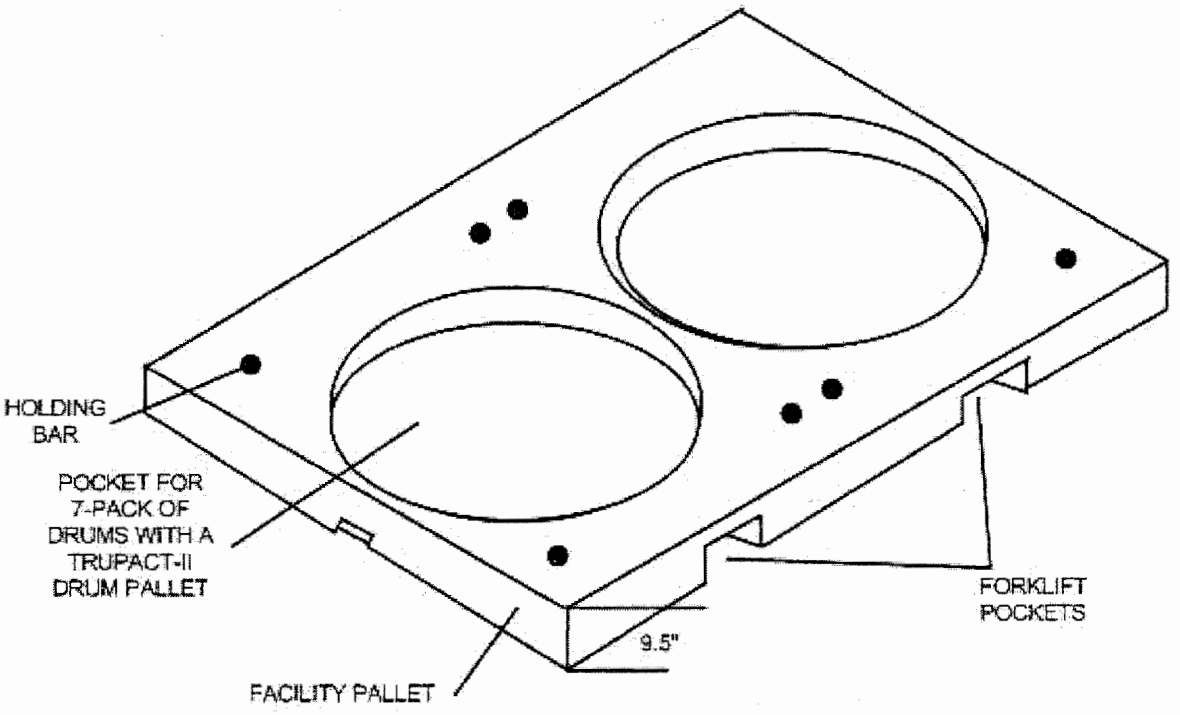

Figure A1-10
Facility Pallet for Seven-Pack of Drums

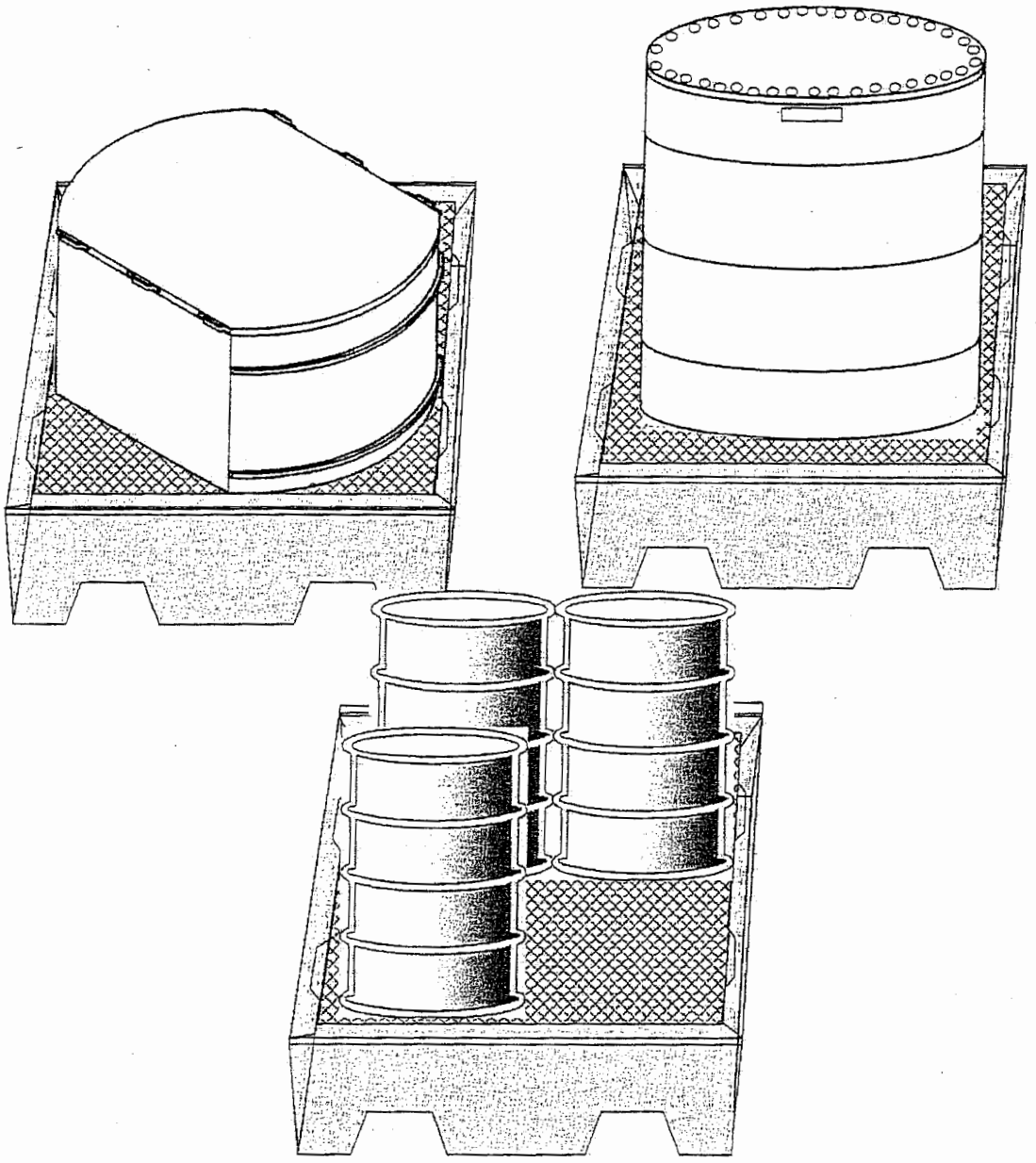

Figure A1-10a
Typical Containment Pallet

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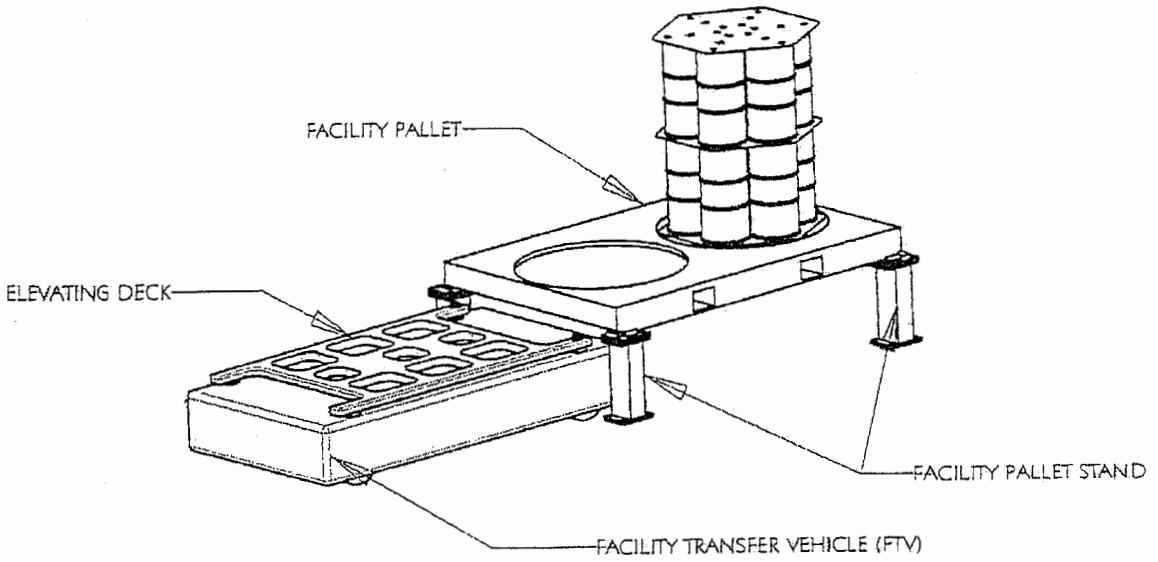

Figure A1-11
Facility Transfer Vehicle, Facility Pallet, and Typical Pallet Stand

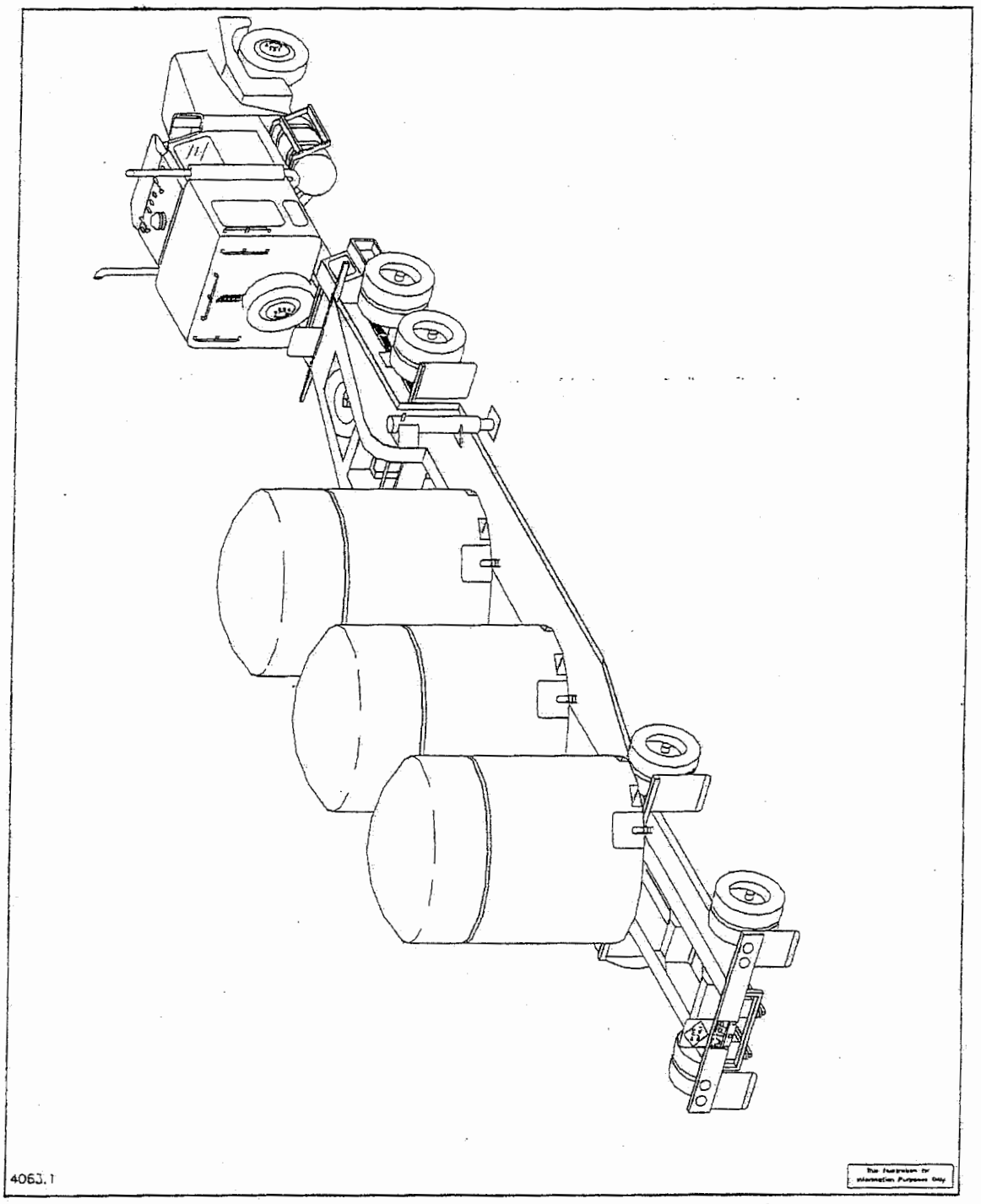

Figure A1-12
TRUPACT-II Containers on Trailer

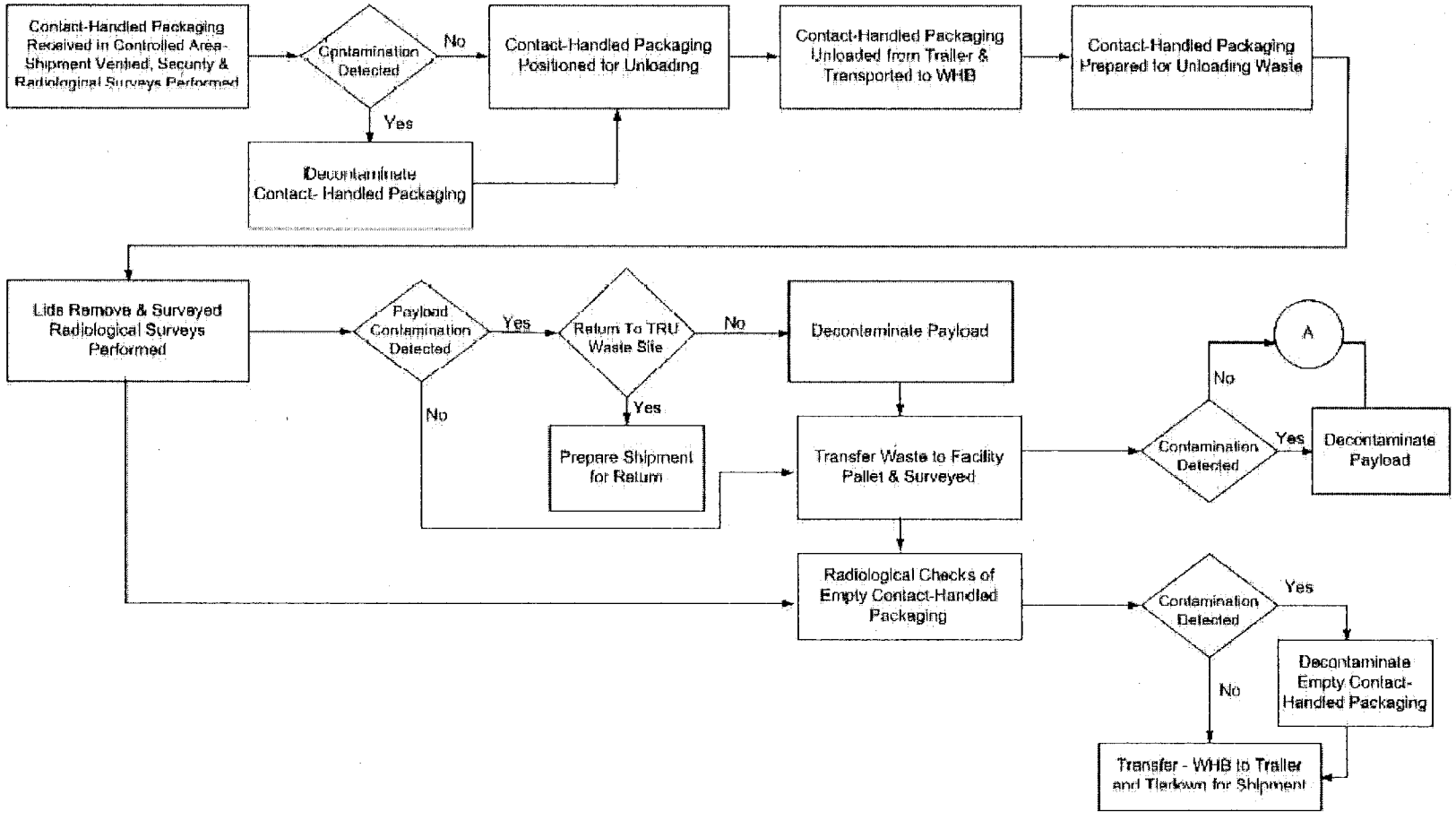

Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

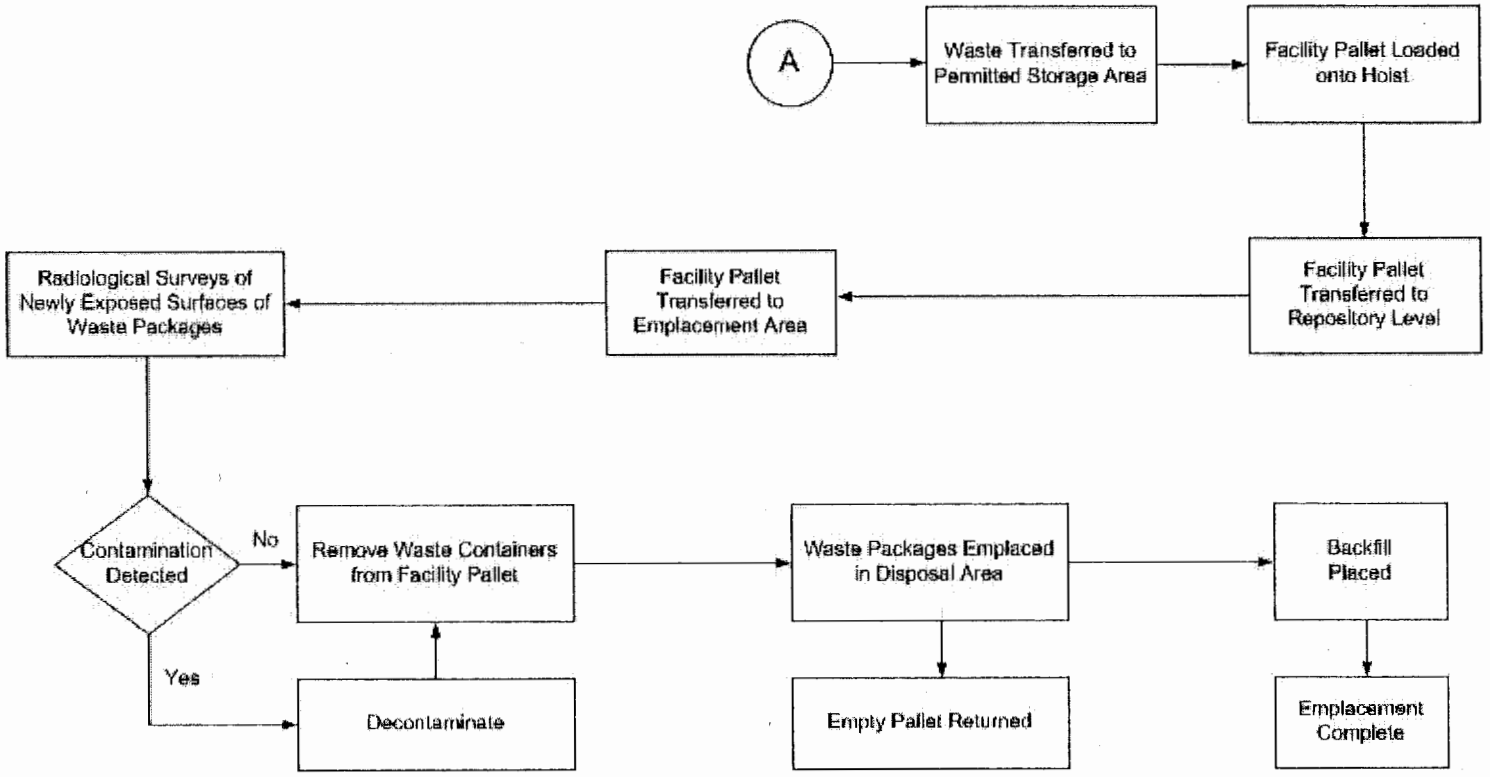

Figure A1-13
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

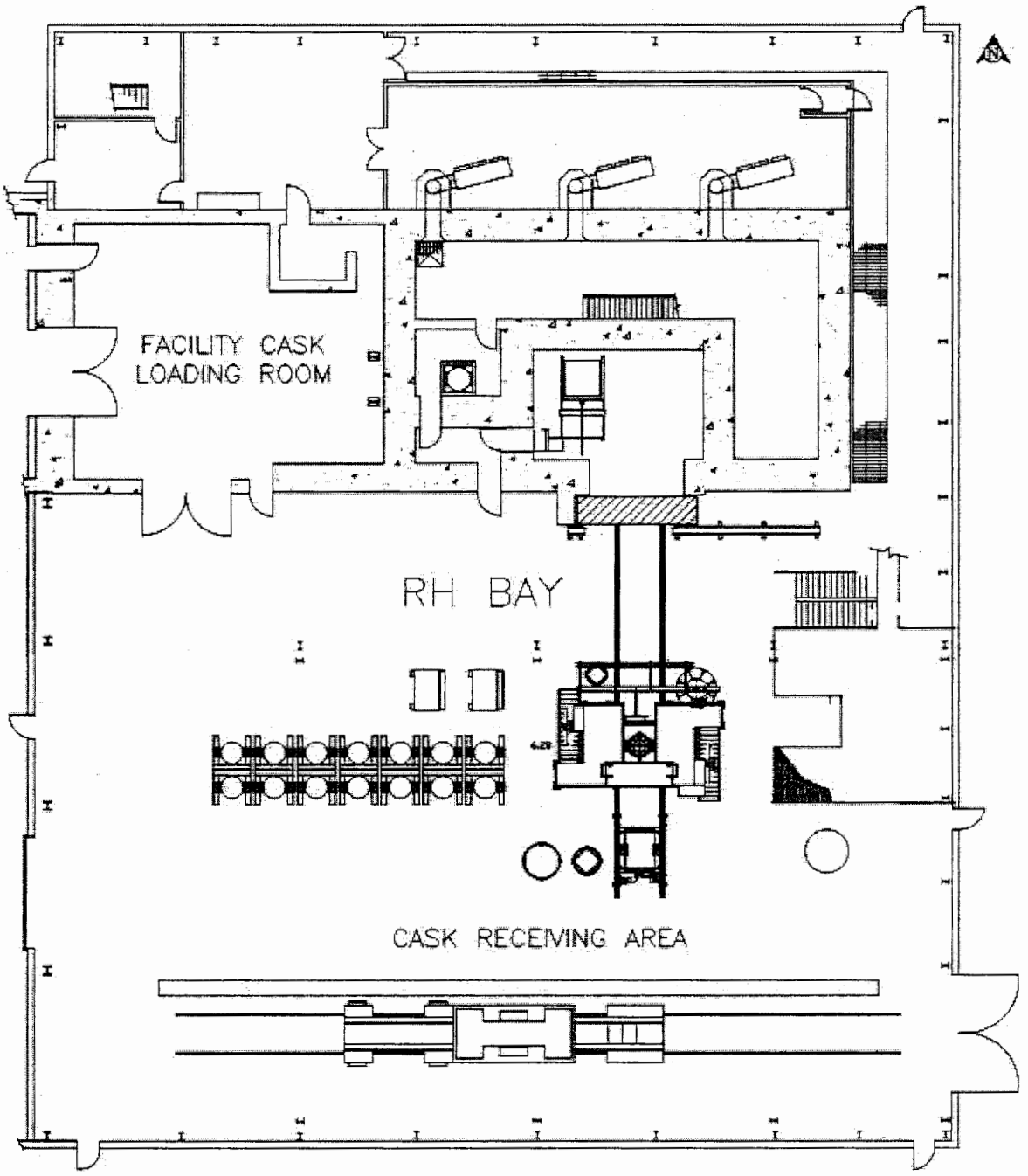

Figure A1-14a
RH Bay Ground Floor

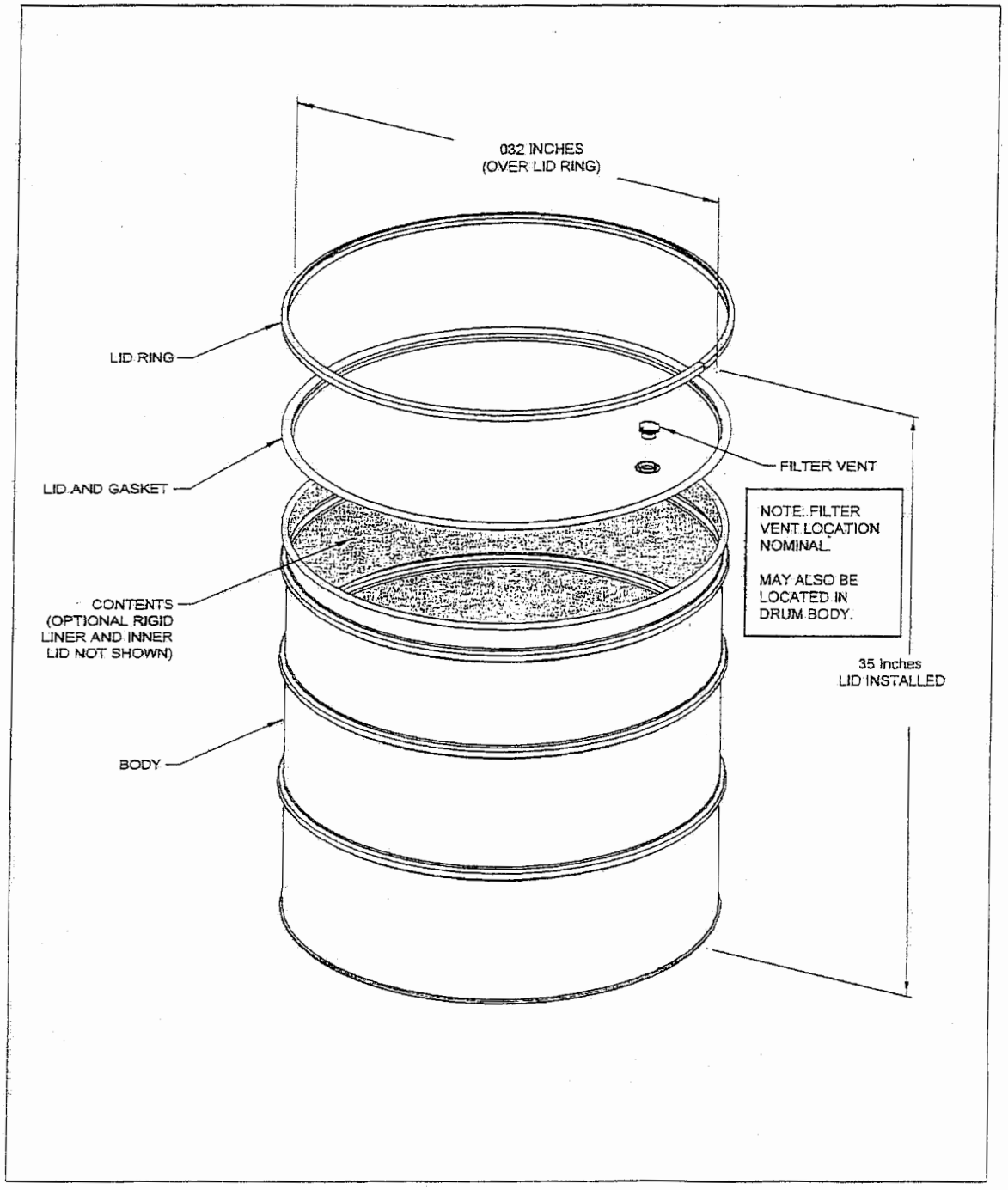

Figure A1-15
100-Gallon Drum

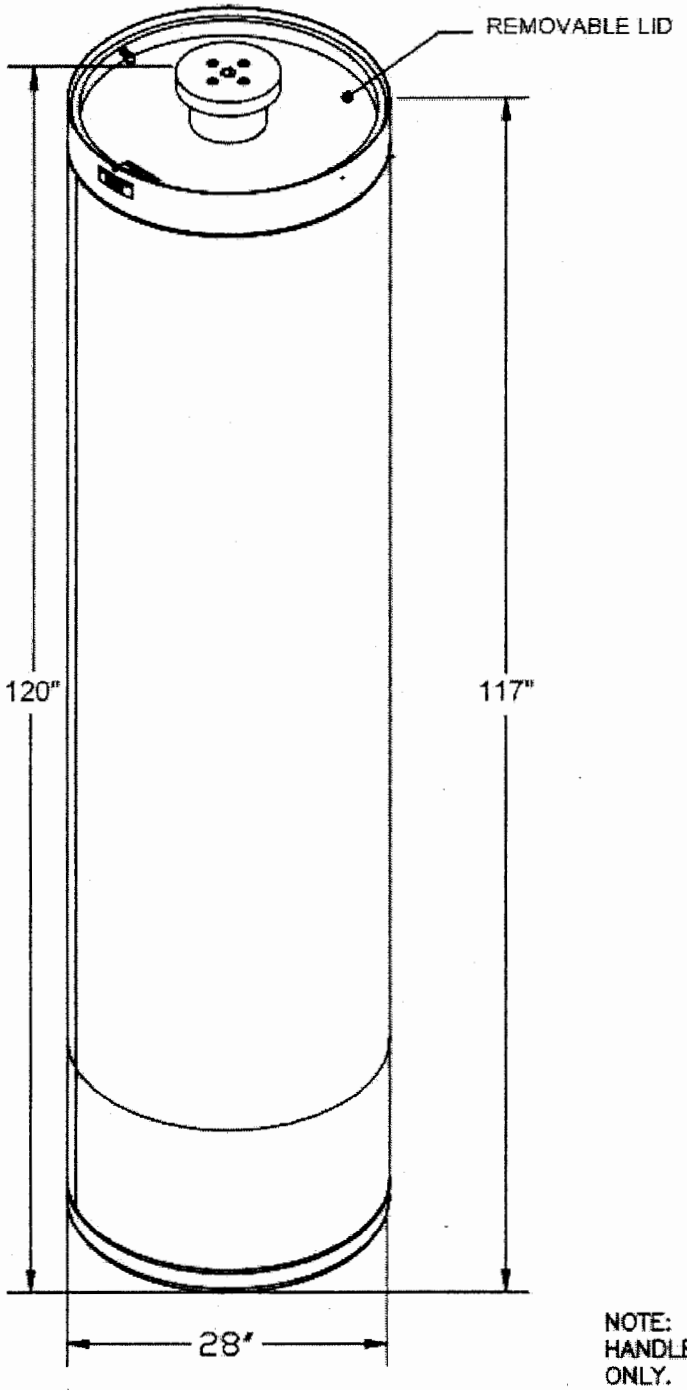

Figure A1-16
Facility Canister Assembly

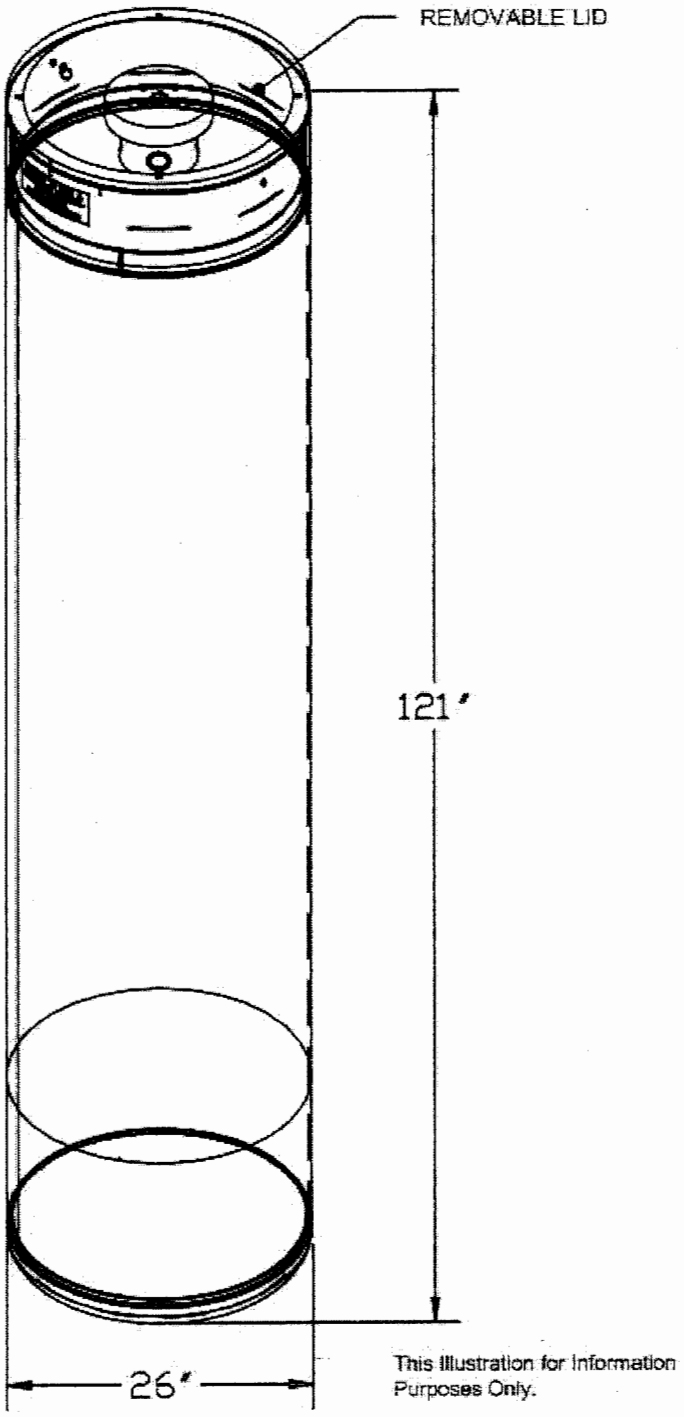

Figure A1-16a
RH-TRU 72-B Canister Assembly

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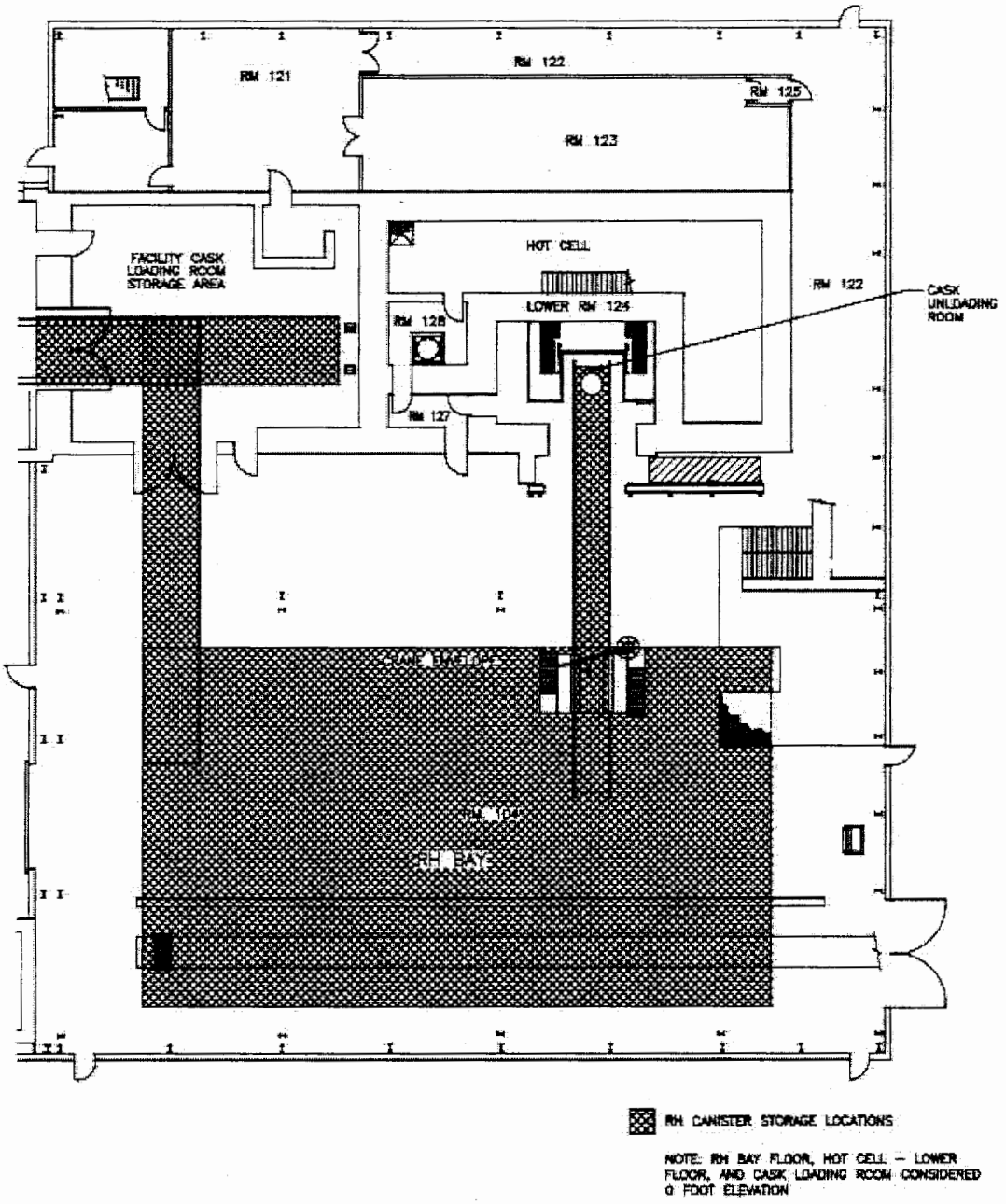

Figure A1-17a
RH Bay, Cask Unloading Room, Hot Cell, Facility Cask Loading Room

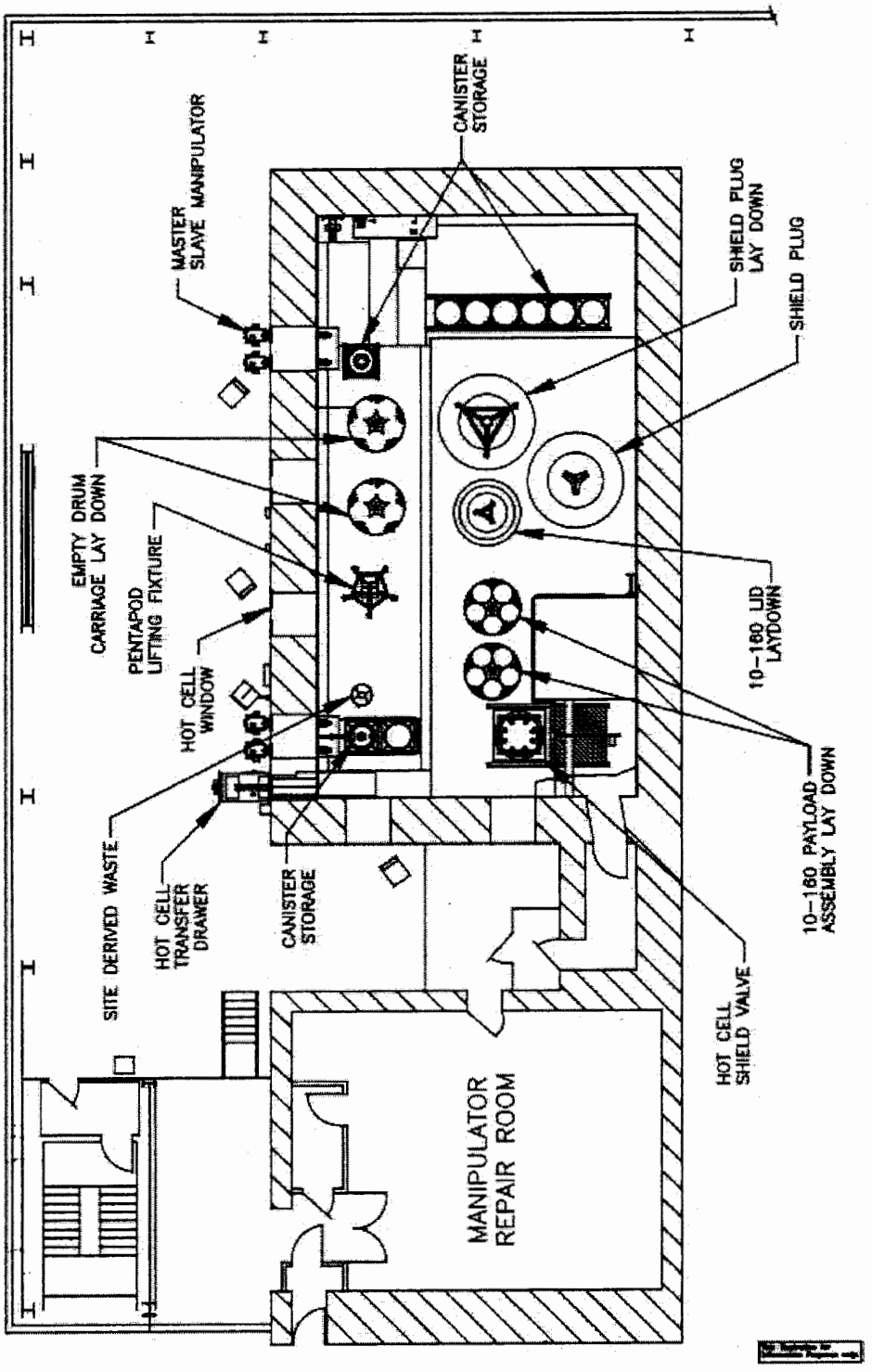

Figure A1-17b
RH Hot Cell Storage Area

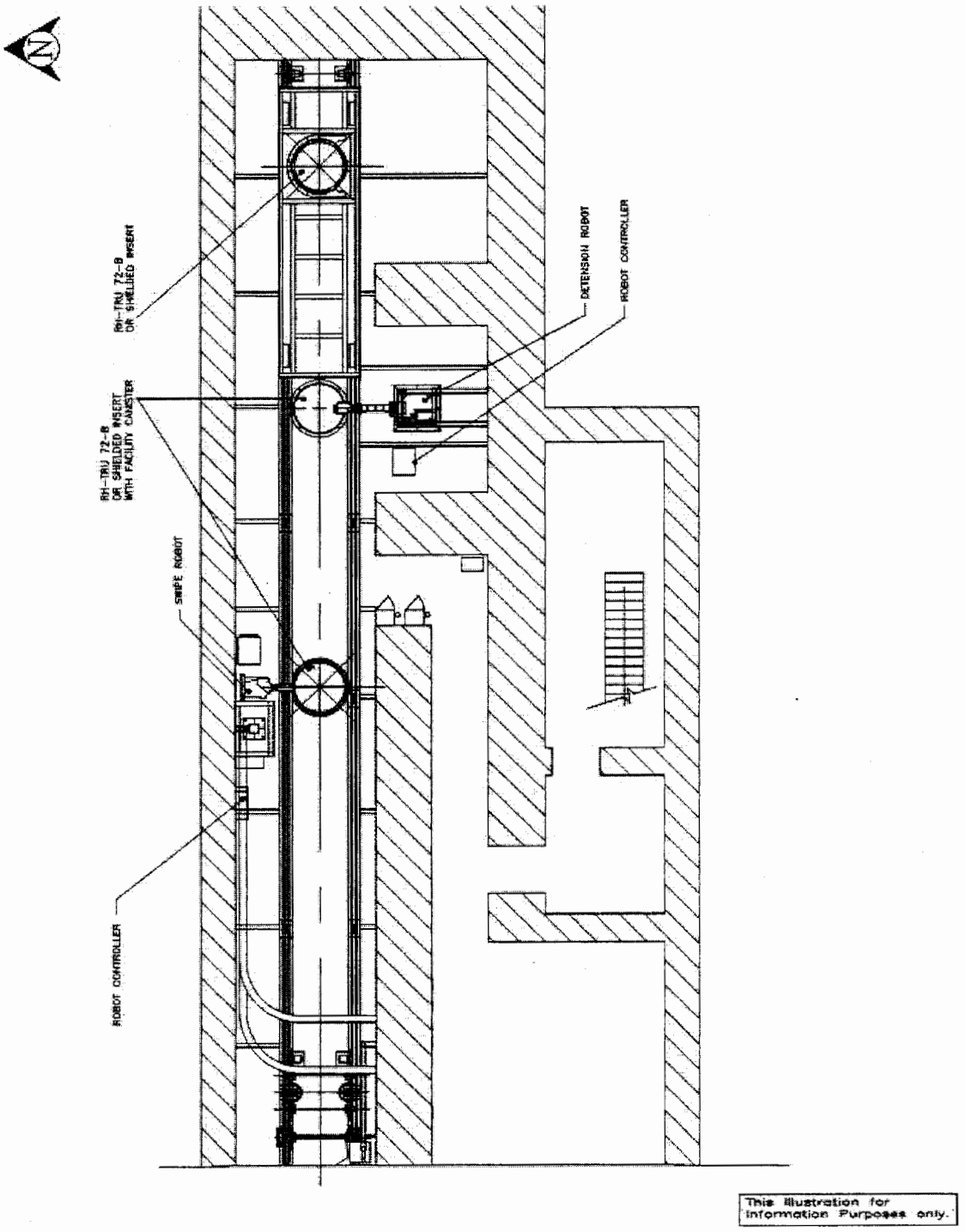

Figure A1-17c
RH Canister Transfer Cell Storage Area

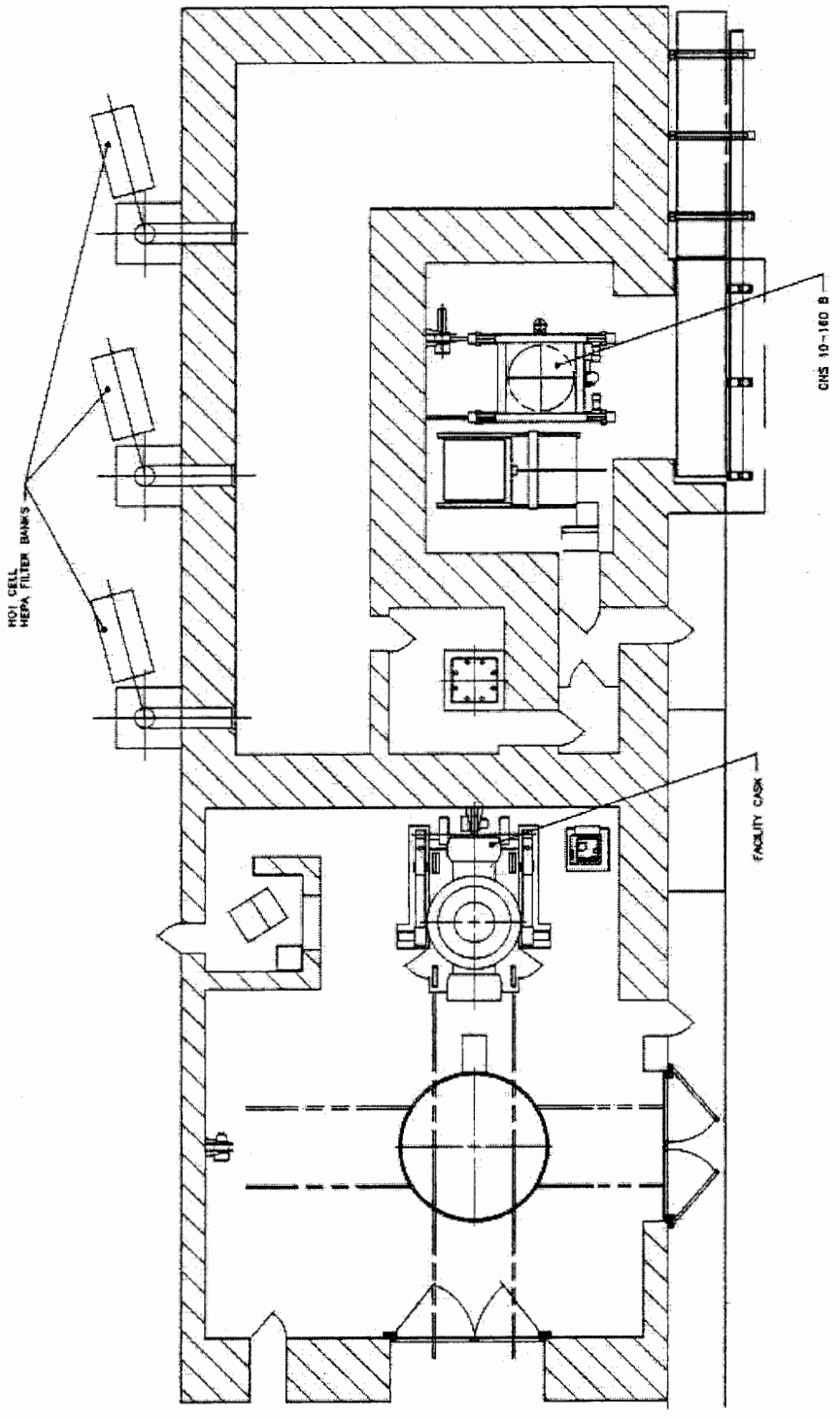

Figure A1-17d
RH Facility Cask Loading Room Storage Area

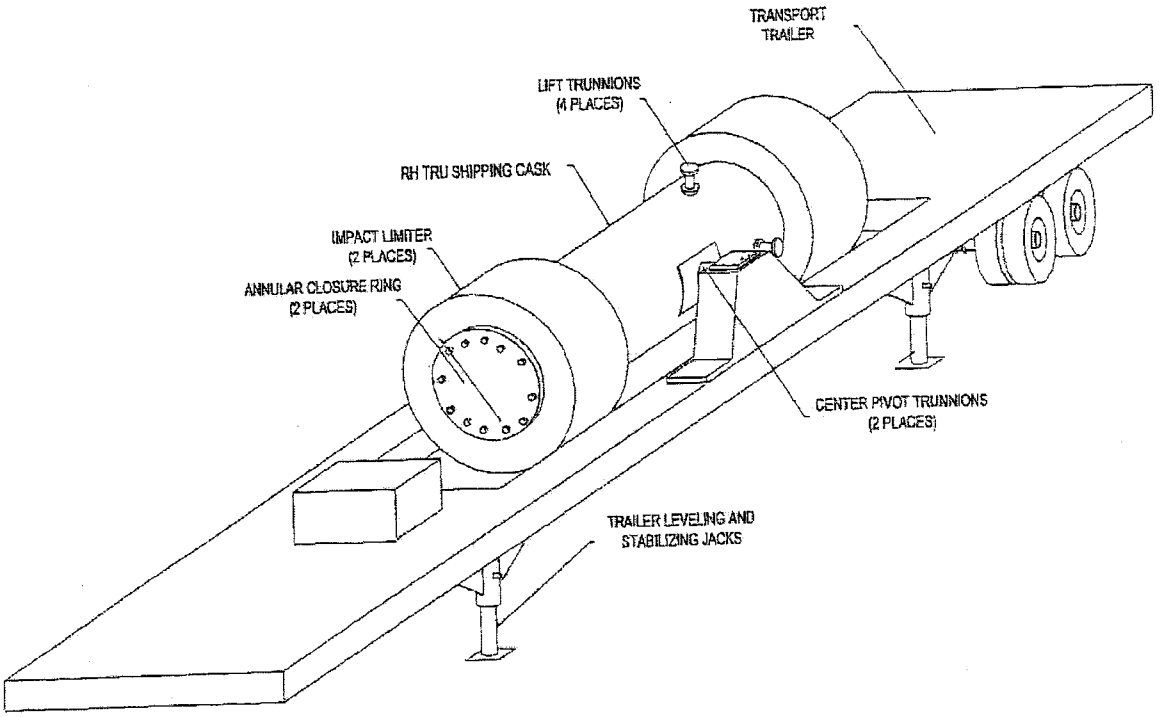

Figure A1-18
RH-TRU 72-B Shipping Cask on Trailer

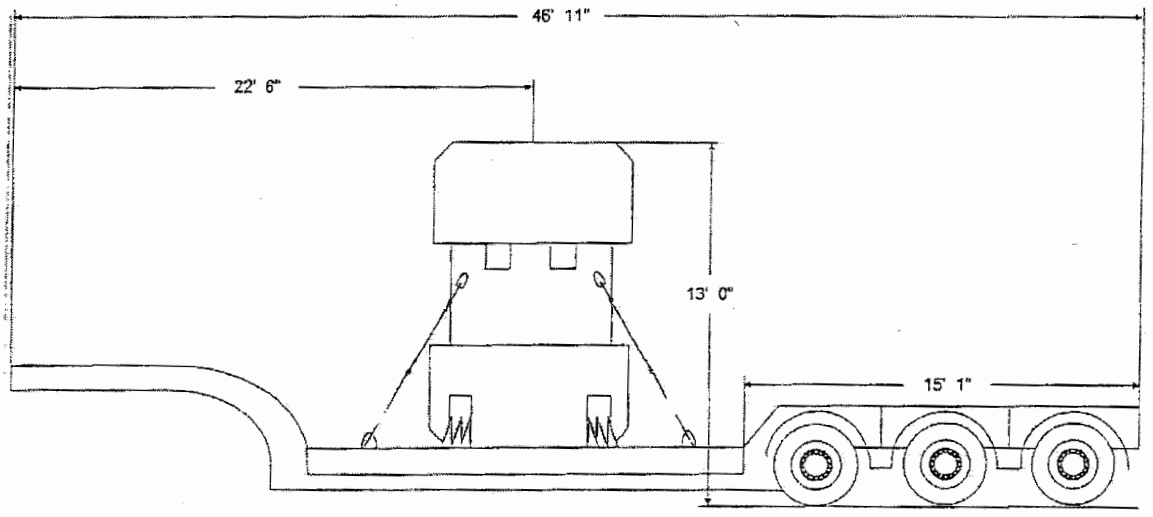

Figure A1-19
CNS 10-160B Shipping Cask on Trailer

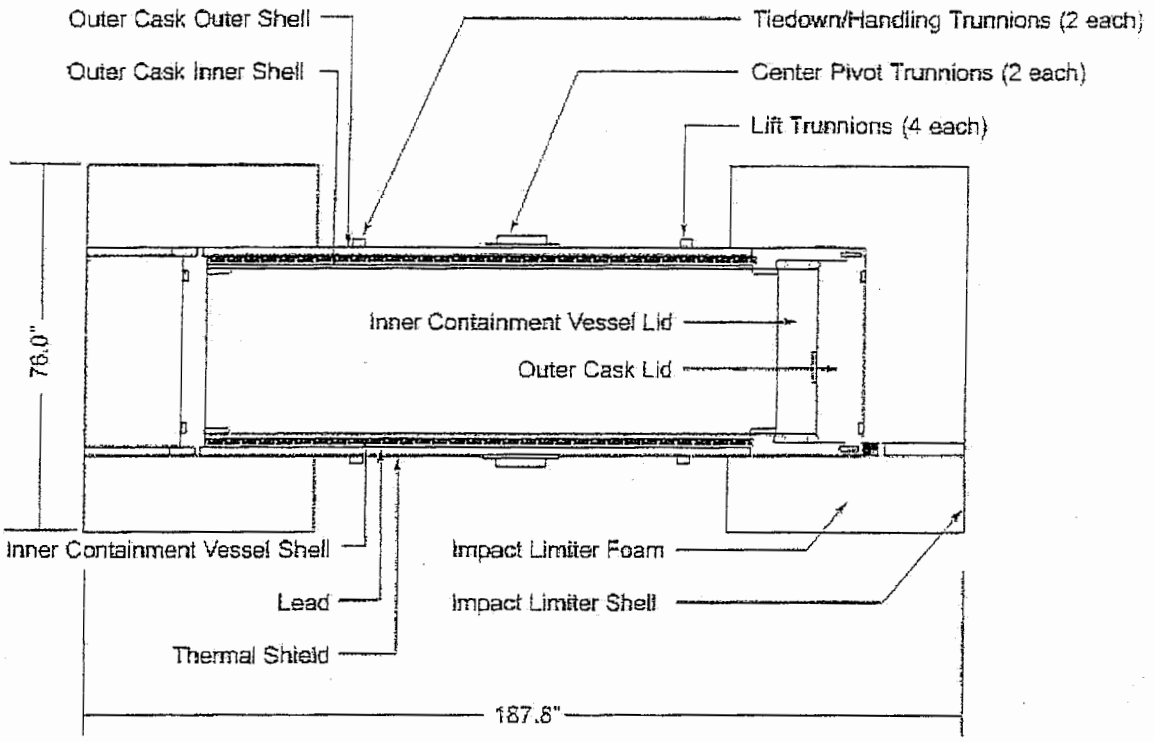

Figure A1-20
RH-TRU 72-B Shipping Cask for RH Transuranic Waste (Schematic)

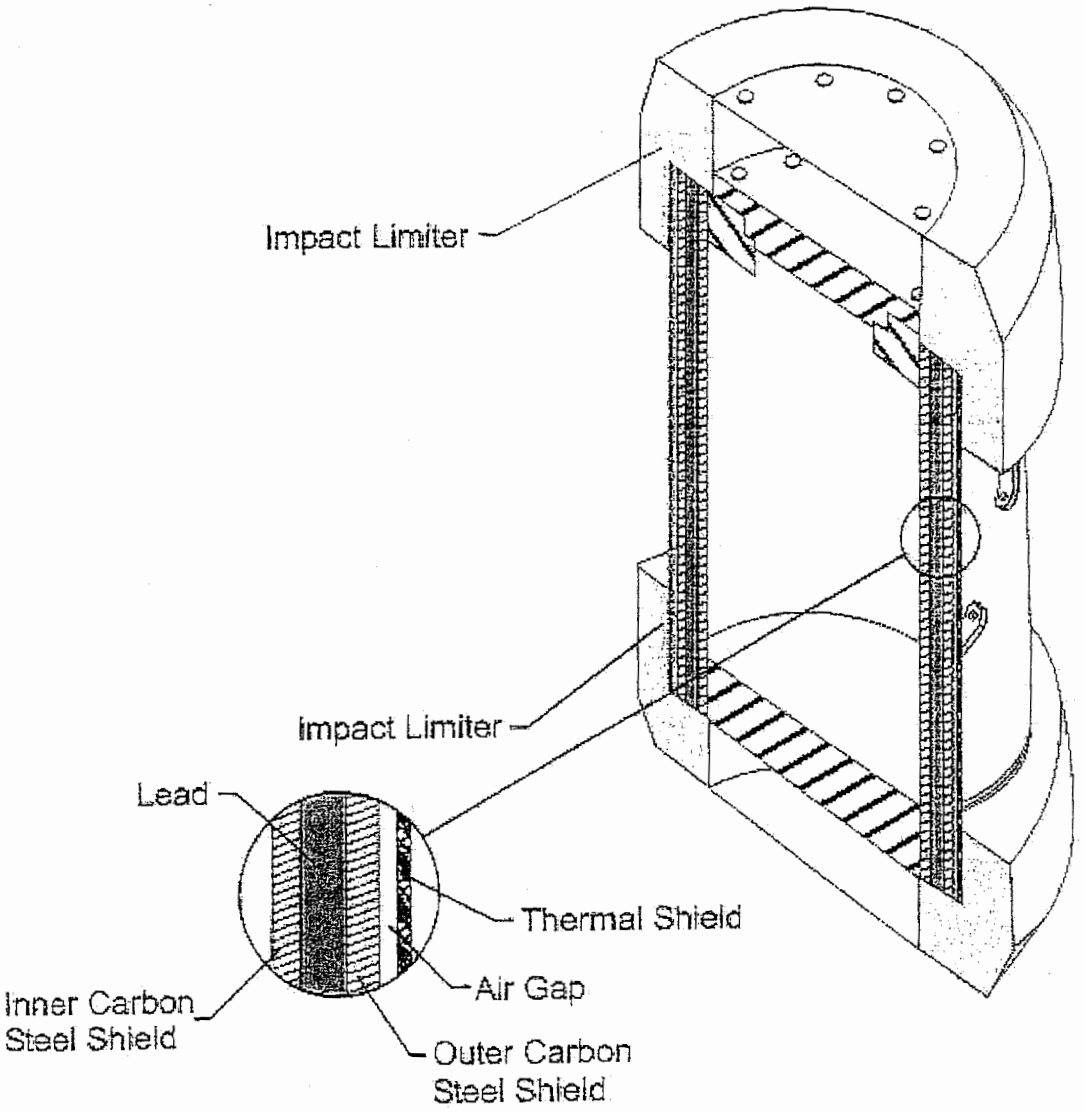

Figure A1-21
CNS 10-160B Shipping Cask for RH Transuranic Waste (Schematic)

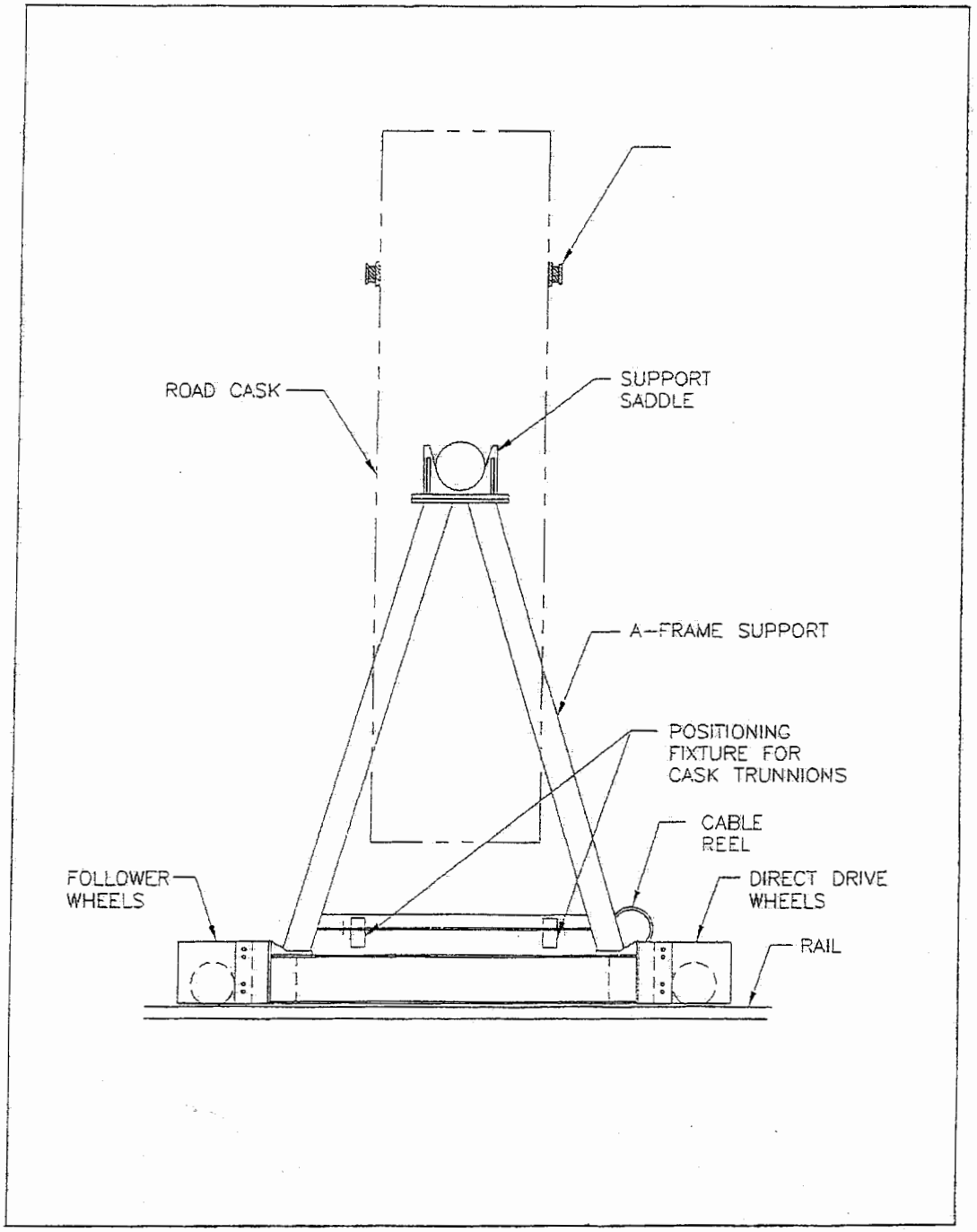

Figure A1-22a
RH-TRU 72-B Cask Transfer Car

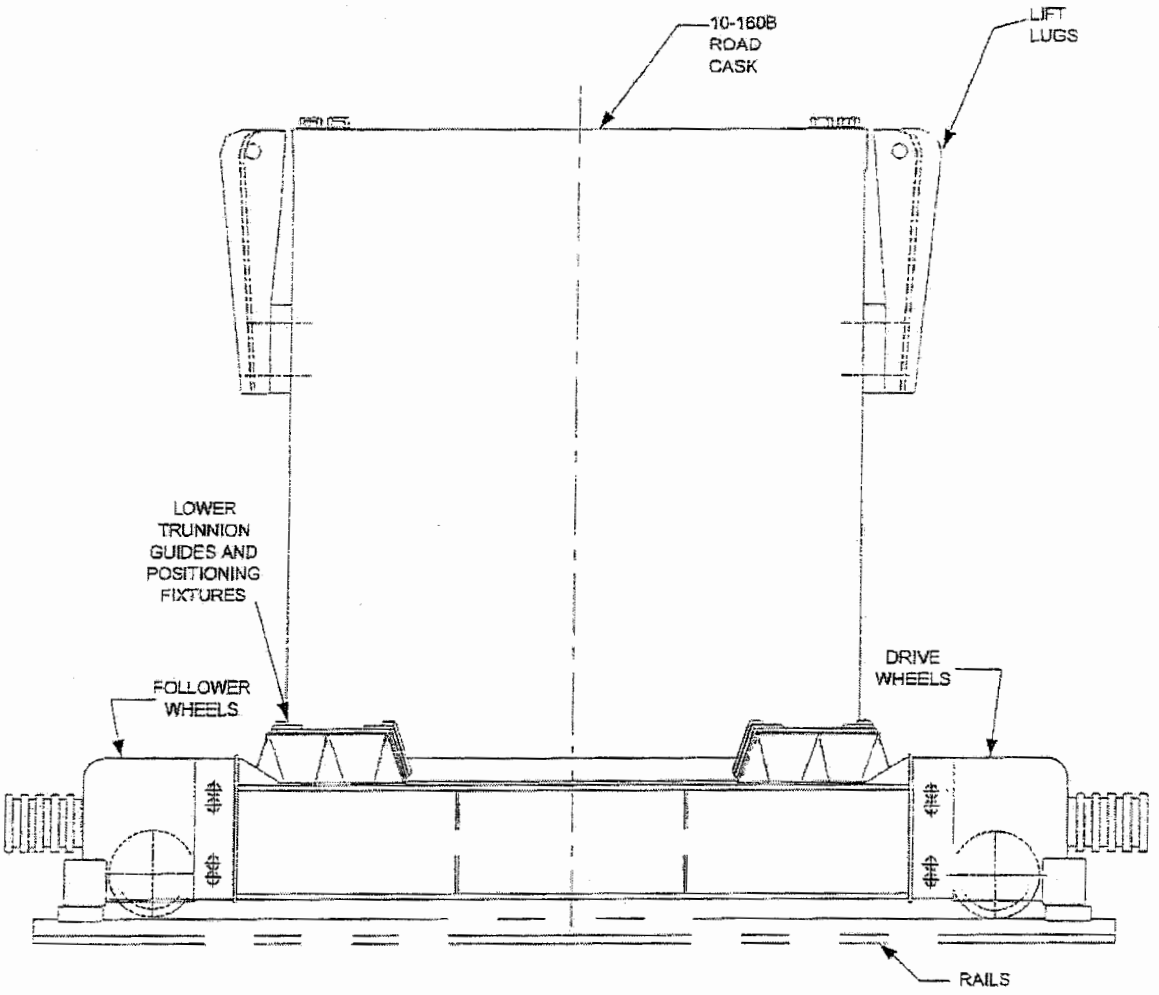

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Figure A1-22b
CNS 10-160B Cask Transfer Car

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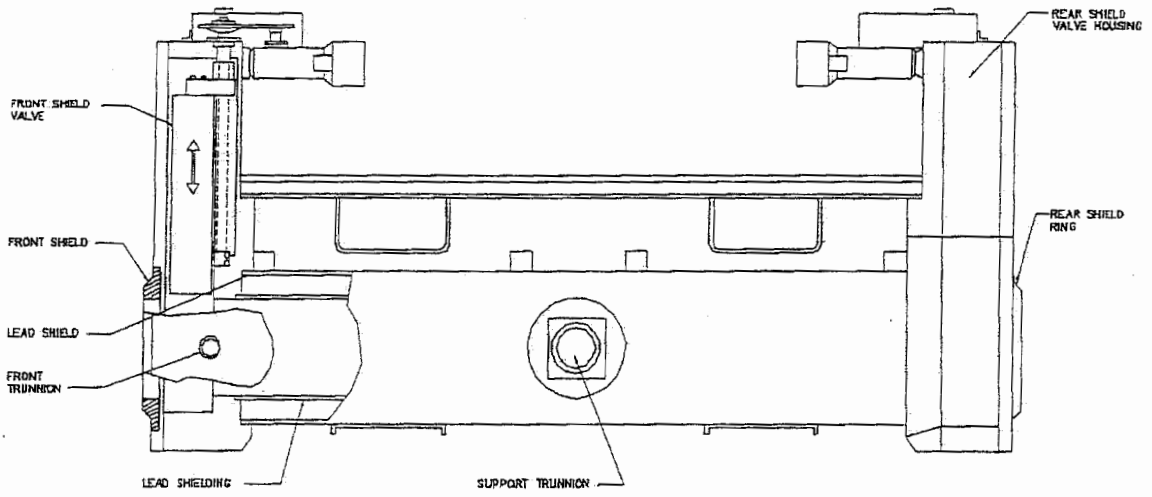


Figure A1-23
RH Transuranic Waste Facility Cask

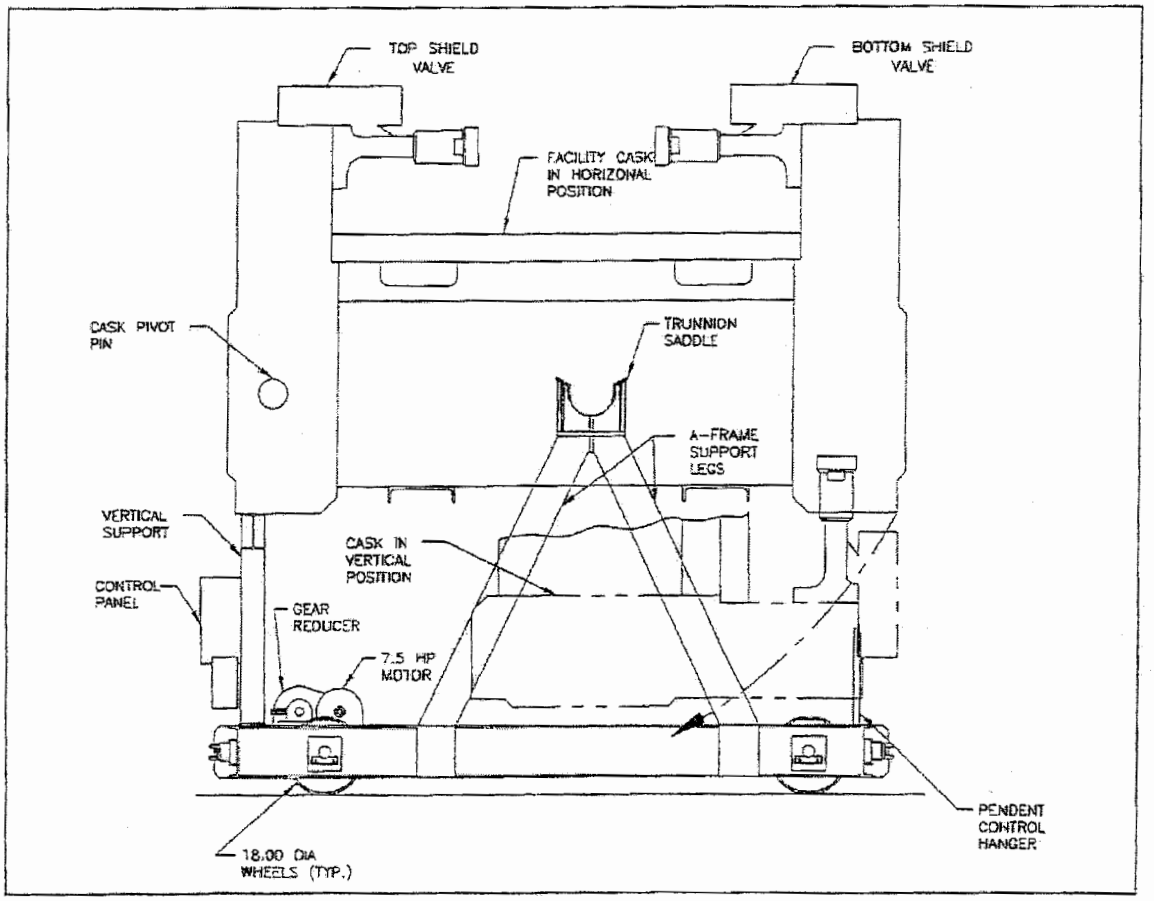


Figure A1-24
RH Facility Cask Transfer Car (Side View)

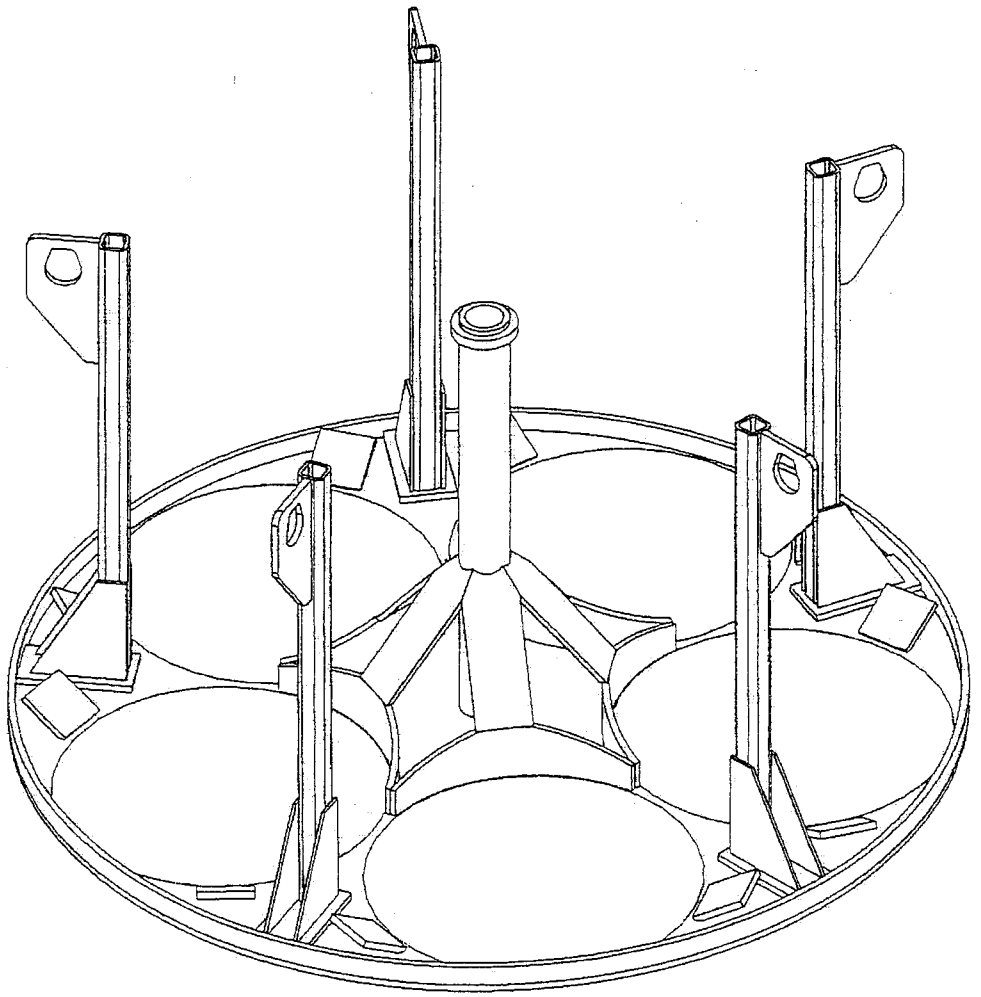


Figure A1-25
CNS 10-160B Drum Carriage

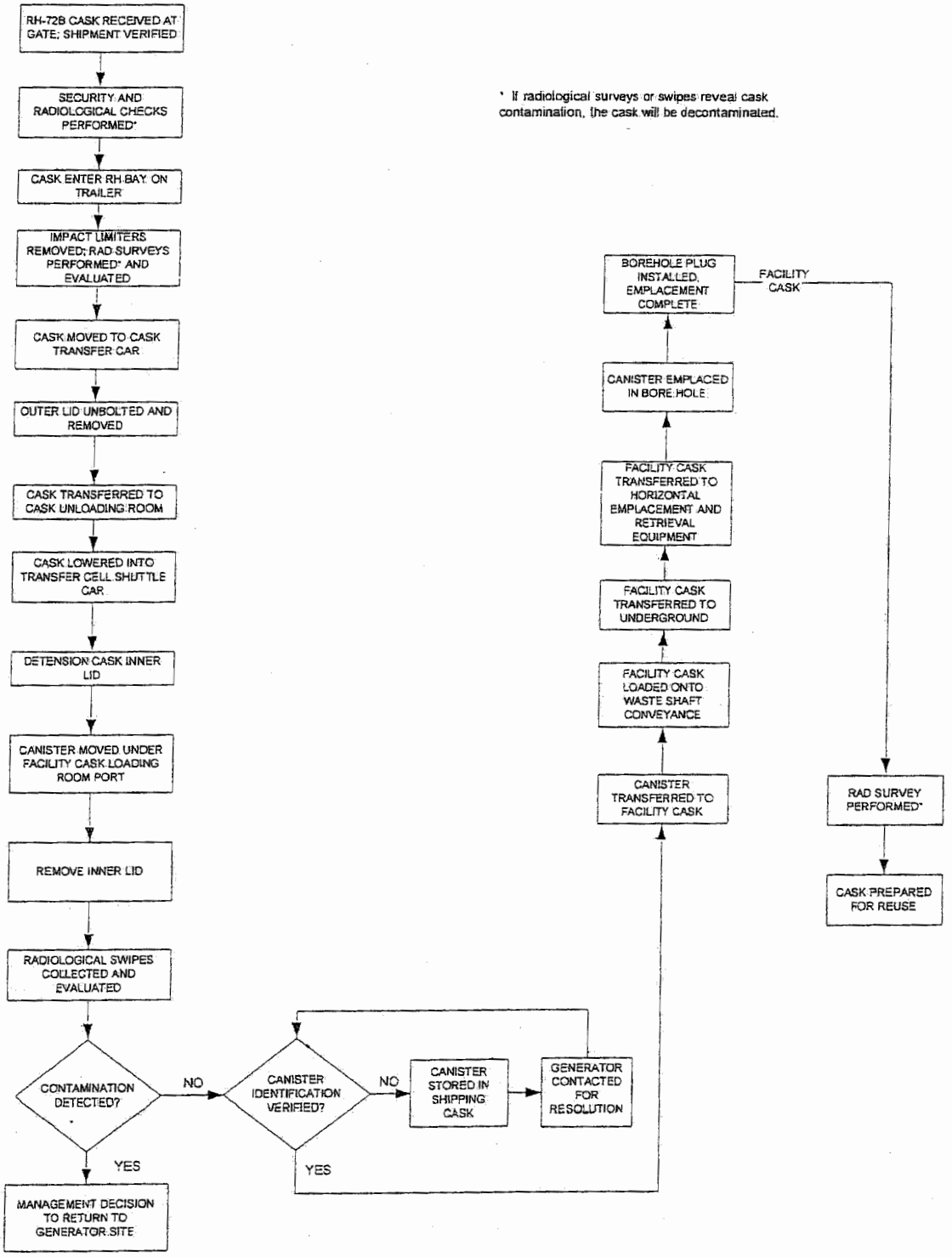


Figure A1-26
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for RH-TRU 72-B Shipping Cask

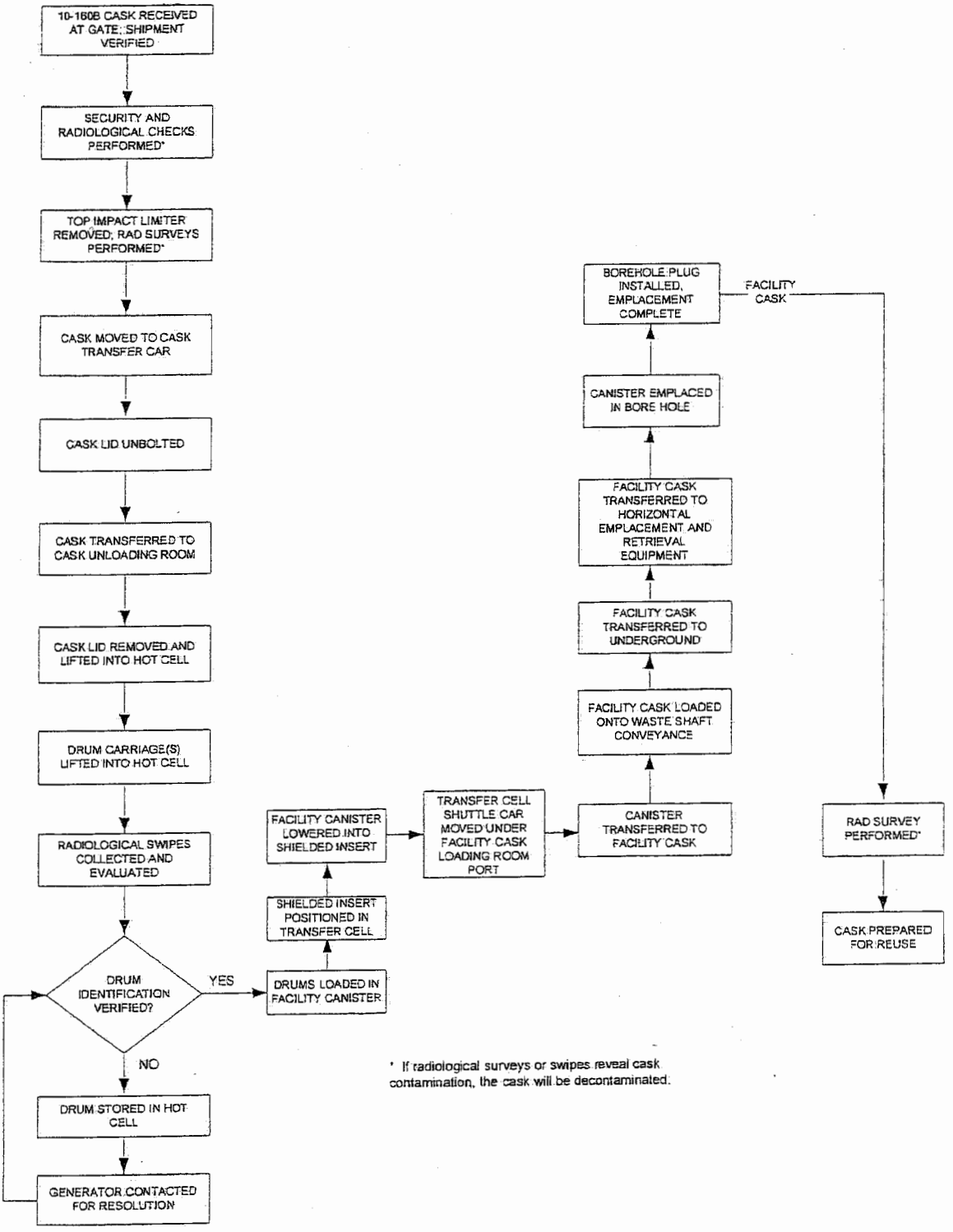


Figure A1-27
Surface and Underground RH Transuranic Mixed Waste Process Flow Diagram for CNS 10-160B Shipping Cask

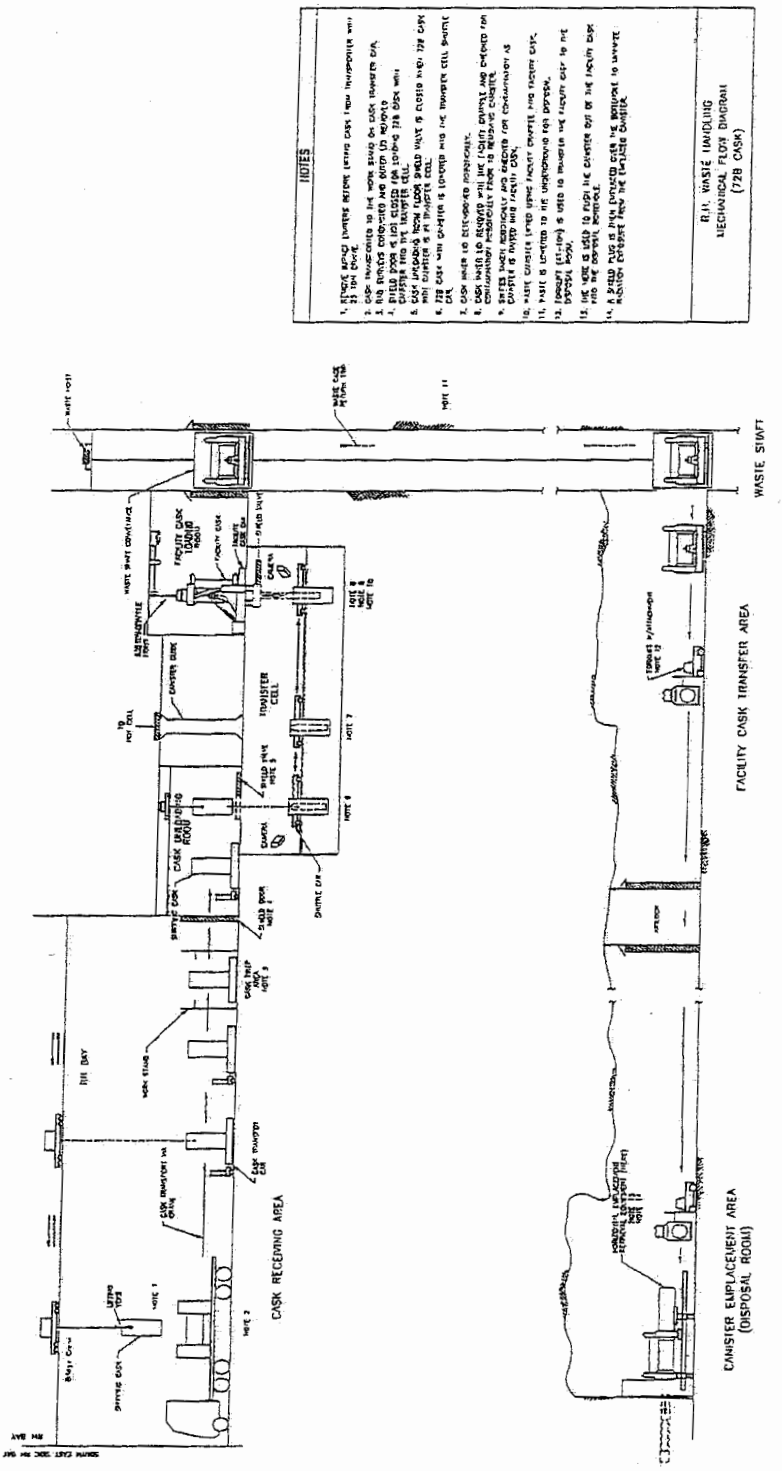


Figure A1-28
Schematic of the RH Transuranic Mixed Waste Process for RH-TRU 72-B Shipping Cask

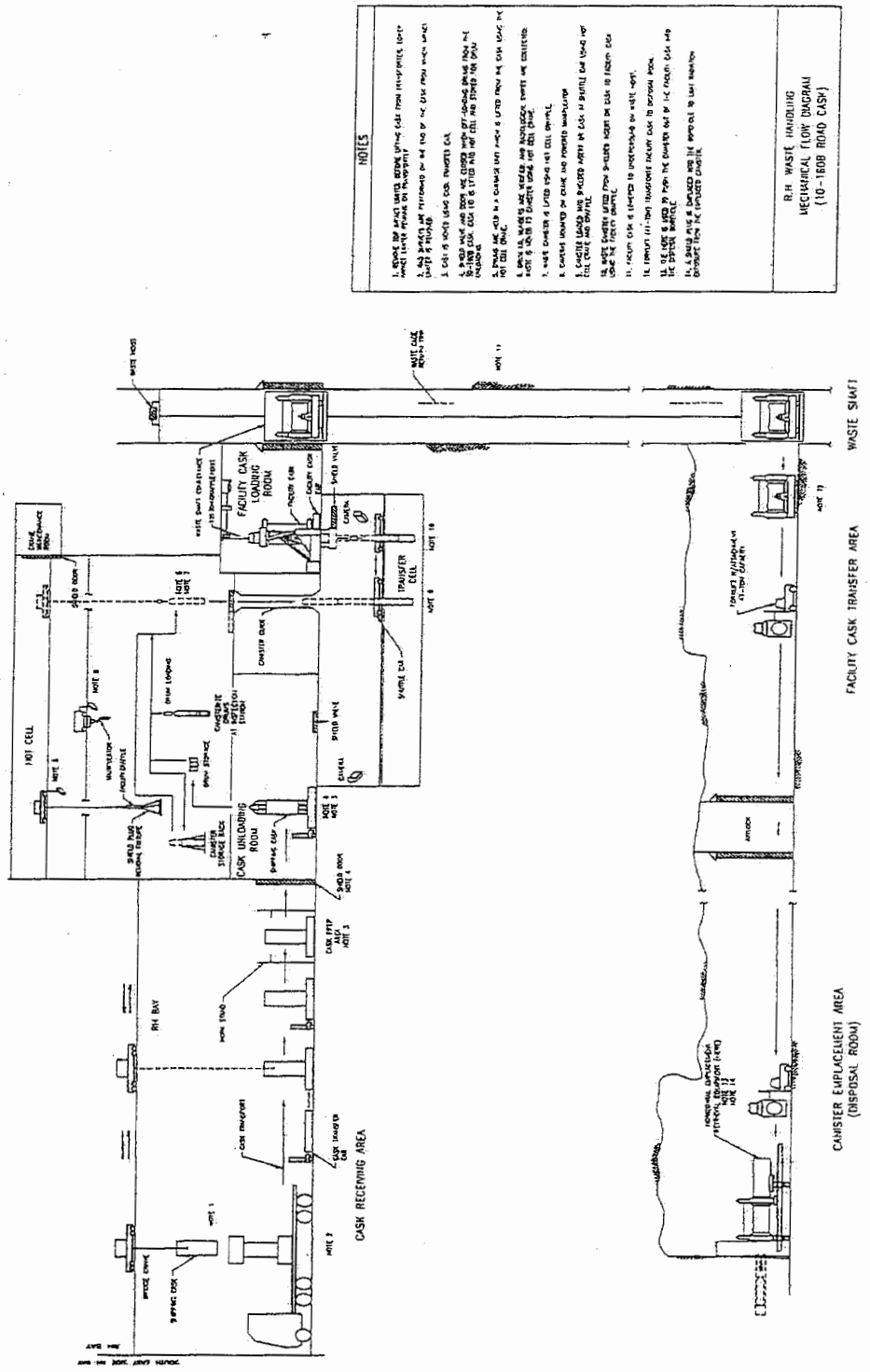


Figure A1-29
Schematic of the RH Transuranic Mixed Waste Process for CNS 10-160B Shipping Cask

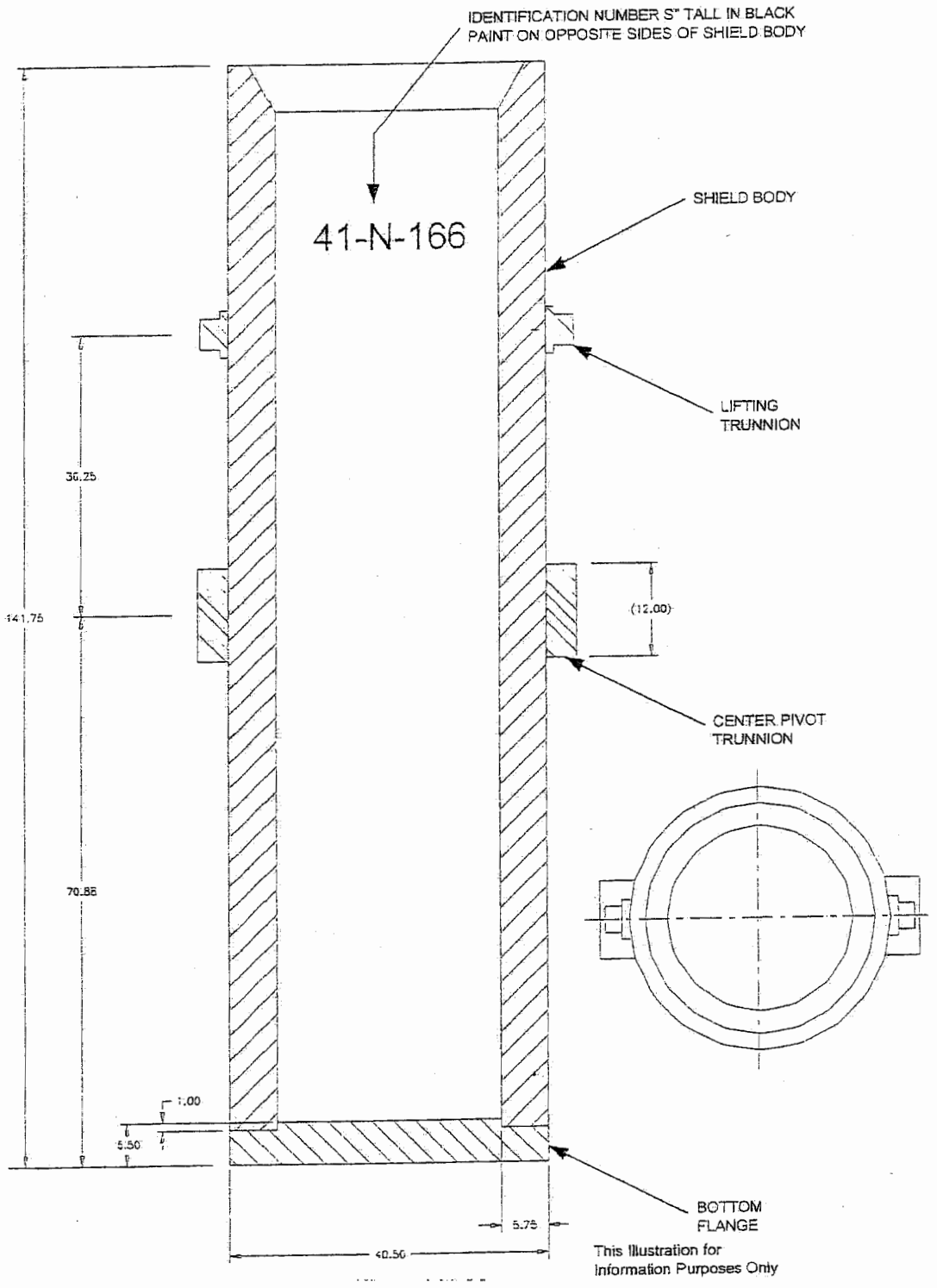


Figure A1-30
RH Shielded Insert Assembly

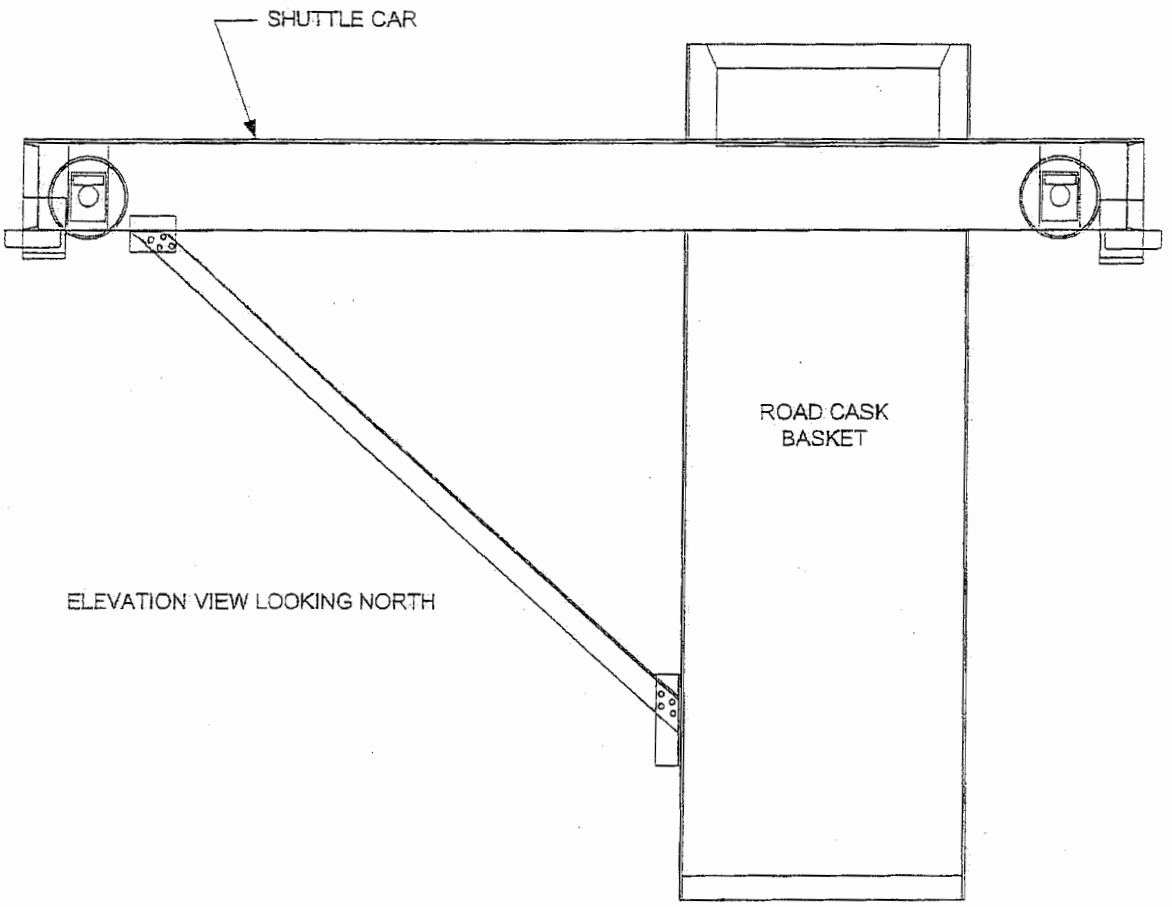
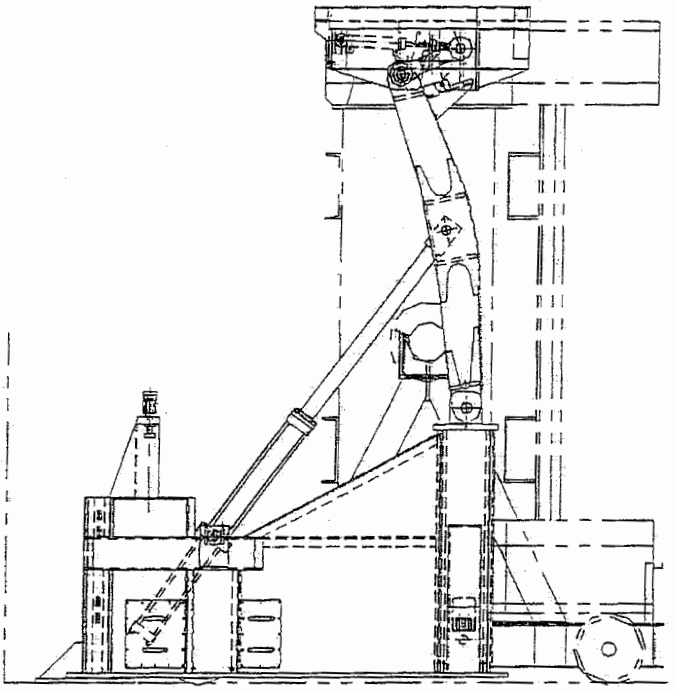
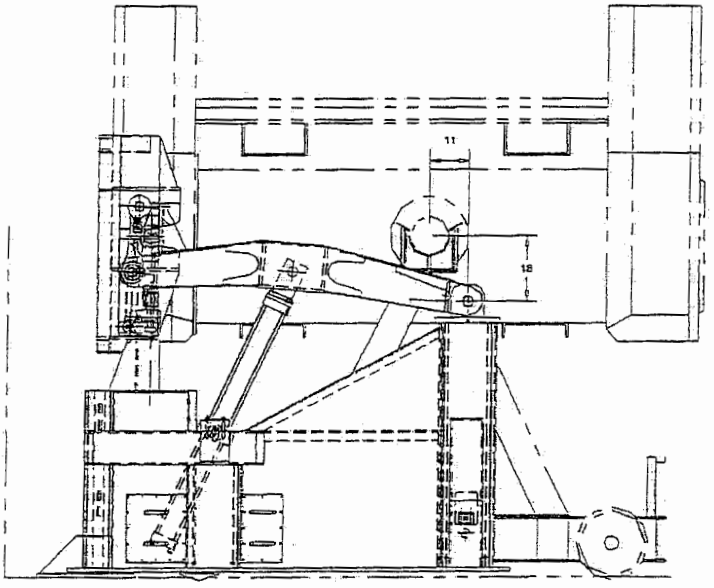


Figure A1-31
Transfer Cell Shuttle Car



FRONT ELEVATION
CASK VERTICAL



FRONT ELEVATION
CASK HORIZONTAL

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Figure A1-32
Facility Rotating Device

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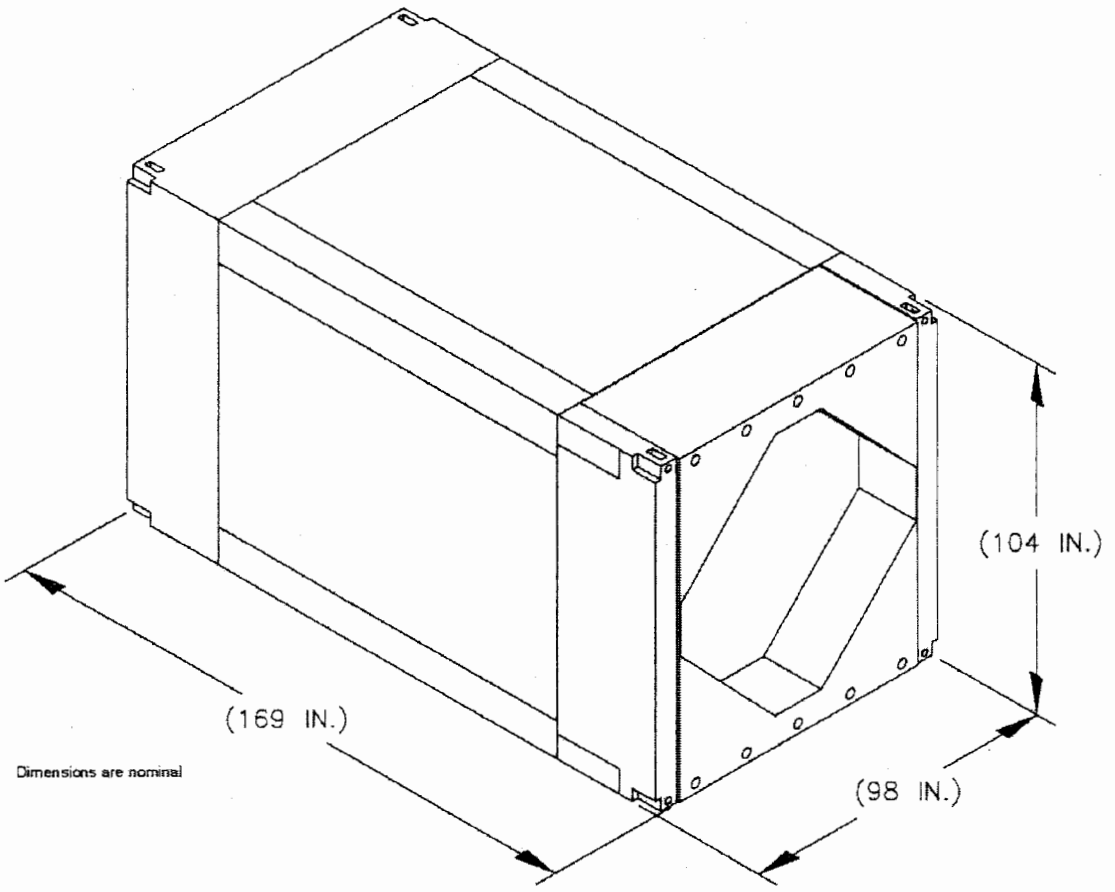

Figure A1-33
Typical TRUPACT-III

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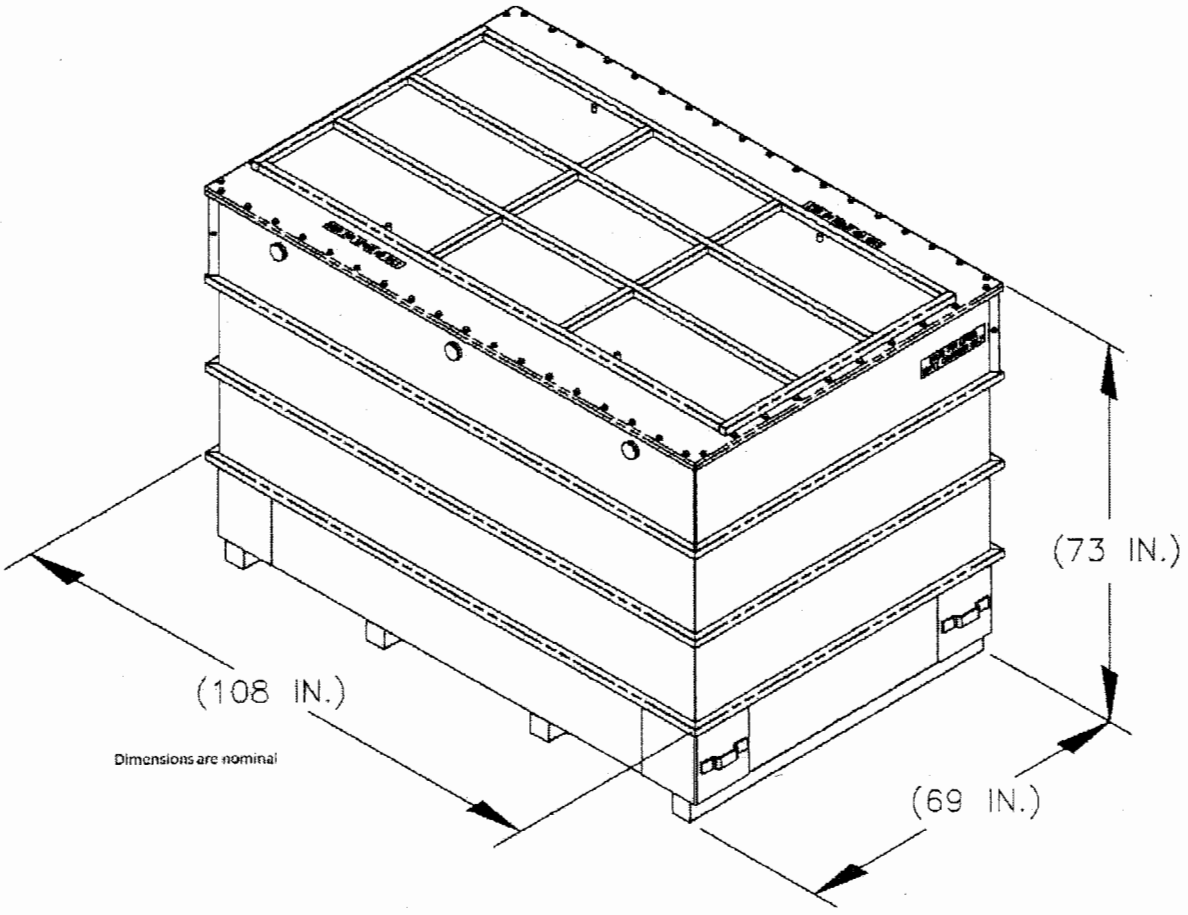

Figure A1-34
Typical Standard Large Box 2

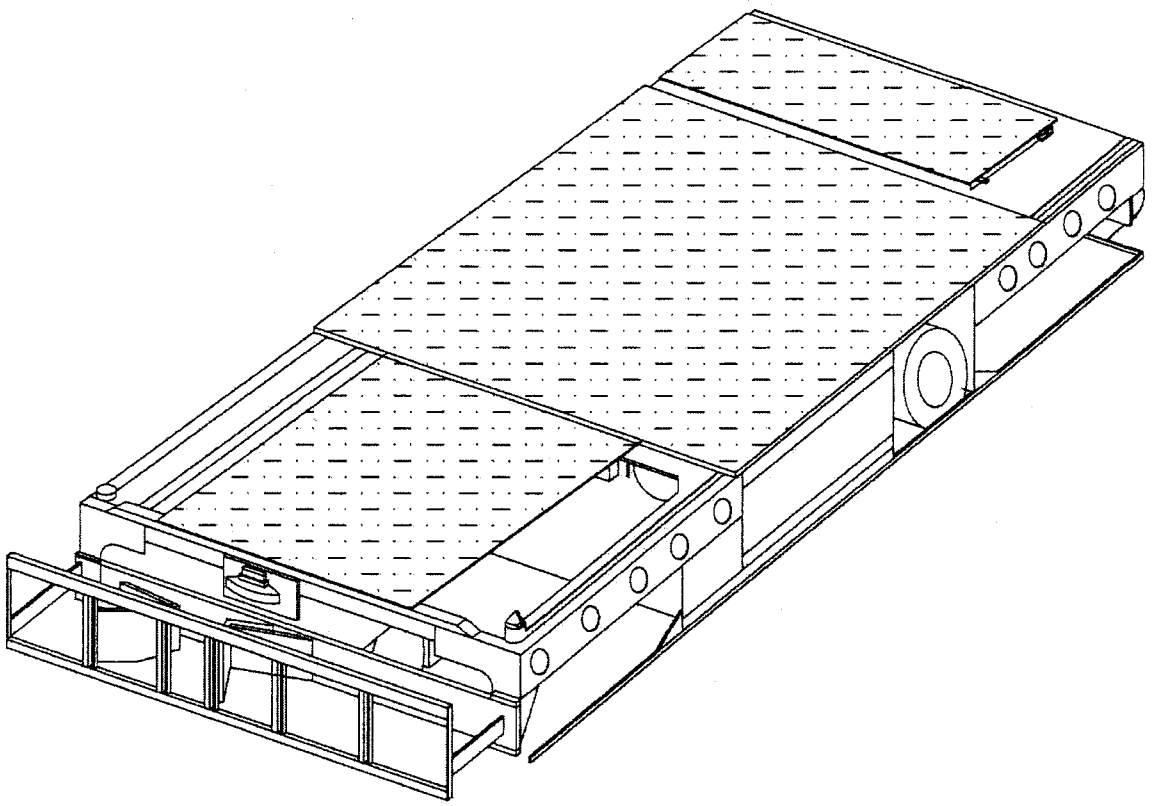

Figure A1-35
Typical Yard Transfer Vehicle

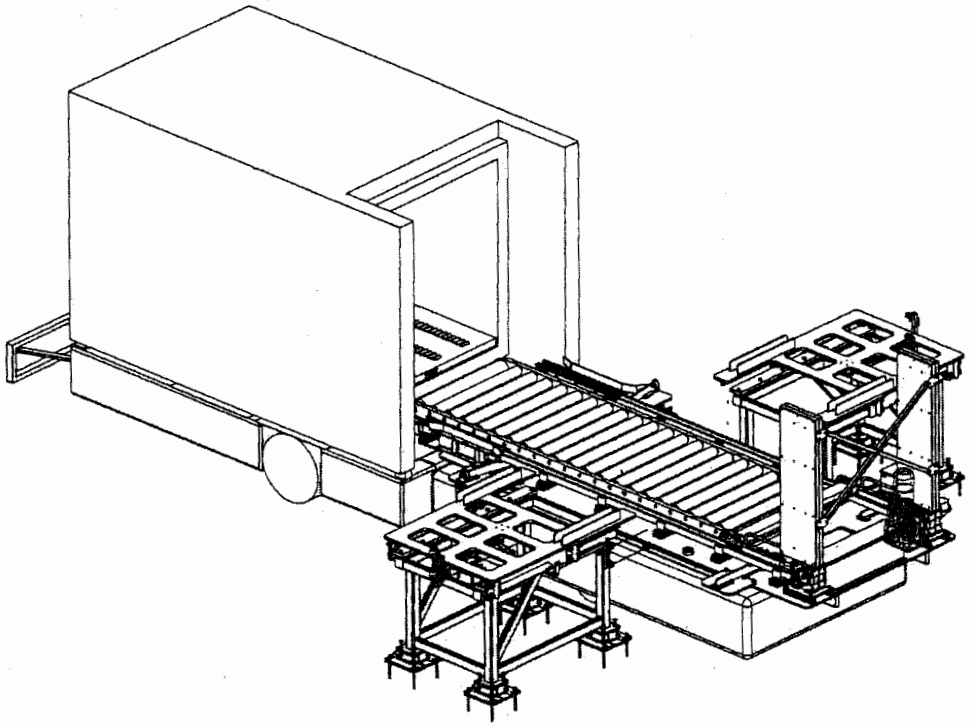

Figure A1-36
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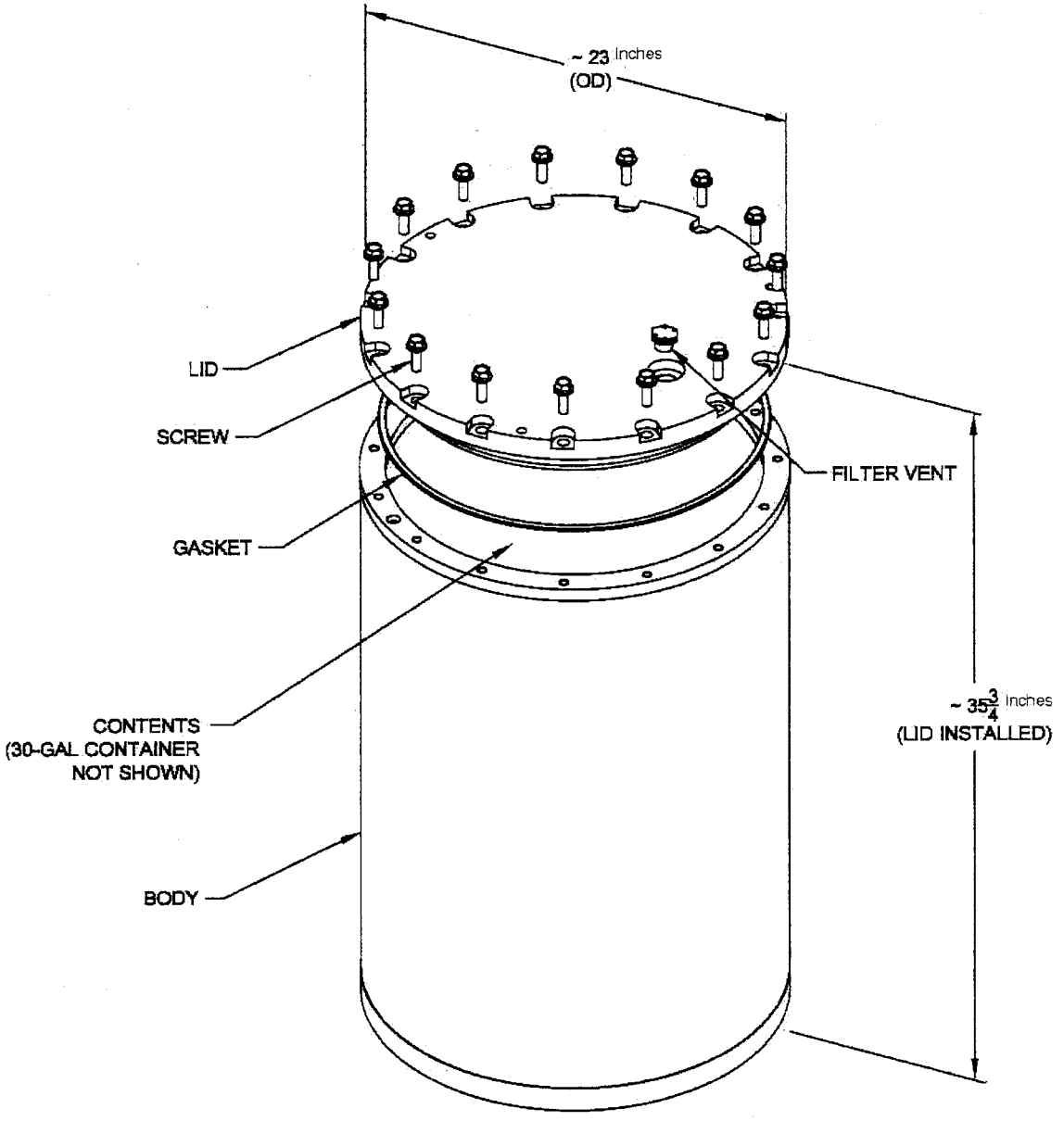

Figure A1-37
Typical Shielded Container

ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

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ATTACHMENT A2

GEOLOGIC REPOSITORY

A2-1 Description of the Geologic Repository

Management, storage, and disposal of transuranic (**TRU**) mixed waste in the Waste Isolation Pilot Plant (**WIPP**) geologic repository is subject to regulation under 20.4.1.500 NMAC. The WIPP is a geologic repository mined within a bedded salt formation, which is defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10) as a miscellaneous unit. As such, HWMUs within the repository are eligible for permitting according to 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and are regulated under 20.4.1.500 NMAC, Miscellaneous Units.

As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the Underground Hazardous Waste Disposal Units (**HWDUs**) in the geologic repository, will be met.

The Disposal Phase will consist of receiving contact-handled (**CH**) and remote-handled (**RH**) TRU mixed waste shipping containers, unloading and transporting the waste containers to the Underground HWDUs, emplacing the waste in the Underground HWDUs, and subsequently achieving closure of the Underground HWDUs in compliance with applicable State and Federal regulations.

The WIPP geologic repository is mined within a 2,000-feet (ft) (610-meters (m))-thick bedded-salt formation called the Salado Formation. The Underground HWDUs (miscellaneous units) are located 2,150 ft (655 m) beneath the ground surface. TRU mixed waste management activities underground will be confined to the southern portion of the 120-acre (48.6 hectares) mined area during the Disposal Phase. During the term of this Permit, disposal of TRU mixed waste will occur only in the HWDUs designated as Panels 5 through 8 and in any currently active panel (See Figure A2-1). RH TRU mixed waste disposal began in Panel 4. The Permittees may also request in the future a Permit to allow disposal of containers of TRU mixed waste in the areas designated as Panels 9 and 10 in Figure A2-1. This Permit, during its 10-year term, authorizes the excavation of Panels 6 through 10 and the disposal of waste in Panels 1 through 8.

Panels 1 through 8 will consist of seven rooms and two access drifts each. Panels 9 and 10 have yet to be designed. Access drifts connect the rooms and have the same cross section (see Section A2-2a(3)). The closure system installed in each HWDU after it is filled will prevent anyone from entering the HWDU and will restrict ventilation airflow. The point of compliance for air emissions from the Underground is Sampling Station VOC-A, as defined in Permit Attachment N (Volatile Organic Compound Monitoring Plan). Sampling Station VOC-A is the location where the concentration of volatile organic compounds (VOCs) in the air emissions from the Underground HWDUs will be measured and then compared to the VOC concentration of concern as required by Permit Part 4.

Four shafts connect the underground area with the surface. The Waste Shaft Conveyance headframe and hoist are located within the Waste Handling Building (**WHB**) and will be used to transport containers of TRU mixed waste, equipment, and materials to the repository horizon. The waste hoist can also be used to transport personnel. The Air Intake Shaft and the Salt Handling Shaft provide ventilation to all areas of the mine except for the Waste Shaft Station.

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This area is ventilated by the Waste Shaft itself. The Salt Handling Shaft is also used to hoist mined salt to the surface and serves as the principal personnel transport shaft. The Exhaust Shaft serves as a common exhaust air duct for all areas of the mine. The relationship between the WIPP surface facility, the four shafts, and the geologic repository horizon is shown on Figure A2-2.

The HWDUs identified as Panels 1 through 8 (Figure A2-1) provide room for up to 5,244,900 cubic feet (ft^3) (148,500 cubic meters (m^3)) of CH TRU mixed waste. The CH TRU mixed waste containers may be stacked up to three high across the width of the room.

Panels 4 through 8 provide room for up to 93,050 ft^3 (2,635 m^3) of RH TRU mixed waste. RH TRU mixed waste may be disposed of in up to 730 boreholes per panel, subject to the limitations in Permit Part 4, Section 4.1.1.2.ii. These boreholes shall be drilled on nominal eight-foot centers, horizontally, about mid-height in the ribs of a disposal room. The thermal loading from RH TRU mixed waste shall not exceed 10 kilowatts per acre when averaged over the area of a panel, as shown in Permit Attachment A3, plus 100 feet of each of a Panel's adjoining barrier pillars.

The WIPP facility is located in a sparsely populated area with site conditions favorable to isolation of TRU mixed waste from the biosphere. Geologic and hydrologic characteristics of the site related to its TRU mixed waste isolation capabilities are discussed in Addendum L1 of the WIPP Hazardous Waste Facility Permit Amended Renewal Application (DOE, 2009). Hazard prevention programs are described in this Permit Attachment. Contingency and emergency response actions to minimize impacts of unanticipated events, such as spills, are described in Permit Attachment D. The closure plan for the WIPP facility is described in Permit Attachment G.

A2-2 Geologic Repository Design and Process Description

A2-2a Geologic Repository Design and Construction

The WIPP facility, when operated in compliance with the Permit, will ensure safe operations and be protective of human health and the environment.

As a part of the design validation process, geomechanical tests were conducted in SPDV test rooms. During the tests, salt creep rates were measured. Separation of bedding planes and fracturing were also observed. Consequently, a ground-control strategy was implemented. The ground-control program at the WIPP facility mitigates the potential for roof or rib falls and maintains normal excavation dimensions, as long as access to the excavation is possible.

A2-2a(1) CH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage CH TRU waste in the geologic repository. A summary of equipment capacities, as required by 20.4.1.500 NMAC is included in Table A2-1.

Facility Pallets

The facility pallet is a fabricated steel unit designed to support 7-packs, 3-packs, or 4-packs of drums, standard waste boxes (**SWBs**), ten-drum overpacks (**TDOPs**), or a standard large box 2

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(**SLB2**), and has a rated load of 25,000 pounds (lbs.) (11,430 kilograms (kg)). The facility pallet will accommodate up to four 7-packs, four 3-packs, two 3-packs of shielded containers, four 4-packs of drums, four SWBs (in two stacks of two units), two TDOPs, or one SLB2. Loads are secured to the facility pallet during transport to the emplacement area. Facility pallets are shown in Figure A2-3. Fork pockets in the side of the pallet allow the facility pallet to be lifted and transferred by forklift to prevent direct contact between TRU mixed waste containers and forklift tines. This arrangement reduces the potential for puncture accidents. WIPP facility operational documents define the operational load of the facility pallet to ensure that the rated load of a facility pallet is not exceeded.

Backfill

Magnesium oxide (**MgO**) will be used as a backfill in order to provide chemical control over the solubility of radionuclides in order to comply with the requirements of 40 CFR §191.13. The MgO backfill will be purchased prepackaged in the proper containers for emplacement in the underground. Purchasing prepackaged backfill eliminates handling and placement problems associated with bulk materials, such as dust creation. In addition, prepackaged materials will be easier to emplace, thus reducing potential worker exposure to radiation. Should a backfill container be breached, MgO is benign and cleanup is simple. No hazardous waste would result from a spill of backfill.

The MgO backfill will be managed in accordance with Specification D-0101 (MgO Backfill Specification) and WP05-WH1025 (CH Waste Downloading and Emplacement). These documents are kept on file at the WIPP facility by the Permittees.

Backfill will be handled in accordance with standard operating procedures. Typical emplacement configurations are shown in Figures A2-5 and A2-5a. Some emplacement configurations may include the use of MgO emplacement racks, as shown in Figure A2-5a.

Quality control will be provided within standard operating procedures to record that the correct number of sacks are placed and that the condition of the sacks is acceptable.

Backfill placed in this manner is protected until exposed when sacks are broken during creep closure of the room and compaction of the backfill and waste. Backfill in sacks utilizes existing techniques and equipment and eliminates operational problems such as dust creation and introducing additional equipment and operations into waste handling areas. There are no mine operational considerations (e.g. ventilation flow and control) when backfill is placed in this manner.

The Waste Shaft Conveyance

The hoist systems in the shafts and all shaft furnishings are designed to resist the dynamic forces of the hoisting system and to withstand a design-basis earthquake of 0.1 g. Appendix D2 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided engineering design-basis earthquake report which provides the basis for seismic design of WIPP facility structures. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system (such as overtravel, overspeed, power loss, circuitry failure, or starting in a wrong direction) and will trigger an alarm that automatically shuts down the hoist.

The waste hoist moves the Waste Shaft Conveyance and is a multirope, friction-type hoist. A counterweight is used to balance the waste shaft conveyance. The waste shaft conveyance (outside dimensions) is 30 ft (9 m) high by 10 ft (3 m) wide by 15 ft (4.5 m) deep and can carry a payload of 45 tons (40,824 kg). During loading and unloading operations, it is steadied by fixed guides. The hoist's maximum rope speed is 500 ft (152.4 m) per min.

The Waste Shaft hoist system has two sets of brakes, with two units per set, plus a motor that is normally used to stop the hoist. The brakes are designed so that either set, acting alone, can stop a fully loaded conveyance under all emergency conditions.

The Underground Waste Transporter

The underground waste transporter is a commercially available diesel-powered tractor. The trailer was designed specifically for the WIPP for transporting facility pallets from the waste shaft conveyance to the Underground HWDU in use. This transporter is shown in Figure A2-6.

Underground Forklifts

CH TRU mixed waste containers loaded on slipsheets will be removed from the facility pallets using forklifts with a push-pull attachment (Figure A2-7) attached to the forklift-truck front carriage. The push-pull attachment grips the edge of the slipsheet (on which the waste containers sit) to pull the containers onto the platen. After the forklift moves the waste containers to the emplacement location, the push-pull attachment pushes the containers into position. The use of the push-pull attachment prevents direct contact between waste containers and forklift tines. SWBs and TDOPs may also be removed from the facility pallet by using forklifts equipped with special adapters for these containers. These special adapters will prevent direct contact between SWBs or TDOPs and forklift tines. In addition, the low clearance forklift that is used to emplace MgO may be used to emplace waste if necessary.

A forklift will be used to offload the SLB2 from the underground transporter and emplace the waste container in the waste stack.

A2-2a(2) Shafts

The WIPP facility uses four shafts: the Waste Shaft, the Salt Handling Shaft, the Air Intake Shaft, and the Exhaust Shaft. These shafts are vertical openings that extend from the surface to the repository level.

The Waste Shaft is located beneath the WHB and is 19 to 20 ft (5.8 to 6.1 m) in diameter. The Salt Handling Shaft, located north of the Waste Shaft beneath the salt handling headframe, is 10 to 12 ft (3 to 3.6 m) in diameter. Salt mined from the repository horizon is removed through the Salt Handling Shaft. The Salt Handling Shaft is the main personnel and materials hoist and also serves as a secondary-supply air duct for the underground areas. The Air Intake Shaft, northwest of the WHB, varies in diameter from 16 ft 7 in. (4.51 m) to 20 ft 3 in. (6.19 m) and is the primary source of fresh air underground. The Exhaust Shaft, east of the WHB, is 14 to 15 ft (4.3 to 4.6 m) in diameter and serves as the exhaust duct for the underground air.

Openings excavated in salt experience closure because of salt creep (or time-dependent deformation at constant load). The closure affects the design of all of the openings discussed in this section. Underground excavation dimensions, therefore, are nominal, because they change

with time. The unlined portions of the shafts have larger diameters than the lined portions, which allows for closure caused by salt creep. Each shaft includes a shaft collar, a shaft lining, and a shaft key section. The Final Design Validation Report in Appendix D1 of the WIPP RCRA Part B Permit Application (DOE, 1997) discusses the shafts and shaft components in greater detail.

The reinforced-concrete shaft collars extend from the surface to the top of the underlying consolidated sediments. Each collar serves to retain adjacent unconsolidated sands and soils and to prevent surface runoff from entering the shafts. The shaft linings extend from the base of the collar to the top of the salt beds approximately 850 ft (259 m) below the surface. Grout injected behind the shaft lining retards water seeping into the shafts from water-bearing formations, and the liner is designed to withstand the natural water pressure associated with these formations. The shaft liners are concrete, except in the Salt Handling Shaft, where a steel shaft liner has been grouted in place.

The shaft key is a circular reinforced concrete section emplaced in each shaft below the liner in the base of the Rustler and extending about 50 ft (15 m) into the Salado. The key functions to resist lateral pressures and assures that the liner will not separate from the host rocks or fail under tension. This design feature also aids in preventing the shaft from becoming a route for groundwater flow into the underground facility.

On the inside surface of each shaft, excluding the Salt Handling Shaft, there are three water-collection rings: one just below the Magenta, one just below the Culebra, and one at the lowermost part of the key section. These collection rings will collect water that may seep into the shaft through the liner. The Salt Handling Shaft has a single water collection ring in the lower part of the key section. Water collection rings are drained by tubes to the base of the shafts where the water is accumulated.

WIPP shafts and other underground facilities are, for all practical purposes, dry. Minor quantities of water (which accumulate in some shaft sumps) are insufficient to affect the waste disposal area. This water is collected, brought to the surface, and disposed of in accordance with current standards and regulations.

The Waste Shaft is protected from precipitation by the roof of the waste shaft conveyance headframe tower. The Exhaust Shaft is configured at the top with a 14 ft- (4.3 m-) diameter duct that diverts air into the exhaust filtration system or to the atmosphere, as appropriate. The Salt Handling and Air Intake Shaft collars are open except for the headframes. Rainfall into the shafts is evaporated by ventilation air.

The waste hoist system in the Waste Shaft and all Waste Shaft furnishings are designed to resist the dynamic forces of the hoisting system, which are greater than the seismic forces on the underground facilities. In addition the Waste Shaft conveyance headframe is designed to withstand the design-basis earthquake (**DBE**). Maximum operating speed of the hoist is 500 ft (152.4 m) per minute. During loading and unloading operations, the waste hoist is steadied by fixed guides. The waste hoist is equipped with a control system that will detect malfunctions or abnormal operations of the hoist system, such as overtravel, overspeed, power loss, or circuitry failure. The control response is to annunciate the condition and shut the hoist down. Operator response is required to recover from the automatic shutdown. Waste hoist operation is continuously monitored by the CMS. A battery powered FM transmitter/receiver allows communication between the hoist conveyance and the hoist house.

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The waste hoist has two pairs of brake calipers acting on independent brake paths. The hoist motor is normally used for braking action of the hoist. The brakes are used to hold the hoist in position during normal operations and to stop the hoist under emergency conditions. Each pair of brake calipers is capable of holding the hoist in position during normal operating conditions and stopping the hoist under emergency conditions. In the event of power failure, the brakes will set automatically.

The waste hoist is protected by a fixed automatic fire suppression system. Portable fire extinguishers are also provided on the hoist floor and in equipment areas.

A2-2a(3) Subsurface Structures

The subsurface structures in the repository, located at 2,150 ft (655 m) below the surface, include the HWDUs, the northern experimental areas, and the support areas. Appendix D3 of the WIPP RCRA Part B Permit Application (DOE, 1997) provided details of the underground layout. Figure A2-8 shows the proposed waste emplacement configuration for the HWDUs.

The status of important underground equipment, including fixed fire-protection systems, the ventilation system, and contamination detection systems, will be monitored by a central monitoring system, located in the Support Building adjacent to the WHB. Backup power will be provided as discussed below. The subsurface support areas are constructed and maintained to conform to Federal mine safety codes.

Underground Hazardous Waste Disposal Units (HWDUs)

During the terms of this and the preceding Permit, the volume of CH TRU mixed waste emplaced in the repository will not exceed 5,244,900 ft^3 (148,500 m^3) and the volume of RH TRU mixed waste shall not exceed 93,050 ft^3 (2,635 m^3). CH TRU mixed waste will be disposed of in Underground HWDUs identified as Panels 1 through 8. RH TRU mixed waste may be disposed of in Panels 4 through 8.

Main entries and cross cuts in the repository provide access and ventilation to the HWDUs. The main entries link the shaft pillar/service area with the TRU mixed waste management area and are separated by pillars. Each of the Underground HWDUs labeled Panels 1 through 8 will have seven rooms. The locations of these HWDUs are shown in Figure A2-1. The rooms will have nominal dimensions of 13 ft (4.0 m) high by 33 ft (10 m) wide by 300 ft (91 m) long and will be supported by 100 ft- (30 m-) wide pillars.

As currently planned, future Permits may allow disposal of TRU mixed waste containers in two additional panels, identified as Panels 9 and 10. Disposal of TRU mixed waste in Panels 9 and 10 is prohibited under this Permit. If waste volumes disposed of in the eight panels fail to reach the stated design capacity, the Permittees may request a Permit to allow disposal of TRU mixed waste in the four main entries and crosscuts adjacent to the waste panels (referred to as the disposal area access drifts). These areas are labeled Panels 9 and 10 in Figure A2-1. A permit modification or future permit would be submitted describing the condition of those drifts and the controls exercised for personnel safety and environmental protection while disposing of waste in these areas. These areas have the following nominal dimensions:

The E-140 waste transport route south of the Waste Shaft Station is mined to be 25 ft wide nominally and its height ranges from about 14 ft to 20 ft.

The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

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RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room when waste disposal is taking place and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

Air will be routed into a panel from the intake side. Air is routed through the individual rooms within a panel using underground bulkheads and air regulators. Bulkheads are constructed by erecting framing of rectangular steel tubing and screwing galvanized sheet metal to the framing. Bulkhead members use telescoping extensions that are attached to framing and the salt which adjust to creep. Flexible flashing attached to the bulkhead on one side and the salt on the other completes the seal of the ventilation. Where controlled airflow is required, a louver-style damper on a slide-gate (sliding panel) regulator is installed on the bulkhead. Personnel access is available through most bulkheads, and vehicular access is possible through selected bulkheads. Vehicle roll-up doors in the panel areas are not equipped with warning bells or strobe lights since these doors are to be used for limited periodic maintenance activities in the return air path. Flow is also controlled using brattice cloth barricades. These consist of chain link fence that is bolted to the salt and covered with brattice cloth; and are used in instances where the only flow control requirement is to block the air. A brattice cloth air barricade is shown in Figure A2-11. Ventilation will be maintained only in all active rooms within a panel until waste emplacement activities are completed and the panel-closure system is installed. The air will be routed simultaneously through all the active rooms within the panel. The filled rooms will be isolated from the ventilation system, while the active rooms that are actively being filled will receive a minimum of 35,000 SCFM of air when workers are present to assure worker safety. After all rooms within a panel are filled, the panel will be closed using a closure system described Permit Attachment G and Permit Attachment G1.

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

Overall, there are six possible modes of exhaust fan operation:

2 main fans in operation
1 main fan in operation
1 filtration fan in filtered operation
1 filtration fan in unfiltered operation
2 filtration fans in unfiltered operation
1 main and 1 filtration fan (unfiltered) in operation

Under some circumstances (such as power outages and maintenance activities, etc.), all mine ventilation may be discontinued for short periods of time.

In the normal mode, two main surface exhaust fans, located near the Exhaust Shaft, will provide continuous ventilation of the underground areas. All underground flows join at the bottom of the Exhaust Shaft before discharge to the atmosphere.

Outside air will be supplied to the mining areas and the waste disposal areas through the Air Intake Shaft, the Salt Handling Shaft, and access entries. A small quantity of outside air will flow down the Waste Shaft to ventilate the Waste Shaft station. The ventilation system is designed to operate with the Air Intake Shaft as the primary source of fresh air. Under these circumstances, sufficient air will be available to simultaneously conduct all underground operations (e.g., waste handling, mining, experimentation, and support). Ventilation may be supplied by operating fans in the configurations listed in the above description of the ventilation modes.

If the nominal flow of 425,000 cfm (12,028 m^3/min) is not available (i.e., only one of the main ventilation fans is available) underground operations may proceed, but the number of activities that can be performed in parallel may be limited depending on the quantity of air available. Ventilation may be supplied by operating one or two of the filtration exhaust fans. To accomplish this, the isolation dampers will be opened, which will permit air to flow from the main exhaust duct to the filter outlet plenum. The filtration fans may also be operated to bypass the HEPA plenum. The isolation dampers of the filtration exhaust fan(s) to be employed will be opened, and the selected fan(s) will be switched on. In this mode, underground operations will be limited, because filtration exhaust fans cannot provide sufficient airflow to support the use of diesel equipment.

In the filtration mode, the exhaust air will pass through two identical filter assemblies, with only one of the three Exhaust Filter Building filtration fans operating (all other fans are stopped). This system provides a means for removing the airborne particulates that may contain radioactive and hazardous waste contaminants in the reduced exhaust flow before they are discharged through the exhaust stack to the atmosphere. The filtration mode is activated manually or automatically if the radiation monitoring system detects abnormally high concentrations of airborne radioactive particulates (an alarm is received from the continuous air monitor in the exhaust drift of the active waste panel) or a waste handling incident with the potential for a waste container breach is observed. The filtration mode is not initiated by the release of gases such as VOCs.

If utility power fails, the exhaust filter system goes into the fail-safe position, and the system high-efficiency particulate-air filter dampers are placed into filtration position. When power is restored by the diesel generators, a decision is made whether to remain in filtration mode and energize a filtration fan or to realign the dampers into the minimum exhaust mode. Without any indication of a radiological release, the decision is usually the latter. TRU mixed waste handling and related operations cease upon loss of utility power and are not resumed until normal utility

power is returned. As specified in Part 2, all waste handling equipment will "fail safe," meaning that it will retain its load during a power outage.

Underground Ventilation Normal Mode Redundancy

The underground ventilation system has been provided redundancy in normal ventilation mode by the addition of a third main fan. Ductwork leading to that new fan ties into the existing main exhaust duct.

Electrical System

The WIPP facility uses electrical power (utility power) supplied by the regional electric utility company. If there is a loss of utility power, TRU mixed waste handling and related operations will cease.

Backup, alternating current power will be provided on site by two 1,100-kilowatt diesel generators. These units provide 480-volt power with a high degree of reliability. Each of the diesel generators can carry predetermined equipment loads while maintaining additional power reserves. Predetermined loads include lighting and ventilation for underground facilities, lighting and ventilation for the TRU mixed waste handling areas, and the Air Intake Shaft hoist. The diesel generator can be brought on line within 30 minutes either manually or from the control panel in the Central Monitoring Room (CMR).

Uninterruptible power supply (**UPS**) units are also on line providing power to predetermined monitoring systems. These systems ensure that the power to the radiation detection system for airborne contamination, the local processing units, the computer room, and the CMR will always be available, even during the interval between the loss of off-site power and initiation of backup diesel generator power.

A2-2a(4) RH TRU Mixed Waste Handling Equipment

The following are the major pieces of equipment used to manage RH TRU mixed waste in the geologic repository. A summary of equipment capacities is included in Table A2-3.

The Facility Cask Transfer Car

The Facility Cask Transfer Car is a self-propelled rail car (Figure A2-14) that operates between the Facility Cask Loading Room and the geologic repository. After the Facility Cask is loaded, the Facility Cask Transfer Car moves onto the waste shaft conveyance and is then transported underground. At the underground waste shaft station, the Facility Cask Transfer Car proceeds away from the waste shaft conveyance to provide forklift access to the Facility Cask.

Horizontal Emplacement and Retrieval Equipment or Functionally Equivalent Equipment

The Horizontal Emplacement and Retrieval Equipment (**HERE**) or functionally equivalent equipment (Figure A2-15) emplaces canisters into a borehole in a room wall of an Underground HWDU. Once the canisters have been emplaced, the HERE then fills the borehole opening with a shield plug.

A2-2b Geologic Repository Process Description

Prior to receipt of TRU mixed waste at the WIPP facility, waste operators will be thoroughly trained in the safe use of TRU mixed waste handling and transport equipment. The training will include both classroom training and on-the-job training.

RH TRU Mixed Waste Emplacement

The Facility Cask Transfer Car is loaded onto the waste shaft conveyance and is lowered to the waste shaft station underground. At the waste shaft station underground, the Facility Cask is moved from the waste shaft conveyance by the Facility Cask Transfer Car (Figure A2-16). A forklift is used to remove the Facility Cask from the Facility Cask Transfer Car and to transport the Facility Cask to the Underground HWDU. There, the Facility Cask is placed on the HERE (Figure A2-17). The HERE is used to emplace the RH TRU mixed waste canister into the borehole. The borehole will be visually inspected for obstructions prior to aligning the HERE and emplacement of the RH TRU mixed waste canister. The Facility Cask is moved forward to mate with the shield collar, and the transfer carriage is advanced to mate with the rear Facility Cask shield valve. The shield valves on the Facility Cask are opened, and the transfer mechanism advances to push the canister into the borehole. After retracting the transfer mechanism into the Facility Cask, the forward shield valve is closed, and the transfer mechanism is further retracted into its housing. The transfer mechanism is moved to the rear, and the shield plug carriage containing a shield plug is placed on the emplacement machine. The transfer mechanism is used to push the shield plug into the Facility Cask. The front shield valve is opened, and the shield plug is pushed into the borehole (Figure A2-18). The transfer mechanism is retracted, the shield valves close on the Facility Cask, and the Facility Cask is removed from the HERE.

A shield plug is a concrete filled cylindrical steel shell (Figure A2-21) approximately 61 in. long and 29 in. in diameter, made of concrete shielding material inside a 0.24 in. thick steel shell with a removable pintle at one end. Each shield plug has integral forklift pockets and weighs approximately 3,750 lbs. The shield plug is inserted with the pintle end closest to the HERE to provide the necessary shielding , limiting the borehole radiation dose rate at 30 cm to less than 10 mrem per hour for a canister surface dose rate of 100 rem/hr . Additional shielding is provided at the direction of the Radiological Control Technician based on dose rate surveys following shield plug emplacement. This additional shielding is provided by the manual emplacement of one or more shield plug supplemental shielding plates and a retainer (Figures A2-19 and A2-20).

The amount of RH TRU mixed waste disposal in each panel is limited based on thermal and geomechanical considerations and shall not exceed 10 kilowatts per acre as described in Permit Attachment A2-1. RH TRU mixed waste emplacement boreholes shall be drilled in the ribs of the panels at a nominal spacing of 8 ft (2.4 m) center-to-center, horizontally.

Figures A1-26 and A1-27 are flow diagrams of the RH TRU mixed waste handling process for the RH-TRU 72-B and CNS 10-160B casks, respectively.

CH TRU Mixed Waste Emplacement

CH TRU mixed waste containers and shielded containers will arrive by tractor-trailer at the WIPP facility in sealed shipping containers, at which time they will undergo security and radiological checks and shipping documentation reviews. The trailers carrying the shipping

containers will be stored temporarily at the Parking Area Container Storage Unit (Parking Area Unit). A forklift will remove the Contact Handled Packages from the transport trailers and a forklift or Yard Transfer Vehicle will transport them into the Waste Handling Building Container Storage Unit for unloading of the waste containers. Each TRUPACT-II may hold up to two 7-packs, two 4-packs, two 3-packs, two SWBs, or one TDOP. Each HalfPACT may hold up to seven 55-gal (208 L) drums, one SWB, one three-pack of shielded containers or four 85-gal (322 L) drums. Each TRUPACT-III will hold one SLB2. An overhead bridge crane or Facility Transfer Vehicle with transfer table will be used to remove the waste containers from the Contact Handled Packaging and place them on a facility or containment pallet. Each facility pallet has two recessed pockets to accommodate two sets of 7-packs, two sets of 3-packs, two sets of 4-packs, two SWBs stacked two-high, two TDOPs, or one SLB2. Each stack of waste containers will be secured prior to transport underground (see Figure A2-3). A forklift or the facility transfer vehicle will transport the loaded facility pallet to the conveyance loading room adjacent to the Waste Shaft. The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance, and the facility transfer vehicle will be backed off. Containers of CH TRU mixed waste (55-gal (208 L) drums, SWBs, 85-gal (322 L) drums, 100-gal (379 L) drums, and TDOPs) or shielded containers can be handled individually, if needed, using the forklift and lifting attachments (i.e., drum handlers, parrot beaks).

The waste shaft conveyance will lower the loaded facility pallet to the underground. At the waste shaft station, the CH TRU underground transporter will back up to the waste shaft conveyance, and the facility pallet will be transferred from the waste shaft conveyance onto the transporter (see Figure A2-6). The transporter will then move the facility pallet to the appropriate Underground HWDU for emplacement. The underground waste transporter is equipped with a fire suppression system, rupture-resistant diesel fuel tanks, and reinforced fuel lines to minimize the potential for a fire involving the fuel system.

A forklift in the HWDU near the waste stack will be used to remove the waste containers from the facility pallets and to place them in the waste stack using a push-pull attachment or, in the case of an SLB2, the SLB2 will be lifted from the facility pallet and placed directly on the floor of the emplacement room. The waste will be emplaced room by room in Panels 1 through 8. Each panel will be closed off when filled. If a waste container is damaged during the Disposal Phase, it will be immediately overpacked or repaired. CH TRU mixed waste containers will be continuously vented. The filter vents will allow aspiration, preventing internal pressurization of the container and minimizing the buildup of flammable gas concentrations.

Once a waste panel is mined and any initial ground control established, flow regulators will be constructed to assure adequate control over ventilation during waste emplacement activities. The first room to be filled with waste will be Room 7, which is the one that is farthest from the main access ways. A ventilation control point will be established for Room 7 just outside the exhaust side of Room 6. This ventilation control point will consist of a bulkhead with a ventilation regulator. When RH TRU mixed waste canister emplacement is completed in a room, CH TRU mixed waste emplacement can begin in that room. Stacking of CH waste will begin at the ventilation control point and proceed down the access drift, through the room and up the intake access drift until the entrance of Room 6 is reached. At that point, a brattice cloth and chain link barricade and, if necessary, bulkheads will be emplaced. This process will be repeated for Room 6, and so on until Room 1 is filled. At that point, the panel closure system will be constructed.

The emplacement of CH TRU mixed waste into the HWDUs will typically be in the order received and unloaded from the Contact Handled Packaging. There is no specification for the amount of space to be maintained between the waste containers themselves, or between the waste containers and the walls. Containers will be stacked in the best manner to provide stability for the stack (which is up to three containers high) and to make best use of available space. It is anticipated that the space between the wall and the container could be from 8 to 18 in. (20 to 46 cm). This space is a function of disposal room wall irregularities, container type, and sequence of emplacement. Bags of backfill will occupy some of this space. Space is required over the stacks of containers to assure adequate ventilation for waste handling operations. A minimum of 16 in. (41 cm) was specified in the Final Design Validation Report (Appendix D1, Chapter 12 of the WIPP RCRA Part B Permit Application (DOE, 1997)) to maintain air flow. Typically, the space above a stack of containers will be 36 to 48 in. (90 to 122 cm). However 18 in. (0.45 m) will contain backfill material consisting of bags of Magnesium Oxide (MgO). Figure A2-8 shows a typical container configuration, although this figure does not mix containers on any row. Such mixing, while inefficient, will be allowed to assure timely movement of waste into the underground. No aisle space will be maintained for personnel access to emplaced waste containers. No roof maintenance behind stacks of waste is planned.

The anticipated schedule for the filling of each of the Underground HWDUs known as Panels 1 through 8 is shown in Permit Attachment G, Table G-1. Panel closure in accordance with the Closure Plan in Permit Attachment G and Permit Attachment G1 is estimated to require an additional 150 days.

Figure A2-12 is a flow diagram of the CH TRU mixed waste handling process.

A2-3 Waste Characterization

TRU mixed waste characterization is described in Permit Attachment C.

A2-4 Treatment Effectiveness

TRU mixed waste treatment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), for which a permit is required, will not be performed at the WIPP facility.

A2-5 Maintenance, Monitoring, and Inspection

A2-5a Maintenance

A2-5a(1) Ground-Control Program

The ground-control program at the WIPP facility will ensure that any room in an HWDU in which waste will be placed will be sufficiently supported to assure compliance with the applicable portions of the Land Withdrawal Act (**LWA**), which requires a regular review of roof-support plans and practices by the Mine Safety and Health Administration (**MSHA**). Support is installed to the requirements of 30 CFR §57, Subpart B.

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A2-5b Monitoring

A2-5b(1) Groundwater Monitoring

Groundwater monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 5 and Permit Attachment L of this permit.

A2-5b(2) Geomechanical Monitoring

The geomechanical monitoring program at the WIPP facility is an integral part of the ground-control program (See Figure A2-13). HWDUs, drifts, and geomechanical test rooms will be monitored to provide confirmation of structural integrity. Geomechanical data on the performance of the repository shafts and excavated areas will be collected as part of the geotechnical field-monitoring program. The results of the geotechnical investigations will be reported annually. The report will describe monitoring programs and geomechanical data collected during the previous year.

A2-5b(2)(a) Description of the Geomechanical Monitoring System

The Geomechanical Monitoring System (**GMS**) provides in situ data to support the continuous assessment of the design for underground facilities. Specifically, the GMS provides for:

- Early detection of conditions that could affect operational safety
- Evaluation of disposal room closure that ensures adequate access
- Guidance for design modifications and remedial actions
- Data for interpreting the behavior of underground openings, in comparison with established design criteria

The instrumentation in Table A2-2 is available for use in support of the geomechanical program.

The minimum instrumentation for each of the eight panels will be one borehole extensometer installed in the roof at the center of each disposal room. The roof extensometers will monitor the dilation of the immediate salt roof beam and possible bed separations along clay seams. Additional instrumentation will be installed as conditions warrant.

Remote polling of the geomechanical instrumentation will be performed at least once every month. This frequency may be increased to accommodate any changes that may develop.

The results from the remotely read instrumentation will be evaluated after each scheduled polling. Documentation of the results will be provided annually in the Geotechnical Analysis Report.

Data from remotely read instrumentation will be maintained as part of a geotechnical instrumentation system. The instrumentation system provides for data maintenance, retrieval, and presentation. The Permittees will retrieve the data from the instrumentation system and verify data accuracy by confirming the measurements were taken in accordance with applicable instructions and equipment calibration is known. Next, the Permittees will review the data after

each polling to assess the performance of the instrument and of the excavation. Anomalous data will be investigated to determine the cause (instrumentation problem, error in recording, changing rock conditions). The Permittees will calculate various parameters such as the change between successive readings and deformation rates. This assessment will be reported to the Permittees' cognizant ground control engineer and operations personnel. The Permittees will investigate unexpected deformation to determine if remediation is needed.

The stability of an open panel excavation is generally determined by the rock deformation rate. The excavation may be unstable when there is a continuous increase in the deformation rate that cannot be controlled by the installed support system. The Permittees will evaluate the performance of the excavation. These evaluations assess the effectiveness of the roof support system and estimate the stand-up time of the excavation. If an open panel shows the trend is toward adverse (unstable) conditions, the results will be reported to determine if it is necessary to terminate waste disposal activities in the open panel. This report of the trend toward adverse conditions in an open HWDU will also be provided to the Secretary of the NMED within seven (7) calendar days of issuance of the report.

A2-5b(2)(b) System Experience

Much experience in the use of geomechanical instrumentation was gained as the result of performance monitoring of Panel 1, which began at the time of completion of the panel excavation in 1988. The monitoring system installed at that time involved simple measurements and observations (e.g., vertical and horizontal convergence rates, and visual inspections). Minimal maintenance of instrumentation is required, and the instrumentation is easily replaced if it malfunctions. Conditions throughout Panel 1 are well known. The monitoring program continues to provide data to compare the performance of Panel 1 with that established elsewhere in the underground. Panel 1 performance is characterized by the following:

The development of bed separations and lateral shifts at the interfaces of the salt and the clays underlying the anhydrites "a" and "b."

Room closures. A closure due only to the roof movement will be separated from the total closure.

The behavior of the pillars.

Fracture development in the roof and floor.

Distribution of load on the support system.

Roof conditions are assessed from observation boreholes and extensometer measurements. Measurements of room closure, rock displacements, and observations of fracture development in the immediate roof beam are made and used to evaluate the performance of a panel. A description of the Panel 1 monitoring program was presented to the members of the Geotechnical Experts Panel (in 1991) who concurred that it was adequate to determine deterioration within the rooms and that it will provide early warning of deteriorating conditions.

The assessment and evaluation of the condition of WIPP excavations is an interactive, continuous process using the data from the monitoring programs. Criteria for corrective action are continually reevaluated and reassessed based on total performance to date. Actions taken

are based on these analyses and planned utilization of the excavation. Because WIPP excavations are in a natural geologic medium, there is inherent variability from point to point. The principle adopted is to anticipate potential ground control requirements and implement them in a timely manner rather than to wait until a need arises.

A2-5b(3) Volatile Organic Compound Monitoring

The volatile organic compound monitoring for the WIPP Underground HWDUs will be conducted in accordance with Part 4 and Permit Attachment N of this permit.

A2-5c Inspection

The inspection of the WIPP Underground HWDUs will be conducted in accordance with Part 2 and Permit Attachment E of this permit.

References

DOE, 1997. Resource Conservation and Recovery Act Part B Permit Application, Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico, Revision 6.5, 1997.

DOE, 2009. WIPP Hazardous Waste Facility Permit Amended Renewal Application, Carlsbad, New Mexico, September 2009.

TABLES

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Table A2-1
CH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
Facility Pallet	25,000 lbs.
Facility Transfer Vehicle	26,000 lbs.
Underground transporter	28,000 lbs.
Underground forklift	12,000 lbs.
Maximum Gross Weights of Containers	
Seven-pack of 55-gallon drums	7,000 lbs.
Four-pack of 85-gallon drums	4,500 lbs.
Three-pack of 100-gallon drums	3,000 lbs.
Ten-drum overpack	6,700 lbs.
Standard waste box	4,000 lbs.
Standard large box 2	10,500 lbs.
Shielded container	2,260 lbs.
Three-pack of shielded containers	7,000 lbs.
Maximum Net Empty Weights of Equipment	
TRUPACT-II	13,140 lbs.
HalfPACT	10,500 lbs.
TRUPACT-III	43,600 lbs.
Facility pallet	4,120 lbs.

Table A2-2
Instrumentation Used in Support of the Geomechanical Monitoring System

Instrument Type	Features	Parameter Measured	Range
Borehole Extensometer	The extensometer provides for monitoring the deformation parallel to the borehole axis. Units suitable for up to 5 measurements anchors in addition to the reference head. Maximum borehole depths shall be 50 feet.	Cumulative Deformation	0-2 inches
Borehole Television Camera	Closed circuit television may be used for monitoring areas otherwise inaccessible, such as boreholes or shafts.	Video Image	N/A
Convergence Points and Tape Extensometers	Mechanically anchored eyebolts to which a portable tape extensometer is attached.	Cumulative Deformation	2-50 feet
Convergence Meters	Includes wire and sonic meters. Mounted on rigid plates anchored to the rock surface.	Cumulative Deformation	2-50 feet
Inclinometers	Both vertical and horizontal inclinometers are used. Traversing type of system in which a probe is moved periodically through casing located in the borehole whose inclination is being measured.	Cumulative Deformation	0-30 degrees
Rock Bolt Load Cells	Spool type units suitable for use with rock bolts. Tensile stress is inferred from strain gauges mounted on the surface of the spool.	Load	0-300 kips
Earth Pressure Cells	Installed between concrete keys and rock. Preferred type is a hydraulic pressure plate connected to a vibrating wire transmitter.	Lithostatic Pressure	0-1000 psi
Piezometer Pressure Transducers	Located in shafts and of robust design and construction. Periodic checks on operability required.	Fluid Pressure	0-500 psi
Strain Gauges	Installed within the concrete shaft key. Suitably sealed for the environment. Two types used--surface mounted and embedded.	Cumulative Deformation	0-3000 µin/in (embedded) 0-2500 µin/in (surface)

Table A2-3
RH TRU Mixed Waste Handling Equipment Capacities

Capacities for Equipment	
41-Ton Forklift	82,000 lbs
Maximum Gross Weights of RH TRU Containers	
RH TRU Facility Canister	10,000 lbs
55-Gallon Drum	1,000 lbs
RH TRU Canister	8,000 lbs
Maximum Net Empty Weights of Equipment	
Facility Cask	67,700 lbs

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FIGURES

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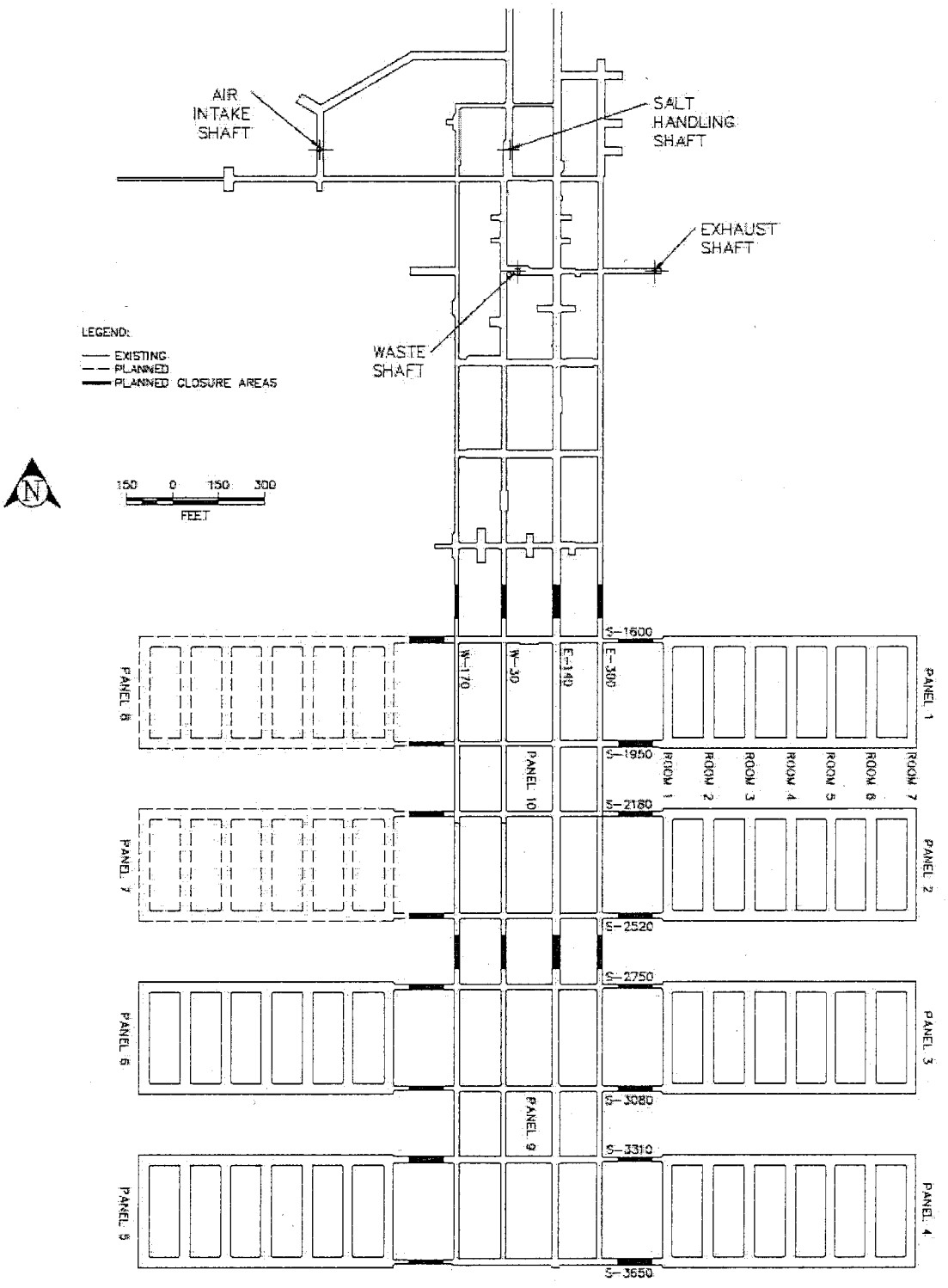

Figure A2-1
Repository Horizon

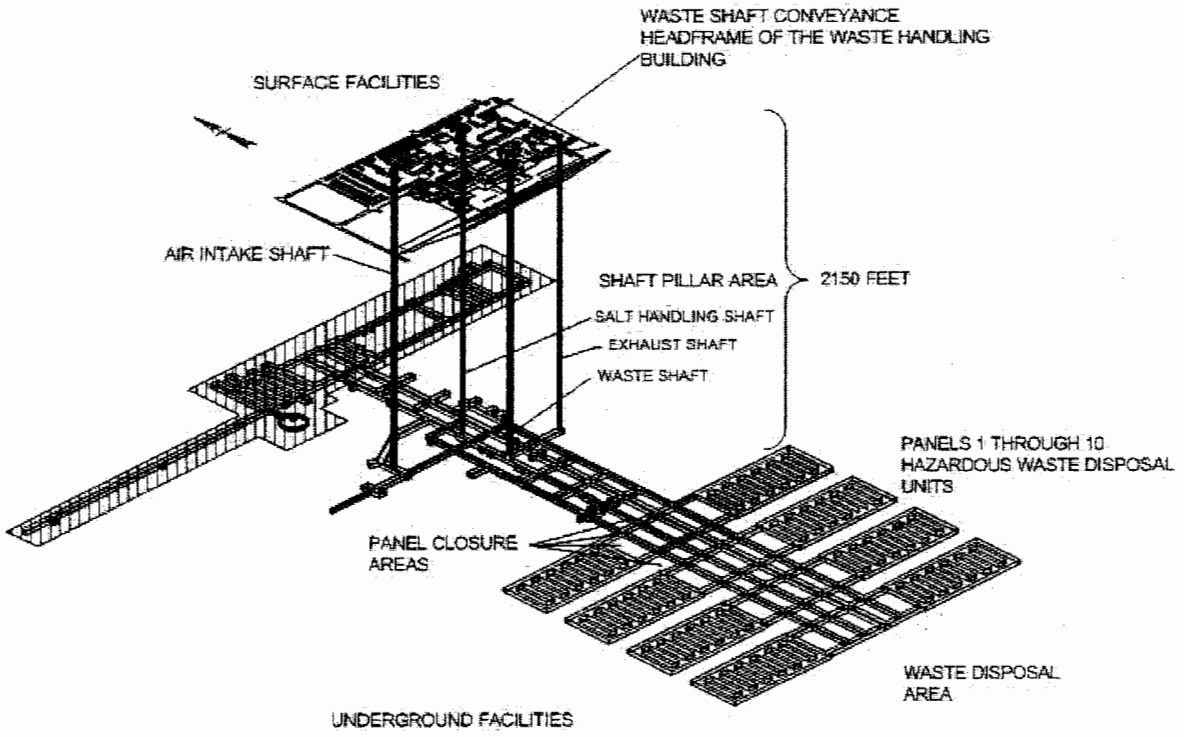

Figure A2-2
Spatial View of the Miscellaneous Unit and Waste Handling Facility

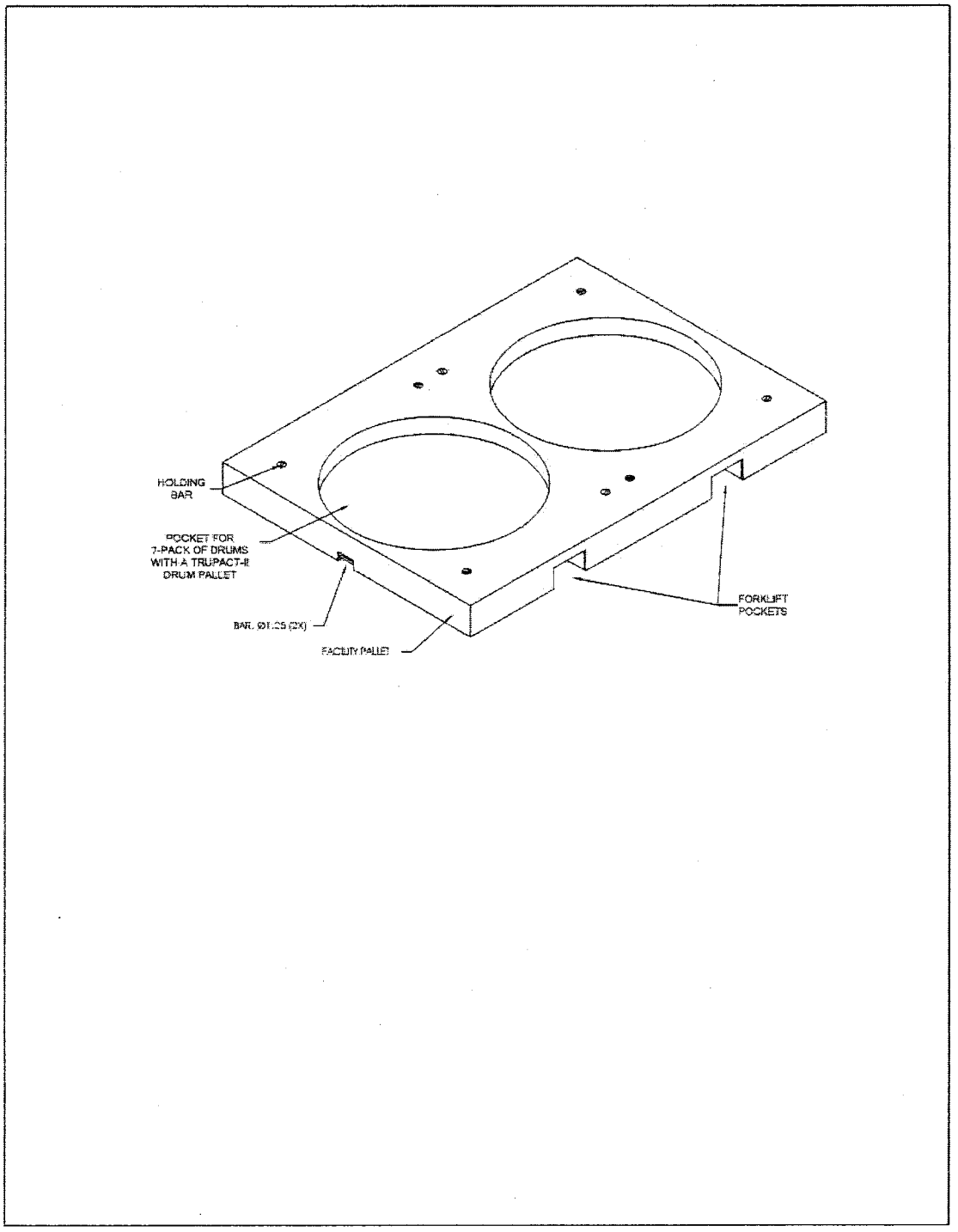

Figure A2-3
Facility Pallet for Seven-Pack of Drums

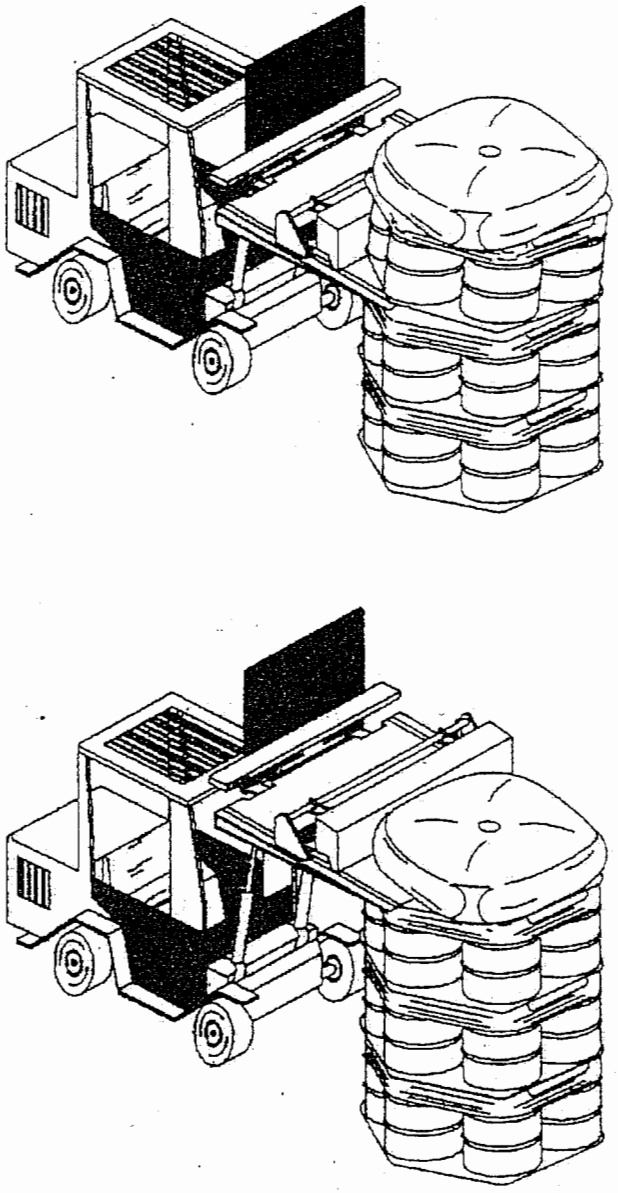

Figure A2-5
Typical Backfill Sacks Emplaced on Drum Stacks

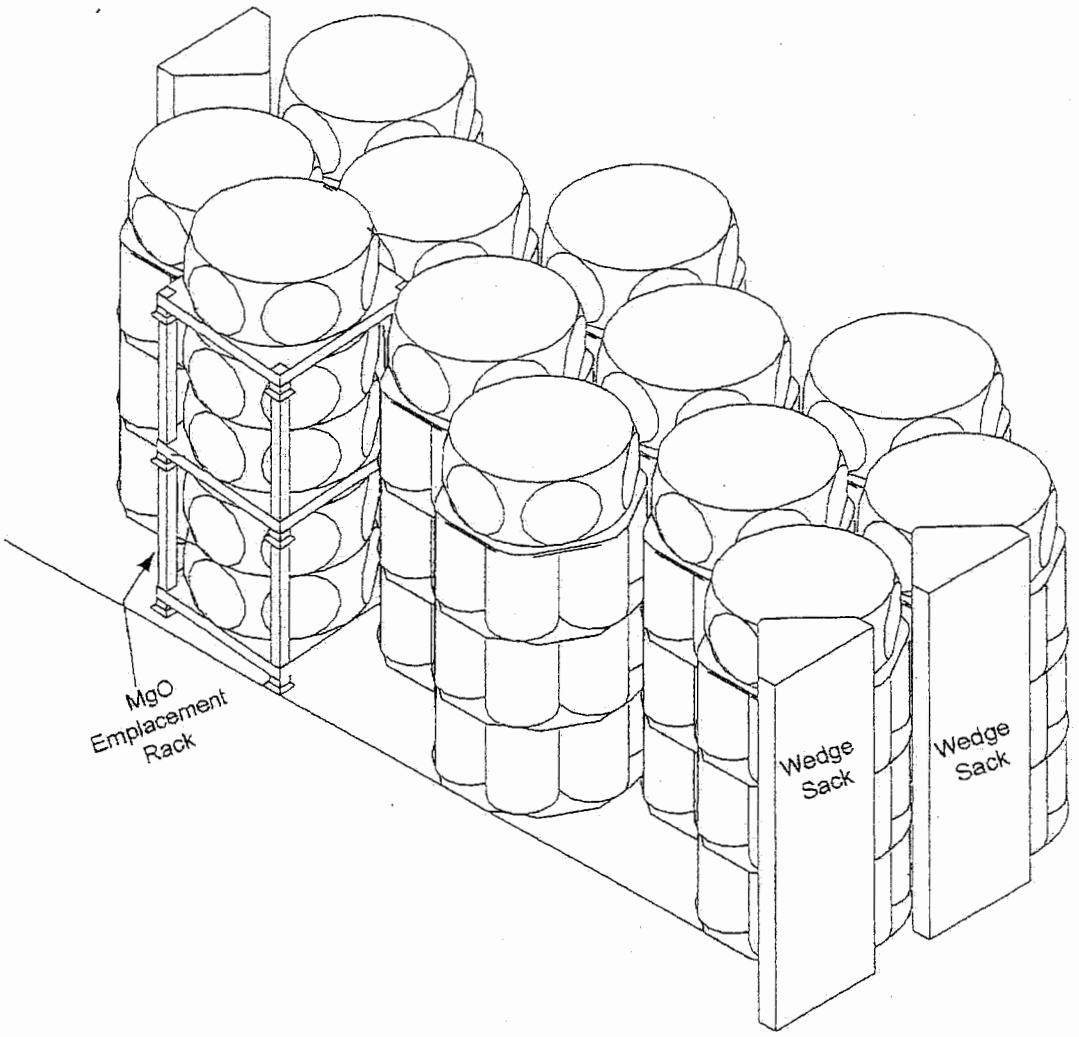

Figure A2-5a
Potential MgO Emplacement Configurations

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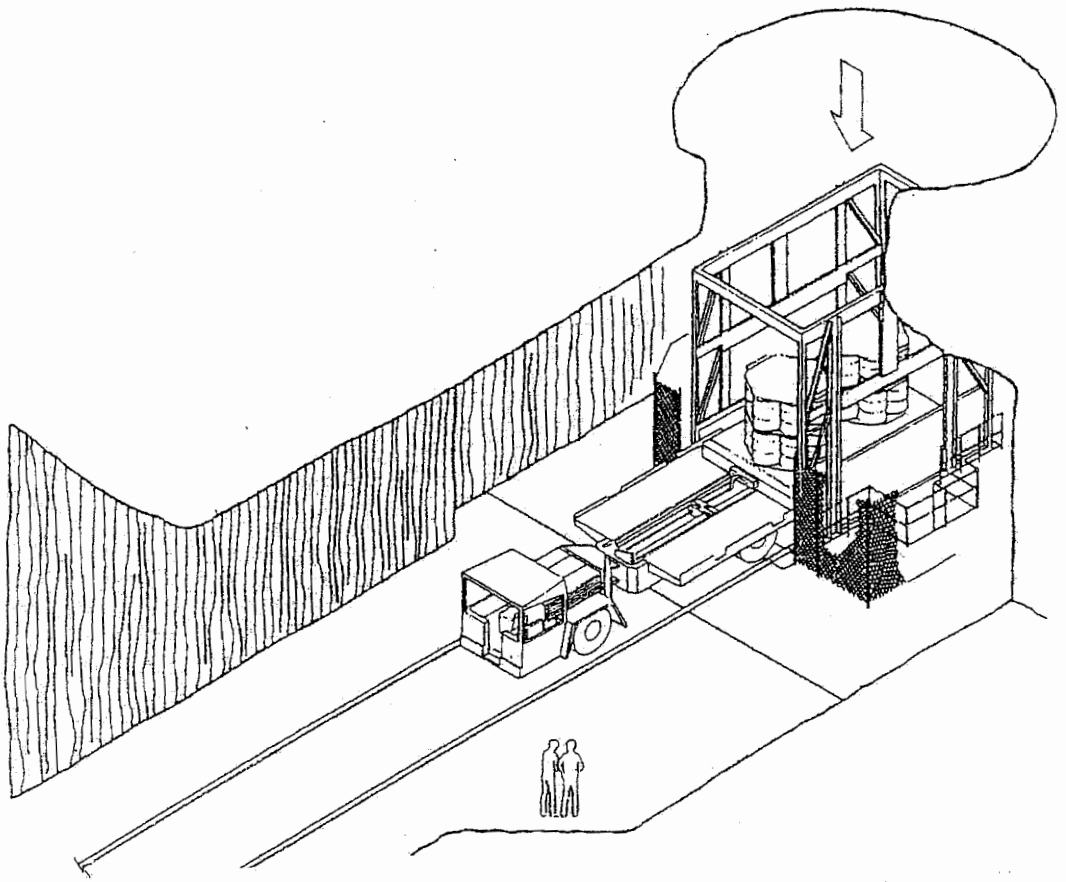

Figure A2-6
Waste Transfer Cage to Transporter

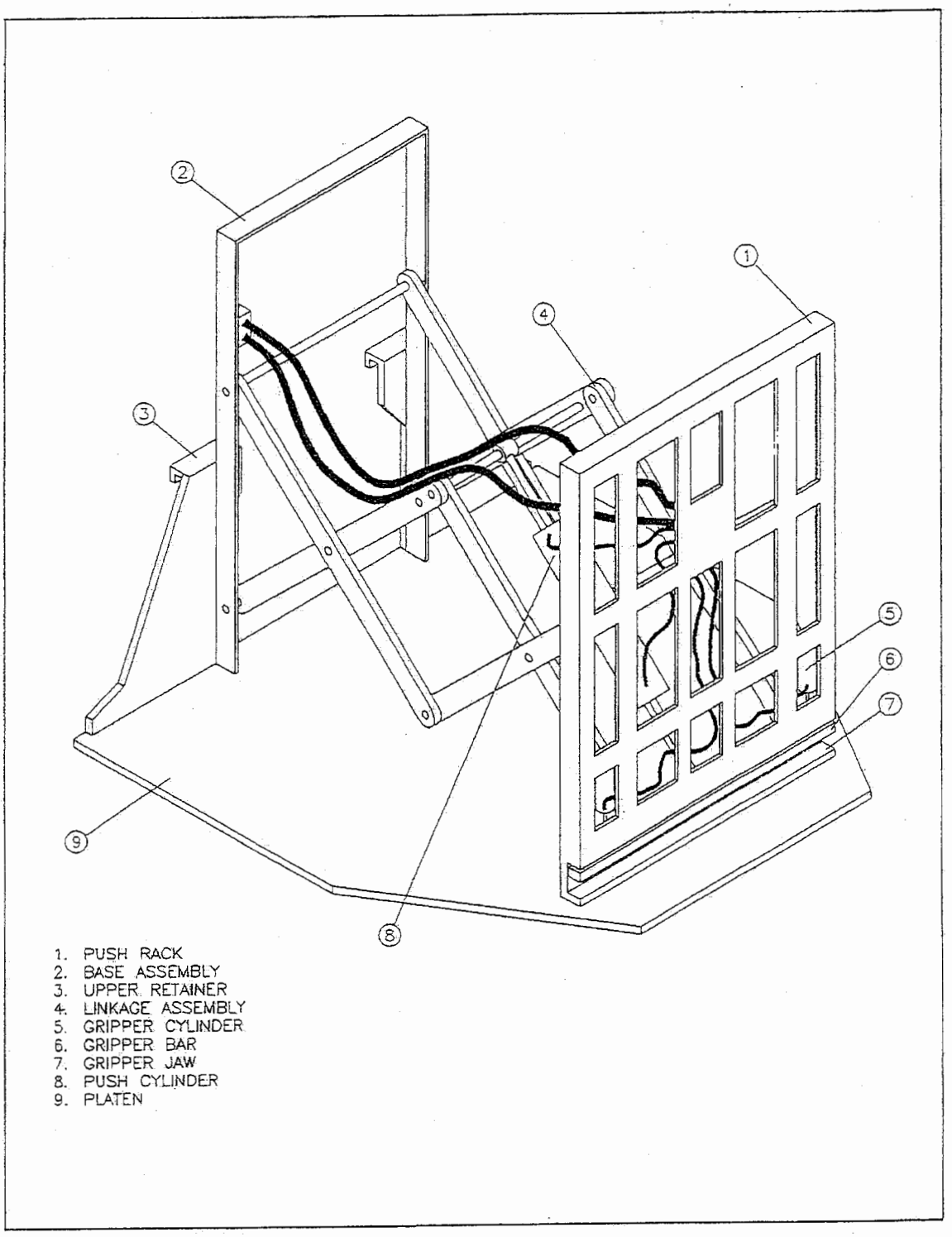

Figure A2-7
Push-Pull Attachment to Forklift to Allow Handling of Waste Containers

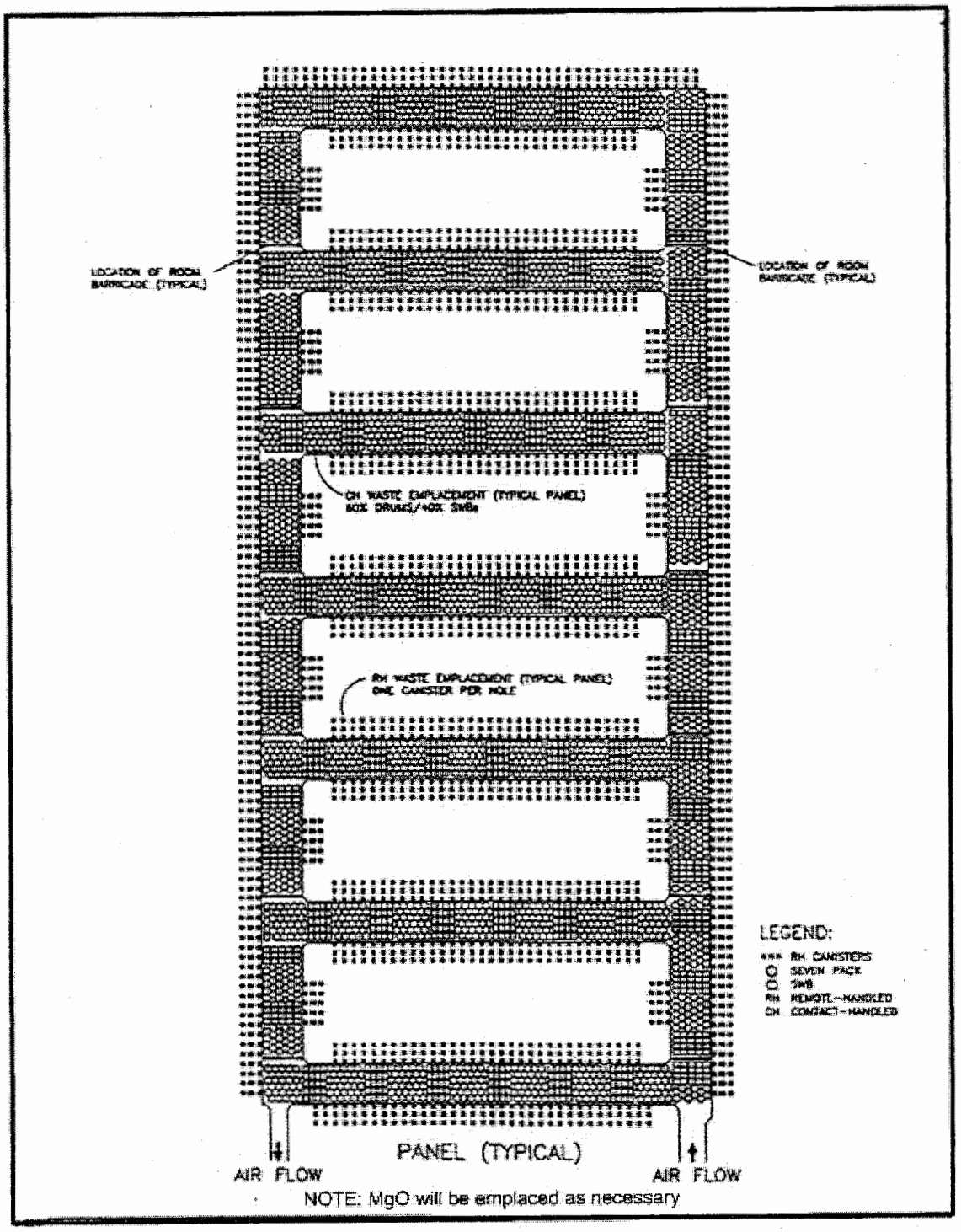

Figure A2-8
Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration

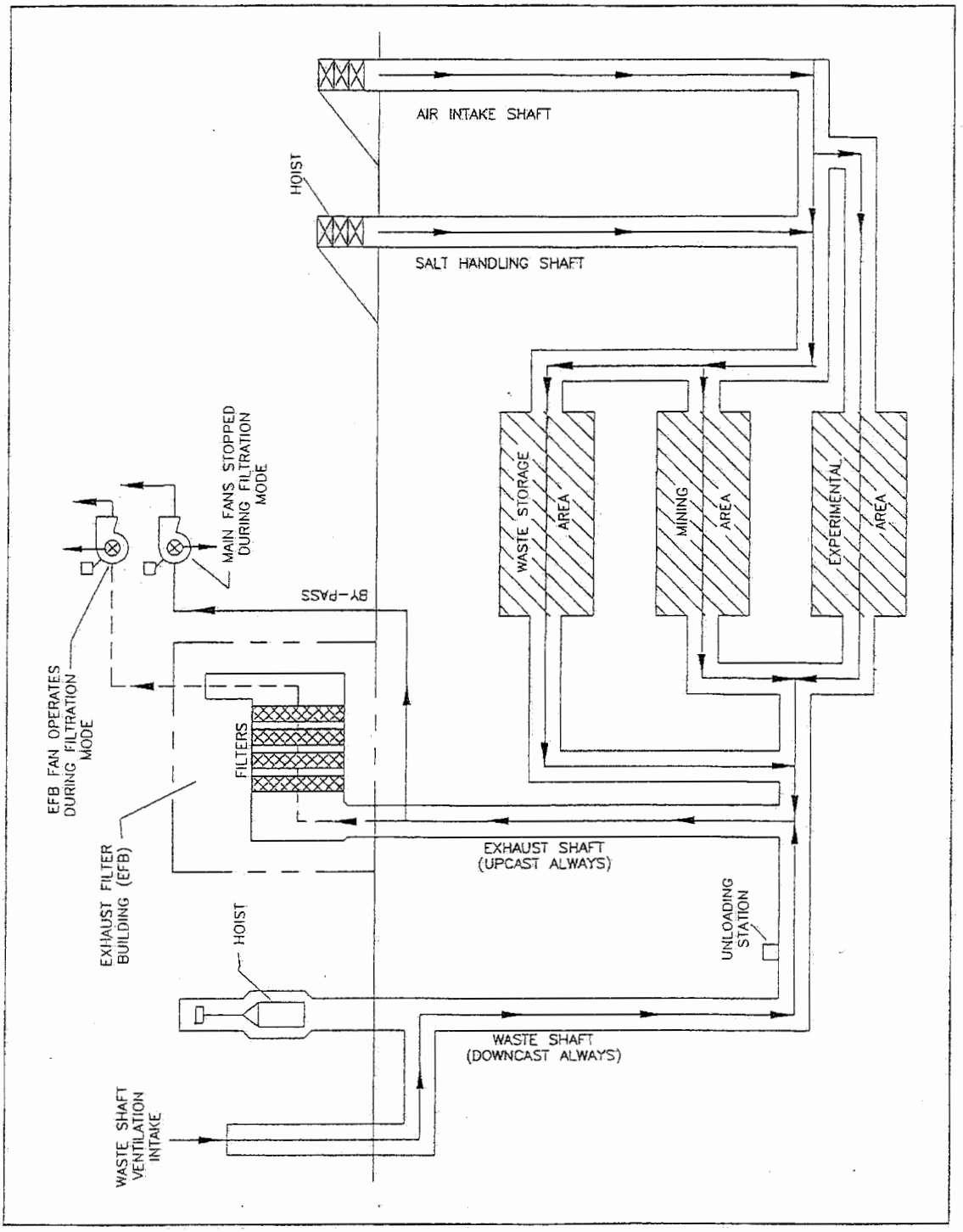

Figure A2-9
Underground Ventilation System Airflow

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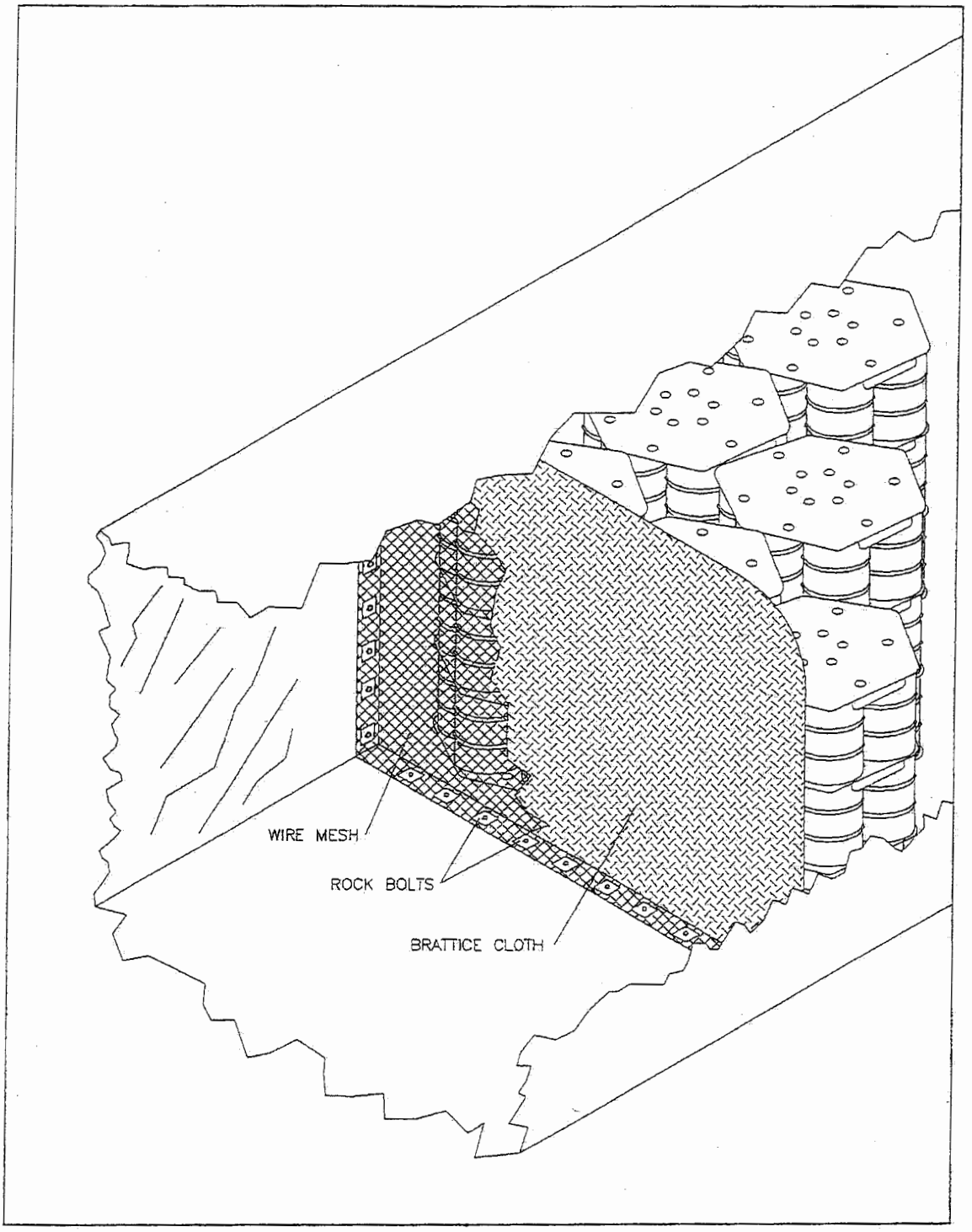

Figure A2-11
Typical Room Barricade

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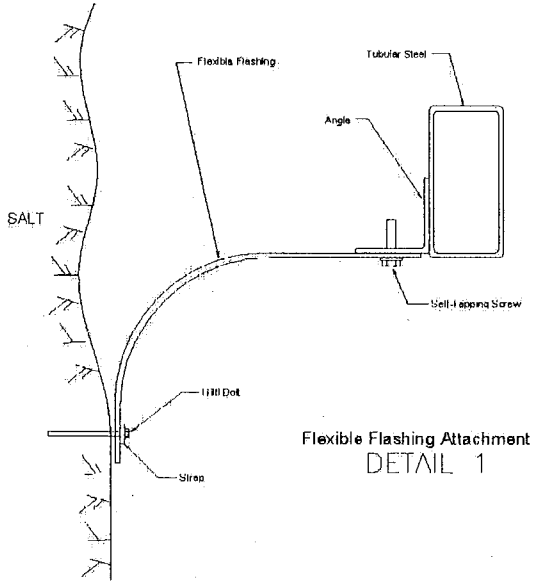

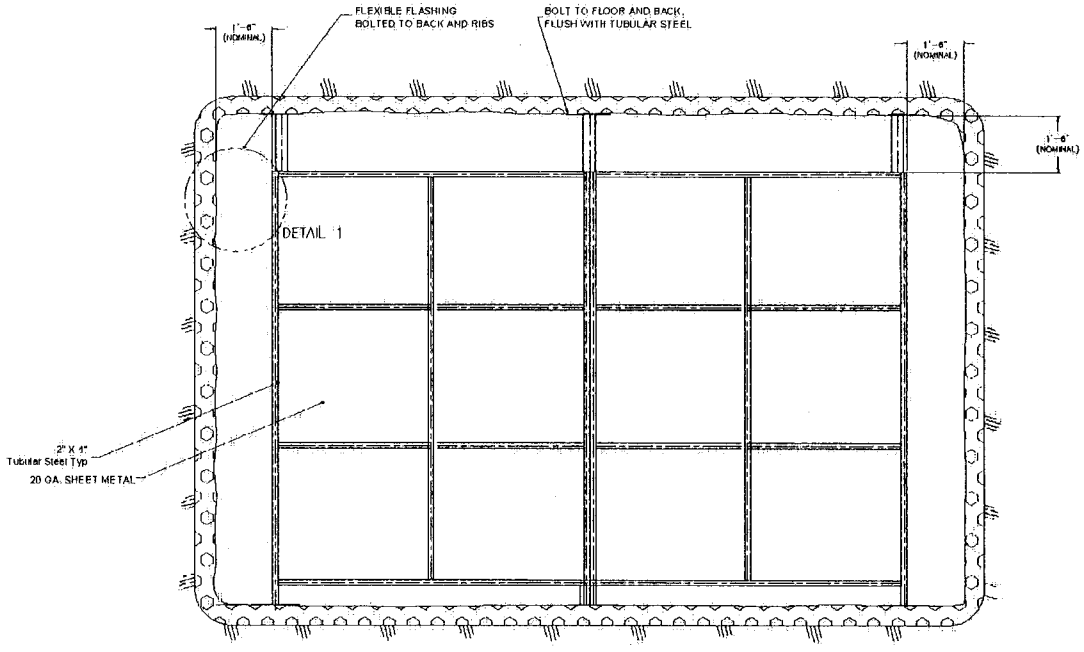

Not to Scale. All dimensions are nominal.

Figure A2-11a
Typical Bulkhead

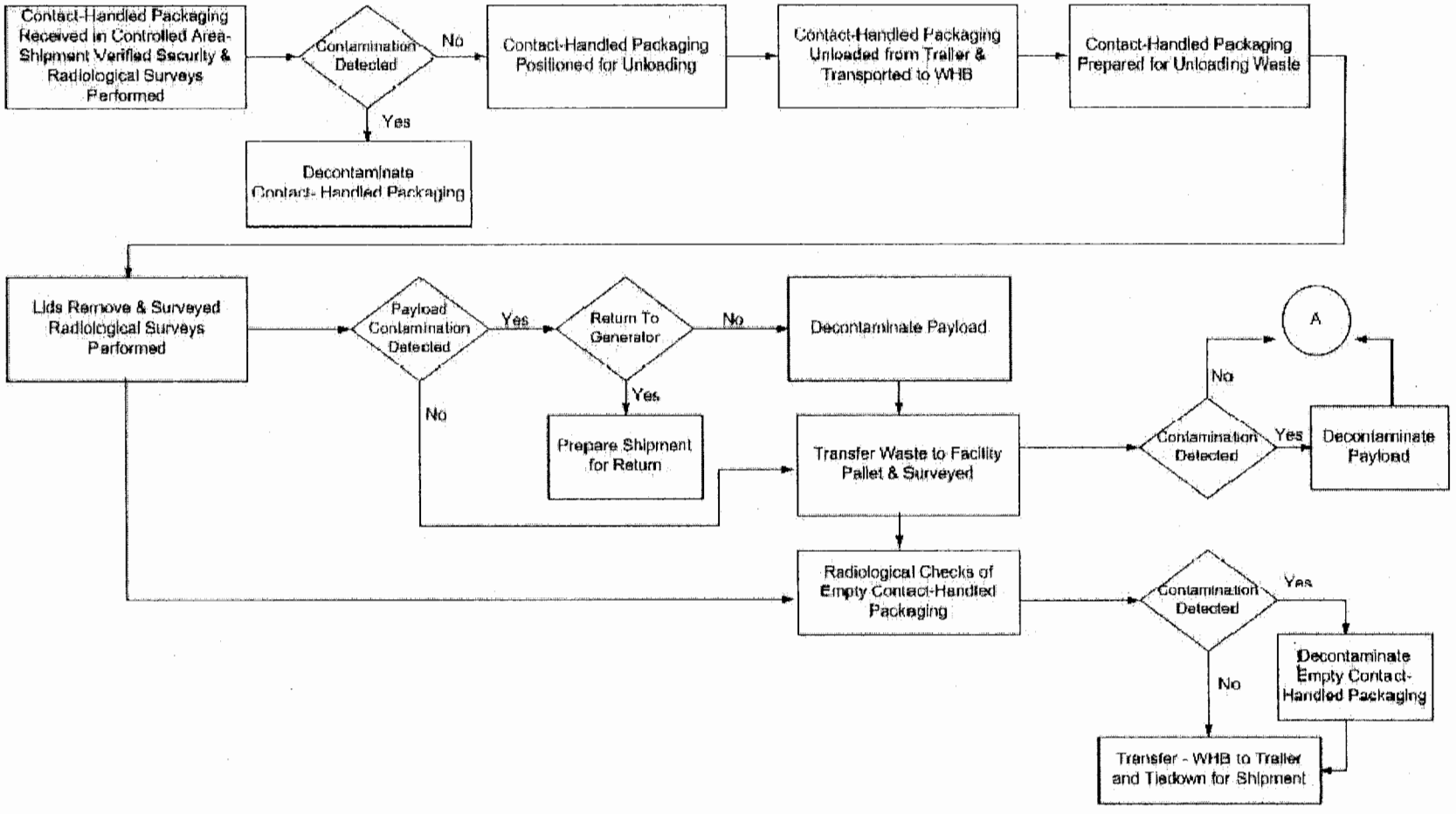

Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram

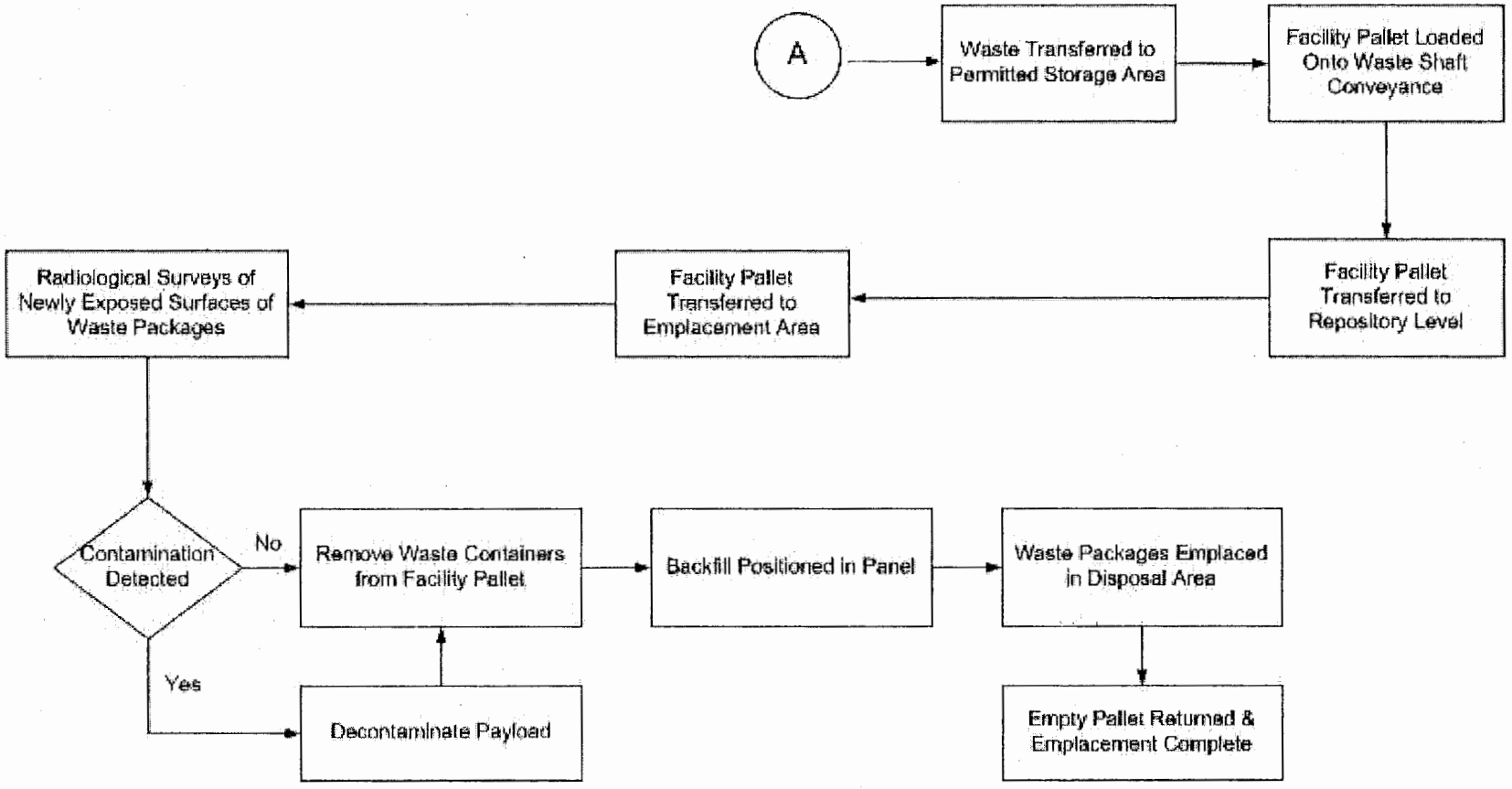

Figure A2-12
WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)

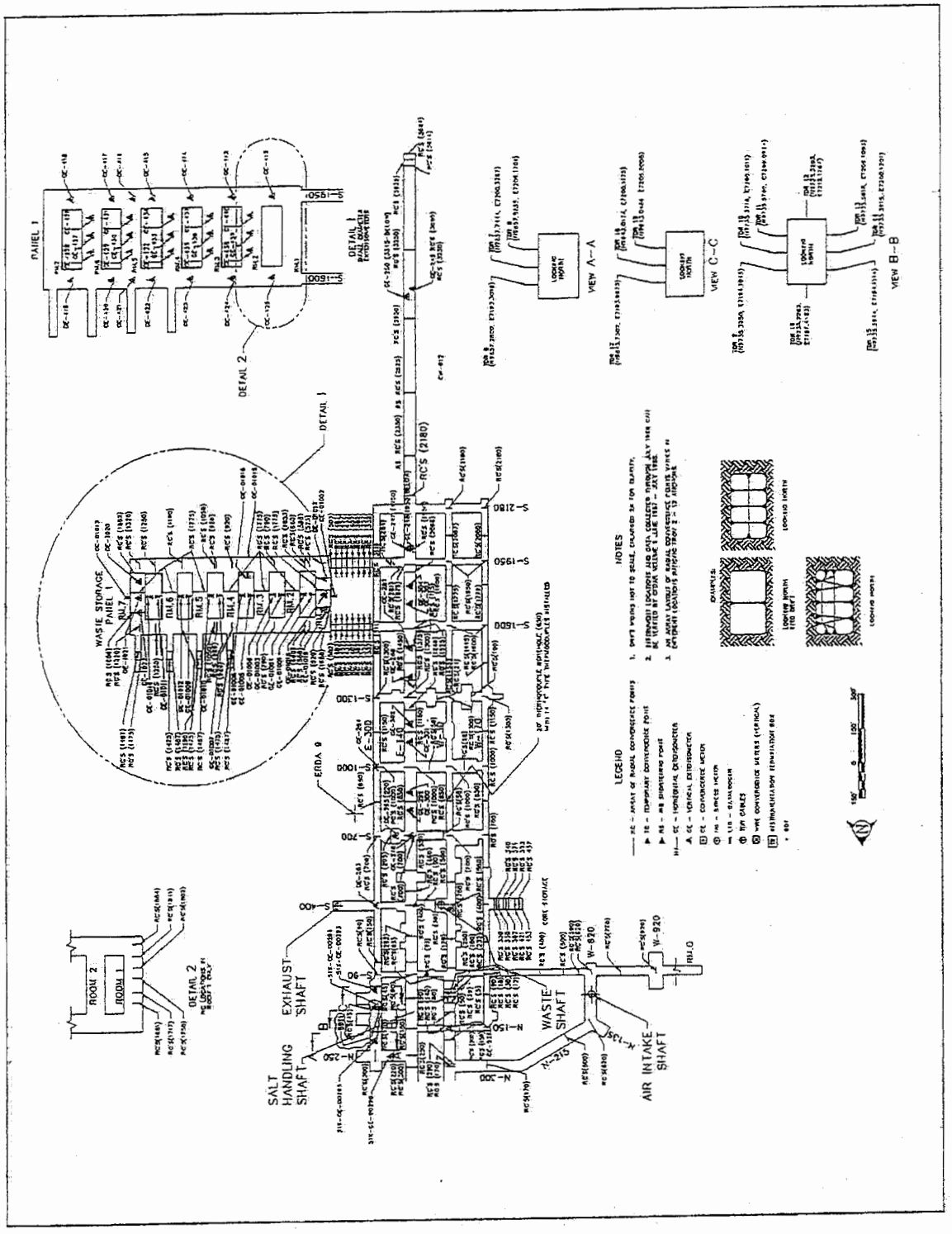

Figure A2-13
Layout and Instrumentation - As of 1/96

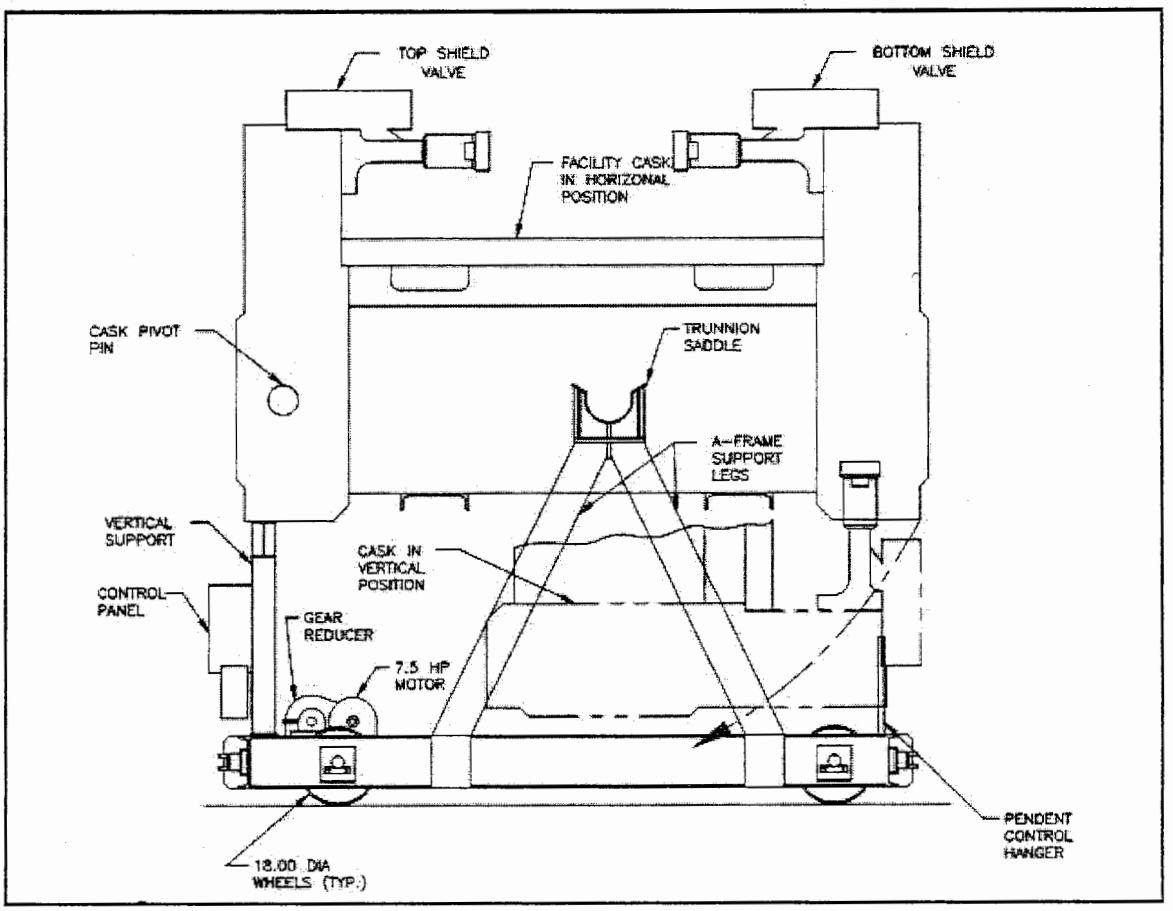

Figure A2-14
Facility Cask Transfer Car (Side View)

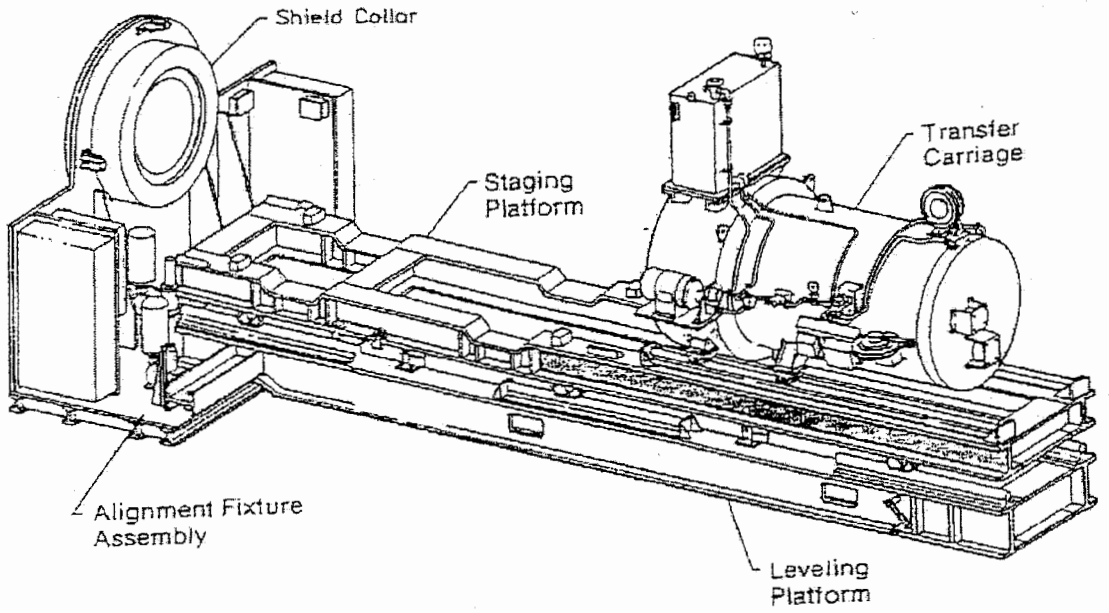

Figure A2-15
Typical Emplacement Equipment

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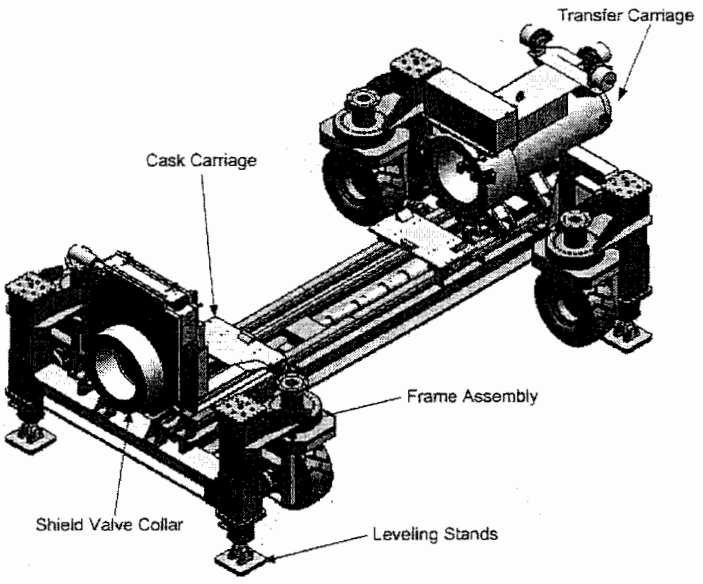

Figure A2-15a
Typical Emplacement Equipment

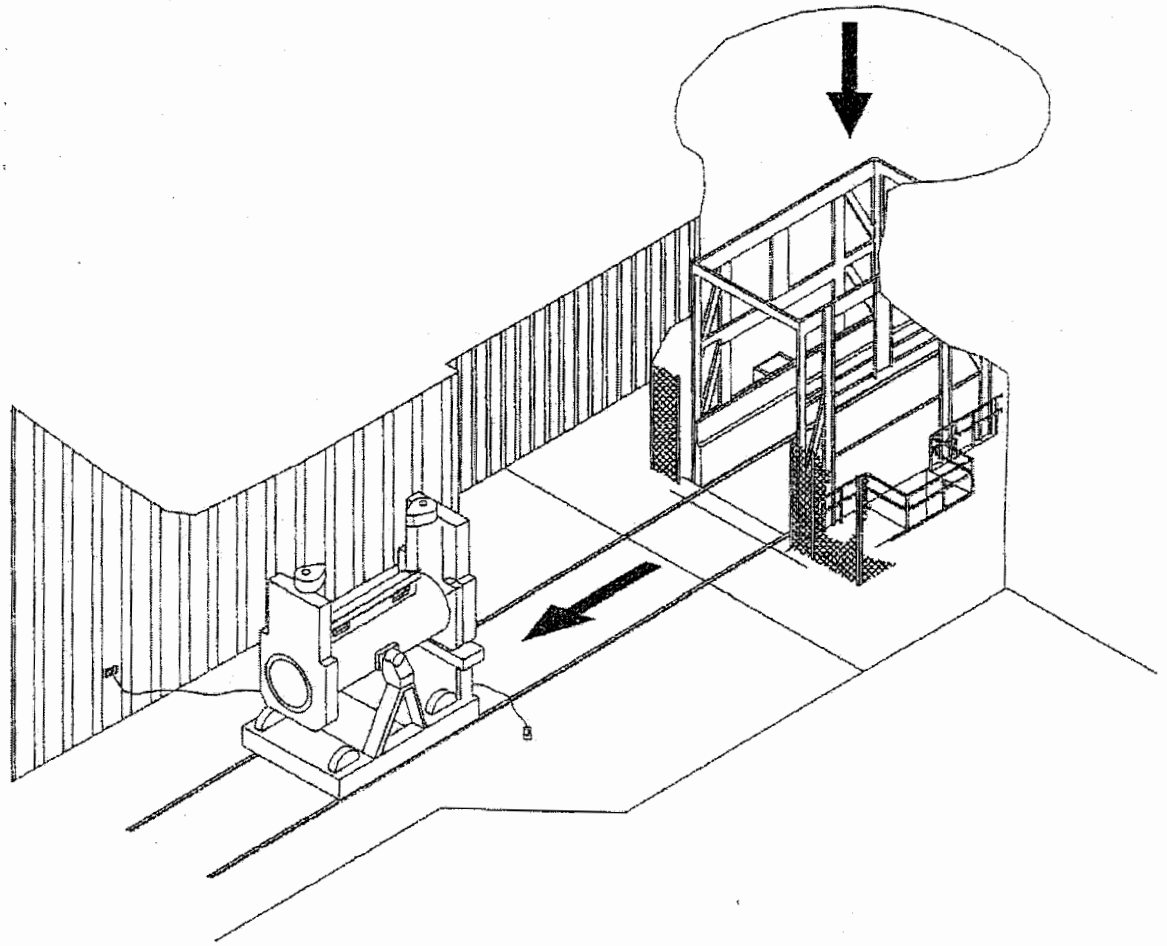

Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

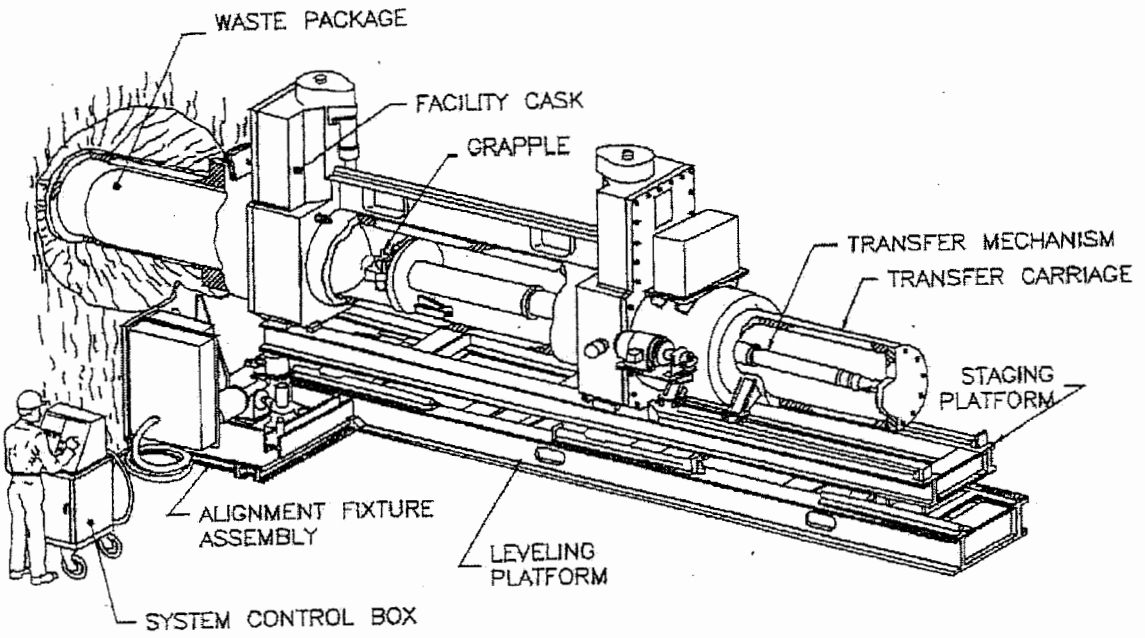

Figure A2-17
Facility Cask Installed on the Typical Emplacement Equipment

FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

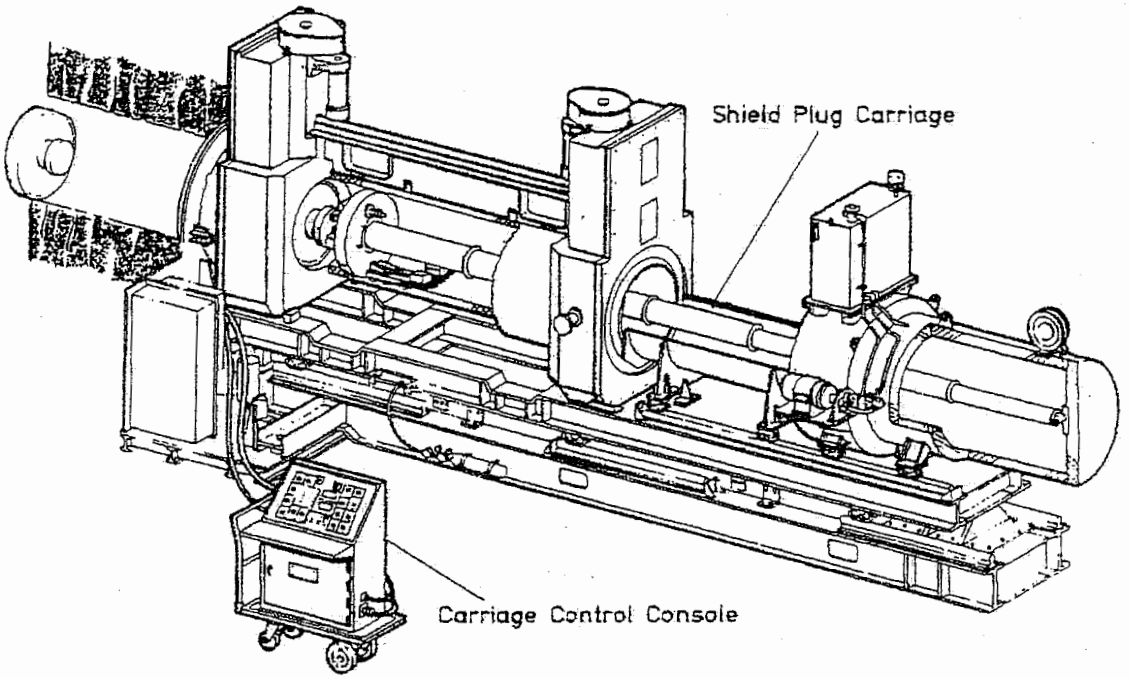

Figure A2-18
Installing Shield Plug

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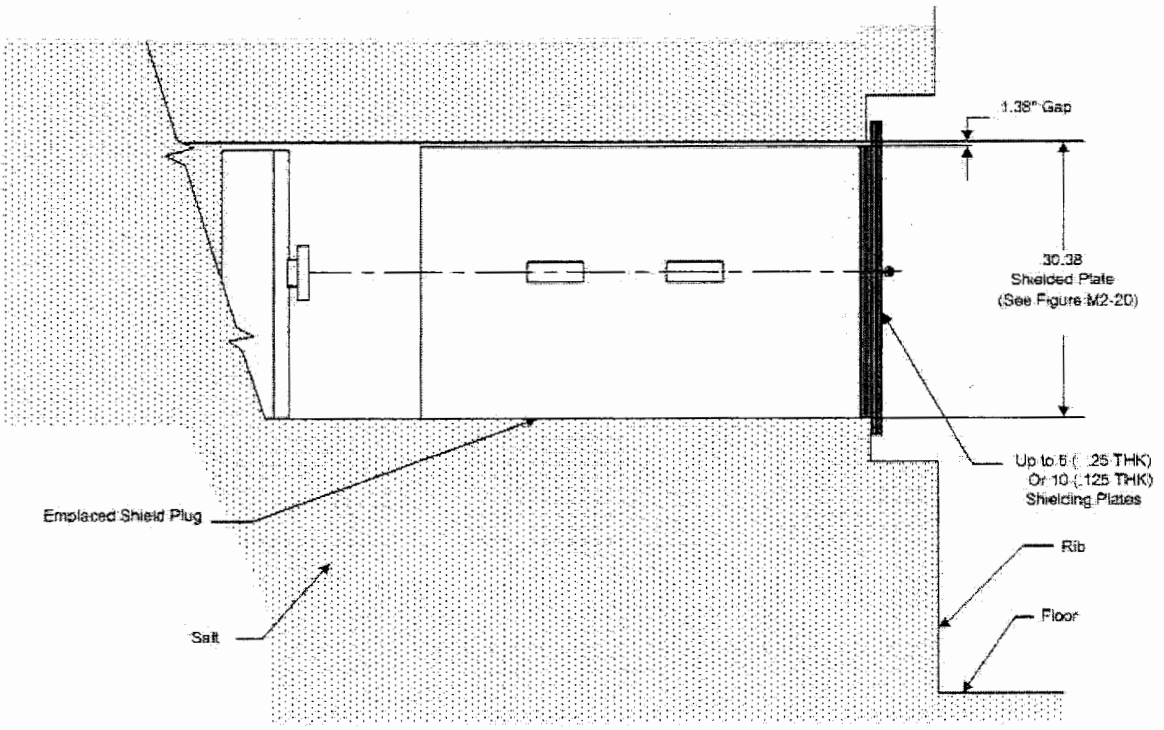


Section of Bore Hole Showing The Shield and Supplemental Shielding Plate(s)

Figure A2-19
Shield Plug Supplemental Shielding Plate(s)

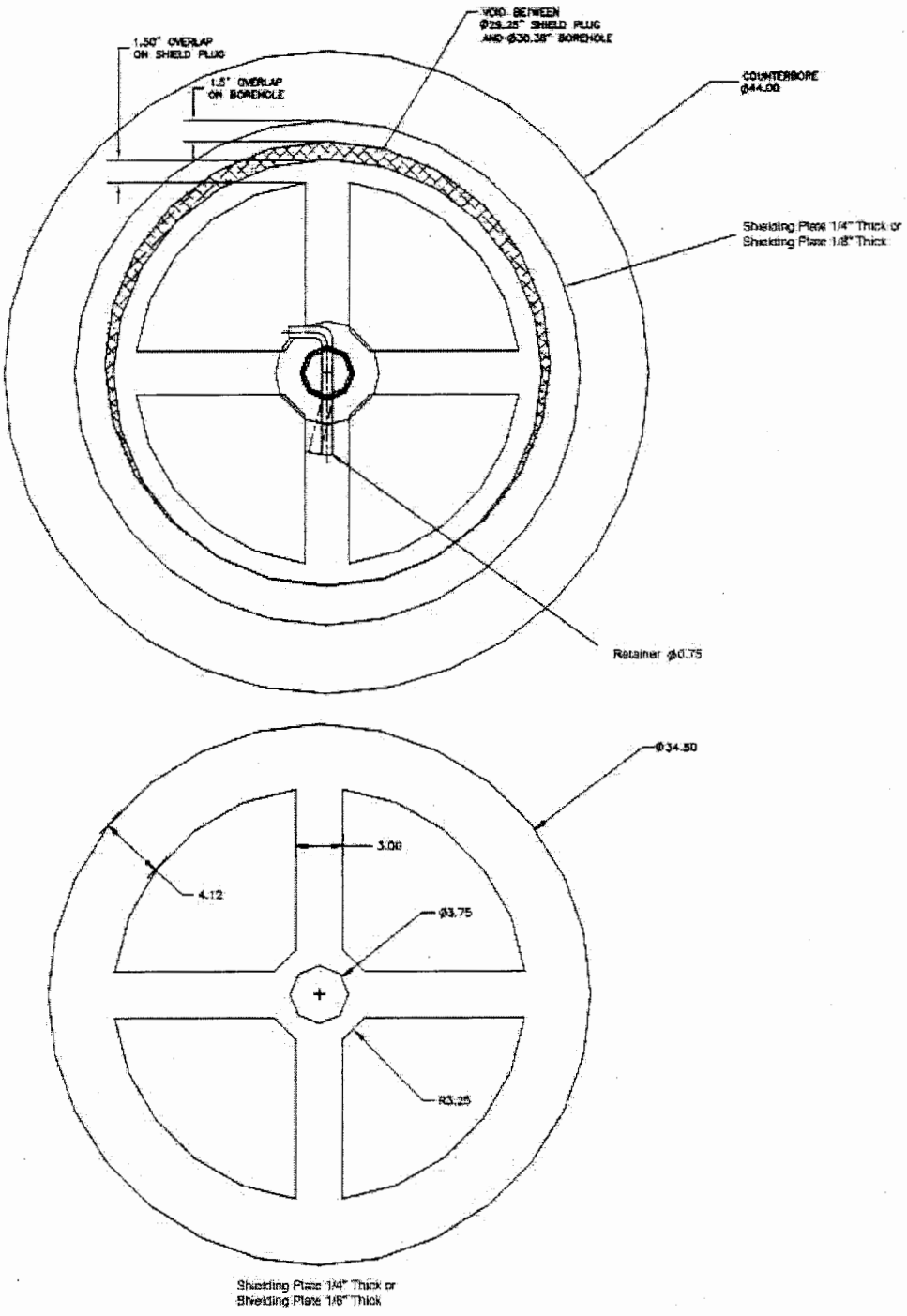
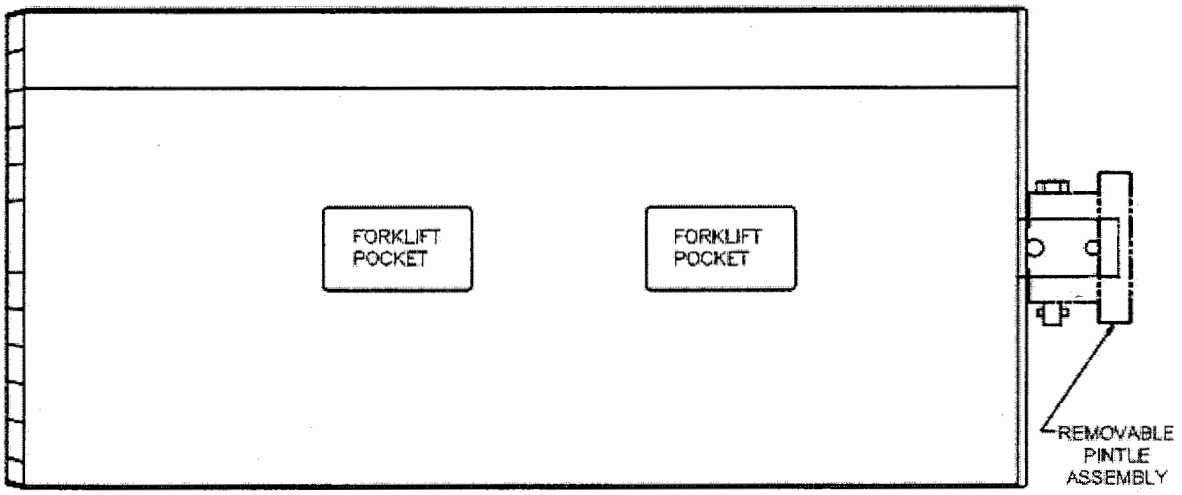


Figure A2-20
Shielding Layers to Supplement RH Borehole Shield Plugs



TYPICAL DIMENSION: APPROXIMATELY 29 INCHES DIAMETER X 81 INCHES SHIELDING LENGTH

Composition: Cylindrical steel shell filled with concrete
Weight: Approximately 3750 pounds

Figure A2-21
Shield Plug Configuration

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ATTACHMENT A3

DRAWING NUMBER 51-W-214-W
UNDERGROUND FACILITIES TYPICAL DISPOSAL PANEL

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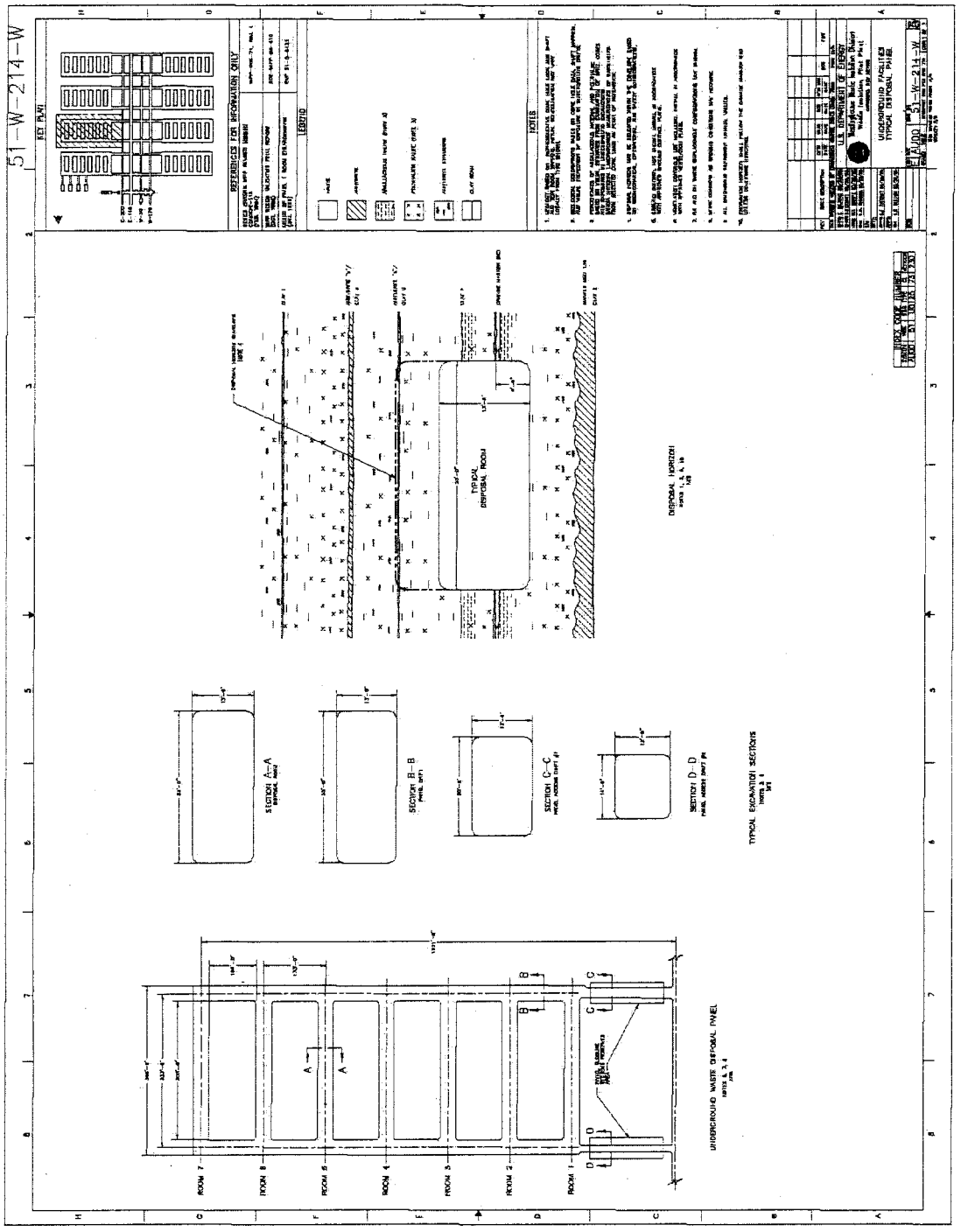

Drawing 51-W-214-W Underground Facilities Typical Disposal Panel

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ATTACHMENT A4

TRAFFIC PATTERNS

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ATTACHMENT A4

TRAFFIC PATTERNS

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A4-2 Facility Access and Traffic.....1
A4-3 Waste Handling Building Traffic.....3
A4-4 Underground Traffic.....4

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Figure A4-2	WIPP Traffic Flow Diagram
Figure A4-3	Waste Transport Routes in Waste Handling Building - Container Storage Unit
Figure A4-3a	Typical Transport Route for TRUPACT-II and Standard Large Box 2
Figure A4-3b	Typical Transport Route for TRUPACT-II and Standard Large Box 2 in Room 108
Figure A4-4	Typical Underground Transport Route Using E-140
Figure A4-4a	Typical Underground Transport Route Using W-30
Figure A4-5	RH Bay Waste Transport Routes
Figure A4-6	RH Bay Cask Loading Room Waste Transport Route
Figure A4-7	RH Bay Canister Transfer Cell Waste Transport Route

ATTACHMENT A4

TRAFFIC PATTERN

A4-1 Traffic Information and Traffic Patterns

Access to the WIPP facility is provided by two access roads that connect with U.S. Highway 62/180, 13 mi (21 km) to the north, and NM Highway 128 (Jal Highway), 4 mi (6.4 km) to the south (Figure A4-1). These access roads were built for the Permittees to transport TRU mixed waste to the site. Both access roads are owned and maintained by the Department of Energy (**DOE**). Signs and pavement markings are located in accordance with the Uniform Traffic Control Devices Manual. Access-road design designation parameters, such as traffic volume, are presented in Table A4-1.

A4-2 Facility Access and Traffic

Access to the facility for personnel, visitors, and trucks carrying supplies and TRU mixed waste is provided through a security checkpoint (vehicle trap). After passing through the security checkpoint, TRU mixed waste transport trucks will normally turn right (south) before reaching the Support Building and then left (east) to park in the parking area HWMU just east of the air locks (Figure A4-2). Outgoing trucks depart the same way they arrived, normally out of the west end of the parking area, north through the fence gate and out through the vehicle trap. An alternate inbound route is to continue straight ahead from the security checkpoint to the second road and to turn south to enter the truck parking area. The alternate outbound route is also the reverse of this route. Salt transport trucks, which remove mined salt from the Salt Handling Shaft area, will not cross paths with TRU mixed waste transporters; instead, they will proceed from the Salt Handling Shaft northward to the salt pile. Figure A4-2 shows surface traffic flow at the WIPP facility.

The site speed limit for motor vehicles is 10 mph (16 kph) and 5 mph (8 kph) for rail movements. Speed limits are clearly posted at the entrance to the site and enforced by security officers. There are no traffic signals. Stop signs are located at the major intersections of roadways with the main east-west road. Safety requirements are communicated to all site personnel via General Employee Training within 30 days of their employment. Employee access to on-site facilities requires an annual refresher course to reinforce the safety requirements. Security officers monitor vehicular traffic for compliance with site restrictions, and provide instructions to off-site delivery shipments. Vehicular traffic other than the waste transporters use the same roads, but there will be no interference because there are two lanes available on the primary and alternate routes for waste shipments. Pedestrian traffic is limited to the sidewalks and prominently marked crosswalks. Site traffic is composed mostly of pickup trucks and electric carts with a frequency of perhaps 10 per hour at peak periods. Emergency vehicles are exercised periodically for maintenance and personnel training, with an average frequency of one each per day. They are used for their intended purpose on an as-required basis.

The traffic circulation system is designed in accordance with American Association of State Highway and Transportation Officials (**AASHTO**) Site Planning Guides for lane widths, lateral clearance to fixed objects, minimum pavement edge radii, and other geometric features. Objects in or near the roadway are prominently marked.

On-site roads, sidewalks, and paved areas are used for the distribution and storage of vehicles and personnel and are designed to handle all traffic generated by employees, visitors, TRU mixed waste shipments, and movements of operational and maintenance vehicles. The facility entrance and TRU mixed waste haul roads are designed for AASHTO H20-S16 wheel loading. Service roads are designed for AASHTO H10 wheel loading. Access and on-site paved roads are designed to bear the anticipated maximum load of115,000 lbs (52,163.1 kg), the maximum allowable weight of a truck/trailer carrying loaded Contact-Handled or Remote-Handled Packages. The facility is designed to handle approximately eight truck trailers per day, each carrying one or more Contact-Handled or Remote-Handled Packages. This is equivalent to 3,640 TRU mixed waste-carrying vehicles per year.

The calculations to support the anticipated maximum load of 115,000 lbs. are shown below:

Soil Resistance R (psi) - is taken directly from the WIPP Soil Report and Bechtel calculation because there is no change.

A. Pavement Thickness

The traffic frequency increase from 10 shipments per day to 10.15 shipments per day has only minimal impact on the Total Expanded Average Load (**EAL**) and the traffic index (**TI**) as shown below, both important parameters in pavement design.

Total EAL (TEAL):
13,780 ~ constant for 5 or more axles over 20 years, taken from Table 7-651.2A - Highway Design Manual (HDM).
TEAL = 13,780 × 25yr./20yr. = 17,225
Using 10.15 shipments per day ~ 17,225 × 10.15 = 174,834

Conversion of EAL to Traffic Index (TI).
For TEAL of 174,834 ~ TI = 7.5 - (from HDM, Table 7-651.2B)

Asphalt Concrete Thickness TAC:
GE = 0.0032 × TI × (100 -R)....R = 80
GE - Gravel Equivalent (Ft).
GE = 0.0032 × 7.5 × 20 = 0.48′ ...GfAC = 2.01⇒ TAC = 0.48/2.01 = 0.24′ ⇒ use 2½" AC Surface Course.
(Actually used: 3")
Gf - Gravel Equivalent Factor (constant from Table 7-651.2C from HDM).

B. Bituminous Treated Base

GE = 0.0032 × TI × (100 -R) .... R = 55 ~ caliche subbase ⇒ GE = 1.08′ GEBTB = 1.08 - 2.01 × 0.21 = 0.66′
TBTB = GEBTB/GfBTB = 0.66/1.2 = 0.55′ ⇒ Use 4" BTB
GfBTB ~ taken from table 7-651.2C

C. Caliche Subbase ~ TCSB

GE = 0.0032 × TI × (100 -R) .....R = 50 - prepared subgrade
GE = 1.2

GECSB = 1.2 - (0.21× 2.07) - (0.33 × 1.2) ⇒ 0.37'
TCBS = 0.37/1.0 = 0.37' ~ 4½"

Based on the results of the above calculation, the site paved roads designated for waste transportation are safe to be used by the heavier truckloads carrying shipping casks used in RH TRU mixed waste transportation to the WIPP.

A4-3 Waste Handling Building Traffic

CH TRU mixed waste will arrive by tractor-trailer at the WIPP facility in sealed Contact Handled Packages. Upon receipt, security checks, radiological surveys, and shipping documentation reviews will be performed. A forklift ~~or~~ Yard Transfer Vehicle will remove the Contact Handled Packages and transport them a short distance through an air lock that is designed to maintain differential pressure in the WHB. The forklift or Yard Transfer Vehicle will place the shipping containers at one of the two TRUPACT-II unloading docks (**TRUDOCK**) inside the WHB or, in the case of the TRUPACT-III, at the payload transfer station in Room 108.

The TRUPACT-II may hold up to two 55-gallon drum seven-packs, two 85-gallon drum four-packs, two 100-gallon drum three-packs, two standard waste boxes (SWB), or one ten-drum overpack (**TDOP**). A HalfPACT may hold seven 55-gallon drums, one SWB, one shielded container 3-pack, or four 85-gallon drums. The TRUPACT-III holds a single SLB2. A six-ton overhead bridge crane or Facility Transfer Vehicle with a transfer table will be used to remove the contents of the Contact Handled Package. Waste containers will be surveyed for radioactive contamination and decontaminated or returned to the Contact Handled Package as necessary.

Each facility pallet will accommodate four 55-gallon drum seven-packs, four SWBs, four 85-gallon drum four-packs, four 100-gallon drum three-packs, two shielded container 3-packs, two TDOPs, or an SLB2. Waste containers will be secured to the facility pallet prior to transfer. A forklift or facility transfer vehicle will transport the loaded facility pallet the air lock at the Waste Shaft (Figures A4-3, A4-3a, and A4-3b). The facility transfer vehicle will be driven onto the waste shaft conveyance deck, where the loaded facility pallet will be transferred to the waste shaft conveyance and downloaded for emplacement.

RH TRU mixed waste will arrive at the WIPP facility in a payload container contained in a shielded cask loaded on a tractor-trailer. Upon arrival, radiological surveys, security checks, and shipping documentation reviews will be performed, and the trailer carrying the cask will be moved into the Parking Area or directly into the RH Bay of the Waste Handling Building Unit.

The cask is unloaded from the trailer in the RH Bay and is placed on the Cask Transfer Car. The Cask Transfer Car is used to move the cask to the Cask Unloading Room. At this point, a crane moves the waste to the Hot Cell or the Transfer Cell. Some RH TRU mixed waste may be moved to the Hot Cell for overpacking before being moved to the Transfer Cell. Once in the Transfer Cell, the Transfer Cell Shuttle Car moves the waste beneath the facility cask. A crane is used to move the waste from the Transfer Cell Shuttle Car into the facility cask. The Facility Cask Transfer Car then moves the facility cask to the underground. A more detailed description of waste handling in the WHB is included in Attachment M1. Figures A4-5, A4-6 and A4-7 show RH TRU mixed waste transport routes.

A4-4 Underground Traffic

The Permittees shall designate the traffic routes of TRU mixed waste handling equipment and construction equipment and record this designation on a map that is posted in a location where it can be examined by personnel entering the underground. The map will be updated whenever the routes are changed. Maps will be available in facility files until facility closure. The ventilation and traffic flow path in the TRU mixed waste handling areas underground are restricted and separate from those used for mining and haulage (construction) equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600 (Figures A4-4 and A4-4a). In general, the Permittees restrict waste traffic to the intake ventilation drift to maximize isolation of this activity from personnel. The exhaust drift in the waste disposal area will normally not be used for personnel access. Non-waste and non-construction traffic is generally comprised of escorted visitors only and is minimized during each of the respective operations.

Adequate clearances that exceed the mining regulations of 30 CFR §57 exist underground for safe passage of vehicles and pedestrians. Pedestrians/personnel are required to yield to vehicles in the WIPP underground facility. This condition is reinforced through the WIPP equipment operating procedures, the WIPP Safety Manual, the WIPP safety briefing required for all underground visitors, the General Employee Training annual refresher course, and the Underground annual refresher course that are mandated by 30 CFR §57, the New Mexico Mine Code, and DOE Order 5480.20A.

In addition, other physical means are utilized to safeguard pedestrians/personnel when underground such as:

All equipment operators are required to sound the vehicle horn when approaching intersections.

All airlock and bulkhead vehicle doors are equipped with warning bells or strobe lights to alert personnel when door opening is imminent.

Hemispherical mirrors are used at blind intersections so that persons can see around corners.

All heavy equipment is required to have operational back-up alarms.

Heavily used intersections are well lighted.

Typically, the traffic routes during waste disposal in all Panels will use the same main access drifts.

All traffic safety is regulated and enforced by the Federal and State mine codes of regulations (30 CFR §57 and New Mexico State Mine Code). The agencies that administer these codes make regular inspection tours of the WIPP underground facilities for the purpose of enforcement.

All underground equipment is designed for off-road use since all driving surfaces are excavated in salt. No loads on the underground roadways will exceed the bearing strength of in situ halite.

TABLES

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Table A4-1
Waste Isolation Pilot Plant Site Design Designation Traffic Parameters [a]

Traffic Parameter	North Access Road (No. of Vehicles, unless otherwise stated)	South Access Road (No. of Vehicles, unless otherwise stated)	On-Site Waste Haul Roads Contact-Handled and Remote-Handled Package Traffic)
Average Daily Traffic (ADT)[b]	800	800	8
Design Hourly Volume (DHV)[c]	144	144	NA [g]
Hourly Volume (Max. at Shift Change)	250	250	NA
Distribution (D)[d]	67%	67%	NA
Trucks (T)[e]	2%	2%	100%
Design Speed [h,i]	70 mph (113 kph)	60 mph (97 kph)	25 mph (40 kph)
Control of Access [f]	None	None	Full

[a] For WIPP personnel and TRU mixed waste shipments only.

[b] ADT—Estimated number of vehicles traveling in both directions per day.

[c] DHV—A two-way traffic count with directional distribution.

[d] D—The percentage of DHV in the predominant direction of travel.

[e] T—The percentage of ADT comprised of trucks (excluding light delivery trucks).

[f] Control of Access—The extent of roadside interference or restriction of movement.

[g] NA—Not applicable.

[h] mph—miles per hour.

[i] kph—kilometers per hour.

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FIGURES

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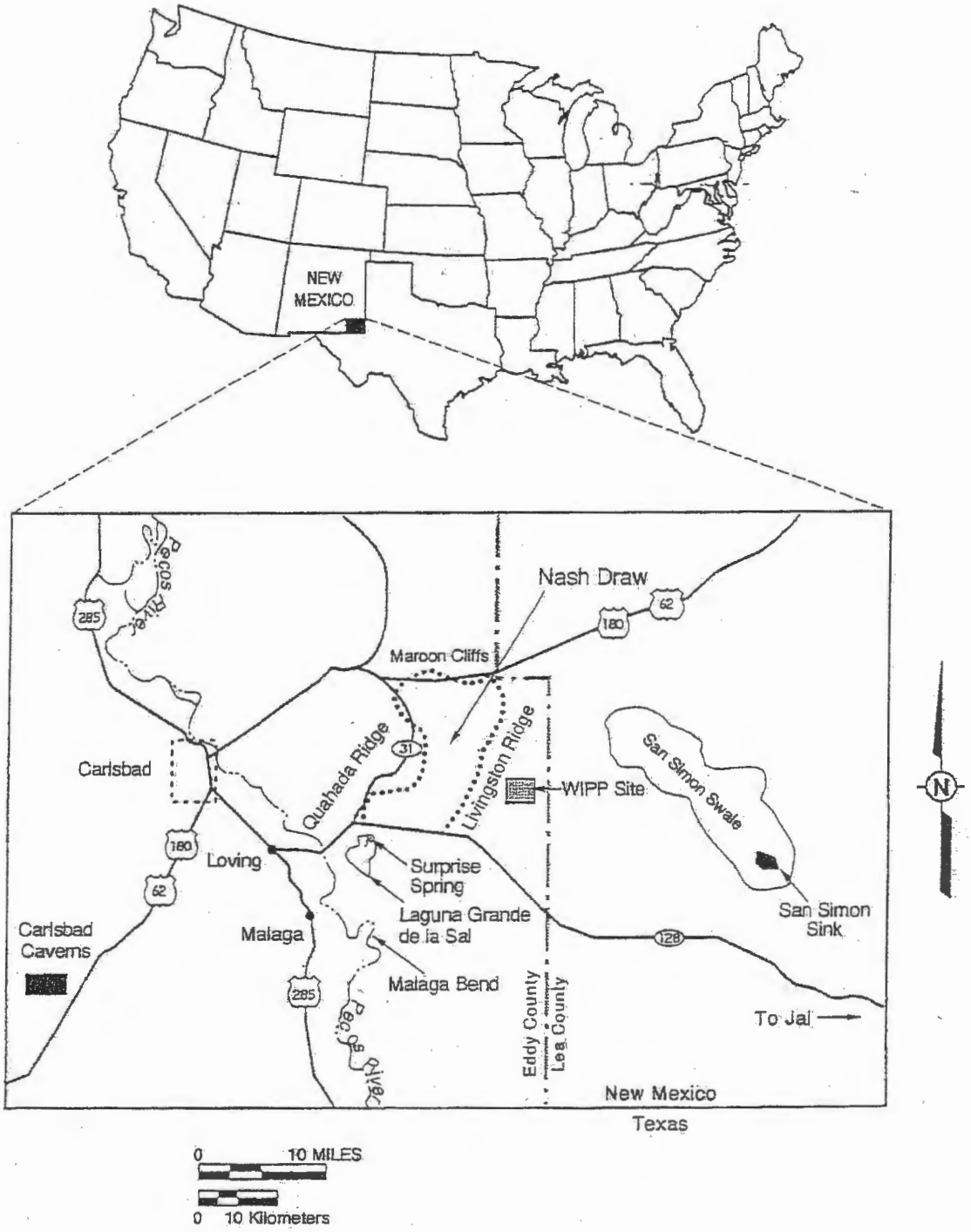

Figure A4-1
General Location of the WIPP Facility

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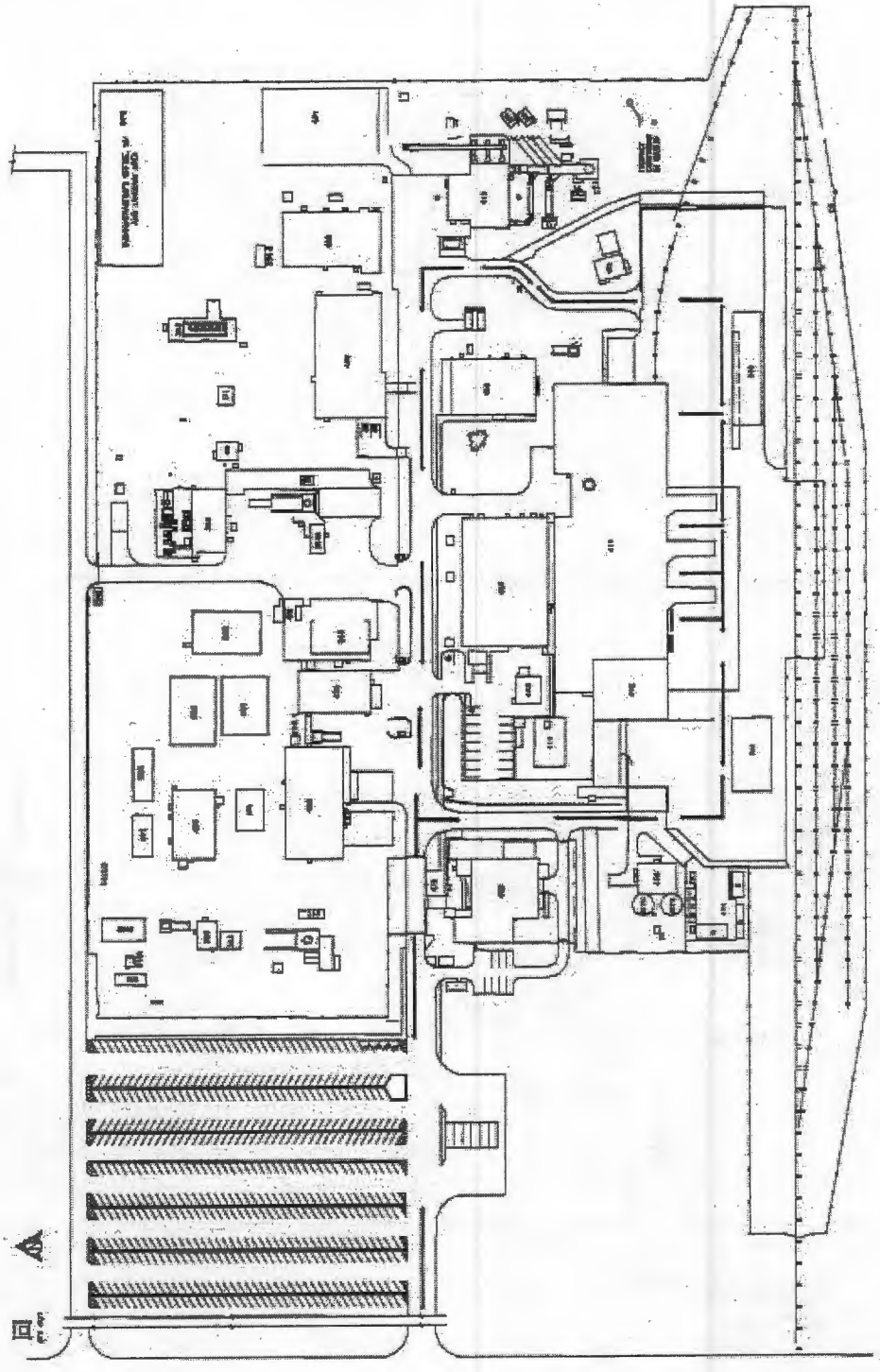

Figure A4-2
WIPP Traffic Flow Diagram

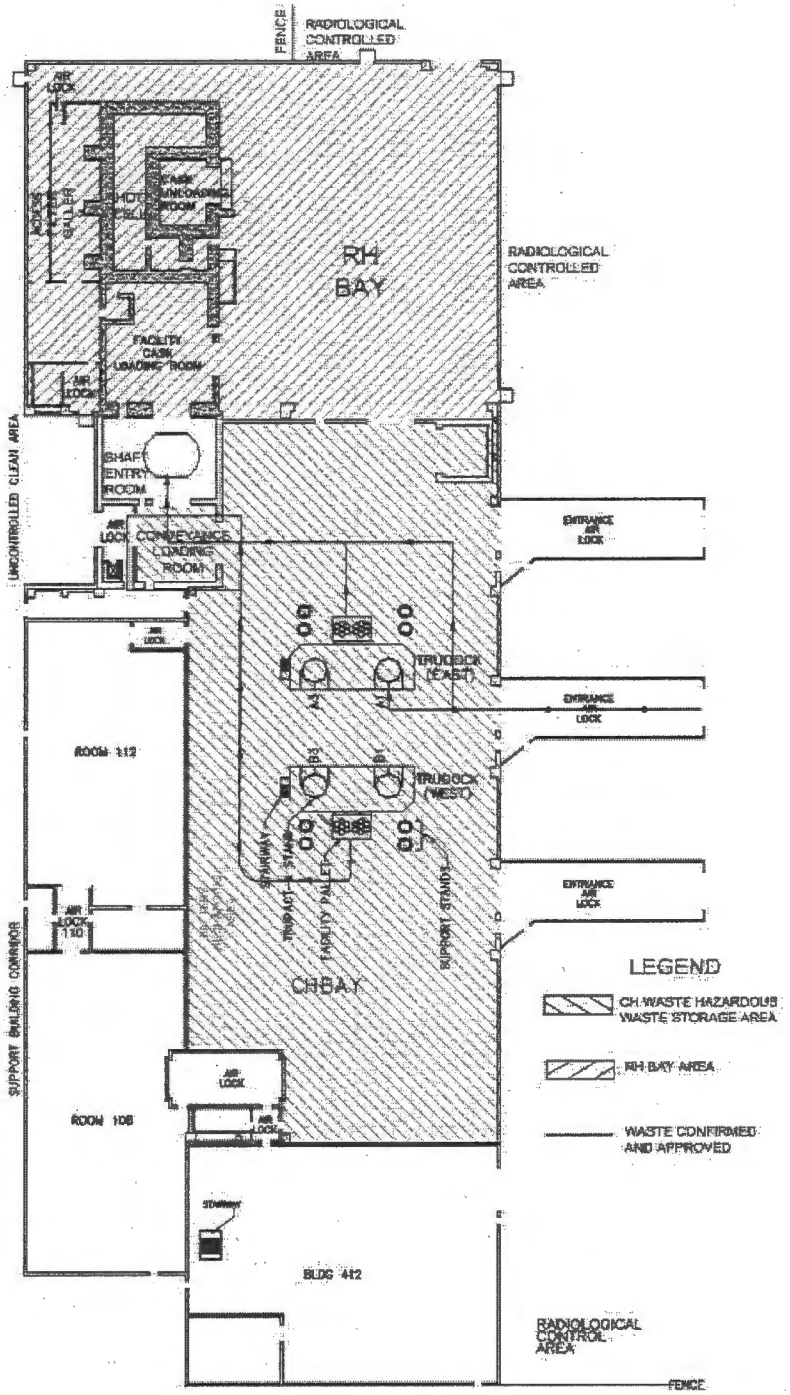

Figure A4-3
Waste Transport Routes in Waste Handling Building - Container Storage Unit

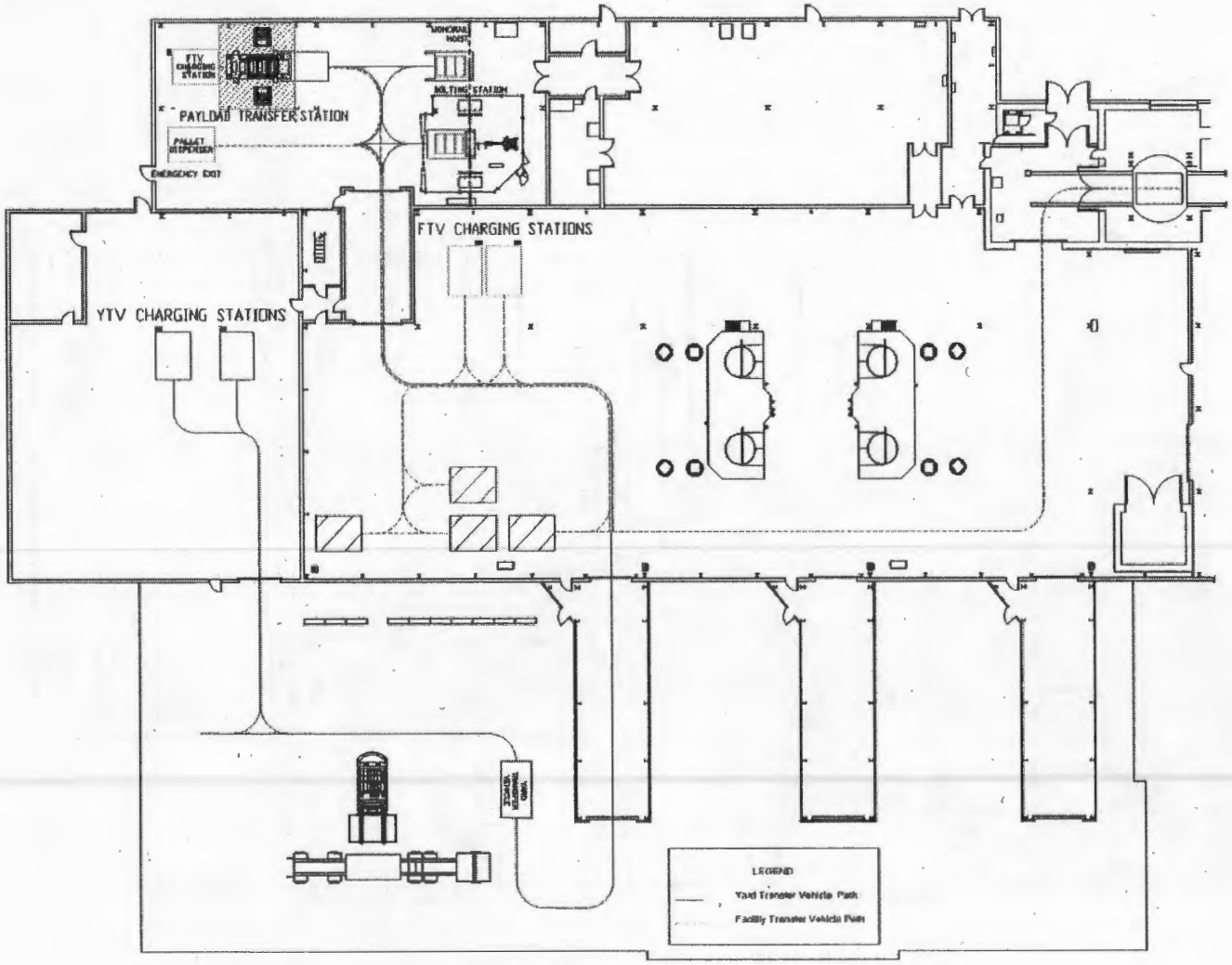

Figure A4-3a
Typical Transport Route for TRUPACT-III and Standard Large Box 2

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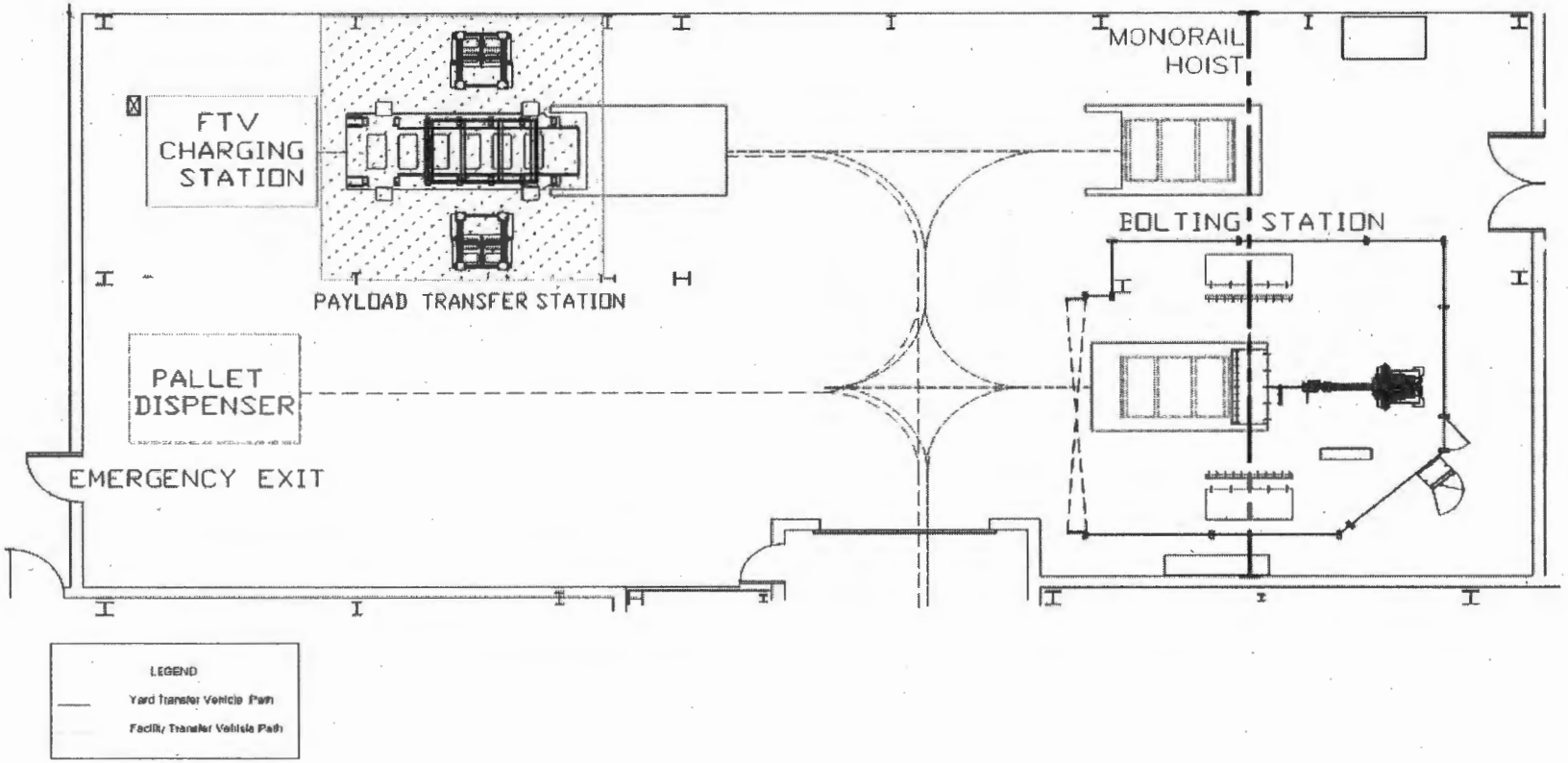

Figure A4-3b
Typical Transport Route for TRUPACT-III and Standard Large Box 2 in Room 108

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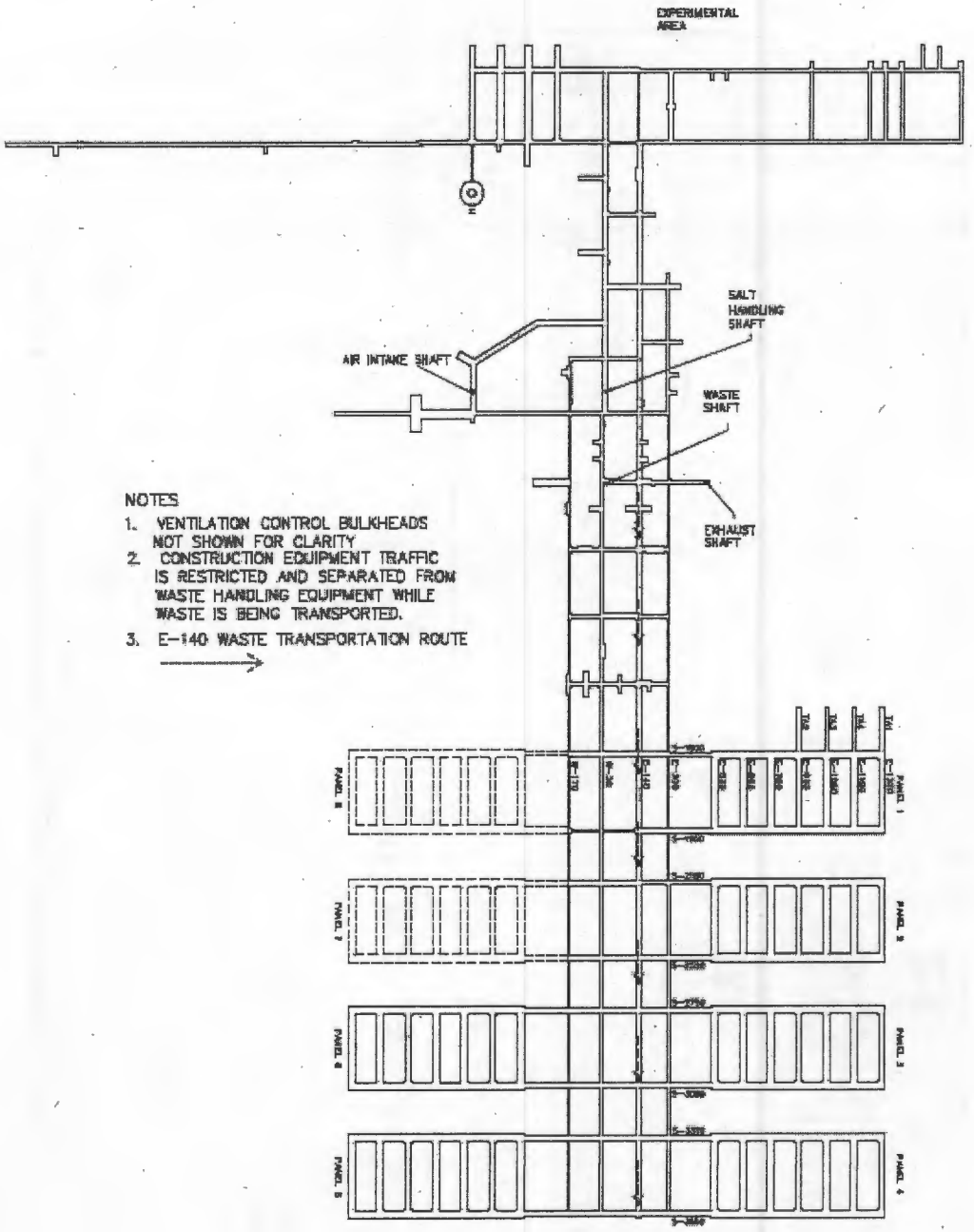

Figure A4-4
Typical Underground Transport Route Using E-140

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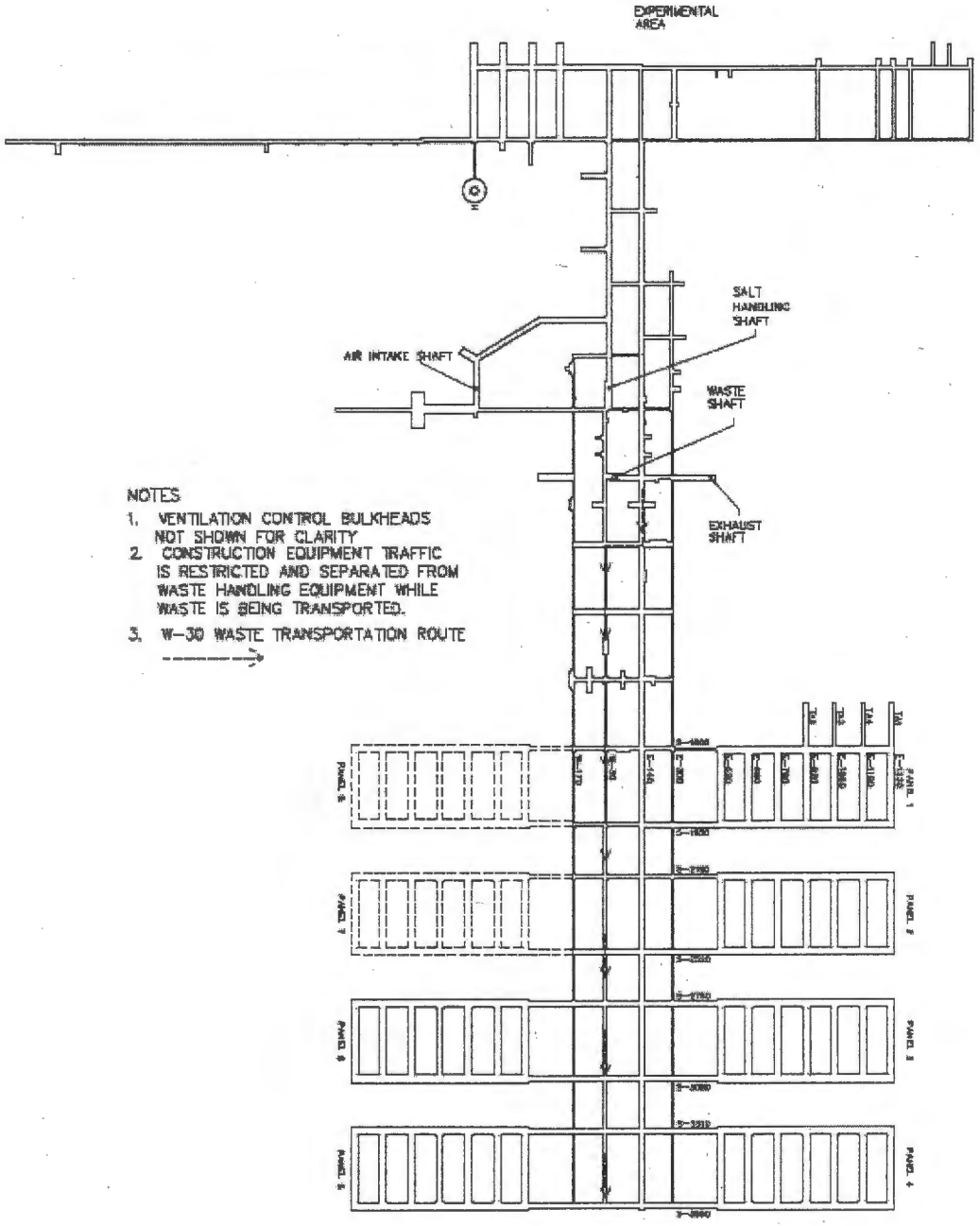

Figure A4-4a
Typical Underground Transport Route Using W-30

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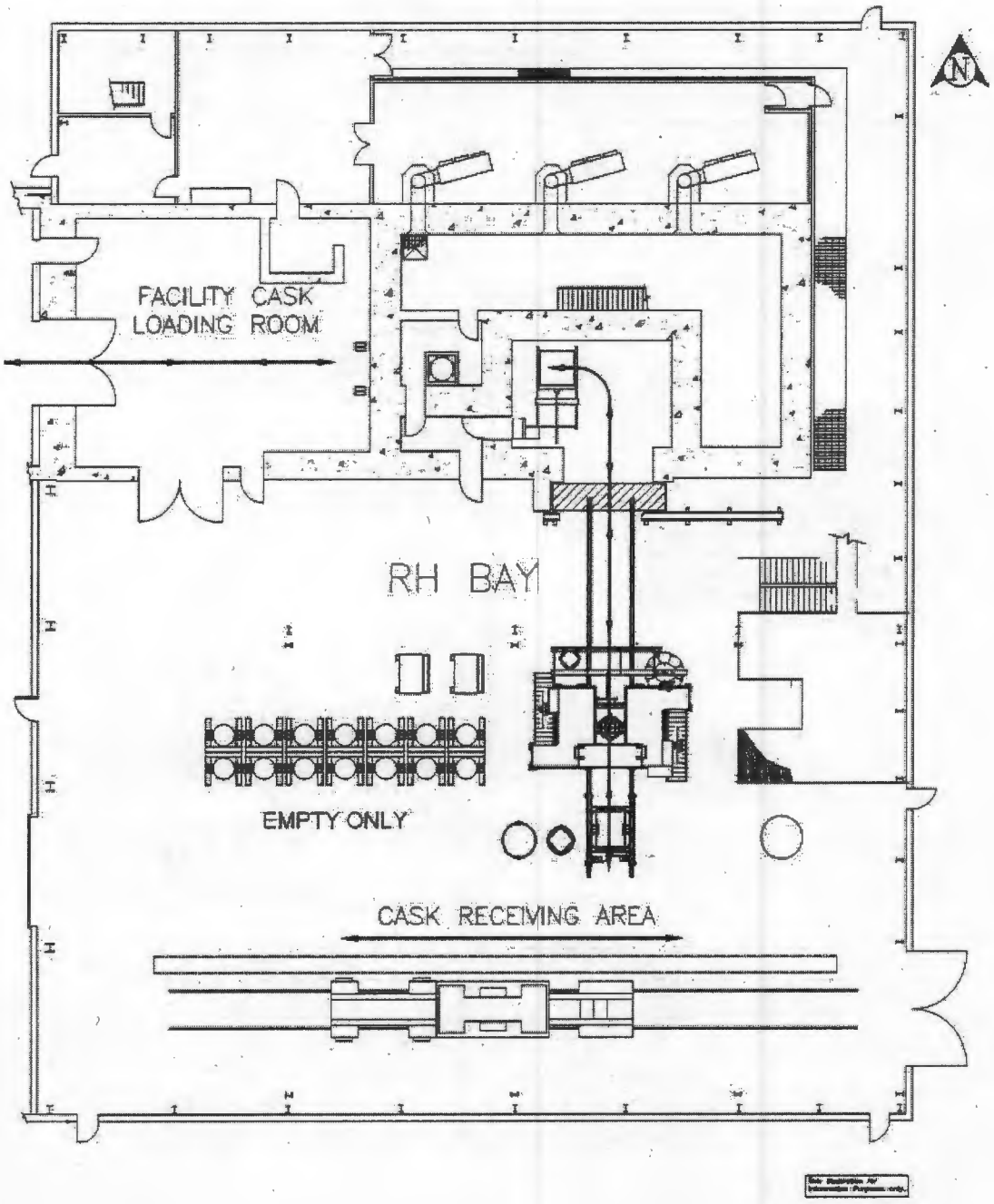

Figure A4-5
RH Bay Waste Transport Routes

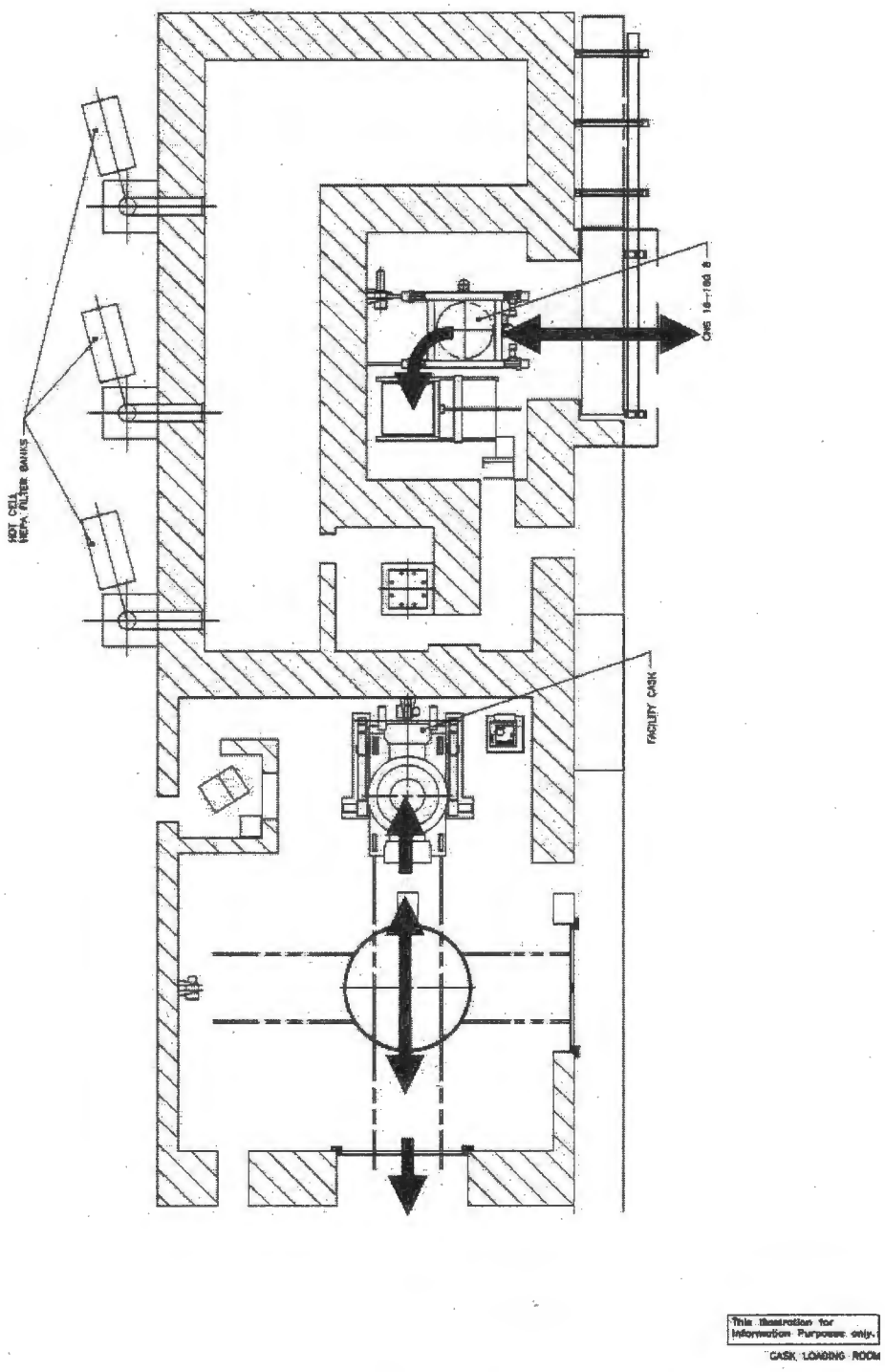

Figure A4-6
RH Bay Cask Loading Room Waste Transport Route

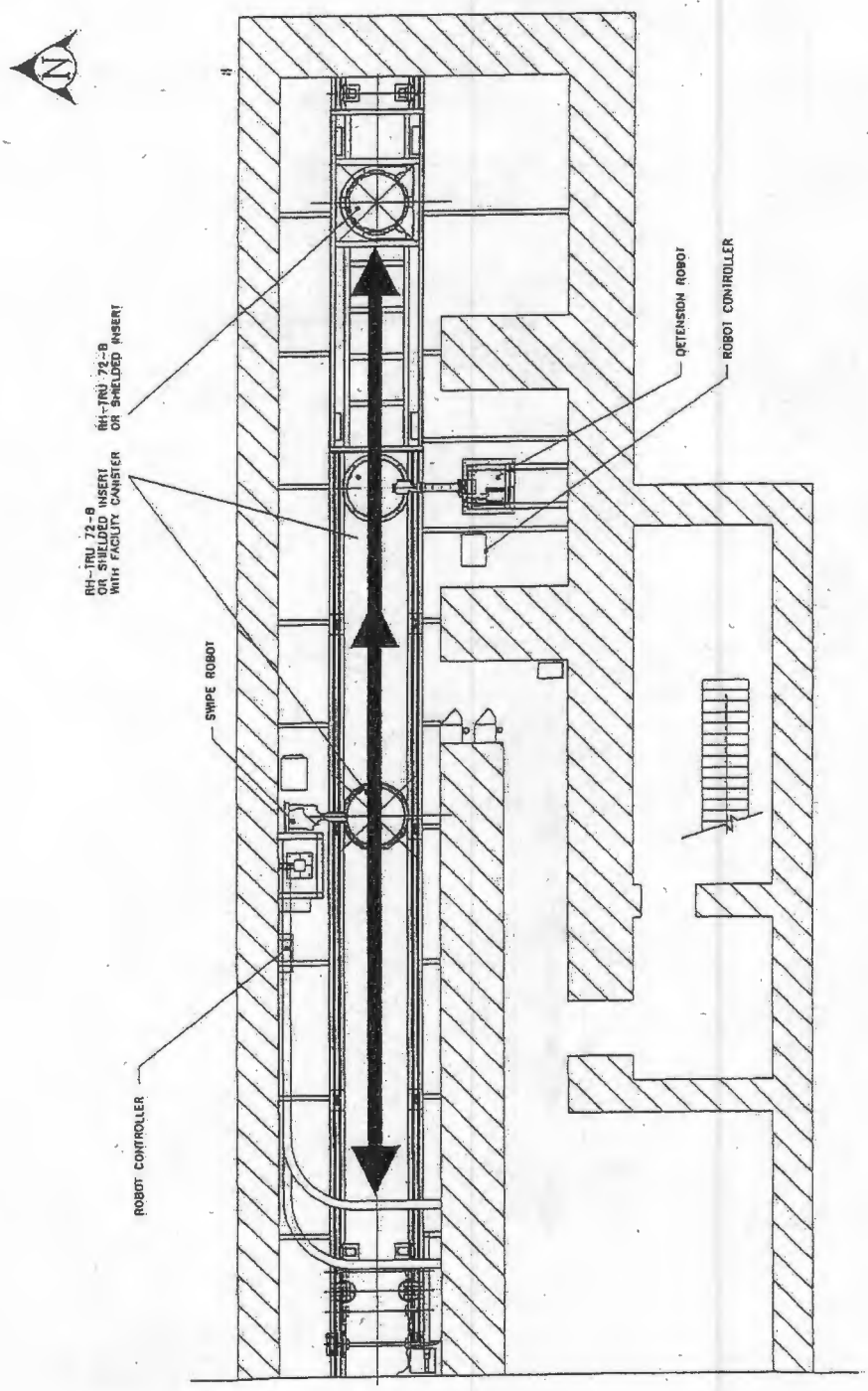

Figure A4-7
RH Bay Canister Transfer Cell Waste Transport Route

1

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ATTACHMENT B

HAZARDOUS WASTE PERMIT APPLICATION PART A

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ATTACHMENT B

HAZARDOUS WASTE PERMIT APPLICATION PART A

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SEND COMPLETED FORM TO: The Appropriate State or Regional Office.	United States Environmental Protection Agency **RCRA SUBTITLE C SITE IDENTIFICATION FORM**	

1. Reason for Submittal (MARK ALL BOX(ES) THAT APPLY)

Reason for Submittal:

- ☐ To provide an Initial Notification (first time submitting site identification information / to obtain an EPA ID number for this location)
- ☒ To provide a Subsequent Notification (to update site identification information for this location)
- ☐ As a component of a First RCRA Hazardous Waste Part A Permit Application
- ☒ As a component of a Revised RCRA Hazardous Waste Part A Permit Application (Amendment # 27)
- ☐ As a component of the Hazardous Waste Report (If marked, see sub-bullet below)
  - ☐ Site was a TSD facility and/or generator of ≥1,000 kg of hazardous waste, >1 kg of acute hazardous waste, or >100 kg of acute hazardous waste spill cleanup in one or more months of the report year (or State equivalent LQG regulations)

2. Site EPA ID Number

EPA ID Number: N M 4 8 9 0 1 3 9 0 8 8

3. Site Name

Name: Waste Isolation Pilot Plant

4. Site Location Information

Street Address: 30 miles east of Carlsbad on Jal Highway
City, Town, or Village: Carlsbad — County: Eddy
State: NM — Country: USA — Zip Code: 88221

5. Site Land Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

6. NAICS Code(s) for the Site (at least 5-digit codes)

A. 5 6 2 2 1 — C.
B. — D.

7. Site Mailing Address

Street or P.O. Box: P.O. Box 3090
City, Town, or Village: Carlsbad
State: NM — Country: USA — Zip Code: 88221

8. Site Contact Person

First Name: Jose — MI: R. — Last: Franco
Title: Manager, Carlsbad Field Office (CBFO)
Street or P.O. Box: P.O. Box 3090
City, Town or Village: Carlsbad
State: NM — Country: USA — Zip Code: 88221
Email: jose.franco@wipp.ws
Phone: (575) 234-7300 — Ext.: — Fax: (575) 234-7027

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner: U.S. Department of Energy — Date Became Owner: 05/18/1981
Owner Type: ☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other
Street or P.O. Box: P.O. Box 3090
City, Town, or Village: Carlsbad — Phone: (575) 234-7300
State: NM — Country: USA — Zip Code: 88221
B. Name of Site's Operator: U.S. Department of Energy — Date Became Operator: 05/18/1981
Operator Type: ☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

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EPA ID Number | N | M | 4 | 8 | 9 | 0 | 1 | 3 | 9 | 0 | 8 | 8 |

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10. Type of Regulated Waste Activity (at your site)
Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities; Complete all parts 1-10.

Y ☑ N ☐ **1. Generator of Hazardous Waste**
If "Yes", mark only one of the following – a, b, or c.

- ☑ a. LQG: Generates, in any calendar month, 1,000 kg/mo (2,200 lbs./mo.) or more of hazardous waste; or Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lbs./mo) of acute hazardous waste; or Generates, in any calendar month, or accumulates at any time, more than 100 kg/mo (220 lbs./mo) of acute hazardous spill cleanup material.
- ☐ b. SQG: 100 to 1,000 kg/mo (220 – 2,200 lbs./mo) of non-acute hazardous waste.
- ☐ c. CESQG: Less than 100 kg/mo (220 lbs./mo) of non-acute hazardous waste.

If "Yes" above, indicate other generator activities in 2-4.

Y ☐ N ☑ **2. Short-Term Generator** (generate from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.

Y ☐ N ☑ **3. United States Importer of Hazardous Waste**

Y ☑ N ☐ **4. Mixed Waste (hazardous and radioactive) Generator**

Y ☐ N ☑ **5. Transporter of Hazardous Waste**
If "Yes", mark all that apply.

- ☐ a. Transporter
- ☐ b. Transfer Facility (at your site)

Y ☑ N ☐ **6. Treater, Storer, or Disposer of Hazardous Waste** Note: A hazardous waste Part B permit is required for these activities.

Y ☐ N ☑ **7. Recycler of Hazardous Waste**

Y ☐ N ☑ **8. Exempt Boiler and/or Industrial Furnace**
If "Yes", mark all that apply.

- ☐ a. Small Quantity On-site Burner Exemption
- ☐ b. Smelting, Melting, and Refining Furnace Exemption

Y ☐ N ☑ **9. Underground Injection Control**

Y ☑ N ☐ **10. Receives Hazardous Waste from Off-site**

B. Universal Waste Activities; Complete all parts 1-2.

Y ☐ N ☑ **1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) [refer to your State regulations to determine what is regulated]. Indicate types of universal waste managed at your site. If "Yes", mark all that apply.**

- a. Batteries ☐
- b. Pesticides ☐
- c. Mercury containing equipment ☐
- d. Lamps ☐
- e. Other (specify) _____ ☐
- f. Other (specify) _____ ☐
- g. Other (specify) _____ ☐

Y ☐ N ☑ **2. Destination Facility for Universal Waste**
Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities; Complete all parts 1-4.

Y ☐ N ☑ **1. Used Oil Transporter**
If "Yes", mark all that apply.

- ☐ a. Transporter
- ☐ b. Transfer Facility (at your site)

Y ☐ N ☑ **2. Used Oil Processor and/or Re-refiner**
If "Yes", mark all that apply.

- ☐ a. Processor
- ☐ b. Re-refiner

Y ☐ N ☑ **3. Off-Specification Used Oil Burner**

Y ☐ N ☑ **4. Used Oil Fuel Marketer**
If "Yes", mark all that apply.

- ☐ a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
- ☐ b. Marketer Who First Claims the Used Oil Meets the Specifications

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EPA ID Number | N | M | 4 | 8 | 9 | 0 | 1 | 3 | 9 | 0 | 8 | 8 | OMB#: 2050-0024; Expires 12/31/2014

D. **Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR Part 262 Subpart K**

- You can **ONLY** Opt into Subpart K if:
  - you are at least one of the following: a college or university; a teaching hospital that is owned by or has a formal affiliation agreement with a college or university; or a non-profit research institute that is owned by or has a formal affiliation agreement with a college or university; AND
  - you have checked with your State to determine if 40 CFR Part 262 Subpart K is effective in your state

Y ☐ N ☐ 1. Opting into or currently operating under 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories **See the item-by-item instructions for definitions of types of eligible academic entities. Mark all that apply:**

☐ a. College or University

☐ b. Teaching Hospital that is owned by or has a formal written affiliation agreement with a college or university

☐ c. Non-profit Institute that is owned by or has a formal written affiliation agreement with a college or university

Y ☐ N ☐ 2. Withdrawing from 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories

11. **Description of Hazardous Waste**

A. **Waste Codes for Federally Regulated Hazardous Wastes.** Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g., D001, D003, F007, U112). Use an additional page if more spaces are needed.

D004	D019	D033	F001	P030	U043	U108
D005	D021	D034	F002	P098	U044	U122
D006	D022	D035	F003	P099	U052	U133
D007	D026	D036	F004	P106	U070	U134
D008	D027	D037	F005	P120	U072	U151
D009	D028	D038	F006	U002	U078	U154
D010	D029	D039	F007	U003	U079	U159
D011	D030	D040	F009	U019	U103	U196
D018	D032	D043	P015	U037	U105	More Codes Attch.

B. **Waste Codes for State-Regulated (i.e., non-Federal) Hazardous Wastes.** Please list the waste codes of the State-Regulated hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

EPA ID Number NM4890139088

Additional Hazardous Waste Numbers from Section 10						
U209						
U210						
U220						
U226						
U228						
U239						

EPA ID Number | N | M | 4 | 8 | 9 | 0 | 1 | 3 | 9 | 0 | 8 | 8 | OMB#: 2050-0024; Expires 12/31/2014

12. Notification of Hazardous Secondary Material (HSM) Activity

Y ☐ N ☑ Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 261.2(a)(2)(ii), 40 CFR 261.4(a)(23), (24), or (25)?

If "Yes", you must fill out the Addendum to the Site Identification Form: Notification for Managing Hazardous Secondary Material.

13. Comments

14. Certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. For the RCRA Hazardous Waste Part A Permit Application, all owner(s) and operator(s) must sign (see 40 CFR 270.10(b) and 270.11).

Signature of legal owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
Original Signature on File	Jose R. Franco, Manager-CBFO	06/25/2012
Original Signature on File	Farok Sharif, Project Manager-NWP	06/25/2012

EPA ID Number | N | M | 4 | 8 | 9 | 0 | 1 | 3 | 9 | 0 | 8 | 8 |

OMB#: 2050-0024; Expires 12/31/2014

United States Environmental Protection Agency

HARDOUS WASTE PERMIT INFORMATION FORM

1. Facility Permit Contact	**First Name:** Jose	**MI:** R.	**Last Name:** Franco	
	Contact Title: Manager, Carlsbad Field Office			
	Phone: (575) 234-7300	**Ext.:**	**Email:** jose.franco@wipp.ws	
2. Facility Permit Contact Mailing Address	**Street or P.O. Box:** P.O. Box 3090			
	City, Town, or Village: Carlsbad			
	State: NM			
	Country: USA		**Zip Code:** 88221	
3. Operator Mailing Address and Telephone Number	**Street or P.O. Box:** P.O. Box 3090			
	City, Town, or Village: Carlsbad			
	State: NM		**Phone:** (575) 234-7300	
	Country: USA		**Zip Code:** 88221	
4. Facility Existence Date	**Facility Existance Date (mm/dd/yyyy):** 05/18/1981			

5. Other Environmental Permits

A. Facility Type *(Enter code)*	B. Permit Number	C. Description
		See Permit Attachment B, Appendix B1

6. Nature of Business: The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy facility which entails receiving, unloading, and transferring radioactive-mixed waste from the surface of the site to the underground hazardous waste management units. Waste will be emplaced in an underground geologic repository horizon located in a deep-bedded salt formation approximately 2,150 feet beneath the surface.

EPA ID Number | N | M | 4 | 8 | 9 | 0 | 1 | 3 | 9 | 0 | 8 | 8 | OMB#: 2050-0024; Expires 12/31/2014

7. Process Codes and Design Capacities – Enter information in the Section on Form Page 3

A. **PROCESS CODE** – Enter the code from the list of process codes below that best describes each process to be used at the facility. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in item a.

B. **PROCESS DESIGN CAPACITY** – For each code entered in item 7.A; enter the capacity of the process.

1. **AMOUNT** – Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.
2. **UNIT OF MEASURE** – For each amount entered in item 7.B(1), enter the code in item 7.B(2) from the list of unit of measure codes below that describes the unit of measure used. Select only from the units of measure in this list.

C. **PROCESS TOTAL NUMBER OF UNITS** – Enter the total number of units for each corresponding process code.

Process Code	Process	Appropriate Unit of Measure for Process Design Capacity
Disposal		
D79	Underground Injection Well Disposal	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet; Hectares-meter; Acres; Cubic Meters; Hectares; Cubic Yards
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day or Liters Per Day
D83	Surface Impoundment Disposal	Gallons; Liters; Cubic Meters; or Cubic Yards
D99	Other Disposal	Any Unit of Measure Listed Below
Storage		
S01	Container	Gallons; Liters; Cubic Meters; or Cubic Yards
S02	Tank Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; Cubic Meters; Hectares; or Cubic Yards
S06	Containment Building Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
Treatment		
T01	Tank Treatment	Gallons Per Day; Liters Per Day
T02	Surface Impoundment	Gallons Per Day; Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons Per Day; Metric Tons Per Hour; or Million BTU Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Short Tons Per Day; BTUs Per Hour; Gallons Per Day; Liters Per Hour; or Million BTU Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; or Million BTU Per Hour
T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; BTU Per Hour; Liters Per Hour; Kilograms Per Hour; or Million BTU Per Hour
T82	Lime Kiln	
T83	Aggregate Kiln	
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	
T87	Smelting, Melting, or Refining Furnace	
T88	Titanium Dioxide Chloride Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used in the Recovery of Sulfur Values from Spent Sulfuric Acid	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed in 40 CFR 260.10	
T94	Containment Building Treatment	Cubic Yards; Cubic Meters; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTU Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million BTU Per Hour
Miscellaneous (Subpart X)		
X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; Kilograms Per Hour; Gallons Per Hour; Liters Per Hour; or Gallons Per Day
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; BTU Per Hour; or Million BTU Per Hour
X04	Geologic Repository	Cubic Yards; Cubic Meters; Acre-feet; Hectare-meter; Gallons; or Liters
X99	Other Subpart X	Any Unit of Measure Listed Below

Unit of Measure	Unit of Measure Code
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V
Short Tons Per Hour	D
Short Tons Per Day	N
Metric Tons Per Hour	W
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	X
Million BTU Per Hour	X
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
BTU Per Hour	I

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7. Process Codes and Design Capacities (Continued)

EXAMPLE FOR COMPLETING Item 7 (shown in line number X-1 below): A facility has a storage tank, which can hold 533.788 gallons.

Line Number		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure	C. Process Total Number of Units	For Official Use Only
X	1	S	0	2	533.788	G	001	
	1	X	0	4	175600.0	C	010	
	2	S	0	1	194.1	C	001	
	3	S	0	1	242.0	C	001	
	4							
	5							
	6							
	7							
	8							
	9							
1	0							
1	1							
1	2							
1	3							

Note: *If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the line sequentially, taking into account any lines that will be used for "other" process (i.e., D99, S99, T04, and X99) in Item 8.*

8. Other Processes (Follow instructions from Item 7 for D99, S99, T04, and X99 process codes)

Line Number (Enter #s in sequence with Item 7)		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure	C. Process Total Number of Units	For Official Use Only
X	2	T	0	4	100.00	U	001	

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9. Description of Hazardous Wastes - Enter Information in the Sections on Form Page 5

A. EPA HAZARDOUS WASTE NUMBER – Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR Part 261, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY – For each listed waste entered in Item 9.A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Item 9.A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE – For each quantity entered in Item 9.B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure, taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all listed hazardous wastes.

For non-listed waste: For each characteristic or toxic contaminant entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

1. Enter the first two as described above.
2. Enter "000" in the extreme right box of Item 9.D(1).
3. Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 9.E.

2. PROCESS DESCRIPTION: If code is not listed for a process that will be used, describe the process in Item 9.D(2) or in Item 9.E(2).

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in Item 9.A. On the same line complete Items 9.B, 9.C, and 9.D by estimating the total annual quantity of the waste and describing all the processes to be used to store, treat, and/or dispose of the waste.
2. In Item 9.A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Item 9.D.2 on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING Item 9 (shown in line numbers X-1, X-2, X-3, and X-4 below) – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)								(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
X	1	K	0	5	4	900	P	T	0	3	D	8	0			
X	2	D	0	0	2	400	P	T	0	3	D	8	0			
X	3	D	0	0	1	100	P	T	0	3	D	8	0			
X	4	D	0	0	2											Included With Above

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9. Description of Hazardous Wastes *(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)*

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)								(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
	1	F	0	0	1	1891	M	X	0	4	S	0	1	S	0	1	
	2	F	0	0	2	1860	M	X	0	4	S	0	1	S	0	1	
	3	F	0	0	3	1593	M	X	0	4	S	0	1	S	0	1	
	4	F	0	0	4	26	M	X	0	4	S	0	1	S	0	1	
	5	F	0	0	5	1829	M	X	0	4	S	0	1	S	0	1	
	6	F	0	0	6	915	M	X	0	4	S	0	1	S	0	1	
	7	F	0	0	7	915	M	X	0	4	S	0	1	S	0	1	
	8	F	0	0	9	915	M	X	0	4	S	0	1	S	0	1	
	9	D	0	0	4	903	M	X	0	4	S	0	1	S	0	1	
1	0	D	0	0	5	484	M	X	0	4	S	0	1	S	0	1	
1	1	D	0	0	6	1819	M	X	0	4	S	0	1	S	0	1	
1	2	D	0	0	7	1248	M	X	0	4	S	0	1	S	0	1	
1	3	D	0	0	8	3246	M	X	0	4	S	0	1	S	0	1	
1	4	D	0	0	9	1727	M	X	0	4	S	0	1	S	0	1	
1	5	D	0	1	0	186	M	X	0	4	S	0	1	S	0	1	
1	6	D	0	1	1	1090	M	X	0	4	S	0	1	S	0	1	
1	7	D	0	1	8	749	M	X	0	4	S	0	1	S	0	1	
1	8	D	0	1	9	761	M	X	0	4	S	0	1	S	0	1	
1	9	D	0	2	1	26	M	X	0	4	S	0	1	S	0	1	
2	0	D	0	2	2	1098	M	X	0	4	S	0	1	S	0	1	
2	1	D	0	2	6	609	M	X	0	4	S	0	1	S	0	1	
2	2	D	0	2	7	26	M	X	0	4	S	0	1	S	0	1	
2	3	D	0	2	8	449	M	X	0	4	S	0	1	S	0	1	
2	4	D	0	2	9	478	M	X	0	4	S	0	1	S	0	1	
2	5	D	0	3	0	26	M	X	0	4	S	0	1	S	0	1	
2	6	D	0	3	2	26	M	X	0	4	S	0	1	S	0	1	
2	7	D	0	3	4	26	M	X	0	4	S	0	1	S	0	1	
2	8	D	0	3	5	139	M	X	0	4	S	0	1	S	0	1	
2	9	D	0	3	6	26	M	X	0	4	S	0	1	S	0	1	
3	0	D	0	3	7	26	M	X	0	4	S	0	1	S	0	1	
3	1	D	0	3	8	26	M	X	0	4	S	0	1	S	0	1	
3	2	D	0	3	9	26	M	X	0	4	S	0	1	S	0	1	
3	3	D	0	4	0	140	M	X	0	4	S	0	1	S	0	1	
3	4	D	0	4	3	26	M	X	0	4	S	0	1	S	0	1	
3	5	P	0	1	5	945	M	X	0	4	S	0	1	S	0	1	
3	6	U	0	0	2	344	M	X	0	4	S	0	1	S	0	1	

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9. Description of Hazardous Wastes *(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)*

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)								(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
3	7	U	0	1	9	344	M	X	0	4	S	0	1	S	0	1	
3	8	U	0	3	7	344	M	X	0	4	S	0	1	S	0	1	
3	9	U	0	4	3	344	M	X	0	4	S	0	1	S	0	1	
4	0	U	0	4	4	344	M	X	0	4	S	0	1	S	0	1	
4	1	U	0	5	2	344	M	X	0	4	S	0	1	S	0	1	
4	2	U	0	7	0	344	M	X	0	4	S	0	1	S	0	1	
4	3	U	0	7	2	344	M	X	0	4	S	0	1	S	0	1	
4	4	U	0	7	8	344	M	X	0	4	S	0	1	S	0	1	
4	5	U	0	7	9	344	M	X	0	4	S	0	1	S	0	1	
4	6	U	1	0	5	344	M	X	0	4	S	0	1	S	0	1	
4	7	U	1	2	2	344	M	X	0	4	S	0	1	S	0	1	
4	8	U	1	3	3	344	M	X	0	4	S	0	1	S	0	1	
4	9	U	1	5	1	344	M	X	0	4	S	0	1	S	0	1	
5	0	U	1	5	4	344	M	X	0	4	S	0	1	S	0	1	
5	1	U	1	5	9	344	M	X	0	4	S	0	1	S	0	1	
5	2	U	1	9	6	344	M	X	0	4	S	0	1	S	0	1	
5	3	U	2	0	9	344	M	X	0	4	S	0	1	S	0	1	
5	4	U	2	1	0	344	M	X	0	4	S	0	1	S	0	1	
5	5	U	2	2	0	344	M	X	0	4	S	0	1	S	0	1	
5	6	U	2	2	6	344	M	X	0	4	S	0	1	S	0	1	
5	7	U	2	2	8	344	M	X	0	4	S	0	1	S	0	1	
5	8	U	2	3	9	344	M	X	0	4	S	0	1	S	0	1	
5	9	P	1	2	0	3.3	M	X	0	4	S	0	1	S	0	1	
6	0	U	1	3	4	344	M	X	0	4	S	0	1	S	0	1	
6	1	D	0	3	3	344	M	X	0	4	S	0	1	S	0	1	
6	2	P	0	3	0	344	M	X	0	4	S	0	1	S	0	1	
6	3	P	0	9	8	344	M	X	0	4	S	0	1	S	0	1	
6	4	P	0	9	9	344	M	X	0	4	S	0	1	S	0	1	
6	5	P	1	0	6	344	M	X	0	4	S	0	1	S	0	1	
6	6	U	0	0	3	344	M	X	0	4	S	0	1	S	0	1	
6	7	U	1	0	3	344	M	X	0	4	S	0	1	S	0	1	
6	8	U	1	0	8	344	M	X	0	4	S	0	1	S	0	1	

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10.	**Map**
	Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.
11.	**Facility Drawing**
	All existing facilities must include a scale drawing of the facility (see instructions for more detail).
12.	**Photographs**
	All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas (see instructions for more detail).
13.	**Comments**
	See attached narrative from previous Part A Form (Section XII)

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8. PROCESS—CODES AND DESIGN CAPACITIES (continued)

The Waste Isolation Pilot Plant (WIPP) geologic repository is defined as a "miscellaneous unit" under 40 CFR §260.10. "Miscellaneous unit" means a hazardous waste management unit where hazardous waste is treated, stored, or disposed of and that is not a container, tank, surface impoundment, waste pile, land treatment unit, landfill, incinerator, containment building, boiler, industrial furnace, or underground injection well with appropriate technical standards under 40 CFR Part 146, corrective action management unit, or unit eligible for research, development, and demonstration permit under 40 CFR §270.65. The WIPP is a geologic repository designed for the disposal of defense-generated transuranic (TRU) waste. Some of the TRU wastes disposed of at the WIPP contain hazardous wastes as co-contaminants. More than half the waste to be disposed of at the WIPP also meets the definition of debris waste. The debris categories include manufactured goods, biological materials, and naturally occurring geological materials. Approximately 120,000 cubic meters (m^3) of the 175,600 m^3 of WIPP wastes is categorized as debris waste. The geologic repository has been divided into ten discrete hazardous waste management units (HWMU) which are being permitted under 40 CFR Part 264, Subpart X.

During the Disposal Phase of the facility, which is expected to last 25 years, the total amount of waste received from off-site generators and any derived waste will be limited to 175,600 m^3 of TRU waste of which up to 7,080 m^3 may be remote-handled (RH) TRU mixed waste. For purposes of this application, all TRU waste is managed as though it were mixed.

The process design capacity for the miscellaneous unit (composed of ten underground HWMUs in the geologic repository) shown in Section 8 B, is for the maximum amount of waste that may be received from off-site generators plus the maximum expected amount of derived wastes that may be generated at the WIPP facility. In addition, two HWMUs have been designated as container storage units (S01) in Section 8 B. One is inside the Waste Handling Building (WHB) and consists of the contact-handled (CH) bay, waste shaft conveyance loading room, waste shaft conveyance entry room, RH bay, cask unloading room, hot cell, transfer cell, and facility cask loading room. This HWMU will be used for waste receipt, handling, and storage (including storage of derived waste) prior to emplacement in the underground geologic repository. No treatment or disposal will occur in this S01 HWMU. The capacity of this S01 unit for storage is 194.1 m^3, based on 36 ten-drum overpacks on 18 facility pallets, four CH Packages at the TRUDOCKs, one standard waste box of derived waste, two loaded casks and one 55-gallon drum of derived waste in the RH Bay, one loaded cask in the Cask Unloading Room, 13 55-gallon drums in the Hot Cell, one canister in the Transfer Cell and one canister in the Facility Cask Unloading Room. The second S01 HWMU is the parking area outside the WHB where the Contact- and Remote-Handled Package trailers and the road cask trailers will be parked awaiting waste handling operations. The capacity of this unit is 50 Contact-Handled Packages and twelve Remote-Handled Packages with a combined volume of 242 m^3. The HWMUs are shown in Figures B3-2, B3-3, and B3-4.

During the ten year period of the permit, up to 148,500 m^3 of CH TRU mixed waste could be emplaced in Panels 1 to 8 and up to 2,635 m^3 of RH TRU mixed waste could be emplaced in Panels 4 to 8. Panels 9 and 10 will be constructed under the initial term of this permit. These latter areas will not receive waste for disposal under this permit.

NM4890139088

RCRA PART A APPLICATION CERTIFICATION

The U.S. Department of Energy (DOE), through its Carlsbad Field Office, has signed as "owner and operator," and Washington TRU Solutions LLC, the Management and Operating Contractor (MOC), has signed this application for the permitted facility as "co-operator."

The DOE has determined that dual signatures best reflect the actual apportionment of Resource Conservation and Recovery Act (RCRA) responsibilities as follows:

The DOE's RCRA responsibilities are for policy, programmatic directives, funding and scheduling decisions, Waste Isolation Pilot Plant (WIPP) requirements of DOE generator sites, auditing, and oversight of all other parties engaged in work at the WIPP, as well as general oversight.

The MOC's RCRA responsibilities are for certain day-to-day operations (in accordance with general directions given by the DOE and in the Management and Operating Contract as part of its general oversight responsibility), including, but not limited to, the following: certain waste handling, monitoring, record keeping, certain data collection, reporting, technical advice, and contingency planning.

For purposes of the certification required by Title 20 of the New Mexico Administrative Code, Chapter 4, Part 1 (20.4.1 NMAC), Subpart IX, §270.11(d), the DOE's and the MOC's representatives certify, under penalty of law that this document and all attachments were prepared under their direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on their inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of their knowledge and belief, true, accurate, and complete for their respective areas of responsibility. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner and Operator Signature:	*Original signed by Jose R. Franco*
Title:	Manager, Carlsbad Field Office
for:	U.S. Department of Energy
Date:	6-25-12
Co-Operator Signature:	*Original signed by Farok Sharif*
Title:	Project Manager
for:	Nuclear Waste partnership LLC
Date:	6-25-12

: 03158

APPENDIX B1
OTHER ENVIRONMENTAL PERMITS

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: 03160

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Active Environmental Permits and Approvals for the Waste Isolation Pilot Plant as of June 25, 2012

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
1.	Department of the Interior, Bureau of Land Management	Right-of-Way for Water Pipeline	NM053809	08/17/83 (Transferred 05/15/06 to City of Carlsbad)	In Perpetuity	Active
2.	Department of the Interior, Bureau of Land Management	Right-of-Way for the North Access Road	NM055676	08/243/83	In Perpetuity	Active
3.	Department of the Interior, Bureau of Land Management	Right-of-Way for Railroad	NM055699	09/27/83	In Perpetuity	Active
4.	Department of the Interior, Bureau of Land Management	Right-of-Way for Dosimetry and Aerosol Sampling Sites	NM063136	07/03/86	12/31/40	Active
5.	Department of the Interior, Bureau of Land Management	Right-of-Way for Seven Subsidence Monuments	NM065801	11/07/86	None	Active
6.	Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Site	NM077921	08/18/89	08/18/19	Active
7.	Department of the Interior, Bureau of Land Management	Right-of-Way for 2 Survey Monuments	NM082245	12/13/89	12/13/19	Active
8.	Department of the Interior, Bureau of Land Management	Right-of-Way for telephone cable	NM046092	09/04/81 (Valor Telecom of NM LLC)	09/04/11	Active Renewal In Process
9.	Department of the Interior, Bureau of Land Management	Right-of-Way for SPS 115 KV Powerline	NM043203	10/19/81 (Southwestern Public Service)	12/31/40	Active
10.	Department of the Interior, Bureau of Land Management	Right-of-Way for South Access Road	NM123703	01/27/10	12/31/39	Active
11.	Department of the Interior, Bureau of Land Management	Right-of-Way for Duval telephone line	NM060174	03/08/85 (Valor Telecom of NM LLC)	03/08/35	Active
12.	Department of the Interior, Bureau of Land Management	Right-of-Way for groundwater monitor wells/pads	NM108365	08/30/02	08/30/32	Active

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
13.	Department of the Interior, Bureau of Land Management	Right-of-Way for Monitoring Well C-2664 (Cabin Baby)	NM107944	04/23/02	04/23/32	Active
14.	Department of the Interior, Bureau of Land Management	Right-of-Way for Wells C-2725 (H-4A), C-2775 (H-4B), & C-2776 (H-4C)	NM-6-5 Cooperative Agreement	04/27/78	None	Active
15.	Department of the Interior, Bureau of Land Management	Right-of-Way for Monitoring Wells C-2723 (WIPP-25), C-2724 (WIPP-26), C-2722 (WIPP-27), C-2636 (WIPP-28), C-2743 (WIPP-29), & C-2727 (WIPP-30)	NM-6-5 Cooperative Agreement	07/14/78	None	Active
16.	New Mexico State Land Office Commissioner of Public Lands	Right-of-Way easement for accessing state trust lands in Eddy & Lea Counties	RW-25430	09/28/04	09/28/14	Active
17.	Department of Interior, Bureau of Land Management	Right of Way for Valor Telecom	NM113339	08/09/05 (Valor Telecom Inc)	12/31/34	Active
18.	Department of Interior, Bureau of Land Management	Right of Way for South Access Road Fence	NM094304	03/15/95	None	Active
19.	New Mexico State Land Office Commissioner of Public Lands	Right-of-Way for High Volume Air Sampler	RW-22789	10/03/85	10/03/20	Active
20.	New Mexico Environment Department Groundwater Quality Bureau	Discharge Permit	DP-831	04/05/10	09/09/13	Active
21.	New Mexico Environment Department Air Quality Bureau	Operating Permit for two backup diesel generators	310-M-2	12/07/93	None	Active
22.	New Mexico Environment Department-Petroleum Storage Tank Bureau	Storage Tank Registration Certificate	Registration Number 2033 Facility Number 31539	07/01/11	06/30/12	Currently being renewed
23.	Office of New Mexico State Engineer	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2801	02/23/01	None	Active

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	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
24.	Office of New Mexico State Engineer	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2802	02/23/01	None	Active
25.	Office of New Mexico State Engineer	Monitoring Well Exhaust Shaft Exploratory Borehole	C-2803	02/23/01	None	Active
26.	Office of New Mexico State Engineer	Monitoring Well	C-2811	03/02/02	None	Active
27.	Office of New Mexico State Engineer	Appropriation: WQSP-1 Well	C-2413	10/21/96	None	Active
28.	Office of New Mexico State Engineer	Appropriation: WQSP-2 Well	C-2414	10/21/96	None	Active
29.	Office of New Mexico State Engineer	Appropriation: WQSP-3 Well	C-2415	10/21/96	None	Active
30.	Office of New Mexico State Engineer	Appropriation: WQSP-4 Well	C-2416	10/21/96	None	Active
31.	Office of New Mexico State Engineer	Appropriation: WQSP-5 Well	C-2417	10/21/96	None	Active
32.	Office of New Mexico State Engineer	Appropriation: WQSP-6 Well	C-2418	10/21/96	None	Active
33.	Office of New Mexico State Engineer	Appropriation: WQSP-6a Well	C-2419	10/21/96	None	Active
34.	Office of New Mexico State Engineer	Monitoring Well AEC-7	C-2742	11/06/00	None	Active
35.	Office of New Mexico State Engineer	Monitoring Well AEC-8	C-2744	11/06/00	None	P&A
36.	Office of New Mexico State Engineer	Monitoring Well Cabin Baby	C-2664	07/30/99	None	Active
37.	Office of New Mexico State Engineer	Monitoring Well DOE-1	C-2757	11/06/00	None	P&A
38.	Office of New Mexico State Engineer	Monitoring Well DOE-2	C-2682	04/17/00	None	Active
39.	Office of New Mexico State Engineer	Monitoring Well ERDA-9	C-2752	11/06/00	None	Active
40.	Office of New Mexico State Engineer	Monitoring Well H-1	C-2765	11/06/00	None	P&A

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	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
41.	Office of New Mexico State Engineer	Monitoring Well H-2A	C-2762	11/06/00	None	P&A
42.	Office of New Mexico State Engineer	Monitoring Well H-2B1	C-2758	11/06/00	None	Active
43.	Office of New Mexico State Engineer	Monitoring Well H-2B2	C-2763	11/06/00	None	Active
44.	Office of New Mexico State Engineer	Monitoring Well H-2C	C-2759	11/06/00	None	P&A
45.	Office of New Mexico State Engineer	Monitoring Well H-3B1	C-2764	11/06/00	None	Active
46.	Office of New Mexico State Engineer	Monitoring Well H-3B2	C-2760	11/06/00	None	Active
47.	Office of New Mexico State Engineer	Monitoring Well H-3B3	C-2761	11/06/00	None	P&A
48.	Office of New Mexico State Engineer	Monitoring Well H-3D	C-3207	11/06/00	None	Active
49.	Office of New Mexico State Engineer	Monitoring Well H-4A	C-2725	11/06/00	None	P&A
50.	Office of New Mexico State Engineer	Monitoring Well H-4B	C-2775	11/06/00	None	P&A
51.	Office of New Mexico State Engineer	Monitoring Well H-4C	C-2776	11/06/00	None	Active
52.	Office of New Mexico State Engineer	Monitoring Well H-5A	C-2746	11/06/00	None	P&A
53.	Office of New Mexico State Engineer	Monitoring Well H-5B	C-2745	11/06/00	None	Active
54.	Office of New Mexico State Engineer	Monitoring Well H-5C	C-2747	11/06/00	None	Active
55.	Office of New Mexico State Engineer	Monitoring Well H-6A	C-2751	11/06/00	None	P&A

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
56.	Office of New Mexico State Engineer	Monitoring Well H-6B	C-2749	11/06/00	None	P&A
57.	Office of New Mexico State Engineer	Monitoring Well H-6C	C-2750	11/06/00	None	Active
58.	Office of New Mexico State Engineer	Monitoring Well H-7A	C-2694	04/17/00	None	P&A
59.	Office of New Mexico State Engineer	Monitoring Well H-7B1	C-2770	11/06/00	None	Active
60.	Office of New Mexico State Engineer	Monitoring Well H-7B2	C-2771	11/06/00	None	P&A
61.	Office of New Mexico State Engineer	Monitoring Well H-8A	C-2780	11/06/00	None	Active
62.	Office of New Mexico State Engineer	Monitoring Well H-9A	C-2785	11/06/00	None	P&A
63.	Office of New Mexico State Engineer	Monitoring Well H-9B	C-2783	11/06/00	None	P&A
64.	Office of New Mexico State Engineer	Monitoring Well H-9C	C-2784	11/06/00	None	Active
65.	Office of New Mexico State Engineer	Monitoring Well H-10A	C-2779	11/06/00	None	Active
66.	Office of New Mexico State Engineer	Monitoring Well H-10B	C-2778	11/06/00	None	P&A
67.	Office of New Mexico State Engineer	Monitoring Well H-10C	C-2695	04/17/00	None	Active
68.	Office of New Mexico State Engineer	Monitoring Well H-11B1	C-2767	11/06/00	None	Active
69.	Office of New Mexico State Engineer	Monitoring Well H-11B2	C-2687	04/17/00	None	Active
70.	Office of New Mexico State Engineer	Monitoring Well H-11B3	C-2768	11/06/00	None	P&A

9915

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
71.	Office of New Mexico State Engineer	Monitoring Well H-11B4	C-2769	11/06/00	None	~~Active~~ P&A
72.	Office of New Mexico State Engineer	Monitoring Well H-12	C-2777	11/06/00	None	Active
73.	Office of New Mexico State Engineer	Monitoring Well H-14	C-2766	11/06/00	None	Active
74.	Office of New Mexico State Engineer	Monitoring Well H-15	C-2685	04/17/00	None	Active
75.	Office of New Mexico State Engineer	Monitoring Well H-16	C-2753	11/06/00	None	Active
76.	Office of New Mexico State Engineer	Monitoring Well H-17	C-2773	11/06/00	None	Active
77.	Office of New Mexico State Engineer	Monitoring Well H-18	C-2683	04/17/00	None	Active
78.	Office of New Mexico State Engineer	Monitoring Well H-19B0	C-2420	01/25/95	None	Active
79.	Office of New Mexico State Engineer	Monitoring Well H-19B1	C-2420	01/25/95	None	Active
80.	Office of New Mexico State Engineer	Monitoring Well H-19B2	C-2421	01/25/95	None	Active
81.	Office of New Mexico State Engineer	Monitoring Well H-19B3	C-2422	01/25/95	None	Active
82.	Office of New Mexico State Engineer	Monitoring Well H-19B4	C-2423	01/25/95	None	Active
83.	Office of New Mexico State Engineer	Monitoring Well H-19B5	C-2424	01/25/95	None	Active
84.	Office of New Mexico State Engineer	Monitoring Well H-19B6	C-2425	01/25/95	None	Active
85.	Office of New Mexico State Engineer	Monitoring Well H-19B7	C-2426	01/25/95	None	Active

99168

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
86.	Office of New Mexico State Engineer	Monitoring Well P-14	C-2637	01/02/99	None	P&A
87.	Office of New Mexico State Engineer	Monitoring Well P-15	C-2686	04/17/00	None	P&A
88.	Office of New Mexico State Engineer	Monitoring Well P-17	C-2774	11/06/00	None	P&A
89.	Office of New Mexico State Engineer	Monitoring Well P-18	C-2756	11/06/00	None	P&A
90.	Office of New Mexico State Engineer	Monitoring Well WIPP-12	C-2639	01/12/99	None	P&A
91.	Office of New Mexico State Engineer	Monitoring Well WIPP-13	C-2748	11/06/00	None	Active
92.	Office of New Mexico State Engineer	Monitoring Well WIPP-18	C-2684	04/17/00	None	Active
93.	Office of New Mexico State Engineer	Monitoring Well WIPP-19	C-2755	11/06/00	None	Active
94.	Office of New Mexico State Engineer	Monitoring Well WIPP-21	C-2754	11/06/00	None	P&A
95.	Office of New Mexico State Engineer	Monitoring Well WIPP-25	C-2723	07/26/00	None	P&A
96.	Office of New Mexico State Engineer	Monitoring Well WIPP-26	C-2724	11/06/00	None	P&A
97.	Office of New Mexico State Engineer	Monitoring Well WIPP-27	C-2722	11/06/00	None	P&A
98.	Office of New Mexico State Engineer	Monitoring Well WIPP28	C-2636	01/12/99	None	P&A
99.	Office of New Mexico State Engineer	Monitoring Well WIPP-29	C-2743	11/06/00	None	P&A
100.	Office of New Mexico State Engineer	Monitoring Well WIPP-30	C-2727	08/04/00	None	P&A

19367

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
101.	Office of New Mexico State Engineer	Monitoring Well H-6BR	C-3362	12/27/07	None	Active
102.	Office of New Mexico State Engineer	Monitoring Well H-15R	C-3361	12/27/07	None	Active
103.	Office of New Mexico State Engineer	Monitoring Well SNL-2	C-2948	02/14/03	None	Active
104.	Office of New Mexico State Engineer	Monitoring Well SNL-9	C-2950	02/14/03	None	Active
105.	Office of New Mexico State Engineer	Monitoring Well SNL-12	C-2954	02/25/03	None	Active
106.	Office of New Mexico State Engineer	Monitoring Well SNL-1	C-2953	02/25/03	None	Active
107.	Office of New Mexico State Engineer	Monitoring Well SNL-3	C-2949	02/14/03	None	Active
108.	Office of New Mexico State Engineer	Monitoring Well SNL-5	C-3002	10/01/03	None	Active
109.	Office of New Mexico State Engineer	Monitoring Well IMC-461	C-3015	11/25/03	None	Active
110.	Office of New Mexico State Engineer	Monitoring Well SNL-10	C-3221	07/26/05	None	Active
111.	Office of New Mexico State Engineer	Monitoring Well SNL-16	C-3220	07/26/05	None	Active
112.	Office of New Mexico State Engineer	Monitoring Well SNL-17	C-3222	07/26/05	None	Active
113.	US Environmental Protection Agency Region 6	Conditions of Approval for Disposal of PCB/TRU and PCB/TRU Mixed Waste at the US Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Carlsbad, New Mexico	N/A	04/30/08	04/30/13	Active-In Renewal Process
114.	US Fish and Wildlife Service	Special Purpose – Relocate	MB155189-0	06/01/10	05/31/12	Active-In Renewal Process
115.	New Mexico Department of Game and Fish	Biotic Collection Permit	Authorization # 3293	01/26/11	12/31/13	Active
116.	Office of New Mexico State Engineer	Monitoring Well H-4bR	C-3404	01/13/09	None	Active

03158

	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
117.	Office of New Mexico State Engineer	Monitoring Well H-9bR	C-2783-POD2	07/14/10	None	Active
118.	Office of New Mexico State Engineer	Monitoring Well C-2737	C-2737	09/27/00	None	Active
119.	Office of New Mexico State Engineer	Monitoring Well WIPP-11	C3112	12/27/07	None	Active
120.	Office of New Mexico State Engineer	Monitoring Well SNL-6	C-3151	02/10/05	None	Active
121.	Office of New Mexico State Engineer	Monitoring Well SNL-8	C-3150	02/10/05	None	Active
122.	Office of New Mexico State Engineer	Monitoring Well SNL-13	C-3139	12/17/04	None	Active
123.	Office of New Mexico State Engineer	Monitoring Well SNL-14	C-3140	12/17/04	None	Active
124.	Office of New Mexico State Engineer	Monitoring Well SNL-15	C-3152	02/10/05	None	Active
125.	Office of New Mexico State Engineer	Monitoring Well SNL-18	C-3233	10/06/05	None	Active
126.	Office of New Mexico State Engineer	Monitoring Well SNL-19	C-3234	10/06/05	None	Active
127.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-18 and SNL-19 well pads	NM115315	03/21/06	12/31/35	Active
128.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-11 and SNL-5	NM110735	10/17/03	10/17/33	Active
129.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-12 well pad	NM109176	04/15/03	04/15/33	Active
130.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-9 well pad	NM109175	04/15/03	04/15/33	Active
131.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-2 well pad	NM109174	04/15/03	04/15/33	Active
132.	Department of the Interior, Bureau of Land Management	Right-of-Way grant for SNL-1 Access Road	NM109177	06/17/03	06/17/33	Active
133.	Department of the Interior, Bureau of Land Management	Right-of-Way for SPS 69KV Electric Distribution line	NM091163	12/16/94 (Southwestern Public Service)	12/15/24	Active

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	Granting Agency	Type of Permit	Permit/Right of Way Number	Granted/ Submitted *	Expiration	Current Permit Status
134.	Office of New Mexico State Engineer	Monitor Well H-11b4R	C-2769-POD2	05/16/11	None	Active

*Non DOE grantee is noted
P&A=Plugged and Abandoned

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(APPENDIX B2
MAPS

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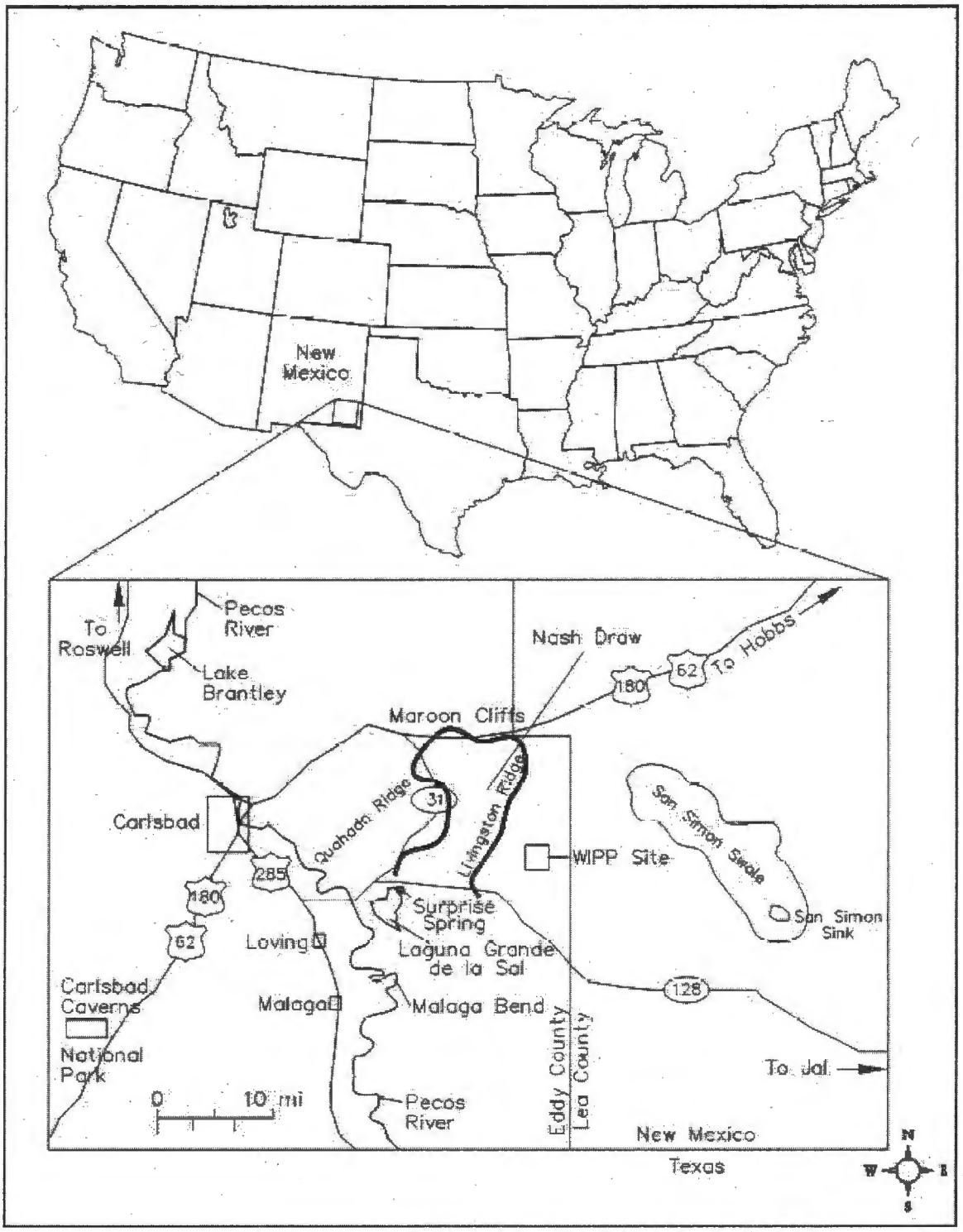

Figure B2-1
General Location of the WIPP Facility

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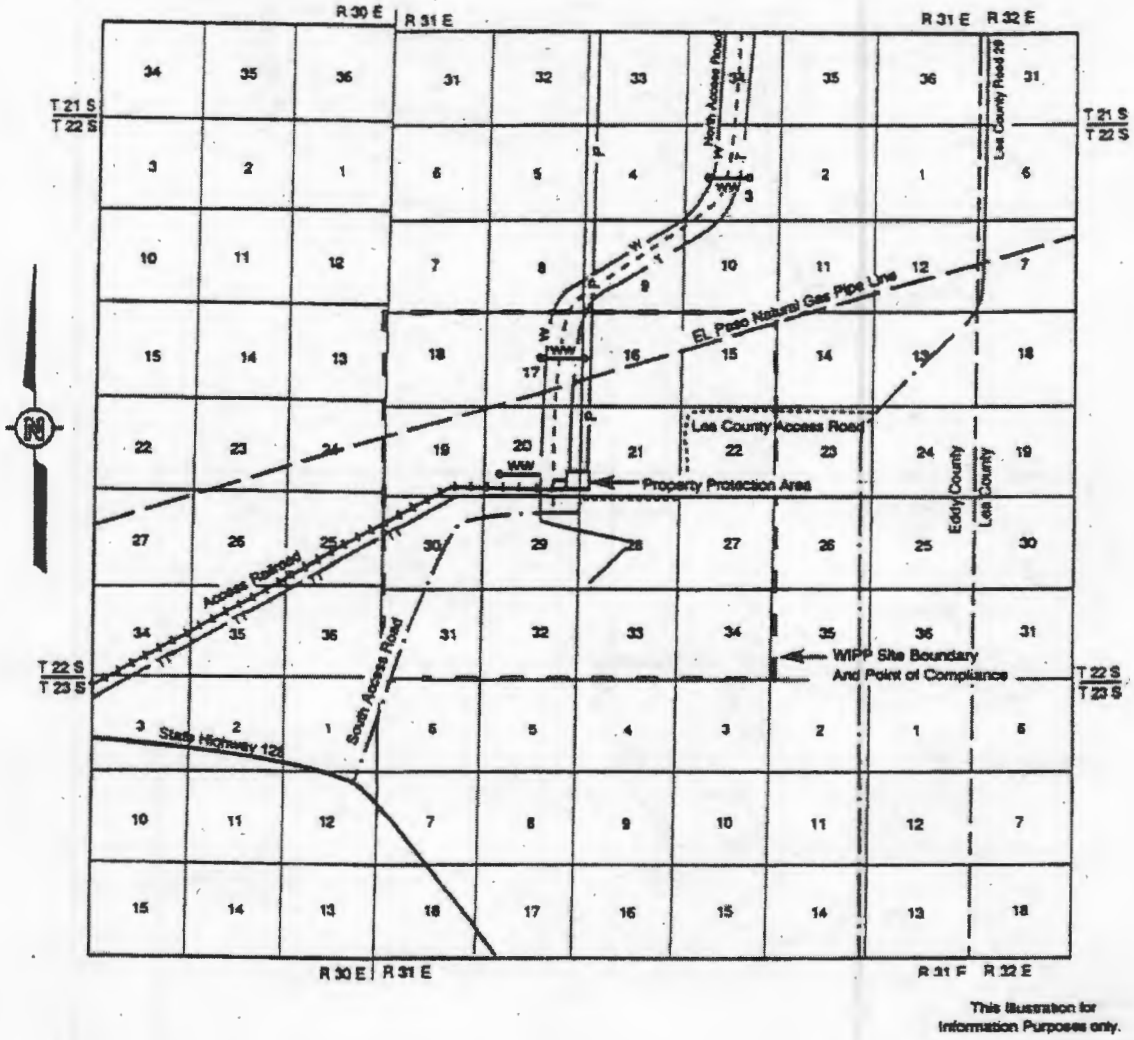

Figure B2-2
Planimetric Map-WIPP Facility Boundaries

03174

LEGEND

- — — — WIPP Site Boundary 10,240 Acres.
- — W — U.S. DOE Right of Way Number NM-53808. For Waterline, 50 Feet Wide. The DOE had Agreed with the City of Carlsbad to Allow the Individuals to Tap this Line Located within the North Access Road Right of Way.
- ——WW—— Stock Water Tanks and Tap Lines Connected to the Main WIPP Waterline.
- ——P—— Southwestern Public Service Company Right of Way Number NM-43203 for Power 60 Feet Wide.
- ——T—— General Telephone of the Southwest Right of Way for Telephone Line, 30 Feet Wide, Located within the North access Road Right of Way.
- ——TT—— General Telephone of the Southwest Right of Way Number NM-60174 for Telephone Line, 30 Feet Wide, Located within the Railroad Right of Way.
- ..... U.S. DOE Right of Way Number NM-55575 for North Access Road, 170 Feet Wide.
- —— —— El Paso Natural Gas company Right of Way for Gas Pipeline, 30 Feet Wide in Section 16, 50 Feet Wide Elsewhere.
- ——+—+—— U.S. DOE Right of Way Number NM-55699 for Access Railroad, 150 Feet Wide.
- ——.—— U.S. DOE Right of Way for Access Roads Includes Right of Way Number NM-123703 for the South Access Road which is 140 Feet Wide.

NOTES

1. The Property Protection Area is a fenced area of approximately 35 acres. It contains all surface facilities with the exception of salt storage piles, parking lot, landfill and waste water stabilization lagoons.

2. Zone II overlies the maximum extent of the Area available for underground development.

3. WIPP site boundary (WSB) provides a one mile buffer area around the area available for underground development.

Figure B2-2a
Legend to Figure B2-2

Replace this page with the Topographic Map from the earlier version of the draft Permit

Figure B2-3
Topographic Map

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APPENDIX B3
FACILITIES

: 03177

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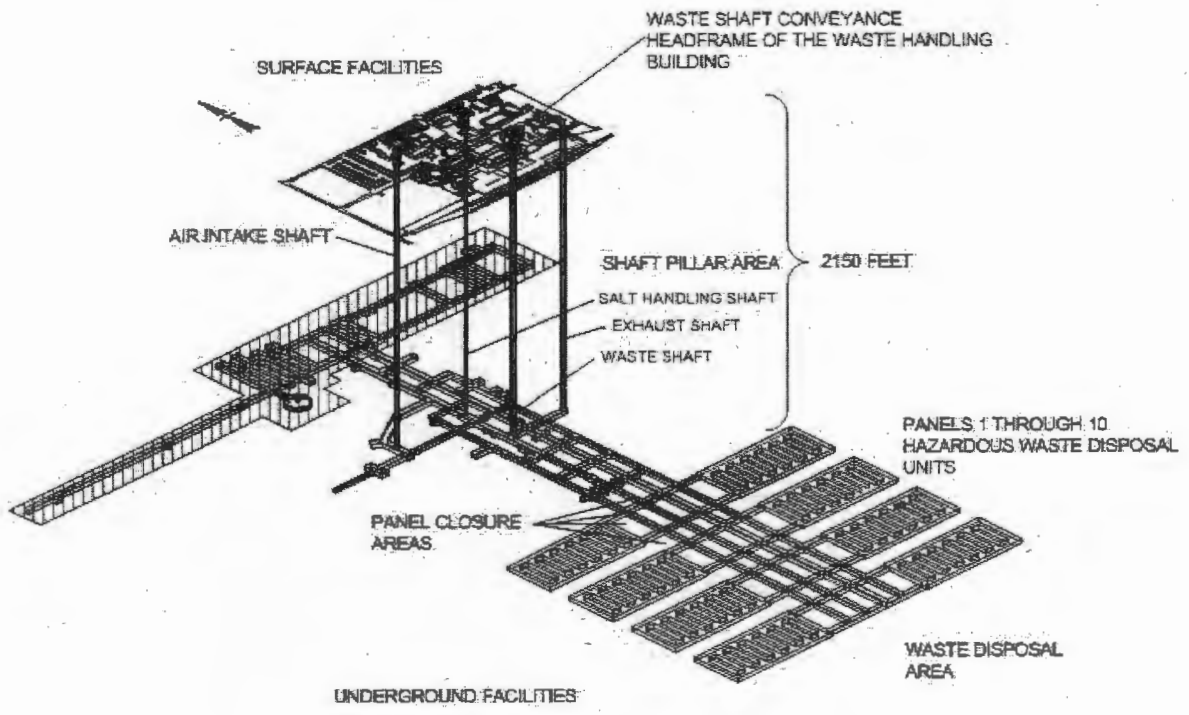

Figure B3-1
Spatial View of the WIPP Facility

: 03179

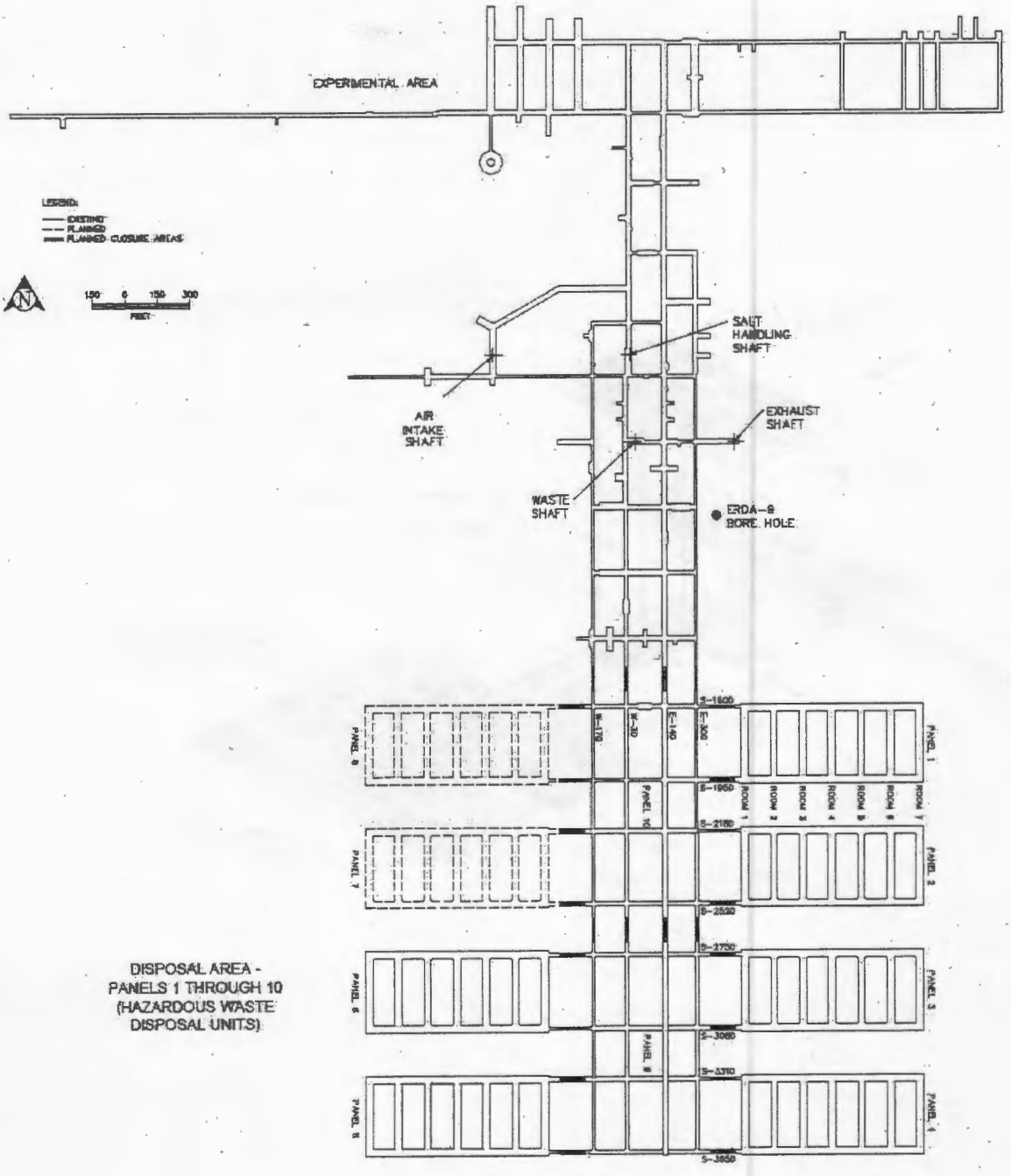

Figure B3-2
Repository Horizon

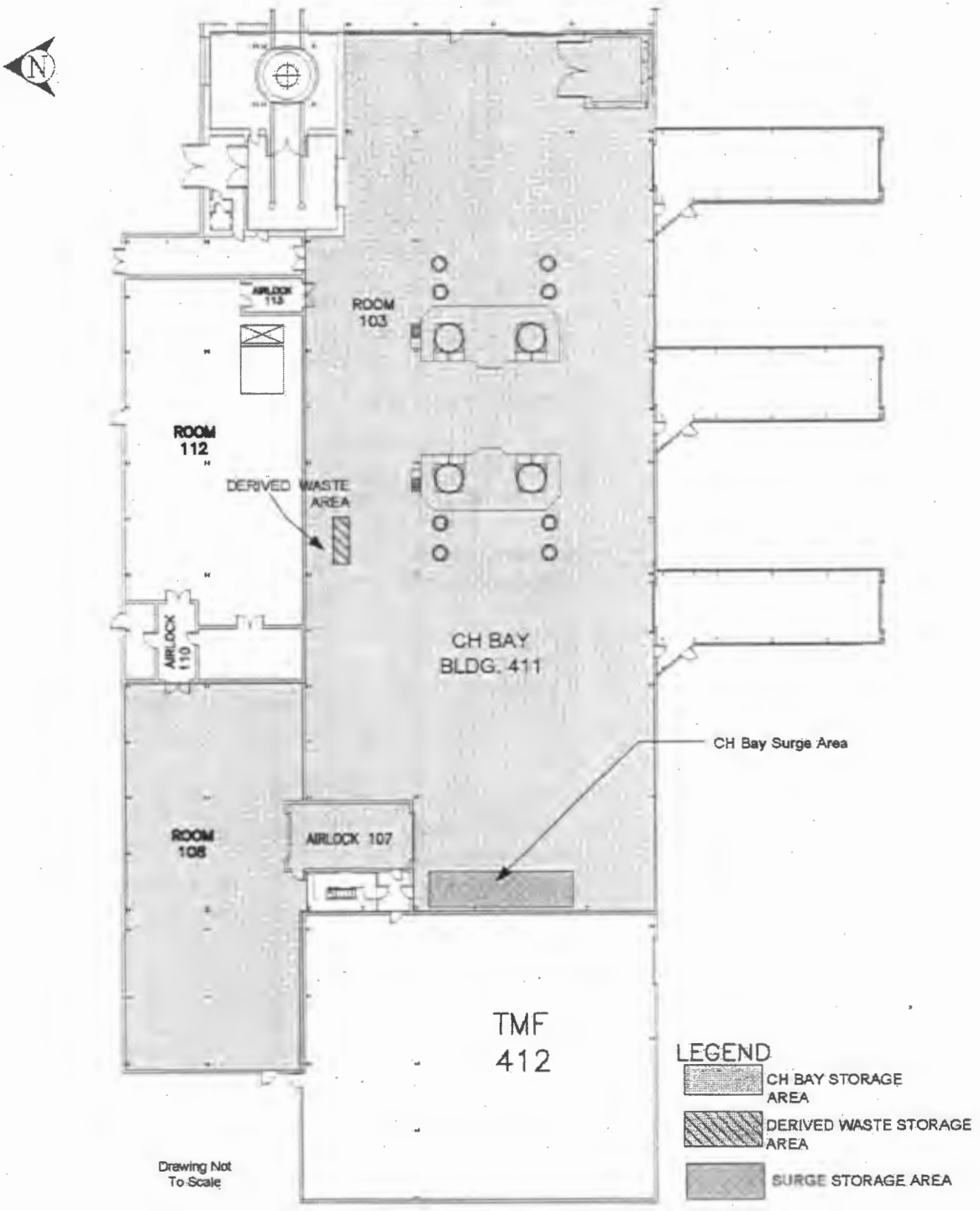

Figure B3-3
Waste Handling Building - CH TRU Mixed Waste Container Storage and Surge Areas

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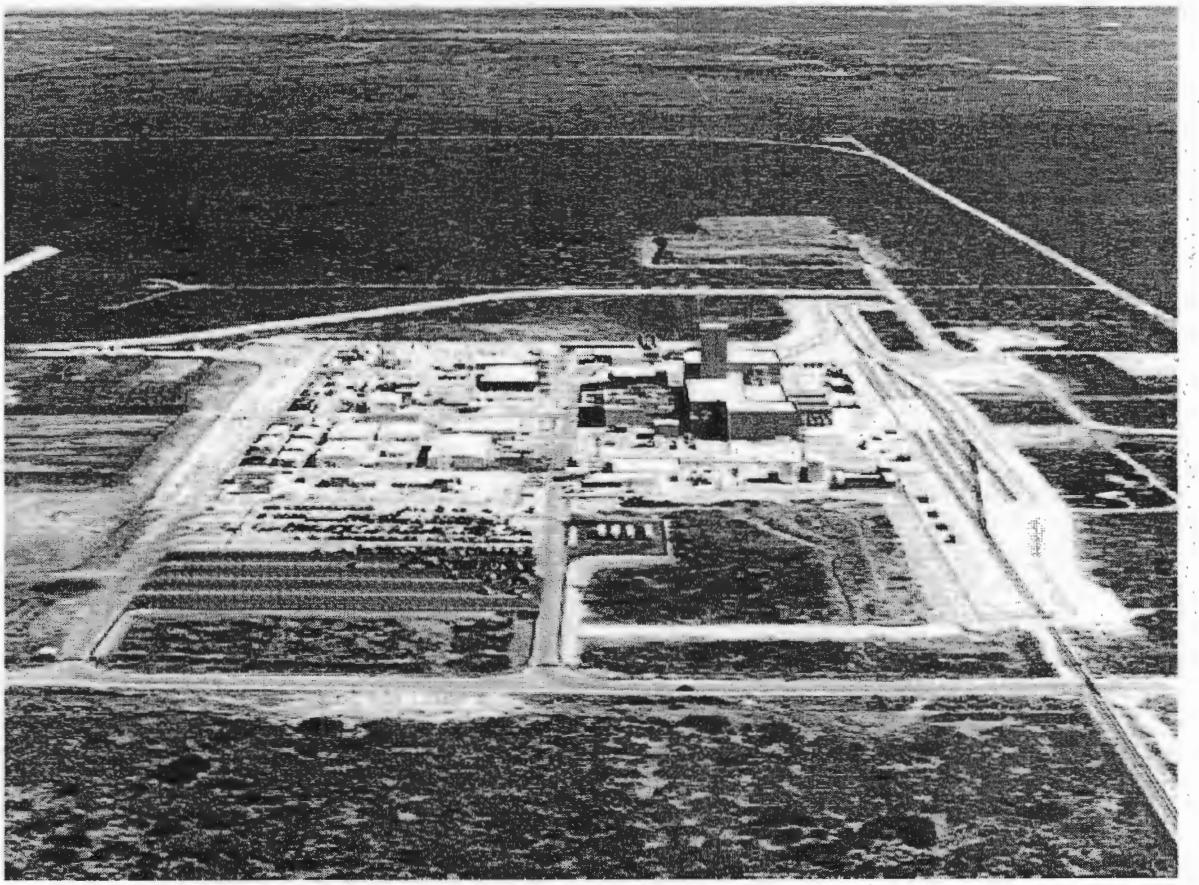

Figure B4-1
Aerial Photograph of the Waste Isolation Pilot Plant

Figure B4-2
Underground - Panel One - Waste Disposal Room

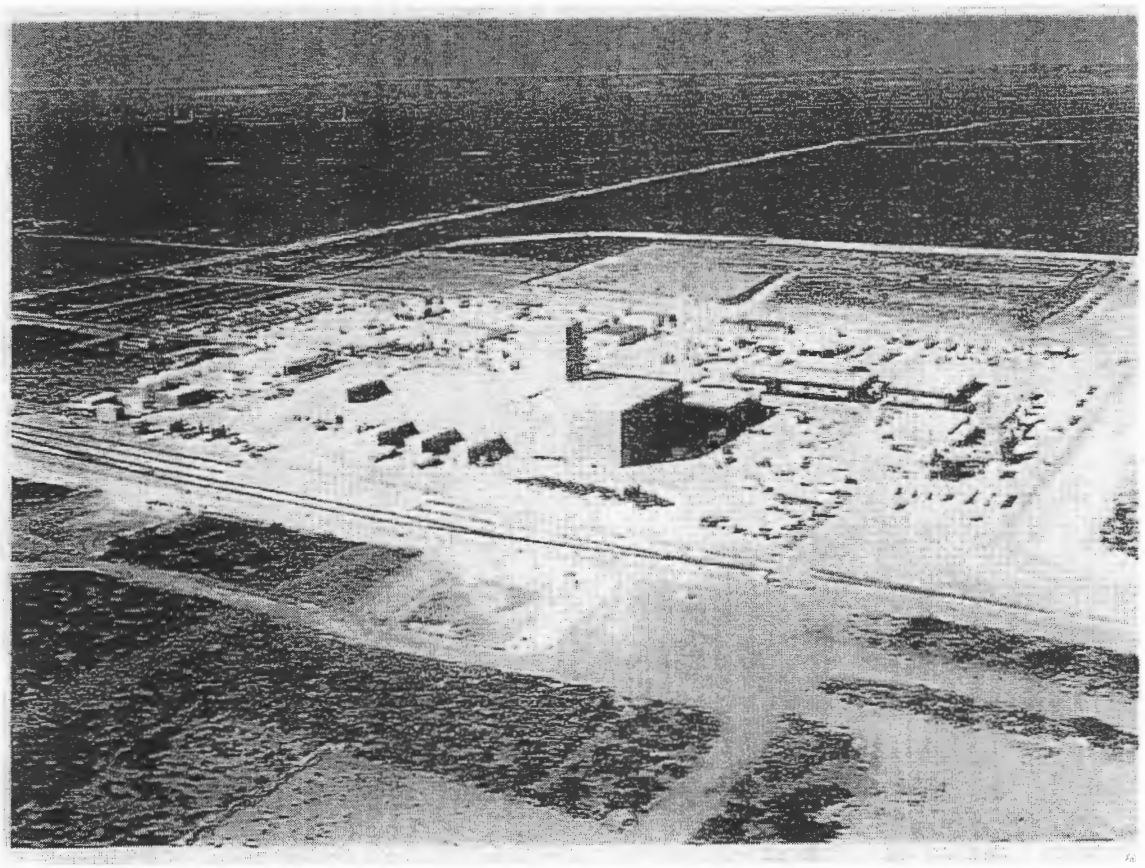

Figure B4-3
Aerial Photograph of the Waste Handling Building

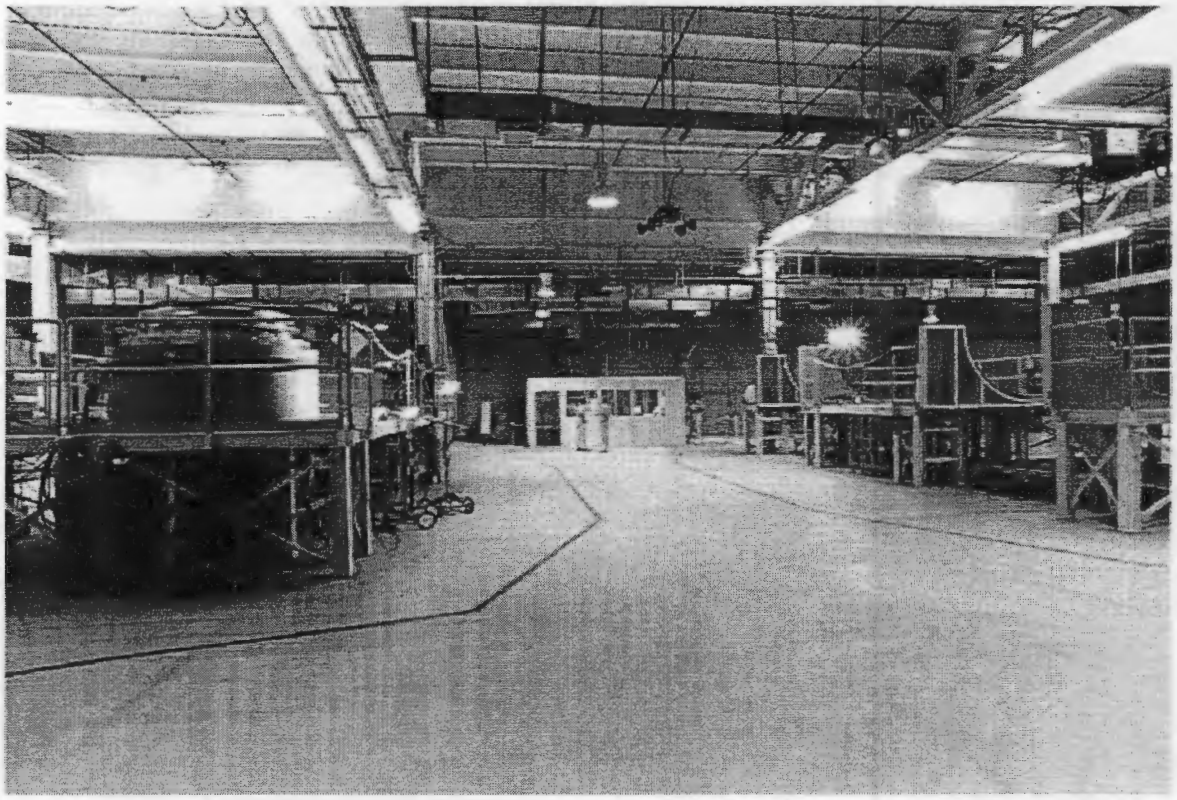

Figure B4-4
TRUDOCKs in CH Bay of the Waste Handling Building

Figure B4-5
NE Corner of CH Bay of the Waste Handling Building

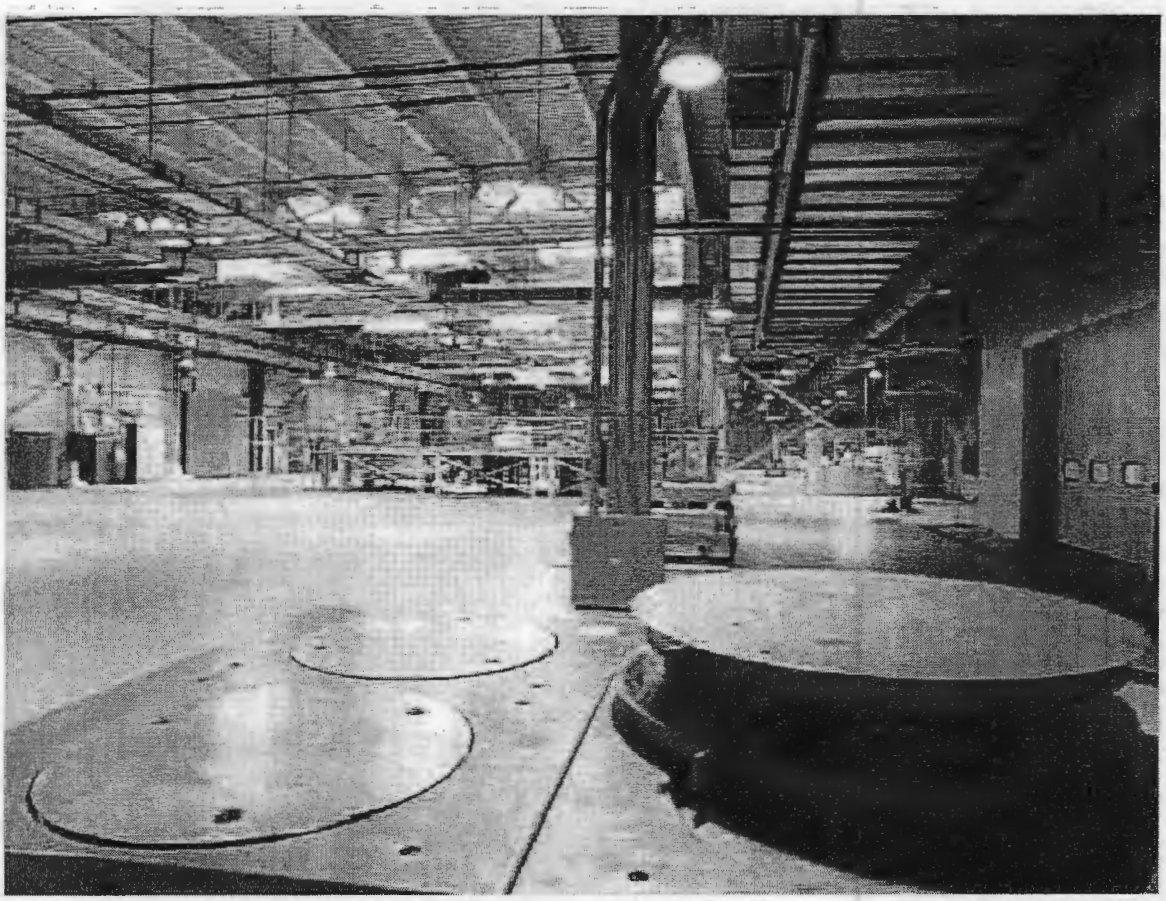

Figure B4-6
Westward View of CH Bay of the Waste Handling Building

Figure B4-7
Waste Shaft Conveyance - Loading Facility Pallet with CH Waste, Waste Handling Building

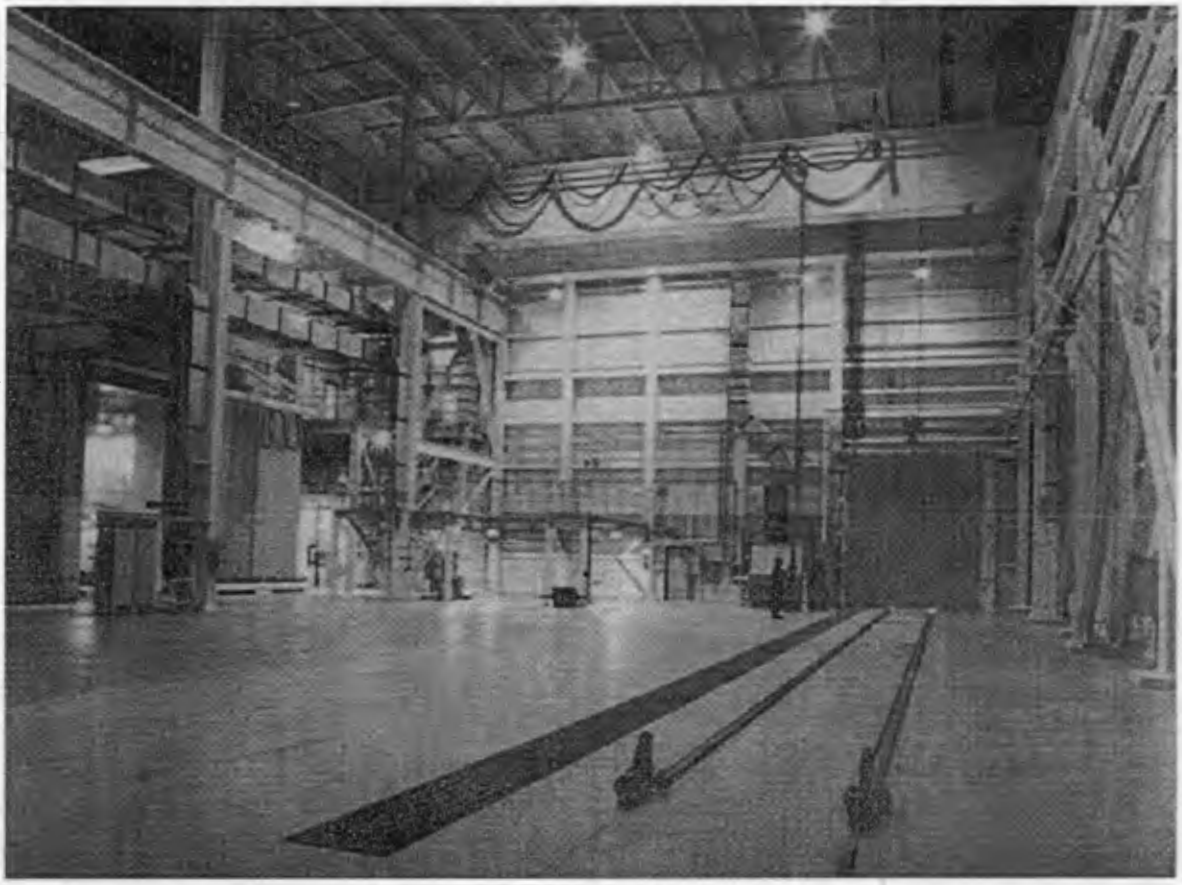

Figure B4-8
RH Bay (Photo Taken July 2000)

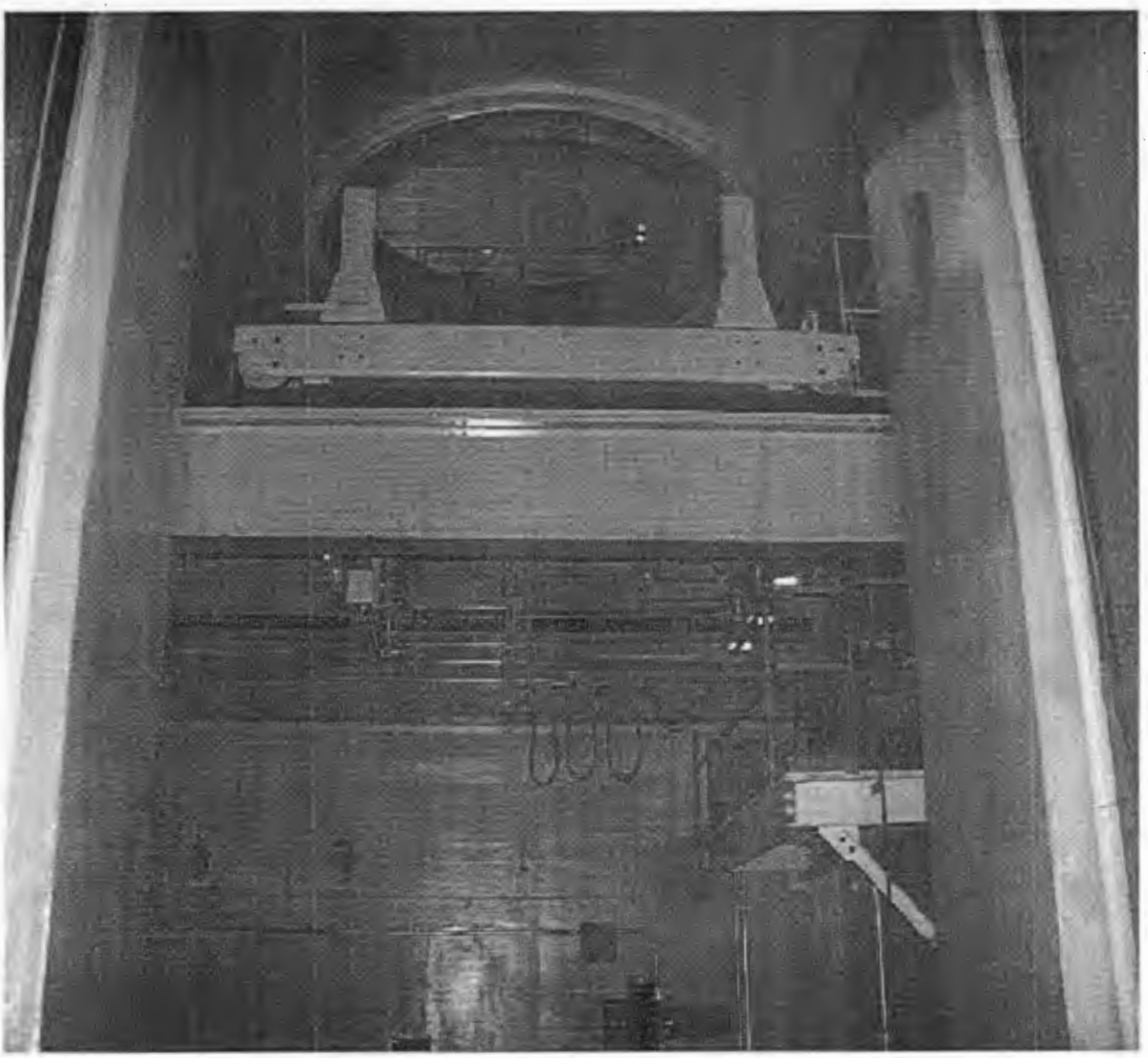

Figure B4-9
Cask Unloading Room and Bridge Crane

Figure B4-10
Hot Cell

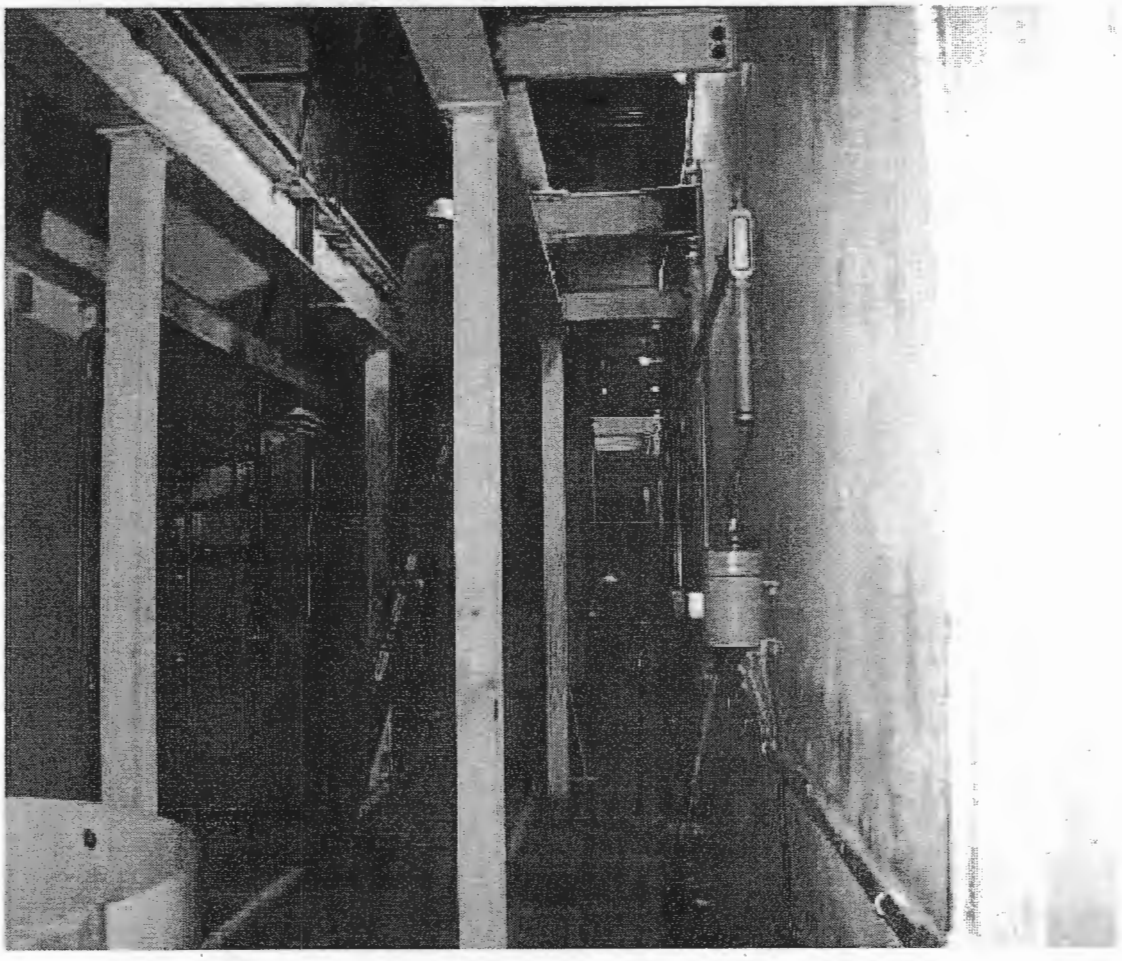

Figure B4-11
Transfer Cell

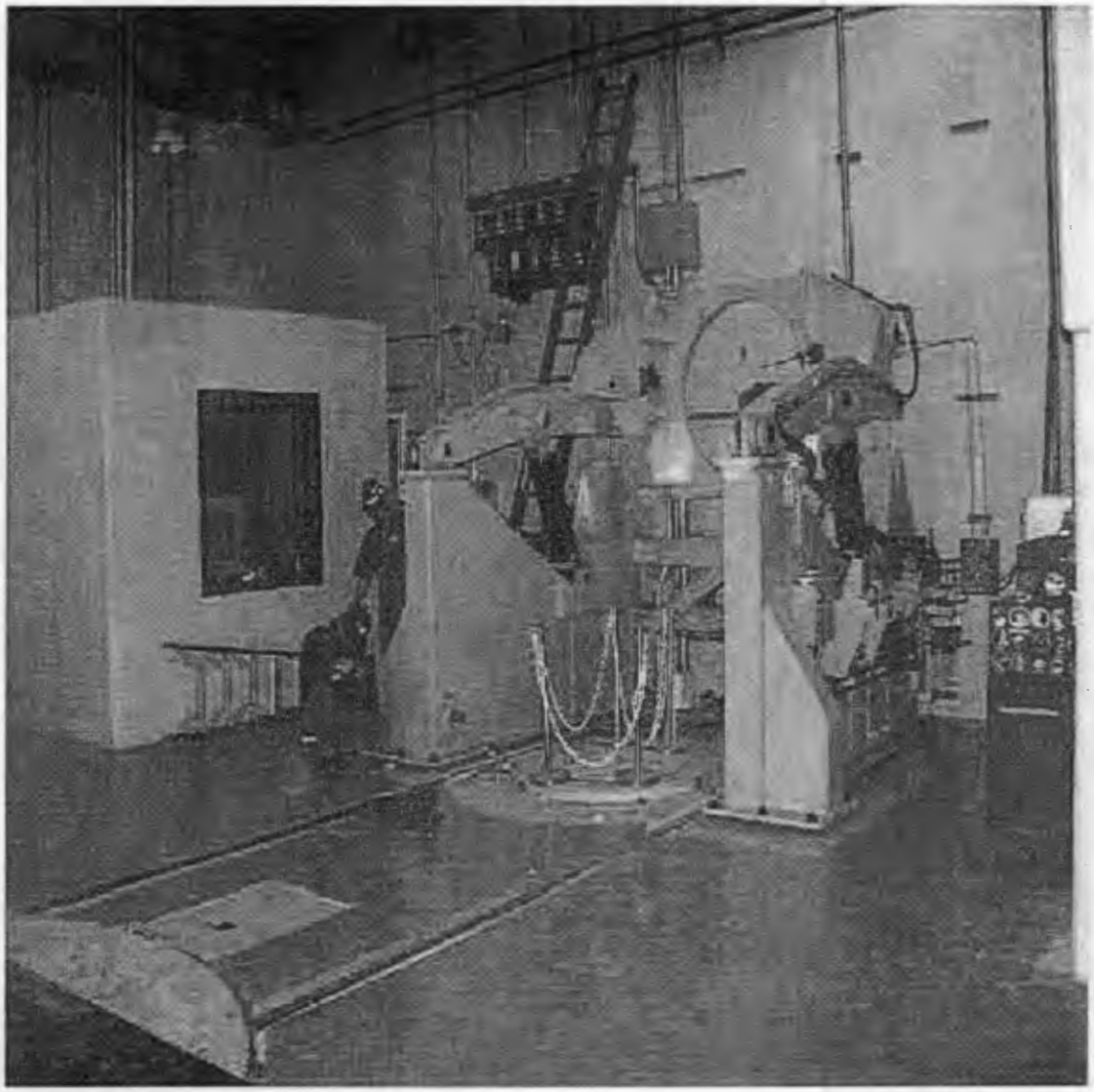

Figure B4-12
Facility Cask Loading Room and Facility Cask Rotating Device

1

ATTACHMENT C

WASTE ANALYSIS PLAN

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ATTACHMENT C

WASTE ANALYSIS PLAN

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ATTACHMENT C

WASTE ANALYSIS PLAN

C-0 Introduction and Attachment Highlights

This waste analysis plan (**WAP**) has been prepared for management, storage, or disposal activities to be conducted at the Waste Isolation Pilot Plant (**WIPP**) facility to meet requirements set forth in 20.4.1.500 NMAC (incorporating 40 CFR §264.13). Guidance in the most recent U.S. Environmental Protection Agency (**EPA**) manual on waste analysis has been incorporated into the preparation of this WAP (EPA, 1994). This WAP includes test methods, details of planned waste sampling and analysis for complying with the general waste analysis requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13), a description of the waste shipment screening and verification process, and a description of the quality assurance (**QA**)/quality control (**QC**) program. Before the Permittees manage, store, or dispose transuranic (**TRU**) mixed waste from a generator/storage site (**site**), the Permittees shall require that site to implement the applicable requirements of this WAP.

TRU mixed waste that may be stored or disposed at WIPP are or were generated at U.S. Department of Energy (**DOE**) generator/storage sites by various specific processes and activities. Examples of the major types of operations that generate this waste include:

- Production of Nuclear Products—Production of nuclear products includes reactor operation, radionuclide separation/finishing, and weapons fabrication and manufacturing. The majority of the TRU mixed waste was generated by weapons fabrication and radionuclide separation/finishing processes. More specifically, wastes consist of residues from chemical processes, air and liquid filtration, casting, machining, cleaning, product quality sampling, analytical activities, and maintenance and refurbishment of equipment and facilities.

- Plutonium Recovery—Plutonium recovery wastes are residues from the recovery of plutonium-contaminated molds, metals, glass, plastics, rags, salts used in electrorefining, precipitates, firebrick, soot, and filters.

- Research and Development (**R&D**)—R&D projects include a variety of hot cell or glovebox activities that often simulate full-scale operations described above, producing similar TRU mixed wastes. Other types of R&D projects include metallurgical research, actinide separations, process demonstrations, and chemical and physical properties determinations.

- Decontamination and Decommissioning—Facilities and equipment that are no longer needed or usable are decontaminated and decommissioned, resulting in TRU mixed wastes consisting of scrap materials, cleaning agents, tools, piping, filters, Plexiglas™, gloveboxes, concrete rubble, asphalt, cinder blocks, and other building materials. These materials are expected to be the largest category by volume of TRU mixed waste to be generated in the future.

TRU mixed waste contains both TRU radioactive and hazardous components, as defined in Permit Section 1.5.7. It is designated and separately packaged as either contact-handled (**CH**)

or remote-handled (**RH**), based on the radiological dose rate at the surface of the waste container.

The hazardous components of the TRU mixed waste to be managed at the WIPP facility are designated in Table C-9. Some of the waste may also be identified by unique state hazardous waste codes or numbers. These wastes are acceptable at WIPP as long as the Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Part 2 are met. This WAP describes the measures that will be taken to ensure that the TRU mixed wastes received at the WIPP facility are within the scope of Table C-9 as established by 20.4.1.500 NMAC (incorporating 40 CFR §264), and that they comply with unit-specific requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.600), Miscellaneous Units

Some TRU mixed waste is retrievably stored at the DOE generator/storage sites. Additional TRU mixed waste will be generated and packaged into containers at these generator/storage sites in the future. TRU mixed waste will be retrieved from storage areas at a DOE generator/storage site. Retrievably stored waste is defined as TRU mixed waste generated after 1970 and before the New Mexico Environment Department (**NMED**) notifies the Permittees, by approval of the final audit report, that the characterization requirements of the WAP at a generator/storage site have been implemented. Newly generated waste is defined as TRU mixed waste generated after NMED approves the final audit report for a generator/storage site. Acceptable knowledge (**AK**) information is assembled for both retrievably stored and newly generated waste. Waste characterization of retrievably stored TRU mixed waste will be performed on an ongoing basis, as the waste is retrieved. Waste characterization of newly generated TRU mixed waste is typically performed as it is generated, although some characterization occurs post-generation. Waste characterization requirements for newly generated and retrievably stored TRU mixed wastes differ, as discussed in Sections C-3d(1) and C-3d(2).

Waste characterization is defined in Part 1 as the activities performed by the waste generator to satisfy the general waste analysis requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.13(a)) before waste containers have been certified for disposal at WIPP. The characterization process for WIPP waste is presented in Figure C-2. Generator site waste characterization programs are first audited by DOE, with NMED approving the final audit report. After this, generator sites determine whether AK alone is sufficient for characterization, or whether a sampling and analysis program in conjunction with AK is necessary to adequately characterize wastes. If an AK Sufficiency Determination is sought, information is provided to the Permittees for their review and DOE's provisional approval; NMED determination of adequacy of the AK information is required before final approval by DOE. If the sampling and analysis route is chosen, sites proceed to sample and analyze waste in conjunction with AK and in accordance with this WAP. Once an AK Sufficiency Determination is obtained, or when required sampling and analysis data are obtained, sites would then prepare and submit the Waste Stream Profile Form for DOE's approval. Once the WSPF is approved, a site may ship waste to WIPP. The Permittees will perform waste confirmation prior to shipment of the waste from the generator/storage site to WIPP pursuant to Permit Attachment C7, by performing radiography or visual examination of a representative subpopulation of certified waste containers, to ensure that the wastes meet the applicable requirements of the TSDF-WAC.

C-0a Waste Characterization

Characterization requirements for individual containers of TRU mixed waste are specified on a waste stream basis. A waste stream is defined as waste materials that have common physical form, that contain similar hazardous constituents, and that are generated from a single process or activity. Waste streams are grouped by Waste Matrix Code Groups related to the physical and chemical properties of the waste. Generator/storage sites shall use the characterization techniques described in this WAP to assign appropriate Waste Matrix Code Groups to waste streams for WIPP disposal. The Waste Matrix Code Groups are solidified inorganics, solidified organics, salt waste, soils, lead/cadmium metal, inorganic nonmetal waste, combustible waste, graphite, filters, heterogeneous debris waste, and uncategorized metal. Waste Matrix Code Groups can be grouped into three Summary Category groups: Homogeneous Solids (Summary Category S3000), Soil/Gravel (Summary Category S4000), and Debris Waste (Summary Category S5000).

TRU mixed wastes are initially categorized into the three broad Summary Category Groups that are related to the final physical form of the wastes. Waste characterization requirements for these groups are specified separately in Section C-2 of this WAP. Each of the three groups is described below.

S3000 - Homogeneous Solids

Homogeneous solids are defined as solid materials, excluding soil, that do not meet the NMED criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2[g] and [h])). Included in the series of homogeneous solids are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Summary Category Group based on the specific waste stream types and final waste form. This Summary Category Group is expected to contain toxic metals and spent solvents. This category includes wastes that are at least 50 percent by volume homogeneous solids.

S4000 - Soils/Gravel

This Summary Category Group includes S4000 waste streams that are at least 50 percent by volume soil/gravel. This Summary Category Group is expected to contain toxic metals.

S5000 - Debris Wastes

This Summary Category Group includes heterogeneous waste that is at least 50 percent by volume materials that meet the criteria specified in 20.4.1.800 NMAC (incorporating 40 CFR §268.2 (g)). Debris means solid material exceeding a 2.36 inch (in.) (60 millimeter) particle size that is intended for disposal and that is:

1. a manufactured object, or
2. plant or animal matter, or
3. natural geologic material.

Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

If a waste does not include at least 50 percent of any given Summary Category Group by volume, characterization shall be performed using the waste characterization process required

for the category constituting the greatest volume of waste for that waste stream (see Section C-3d).

The most common hazardous constituents in the TRU mixed waste to be managed in the WIPP facility consist of the following:

Metals

Some of the TRU mixed waste to be emplaced in the WIPP facility contains metals for which 20.4.1.200 NMAC (incorporating 40 CFR §261.24), toxicity characteristics were established (EPA hazardous waste numbers D004 through D011). Cadmium, chromium, lead, mercury, selenium, and silver are present in discarded tools and equipment, solidified sludges, cemented laboratory liquids, and waste from decontamination and decommissioning activities. A large percentage of the waste consists of lead-lined gloveboxes, leaded rubber gloves and aprons, lead bricks and piping, lead tape, and other lead items. Lead, because of its radiation-shielding applications, is the most prevalent toxicity-characteristic metal present.

Halogenated Volatile Organic Compounds

Some of the TRU mixed waste to be emplaced in the WIPP facility contains spent halogenated volatile organic compound (**VOC**) solvents identified in 20.4.1.200 NMAC (incorporating 40 CFR, §261.31) (EPA hazardous waste numbers F001 through F005). Tetrachloroethylene; trichloroethylene; methylene chloride; carbon tetrachloride; 1,1,1-trichloroethane; and 1,1,2-trichloro-1,2,2-trifluoroethane (EPA hazardous waste numbers F001 and F002) are the most prevalent halogenated organic compounds identified in TRU mixed waste that may be managed at the WIPP facility during the Disposal Phase. These compounds are commonly used to clean metal surfaces prior to plating, polishing, or fabrication; to dissolve other compounds; or as coolants. Because they are highly volatile, only small amounts typically remain on equipment after cleaning or, in the case of treated wastewaters, in the sludges after clarification and flocculation. Radiolysis may also generate halogenated volatile organic compounds.

Nonhalogenated Volatile Organic Compounds

Xylene, methanol, and n-butanol are the most prevalent nonhalogenated VOCs in TRU mixed waste that may be managed at the WIPP facility during the Disposal Phase. Like the halogenated VOCs, they are used as degreasers and solvents and are similarly volatile. The same analytical methods that are used for halogenated VOCs are used to detect the presence of nonhalogenated VOCs. Radiolysis may also generate non-halogenated volatile organic compounds.

The generator/storage sites shall characterize their waste in accordance with this WAP and associated Permit Attachments, and ensure that waste proposed for storage and disposal at WIPP meets the applicable requirements of the TSDF-WAC in Part 2. The generator/storage site shall assemble the Acceptable Knowledge (**AK**) information into an auditable record[1] for the

[1] "Auditable records" mean those records which allow the Permittees to conduct a systematic assessment, analysis, and evaluation of the Permittees' compliance with the WAP and this Permit.

waste stream as described in Permit Attachment C4. For those waste streams with an approved AK Sufficiency Determination (see below), sampling and analysis per the methods described in Permit Attachments C1 and C2 are not required.

All waste characterization activities specified in this WAP and associated Permit Attachments shall be carried out at generator/storage sites and DOE approved laboratories in accordance with this WAP. DOE will audit generator/storage site waste characterization programs and activities as described in Section C-3. Waste characterization activities at the generator/storage sites include the following, although not all these techniques will be used on each container, as discussed in Section C-3:

- Radiography, which is an x-ray technique to determine physical contents of containers
- Visual examination of opened containers as an alternative way to determine their physical contents
- Headspace-gas sampling to determine VOC content of gases in the void volume of the containers
- Sampling and analysis of waste forms that are homogeneous and can be representatively sampled to determine concentrations of hazardous waste constituents and toxicity characteristic contaminants of waste in containers
- Compilation of AK documentation into an auditable record

C-0b AK Sufficiency Determination

Generator/storage sites may submit a request to the Permittees for an AK Sufficiency Determination (**Determination Request**) to meet all or part of the waste characterization requirements. The contents of the Determination Request are specified in Permit Attachment C4, Section C4-3d. The Determination Request may take one of the following forms:

Scenario 1 Radiography or visual examination (**VE**) of the waste stream is not required, and chemical sampling and analysis is not required;

Scenario 2 Radiography or VE of the waste stream is not required, but chemical sampling and analysis of a representative sample of the waste stream is required; or

Scenario 3 Chemical sampling and analysis is not required, but radiography or VE of 100% of the containers in the waste stream is required.

The Permittees shall evaluate the Determination Request for completeness and technical adequacy. This evaluation shall include, but not be limited to whether the Determination Request is technically sufficient for the following:

The Determination Request must include all information specified in Permit Attachment C4, Section C4-3d

The AK Summary must identify relevant hazardous constituents, and must correctly identify all toxicity characteristic and listed hazardous waste numbers.

All hazardous waste number assignments must be substantiated by supporting data and, if not, whether this lack of substantiation compromises the interpretation.

Resolution of data discrepancies between different AK sources must be technically correct and documented.

The AK Summary must include all the identification of waste material parameter weights by percentage of the material in the waste stream, and determinations must be technically correct.

All prohibited items specified in the TSDF-WAC should be addressed, and conclusions drawn must be technically adequate and substantiated by supporting information.

If the AK record includes process control information specified in Permit Attachment C4, Section C4-3b, the information should include procedures, waste manifests, or other documentation demonstrating that the controls were adequate and sufficient.

- The site must provide the supporting information necessary to substantiate technical conclusions within the Determination Request, and this information must be correctly interpreted.

The Permittees will review the Determination Request for technical adequacy and compliance with the requirements of the Permit, using trained and qualified individuals in accordance with standard operating procedures that shall, at a minimum, address all of the technical and procedural requirements listed above. The Permittees shall resolve comments with the generator/storage site, and the Permittees may change the scope of the Determination Request to one of the three scenarios.

If DOE determines that the AK is sufficient, it shall inform the public of the Determination Request, the Permittees' evaluation of it, and the date and time of a public meeting to provide information to and solicit comments from interested members of the public regarding the Determination Request. Notice of the meeting and comment period shall be provided by the following methods:

1. Written notice to all individuals on the facility mailing list;

2. Public notice in area newspapers, including the Carlsbad Current-Argus, Albuquerque Journal, and Santa Fe New Mexican

3. Notice on the WIPP Home Page;

4. E-mail notification as specified in Permit Section 1.11.

DOE shall take written comment on the Determination Request for at least 30 days following the public meeting. DOE shall compile all such comments, including any disagreement between the DOE and commenters.

If DOE provisionally approves the Determination Request, it may forward it along with all relevant information submitted with the Determination Request to NMED for an evaluation that the provisional approval made by DOE is adequate. DOE shall also provide to NMED, as a separate appendix to the Determination Request, the compilation of all comments and DOE's response to each comment. After submitting a Determination Request to NMED, the Permittees will post a link to the transmittal letter to NMED on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11. Based on the results of NMED's evaluation, the Permittees will notify the generator/storage sites whether the AK information is sufficient and the Determination Request is approved. DOE will not approve a Determination Request that NMED has determined to be inadequate unless the generator/storage site resolves the inadequacies and provides the resolution to NMED for evaluation of adequacy. Should the inadequacies not be resolved to NMED's satisfaction, DOE shall not submit a Determination Request for the same waste stream at a later date. DOE shall not submit a Determination Request if a previous Determination Request is pending evaluation by NMED.

In the event DOE disagrees, in whole or in part, with an evaluation performed by NMED resulting in a determination by NMED that DOE's provisional approval for a particular waste stream is inadequate, DOE may seek dispute resolution. The dispute resolution process is specified in Part 1. The Secretary's final decision under Permit Section 1.16.4 shall constitute a final agency action.

By July 1 of each year, the Permittees shall submit to NMED a list of waste streams the Permittees may submit for an AK Sufficiency Determination during the upcoming federal fiscal year. The Permittees will post a link to the transmittal letter to NMED and announce a public meeting to discuss the list with interested members of the public on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

If a generator/storage site does not submit a Determination Request, or if DOE does not approve a Determination Request, or if NMED finds that DOE's provisional approval of a Determination Request is inadequate, the generator/storage site shall perform radiography or VE on 100% of the containers in a waste stream and chemical sampling and analysis on a representative sample of the waste stream using headspace gas sampling and analysis (for debris waste) or solids sampling and analysis (for homogeneous solid or soil/gravel waste) as specified in Permit Attachments C1 and C2.

If a generator/storage site submits a Determination Request, DOE provisionally approves the Determination Request as Scenario 1, and NMED finds that DOE's provisional approval is adequate, neither radiography or VE nor chemical sampling and analysis of the waste stream is required.

If a generator/storage site submits a Determination Request, DOE provisionally approves the Determination Request as Scenario 2, and NMED finds that DOE's provisional approval is adequate, chemical sampling and analysis of a representative sample of the waste stream is required, but radiography or VE is not required.

If a generator/storage site submits a Determination Request, DOE provisionally approves the Determination Request as Scenario 3, and NMED finds that DOE's provisional approval is adequate, radiography or VE of 100% of the containers in the waste stream is required, but chemical sampling and analysis is not required.

C-0c Waste Stream Profile Form Completion

After a complete AK record has been compiled and either a Determination Request has been approved by DOE or the generator/storage site has completed the applicable representative sampling and analysis requirements specified in Permit Attachments C1 and C2, the generator/storage site will complete a Waste Stream Profile Form (**WSPF**) and Characterization Information Summary (**CIS**). The requirements for the completion of a WSPF and a CIS are specified in Permit Attachment C3, Sections C3-12b(1) and C3-12b(2) respectively.

The WSPF and the CIS for the waste stream resulting from waste characterization activities shall be transmitted to the Permittees, who shall review them for completeness, and screen them for acceptance prior to loading any TRU mixed waste into the Contact-Handled or Remote-Handled Packaging at the generator facility, as described in Section C-4. The review and approval process will ensure that the submitted waste analysis information is sufficient to meet the Data Quality Objectives (**DQOs**) for AK in Section C-4a(1) and allow the Permittees to demonstrate compliance with the requirements of this WAP. Only TRU mixed waste and TRU waste that has been characterized in accordance with this WAP and that meets the **TSDF-WAC** specified in this Permit will be accepted at the WIPP facility for disposal in a permitted Underground Hazardous Waste Disposal Unit (**HWDU**). DOE will approve and provide NMED with copies of the approved WSPF and accompanying CIS prior to waste stream shipment. Upon notification of DOE's approval of the WSPF, the generator/storage site may be authorized to ship waste to WIPP.

In the event the Permittees request detailed information on a waste stream, the site will provide a Waste Stream Characterization Package (Section C3-12b(2)). For each waste stream, this package will include the WSPF, the CIS, and the complete AK summary. The Waste Stream Characterization Package will also include specific Batch Data Reports (**BDRs**) and raw analytical data associated with waste container characterization as requested by the Permittees.

C-0d Waste Confirmation

The Permittees will perform waste confirmation on a representative subpopulation of each waste stream shipment after certification and prior to shipment pursuant to Permit Attachment C7. The Permittees will use radiography, review of radiography audio/video recordings, **VE**, or review of VE records (e.g., VE data sheets or packaging logs) to examine at least 7 percent of each waste stream shipment to confirm that the waste does not contain ignitable, corrosive, or reactive waste. Waste confirmation will be performed by the Permittees prior to shipment of the waste from the generator/storage site to WIPP.

C-1 Identification of TRU Mixed Waste to be Managed at the WIPP Facility

C-1a Waste Stream Identification

TRU mixed waste destined for disposal at WIPP will be characterized on a waste stream basis. Generator/storage sites will delineate waste streams using acceptable knowledge. Required acceptable knowledge is specified in Section C-3b and Permit Attachment C4.

All of the waste within a waste stream may not be accessible for sampling and analysis at one time. Permit Attachment C2 addresses the requirements for selecting waste containers used for characterization of waste streams as they are generated or retrieved.

C-1b Waste Summary Category Groups and Hazardous Waste Accepted at the WIPP Facility

Once a waste stream has been delineated, generator/storage sites will assign a Waste Matrix Code to the waste stream based on the physical form of the waste. Waste streams are then assigned to one of three broad Summary Category Groups; S3000-Homogeneous Solids, S4000-Soils/Gravel, and S5000-Debris Wastes. These Summary Category Groups are used to determine further characterization requirements.

The Permittees will only allow generators to ship those TRU mixed waste streams with EPA hazardous waste numbers listed in Table C-9. Some of the waste may also be identified by unique state hazardous waste codes or numbers. These wastes are acceptable at WIPP as long as the TSDF-WAC are met. The Permittees will require sites to perform characterization of all waste streams as required by this WAP. If during the characterization process, new EPA hazardous waste numbers are identified, those wastes will be prohibited for disposal at the WIPP facility until a permit modification has been submitted to and approved by NMED for these new EPA hazardous waste numbers. Similar waste streams at other generator/storage sites will be examined by the Permittees to ensure that the newly identified EPA hazardous waste numbers do not apply to those similar waste streams. If the other waste streams also require new EPA hazardous waste numbers, shipment of these similar waste streams will also be prohibited for disposal until a permit modification has been submitted to and approved by NMED.

C-1c Waste Prohibited at the WIPP Facility

The following TRU mixed waste are prohibited at the WIPP facility:

- liquid waste is not acceptable at WIPP. Liquid in the quantities delineated below is acceptable:
  - Observable liquid shall be no more than 1 percent by volume of the outermost container at the time of radiography or visual examination
  - Internal containers with more than 60 milliliters or 3 percent by volume observable liquid, whichever is greater, are prohibited
  - Containers with Hazardous Waste Number U134 assigned shall have no observable liquid
  - Overpacking the outermost container that was examined during radiography or visual examination or redistributing untreated liquid within the container shall not be used to meet the liquid volume limits
- non-radionuclide pyrophoric materials, such as elemental potassium
- hazardous wastes not occurring as co-contaminants with TRU mixed wastes (non-mixed hazardous wastes)
- wastes incompatible with backfill, seal and panel closures materials, container and packaging materials, shipping container materials, or other wastes

- wastes containing explosives or compressed gases
- wastes with polychlorinated biphenyls (**PCBs**) not authorized under an EPA PCB waste disposal authorization
- wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003)
- waste that has ever been managed as high-level waste and waste from tanks specified in Table C-8, unless specifically approved through a Class 3 permit modification
- any waste container from a waste stream (or waste stream lot) which has not undergone either radiographic or visual examination of a statistically representative subpopulation of the waste stream in each shipment, pursuant to Permit Attachment C7
- any waste container from a waste stream which has not been preceded by an appropriate, certified WSPF (see Section C-1d)

Before accepting a container holding TRU mixed waste, the Permittees will perform waste confirmation activities pursuant to Permit Attachment C7 on each waste stream shipment to confirm that the waste does not contain ignitable, corrosive, or reactive waste and the assigned EPA hazardous waste numbers are allowed for storage and disposal by this Permit. Waste confirmation activities will be performed on at least 7 percent of each waste stream shipped, equating to examination of at least one of fourteen containers in each waste stream shipment. If a waste stream shipment contains fewer than fourteen containers, one container will be examined to satisfy waste confirmation requirements. Section C-4 and Permit Attachment C7 include descriptions of the waste confirmation processes that the Permittees will conduct prior to receiving a shipment at the WIPP facility.

Containers are vented through filters, allowing any gases that are generated by radiolytic and microbial processes within a waste container to escape, thereby preventing over pressurization or development of conditions within the container that would lead to the development of ignitable, corrosive, reactive, or other characteristic wastes.

To ensure the integrity of the WIPP facility, waste streams identified to contain incompatible materials or materials incompatible with waste containers cannot be shipped to WIPP unless they are treated to remove the incompatibility. Only those waste streams that are compatible or have been treated to remove incompatibilities will be shipped to WIPP.

C-1d Control of Waste Acceptance

Every waste stream shipped to WIPP shall be preceded by a WSPF (Figure C-1) and a CIS. The required WSPF information and the CIS elements are found in Section C3-12b(1) and Section C3-12b(2).

Generator/storage sites will provide the WSPF to the Permittees for each waste stream prior to its acceptance for disposal at WIPP. The WSPF and the CIS will be transmitted to the Permittees for each waste stream from a generator/storage site. If continued waste characterization reveals discrepancies that identify different hazardous waste numbers or

indicates that the waste belongs to a different waste stream, the waste will be redefined to a separate waste stream and a new WSPF submitted. Generator/storage sites will develop criteria to determine the specific circumstances under which a WSPF is revised versus when a new WSPF is required. These criteria will be evaluated by DOE during site audits (Attachment C6).

The Permittees are responsible for the review of WSPFs and CISs to verify compliance with the restrictions on TRU mixed wastes for WIPP disposal. DOE will approve and submit completed WSPFs to NMED prior to waste stream shipment. The Permittees will be responsible for the review of shipping records (Section C-5) to ensure that each waste container has been prepared and characterized in accordance with applicable provisions of this WAP. Waste characterization data shall ensure the absence of prohibited items specified in Section C-1c.

Any time the Permittees request additional information concerning a waste stream, the generator/storage site will provide a Waste Stream Characterization Package (Section C3-12b(2)). The option for the Permittees to request additional information ensures that the waste being offered for disposal is adequately characterized and accurately described on the WSPF.

C-1e Waste Generating Processes at the WIPP Facility

Waste generated as a result of the waste containers handling and processing activities at the WIPP facility is termed "derived" waste. Because derived wastes can contain only those RCRA-regulated materials present in the waste from which they were derived, no additional characterization of the derived waste is required for disposal purposes. In other words, the generator/storage site's characterization data and knowledge of the processes at the WIPP facility will be used to identify and characterize hazardous waste and hazardous constituents in derived waste. The management of derived waste is addressed in Permit Attachment A1.

C-2 Waste Characterization Program Requirements and Waste Characterization Parameters

The Permittees shall require the sites to develop the procedure(s) which specify their programmatic waste characterization requirements. DOE will evaluate the procedures during audits conducted under the Audit and Surveillance Program (Section C-5a(3)) and may also evaluate the procedures as part of the review and approval of the WSPF. Sites must notify the Permittees and obtain DOE approval prior to making data-affecting modifications to procedures (Permit Attachment C3, Section C3-15). Program procedures shall address the following minimum elements:

- Waste characterization and certification procedures for retrievably stored and newly generated wastes to be sent to the WIPP facility
- Methods used to ensure prohibited items are documented and managed. These will include procedures for performing radiography, VE, or treatment, if these methods are used to ensure prohibited items are not present in the waste prior to shipment of the waste to WIPP.
- Procedures used to verify packaging configurations to determine the correct drum age criteria (**DAC**) if headspace gas sampling and analysis is used to collect waste characterization information per Section C1-1a(1) of the WAP.

- Identify the organization(s) responsible for compliance with waste characterization and certification procedures.
- Identify the oversight procedures and frequency of actions to verify compliance with waste characterization and certification procedures.
- Develop training specific to waste characterization and certification procedures.
- Ensure that personnel may stop work if noncompliance with waste characterization or certification procedures is identified.
- Develop a nonconformance process that complies with the requirements in Permit Attachment C3 of the WAP to document and establish corrective actions.
- As part of the corrective action process, assess the potential time frame of the noncompliance, the potentially affected waste population(s), and the reassessment and recertification of those wastes.
- A listing of all approved hazardous waste numbers which are acceptable at WIPP are included in Table C-9.

For those waste streams or containers that are not amenable to radiography (e.g., RH TRU mixed waste, direct loaded ten-drum overpacks (**TDOPs**)) for waste confirmation by the Permittees pursuant to Permit Attachment C7, generator/storage site VE data may be used for waste acceptance. In those cases, the Permittees will review the generator/storage site VE procedures to ensure that data sufficient for the Permittees' waste acceptance activities pursuant to Permit Attachment C7 will be obtained and the procedures meet the minimum requirements for visual examination specified in Permit Attachment C1, Section C1-4.

The following waste characterization parameters shall be obtained from the generator/storage sites:

- Determination whether TRU mixed waste streams comply with the applicable provisions of the TSDF-WAC
- Determination whether TRU mixed wastes exhibit a hazardous characteristic (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart C)
- Determination whether TRU mixed wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart D)
- Estimation of waste material parameter weights

Tables C-1, C-2, C-3 and C-4 provide the parameters of interest for the various constituent groupings and analytical methodologies. The following sections provide a description of the acceptable methods to evaluate these parameters for each waste Summary Category Group.

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C-3 Generator Waste Characterization Methods

The characterization techniques used by generator/storage sites includes acceptable knowledge and may also include, as necessary, headspace-gas sampling and analysis, radiography, visual examination, and homogeneous waste sampling and analysis. All characterization activities are performed in accordance with the WAP. Table C-5 provides a summary of the characterization requirements for TRU mixed waste.

C-3a Sampling and Analytical Methods

C-3a(1) Headspace Gas Sampling and Analysis

Representative headspace gas sampling and analysis shall be used by generator/storage sites to determine the types and concentrations of VOCs in the void volume of randomly selected waste containers in order to resolve the assignment of EPA hazardous waste numbers for those debris waste streams for which an AK Sufficiency Determination Request has not been approved by DOE. In addition, VOC constituents will be compared to those assigned by acceptable knowledge, which may include an analysis of radiolytically derived VOCs. The generator/storage sites may also consider radiolysis and packaging materials when assessing the presence of hazardous constituents in the headspace gas results, and whether radiolysis would generate wastes which exhibit the toxicity characteristic. Refer to Permit Attachment C4 for additional clarification regarding hazardous waste number assignment and headspace gas results. The methods for random selection of containers for headspace gas sampling and analysis are specified in Permit Attachment C2. Headspace gas sampling and analysis shall be subject to the Audit and Surveillance Program (Permit Attachment C6).

In accordance with EPA convention, identification of hazardous constituents detected by gas chromatography/mass spectrometry methods that are not on the list of target analytes shall be reported. These compounds are reported as tentatively identified compounds (**TICs**) in the analytical BDR and shall be added to the target analyte list if detected in a given waste stream, if they appear in the 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII, and if they are reported in 25% of the waste containers sampled from a given waste stream. The headspace gas analysis method Quality Assurance Objectives (**QAOs**) are specified in Permit Attachment C3.

C-3a(2) Homogeneous and Soil/Gravel Waste Sampling and Analysis

Representative homogeneous and soil/gravel waste sampling and analysis shall be used by generator/storage sites to resolve the assignment of EPA hazardous waste numbers for homogeneous and soil/gravel waste streams for which an AK Sufficiency Determination Request has not been approved by DOE. Sampling of homogeneous and soil/gravel wastes shall result in the collection of a sample that is used to resolve the assignment of hazardous waste numbers. Sampling is accomplished through coring or other EPA approved sampling, which is described in Permit Attachment C1.For those waste streams defined as Summary Category Groups S3000 or S4000 on page C-3, debris that may also be present within these wastes need not be sampled. The waste containers for sampling and analysis are to be selected randomly from the population of containers for the waste stream. The random selection methodology is specified in Permit Attachment C2. Homogeneous and soil/gravel sampling and analysis shall be subject to the Audit and Surveillance Program (Permit Attachment C6).

Totals or TCLP analyses for VOCs, SVOCs, and RCRA-regulated metals are used to determine waste parameters in soils/gravels and solids that may be important to the performance within the disposal system (Tables C-3 and C-4). To determine if a waste exhibits a toxicity characteristic for compounds specified in 20.4.1.200 NMAC (incorporating 40 CFR §261, Subpart C), TCLP may be used instead of total analyses. The generator will use the results from these analyses to determine if a waste exhibits a toxicity characteristic. The mean concentration of toxicity characteristic contaminants are calculated for each waste stream such that it can be reported with an upper 90 percent confidence limit (**UCL_{90}**). The UCL_{90} values for the mean measured contaminant concentrations in a waste stream will be compared to the specified regulatory levels in 20.4.1.200 NMAC (incorporating 40 CFR §261 Subpart C), expressed as total/TCLP values, to determine if the waste stream exhibits a toxicity characteristic. A comparison of total analyses and TCLP analyses is presented in Appendix C3 of the WIPP RCRA Part B Permit Application (DOE, 1997), and a discussion of the UCL_{90} is included in Permit Attachment C2. If toxicity characteristic (**TC**) wastes are identified, these will be compared to those determined by acceptable knowledge and TC waste numbers will be revised, as warranted. Refer to Permit Attachment C4 for additional clarification regarding hazardous waste number assignment and homogeneous solid and soil/gravel analytical results.

C-3a(3) Laboratory Qualification

DOE will ensure that generator/storage sites conduct analyses using laboratories that are qualified through participation in the Performance Demonstration Program (**PDP**) (DOE, 2003, 2005). Required QAOs are specified in Permit Attachment C3. In addition, methods and supporting performance data demonstrating QAO compliance shall be ensured by DOE during the annual certification audit of the laboratories.

Analytical methods used by the laboratories shall: 1) satisfy all of the appropriate QAOs, and 2) be implemented through laboratory-documented standard operating procedures. These analytical QAOs are discussed in detail in Permit Attachment C3.

C-3b Acceptable Knowledge

Acceptable knowledge (**AK**) is used in TRU mixed waste characterization activities in five ways:

- To delineate TRU mixed waste streams
- To assess whether TRU mixed wastes comply with the TSDF-WAC
- To assess whether TRU mixed wastes exhibit a hazardous characteristic (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart C)
- To assess whether TRU mixed wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart D)
- To estimate waste material parameter weights

Acceptable knowledge is discussed in detail in Permit Attachment C4, which outlines the minimum set of requirements and DQOs which shall be met by the generator/storage sites in order to use acceptable knowledge. In addition, Section C-5a(3) of this permit attachment

describes the assessment of acceptable knowledge through the Audit and Surveillance Program.

C-3c Radiography and Visual Examination

Radiography and visual examination (**VE**) are nondestructive qualitative and quantitative techniques used to identify and verify waste container contents as specified in Permit Attachment C1. Generator/storage sites shall perform radiography or VE of 100 percent of CH TRU mixed waste containers in waste streams except for those waste streams for which DOE approves a Scenario 1 or Scenario 2 Determination Request. No RH TRU mixed waste will be shipped to WIPP for storage or disposal without documentation of radiography or VE of 100 percent of the containers as specified in Permit Attachment C1. Radiography and/or VE will be used, when necessary, to examine a waste container to verify its physical form. These techniques can detect observable liquid in excess of TSDF-WAC limits and containerized gases, which are prohibited for WIPP disposal. The prohibition of liquid in excess of TSDF-WAC limits and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes. Radiography and/or VE are also able to verify that the physical form of the waste matches its waste stream description (i.e. Homogeneous Solids, Soil/Gravel, or Debris Waste [including uncategorized metals]). If the physical form does not match the waste stream description, the waste will be designated as another waste stream and assigned the preliminary hazardous waste numbers associated with that new waste stream assignment. That is, if radiography and/or VE indicates that the waste does not match the waste stream description arrived at by acceptable knowledge characterization, a non-conformance report (**NCR**) will be completed and the inconsistency will be resolved as specified in Permit Attachment C4, and the NCR will be dispositioned as specified in Permit Attachment C3, Section C3-13. The proper waste stream assignment will be determined (including preparation of a new WSPF), the correct hazardous waste numbers will be assigned, and the resolution will be documented. Refer to Permit Attachment C4 for a discussion of acceptable knowledge and its verification process.

For generator/storage sites that use VE, the detection of any liquid in non-transparent internal containers, detected from shaking the internal container, will be handled by assuming that the internal container is filled with liquid and adding this volume to the total liquid in the container being characterized using VE. The container being characterized using VE would be rejected and/or repackaged to exclude the internal container if it is over the TSDF-WAC limits. When radiography is used, or visual examination of transparent containers is performed, if any liquid in internal containers is detected, the volume of liquid shall be added to the total for the container being characterized using radiography or VE. Radiography, or the equivalent, will be used as necessary on the existing/stored waste containers to verify the physical characteristics of the TRU mixed waste correspond with its waste stream identification/waste stream Waste Matrix Code and to identify prohibited items. Radiographic examination protocols and QA/QC methods are provided in Permit Attachment C1. Radiography and VE shall be subject to the Audit and Surveillance Program (Permit Attachment C6).

C-3d Characterization Techniques and Frequency for Newly Generated and Retrievably Stored Waste

Generator/storage sites will use acceptable knowledge to delineate all TRU mixed waste containers into waste streams for the purposes of grouping waste for further characterization. The analyses performed may differ based on the waste stream and the physical form of the waste (i.e., heterogeneous debris waste cannot be sampled for totals analyses). Both

retrievably stored and newly generated wastes will be delineated in this fashion, though the types of acceptable knowledge used may differ. Section C-3b discusses the use of acceptable knowledge, sampling, and analysis in more detail. Acceptable knowledge is discussed more completely in Permit Attachment C4. Every TRU mixed waste stream will be assigned hazardous waste numbers based upon acceptable knowledge, and the generator/storage sites may resolve the assignment of hazardous waste numbers using headspace gas (Summary Category Group S5000 only) and solid sampling and analysis (Summary Category Groups S3000 and S4000 only).

In the CIS for each waste stream, the generator/storage site will be required to document their methods, and the findings from those methods, for determining the physical form of the waste and the presence or absence of prohibited items for both retrievably stored and newly generated waste. Radiography and/or VE may be used to verify the physical form of retrievably stored TRU mixed waste. For newly generated waste, physical form and prohibited items may either be documented during packaging using VE or verified after packaging using radiography or VE.

For debris waste streams that do not have an AK Sufficiency Determination approved by DOE, containers selected in accordance with Permit Attachment C2 from those waste streams must be sampled and analyzed for VOCs in the headspace gas. Likewise, a statistically selected portion of homogeneous solids and soil/gravel waste streams must be sampled and analyzed for RCRA-regulated total VOCs, SVOCs, and metals when those waste streams do not have an AK Sufficiency Determination approved by DOE. Sampling and analysis methods used for waste characterization are discussed in Section C-3a.

In the process of performing organic headspace and solid sample analyses, nontarget compounds may be identified. These compounds will be reported as TICs. TICs reported in 25% of the samples and listed in 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII, will be compared with acceptable knowledge data to determine if the TIC is in a listed hazardous waste in the waste stream. TICs identified through headspace gas analyses that meet the Appendix VIII list criteria and the 25 percent reporting criteria for a waste stream will be added to the headspace gas waste stream target list, regardless of the hazardous waste listing associated with the waste stream. TICs subject to inclusion on the target analyte list that are toxicity characteristic parameters shall be added to the target analyte list regardless of origin because the hazardous waste designation for these numbers is not based on source. However, for toxicity characteristic and non-toxic F003 constituents, the site may take concentration into account when assessing whether to add a hazardous waste number. TICs reported from the Totals VOC or SVOC analyses may be excluded from the target analyte list for a waste stream if the TIC is a constituent in an F-listed waste whose presence is attributable to waste packaging materials or radiolytic degradation from acceptable knowledge documentation. If the TIC associated with a total VOC or SVOC analysis cannot be identified as a component of waste packaging materials or as a product of radiolysis, the generator/storage site will add these TICs to the list of hazardous constituents for the waste stream (and assign additional EPA listed hazardous waste numbers, if appropriate). A permit modification will be submitted to NMED for their approval to add these constituents (and waste numbers), if necessary. For toxicity characteristic compounds and non-toxic F003 constituents, the generator/storage site may consider waste concentration when determining whether to change a hazardous waste number. Refer to Permit Attachment C3 for additional information on TIC identification.

Waste characterization solid sampling and analysis activities may differ for retrievably stored waste and newly generated waste. The waste characterization processes used by the generator/storage sites for both retrievably stored and newly generated waste streams will be evaluated during DOE's audit of the site. The typical waste characterization data collection design used by the generator/storage sites for each type of waste is described in the following sections. Table C-1 provides a summary of hazardous waste characterization requirements for all TRU mixed waste by waste characterization parameters.

Table C-5 summarizes the parameters, methods, and rationales for stored and newly generated CH TRU mixed wastes according to their waste forms.

WIPP may accept TRU mixed waste that has been repackaged or treated. Treated waste shall retain the original waste stream's listed hazardous waste number designation.

C-3d(1) Newly Generated Waste

The RCRA-regulated constituents in newly generated wastes will typically be documented at the time of generation based on acceptable knowledge for the waste stream. Newly generated TRU mixed waste characterization typically begins with verification that processes generating the waste have operated within established written procedures. Waste containers are delineated into waste streams using acceptable knowledge. The Permittees will require that the generator/storage sites document the methods used to delineate waste streams in the acceptable knowledge record and Acceptable Knowledge Summary Report. Determination that the physical form of the waste (Summary Category Group) corresponds to the physical form of the assigned waste stream may be accomplished either using VE during packaging or by performing radiography as specified in Permit Attachment C1, Section C1-3 for retrievably stored waste. Instead of using a video/audio tape and a single operator, the VE method for newly generated waste (or repackaged retrievably stored waste) may use a second operator, who is equally trained to the requirements stipulated in Permit Attachment C1, to provide additional verification by reviewing the contents of the waste container to ensure correct reporting. If the second operator cannot provide concurrence, corrective actions [2] will be taken as specified in Permit Attachment C3. The subsequent waste characterization activities depend on the assigned Summary Category Group, since waste within the Homogeneous Solids and Soils/Gravel Summary Category Groups may be characterized using different techniques than the waste in the Debris Waste Summary Category Group. The packaging configuration, type and number of filters, and rigid liner vent hole presence and diameter necessary to determine the appropriate drum age criteria (**DAC**) in accordance with Permit Attachment C1, Section C1-1, may be documented as part of the characterization information collected during the packaging of newly generated waste or repackaging of retrievably stored waste for those containers of debris waste that will undergo headspace gas sampling and analysis.

C-3d(1)(a) Sampling of Newly Generated Homogeneous Solids and Soil/Gravel

When a Determination Request has not been approved by DOE, sampling and analysis of newly generated homogeneous solid and soil/gravel waste streams shall be conducted in accordance with the requirements specified in Permit Attachment C1, Section C1-2. The

[2] "Corrective action" as used in this WAP and its attachments does not mean corrective action as defined under HWA, RCRA, and their implementing regulations.

number of newly generated homogeneous solid and soil/gravel waste containers to be sampled will be determined using the procedure specified in Section C2-1, wherein a statistically selected portion of the waste will be sampled.

C-3d(2) Retrievably Stored Waste

All retrievably stored waste containers will first be delineated into waste streams using acceptable knowledge. The Permittees will require that the generator/storage sites document the methods used to delineate waste streams in the acceptable knowledge record and Acceptable Knowledge Summary Report. Retrievably stored waste containers may be examined using radiography or VE to determine the physical waste form (Summary Category Group), the absence of prohibited items, and additional waste characterization techniques that may be used based on the Summary Category Groups (i.e., S3000, S4000, S5000).

The headspace gas sampling method provided in Permit Attachment C1 will be used, when necessary, to resolve the assignment of EPA hazardous waste numbers to debris waste streams, as specified in Permit Attachment C4.

A statistically selected portion of retrievably stored homogeneous solids and soil/gravel wastes will be sampled and analyzed for total VOCs, SVOCs, and metals, when necessary. The sample location selection method is described in Permit Attachment C2. The sampling methods for these wastes are provided in Permit Attachment C1.

The toxicity characteristic of retrievably stored homogeneous solids and soil/gravel wastes will be determined using total analysis of toxicity characteristic parameters or TCLP. To determine if a waste exhibits a toxicity characteristic for compounds specified in 20.4.1.200 NMAC (incorporating 40 CFR §261, Subpart C), TCLP may be used instead of total analyses. Appendix C3 of the WIPP RCRA Part B Permit Application (DOE, 1997) discusses comparability of totals analytical results to those of the TCLP method.

Representativeness of containers selected for headspace gas sampling and waste subjected to homogeneous solids and soil/gravel sampling and analysis will be validated by the generator/storage site and by DOE during an audit (Permit Attachment C6) via examination of documentation that shows that random samples were collected. (Because representativeness is a quality characteristic that expresses the degree to which a sample or group of samples represent the population being studied, the random sampling of waste streams ensures representativeness.)

C-4 Data Verification and Quality Assurance

The Permittees will ensure that applicable waste characterization processes performed by generator/storage sites sending TRU mixed waste to the WIPP for disposal meets WAP requirements through data validation, usability and reporting controls. Verification occurs at three levels: 1) the data generation level, 2) the project level, and 3) the Permittee level. The validation and verification process and requirements at each level are described in Permit Attachment C3, Section C3-10. The validation and verification process at the Permittee Level is also described in Section C-5.

C-4a Data Generation and Project Level Verification Requirements

C-4a(1) Data Quality Objectives

The waste characterization data obtained through WAP implementation will be used to ensure that the Permittees meet regulatory requirements with regard to both regulatory compliance and to ensure that all TRU mixed wastes are properly managed during the Disposal Phase. To satisfy the RCRA regulatory compliance requirements, the following DQOs are established by this WAP:

- Acceptable Knowledge
  - To delineate TRU mixed waste streams.
  - To assess whether TRU mixed wastes comply with the applicable requirements of the TSDF-WAC.
  - To assess whether TRU mixed wastes exhibit a hazardous characteristic (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart C).
  - To assess whether TRU mixed wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR §261, Subpart D).
  - To estimate waste material parameter weights.
- Headspace-Gas Sampling and Analysis
  - To identify VOCs and quantify the concentrations of VOC constituents in waste containers to resolve the assignment of EPA hazardous waste numbers
- Homogeneous Waste Sampling and Analysis
  - To compare UCL_{90} values for the mean measured contaminant concentrations in a waste stream with specified toxicity characteristic levels in 20.4.1.200 NMAC (incorporating 40 CFR §261), to determine if the waste is hazardous, and to resolve the assignment of EPA hazardous waste numbers.
- Radiography
  - To determine the physical waste form, the absence of prohibited items, and additional waste characterization techniques that may be used based on the Summary Category Groups (i.e., S3000, S4000, S5000).
- Visual Examination
  - To determine the physical waste form, the absence of prohibited items, and additional waste characterization techniques that may be used based on the Summary Category Groups (i.e., S3000, S4000, S5000).

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Reconciliation of these DQOs by the Generator/Storage Site Project Manager or DOE approved laboratories, as applicable, is addressed in Permit Attachment C3. Reconciliation requires determining whether sufficient type, quality, and quantity of data have been collected to ensure the DQOs cited above can be achieved.

C-4a(2) Quality Assurance Objectives

The generator/storage sites or DOE approved laboratories, as applicable, shall demonstrate compliance with each QAO associated with the various characterization methods as presented in Permit Attachment C3. Generator/Storage Site Project Managers or DOE approved laboratories, as applicable, are further required to perform a reconciliation of the data with the DQOs established in this WAP. The Generator/Storage Site Project Manager or DOE approved laboratories, as applicable, shall conclude that all of the DQOs have been met for the characterization of the waste stream prior to submitting a WSPF to DOE for approval (Permit Attachment C3). The following QAO elements shall be considered for each technique, as a minimum:

- Precision
  - Precision is a measure of the mutual agreement among multiple measurements.
- Accuracy
  - Accuracy is the degree of agreement between a measurement result and the true or known value.
- Completeness
  - Completeness is a measure of the amount of valid data obtained from a method compared to the total amount of data obtained that is expressed as a percentage.
- Comparability
  - Comparability is the degree to which one data set can be compared to another.
- Representativeness
  - Representativeness expresses the degree to which data represent characteristics of a population.

A more detailed discussion of the QAOs, including a mathematical representation, where appropriate, can be found in Permit Attachment C3, which describes the QAOs associated with each method of sampling and analysis.

C-4a(3) Sample Control

The generator/storage sites and DOE approved laboratories, as applicable, will implement a sample handling and control program that will include the maintenance of field documentation records, proper labeling, and a chain of custody (**COC**) record. The generator/storage site and DOE approved laboratories, as applicable, Quality Assurance Project Plan (**QAPjP**) or

procedures referenced in the QAPjP will document this program and include COC forms to control the sample from the point of origin to the final analysis result reporting. DOE will review and approve the QAPjP, including their determination that the sample control program is adequate. The approved QAPjP will be provided to NMED prior to shipment of TRU mixed waste and before the generator/storage site audit, as specified in Permit Attachment C5. Details of this sample control program are provided in Permit Attachment C1 and are summarized below to include:

- Field Documentation of samples including: point of origin, date of sample, container ID, sample type, analysis requested, and COC number.
- Labeling and/or tagging including: sample numbering, sample ID, sample date, sampling conditions, and analysis requested.
- COC control including: name of sample relinquisher, sample receiver, and the date and time of the sample transfer.
- Proper sample handling and preservation.

C-4a(4) Data Generation

BDRs, in a format approved by DOE, will be used by each generator/storage site and DOE approved laboratories, as applicable, for reporting waste characterization data. This format will be included in the generator/storage site and DOE approved laboratories, as applicable, QAPjP, controlled electronic databases, or procedures referenced in the QAPjP (Permit Attachment C5) and will include all of the elements required by this WAP for BDR (Permit Attachment C3).

DOE shall perform audits of the generator/storage site waste characterization programs, as implemented by the generator/storage site QAPjP, to verify compliance with the WAP and the DQOs in this WAP (See Permit Attachment C6 for a discussion of the content of the audit program). The primary functions of these audits are to review generator/storage sites' adherence to the requirements of this WAP and ensure adherence to the WAP characterization program. DOE shall provide the results of each audit to NMED. If audit results indicate that a generator/storage site is not in compliance with the requirements of this WAP, DOE will take appropriate action as specified in Permit Attachment C6.

DOE shall perform audits of the DOE approved laboratory's programs, as implemented by the laboratory's QAPjP (See Permit Attachment C6 for a discussion of the content of the audit program). The primary functions of these audits are to review the DOE approved laboratory's adherence to the requirements of this WAP. DOE shall provide the results of each audit to NMED. If audit results indicate that a DOE approved laboratory is not in compliance with the requirements of this WAP, DOE will take appropriate action as specified in Permit Attachment C6.

DOE shall further require all DOE approved laboratories analyzing WIPP waste samples for the generator/storage sites to have established, documented QA/QC programs. DOE annually evaluates these laboratories and their QA/QC programs as part of their participation in DOE's PDP laboratory performance program. DOE's audits cover the requirements of the lab's QA/QC program, as well as compliance with this WAP. Continued compliance with these parameters will be verified by ongoing audits by DOE at the generator/storage sites and these laboratories

as specified in Permit Attachment C6. DOE's audits of the generator/storage sites will verify that the laboratories analyzing the sites' waste have been properly audited by the generator/storage sites. The laboratory's QA/QC program shall include the following:

- Facility organization
- A list of equipment/instrumentation
- Operating procedures
- Laboratory QA/QC procedures
- Quality assurance review
- Laboratory records management

C-4a(5) Data Verification

BDRs will document the testing, sampling, and analytical results from the required characterization activities, and document required QA/QC activities. Data validation and verification at both the data-generation level and the project level will be performed as required by this Permit before the required data are transmitted to the Permittees (Permit Attachment C3). NMED may request, through the Permittees, copies of any BDR, and/or the raw data validated by the generator/storage sites, to check DOE's audit of the validation process.

C-4a(6) Data Transmittal

BDRs will include the information required by Section C3-10 and will be transmitted by hard copy or electronically (provided a hard copy is available on demand) from the data generation level to the project level.

The generator/storage site will transmit waste container information electronically via the WIPP Waste Information System (**WWIS**). Data will be entered into the WWIS in the exact format required by the database. Refer to Section C-5a(1) for WWIS reporting requirements and the *Waste Data System User's Manual* (DOE, 2009) for the WWIS data fields and format requirements.

Once a waste stream is characterized, the Site Project Manager will also submit to the Permittees a WSPF (Figure C-1) accompanied by the CIS for that waste stream which includes reconciliation with DQOs (Sections3 C-12b(1) and C3-12b(2)). The WSPF, the CIS, and information from the WWIS will be used as the basis for acceptance of waste characterization information on TRU mixed wastes to be disposed of at the WIPP.

C-4a(7) Records Management

Records related to waste characterization activities performed by the generator/storage sites will be maintained in the testing, sampling, or analytical facility files or generator/storage site project files, or at the WIPP Records Archive facility. DOE approved laboratories will forward testing, sampling, and analytical records along with BDRs, to the generator/storage site project office for inclusion in the generator/storage site's project files and to the Permittees for inclusion in the WIPP facility operating record. Raw data obtained by testing, sampling, and analyzing TRU mixed waste in support of this WAP will be identifiable, legible, and provide documentary evidence of quality. TRU mixed waste characterization records submitted to the Permittees shall be maintained in the WIPP facility operating record and be available for inspection by NMED.

Records inventory and disposition schedule (**RIDS**) or an equivalent system shall be prepared and approved by generator/storage site personnel. All records relevant to an enforcement action under this Permit, regardless of disposition, shall be maintained at the generator/storage site until NMED determines they are no longer needed for enforcement action, and then dispositioned as specified in the approved RIDS. All waste characterization data and related QA/QC records for TRU mixed waste to be shipped to the WIPP facility are designated as either Lifetime Records or Non-Permanent Records.

Records that are designated as Lifetime Records shall be maintained for the life of the waste characterization program at a participating generator/storage site plus six years or transferred for permanent archival storage to the WIPP Records Archive facility.

Waste characterization records designated as Non-Permanent Records shall be maintained for ten years from the date of (record) generation at the participating generator/storage site or at the WIPP Records Archive facility and then dispositioned according to their approved RIDS. If a generator/storage site ceases to operate, all records shall be transferred before closeout to the Permittees for management at the WIPP Records Archive facility. Table C-6 is a listing of records designated as Lifetime Records and Non-Permanent Records. Classified information will not be transferred to WIPP. Notations will be provided to the Permittees indicating the absence of classified information. The approved generator/storage site RIDS will identify appropriate disposition of classified information. Nothing in this Permit is intended to, nor should it be interpreted to, require the disclosure of any U.S. Department of Energy classified information to persons without appropriate clearance to view such information.

C-5 Permittee Level Waste Screening and Verification of TRU Mixed Waste

Permittee waste screening is a two-phased process. Phase I will occur prior to configuring shipments of TRU mixed waste. Phase II will occur after configuration of shipments of TRU mixed waste but before it is disposed at the WIPP facility. Figure C-3 presents Phase I and a portion of Phase II of the TRU mixed waste screening process. Permit Attachment C7 presents the TRU mixed waste confirmation portion of Phase II activities.

C-5a Phase I Waste Stream Screening and Verification

The first phase of the waste screening and verification process will occur before TRU mixed waste is shipped to the WIPP facility. Before the Permittees begin the process of accepting TRU mixed waste from a generator/storage site, an initial audit of that generator/storage site will be conducted as part of the Audit and Surveillance Program (Permit Attachment C6). The RCRA portion of the generator/storage site audit program will provide on-site verification of characterization procedures; BDR preparation; and recordkeeping to ensure that all applicable provisions of the WAP requirements are met. Another portion of the Phase I verification is the WSPF approval process. At the WIPP facility, this process includes verification that all of the required elements of the WSPF and the CIS are present (Permit Attachment C3) and that the waste characterization information meet acceptance criteria required for compliance with the WAP (Section C3-12b(1)).

A generator/storage site must first prepare a QAPjP, which includes applicable WAP requirements, and submit it to DOE for review and approval (Permit Attachment C5). Once approved, a copy of the QAPjP is provided to NMED for examination. The generator/storage site will implement the specific parameters of the QAPjP after it is approved. An initial audit will

be performed after QAPjP implementation and prior to the generator/storage site being certified for shipment of waste to WIPP. Additional audits, focusing on the results of waste characterization, will be performed at least annually. DOE has the right to conduct unannounced audits and to examine any records that are related to the scope of the audit. See Section C-5a(3) and Permit Attachment C6 for further information regarding audits.

When the required waste stream characterization data have been collected by a generator/storage site and the initial generator/storage site audit has been successfully completed, the generator/storage Site Project Manager will verify that waste stream characterization meets the applicable WAP requirements as a part of the project level verification (Section C3-10b). If the waste characterization does not meet the applicable requirements of the WAP, the mixed waste stream cannot be managed, stored, or disposed at WIPP until those requirements are met. The Site Project Manager will then complete a WSPF and submit it to the Permittees, along with the accompanying CIS for that waste stream (Section C3-12b(1)). All data necessary to check the accuracy of the WSPF will be transmitted to the Permittees for verification. This provides notification that the generator/storage site considers that the waste stream (identified by the waste stream identification number) has been adequately characterized for disposal prior to shipment to WIPP. The Permittees will compare headspace gas, radiographic, visual examination and solid sampling/analysis data obtained subsequent to submittal and approval of the WSPF (and prior to submittal) with characterization information presented on this form. If the Permittees determine (through the data comparison) that the characterization information is adequate, DOE will approve the WSPF. Prior to the first shipment of containers from the approved waste stream, the approved WSPF and accompanying CIS will be provided to NMED. If the data comparison indicates that analyzed containers have hazardous wastes not present on the WSPF, or a different Waste Matrix Code applies, the WSPF is in error and shall be resubmitted. Ongoing WSPF examination is discussed in detail in Section C-5a(2).

Audits of generator/storage sites will be conducted as part of the Audit and Surveillance Program (Permit Attachment C6). The RCRA portion of the generator/storage site audit program will provide on-site verification of waste characterization procedures; BDR preparation; and record keeping to ensure that all applicable provisions of the WAP requirements are met. As part of the waste characterization data submittal, the generator/storage site will also transmit the data on a container basis via the WWIS. This data submittal can occur at any time as the data are being collected, but will be complete for each container prior to shipment of that container. The WWIS will conduct internal edit/limit checks as the data are entered, and the data will be available to the Permittees as supporting information for WSPF review. NMED will have read-only access to the WWIS as necessary to determine compliance with the WAP. The initial WSPF check performed by the Permittees will include WWIS data submitted by the generator/storage site for each waste container submitted for the WSPF review and the CIS. The Permittees will compare ongoing sampling/analysis characterization data obtained and submitted via the WWIS to the approved WSPF. If this comparison shows that containers have hazardous wastes not reported on the WSPF, or a different Waste Matrix Code applies, the data are rejected and the waste containers are not accepted for shipment until a new or revised WSPF is submitted to the Permittees and approved by DOE.

If discrepancies regarding hazardous waste number assignment or Waste Matrix Code designation arise as a result of the Phase I review, the generator/storage sites will be contacted by the Permittees and required to provide the necessary additional information to resolve the discrepancy before that waste stream is approved for disposal at the WIPP facility. If the

discrepancy is not resolved, the waste stream will not be approved. DOE will notify NMED in writing of any discrepancies identified during WSPF review and the resulting discrepancy resolution prior to waste shipment. The Permittees will not manage, store, or dispose the waste stream until this discrepancy is resolved in accordance with this WAP.

C-5a(1) WWIS Description

All generator/storage sites planning to ship TRU mixed waste to WIPP will supply the required data to the WWIS. The WWIS Data Dictionary includes all of the data fields, the field format and the limits associated with the data as established by this WAP. These data will be subjected to edit and limit checks that are performed automatically by the database, as defined in the *Waste Data System User's Manual* (DOE, 2009).

The Permittees will coordinate the data transmission with each generator/storage site. Actual data transmission will use appropriate technology to ensure the integrity of the data transmissions. The Permittees will require sites with large waste inventories and large databases to populate a data structure provided by the Permittees that contains the required data dictionary fields that are appropriate for the waste stream (or waste streams) at that site. For example, totals analysis data will not be requested from sites that do not have homogeneous solids or soil/gravel waste. The Permittees will access these data via the Internet to ensure an efficient transfer of this data. Small quantity sites will be given a similar data structure by the Permittees that is tailored to their types of waste. Sites with very small quantities of waste will be provided with the ability to assemble the data interactively to this data structure on the WWIS.

The Permittees will use the WWIS to verify that all of the supplied data meet the edit and limit checks prior to the shipment of any TRU mixed waste to WIPP. The WWIS automatically will notify the generator/storage site if any of the supplied data fails to meet the requirements of the edit and limit checks via an appropriate error message. The generator/storage site will be required to correct the discrepancy with the waste or the waste data and re-transmit the corrected data prior to acceptance of the data by the WWIS. The Permittees will review data reported for each container of each shipment prior to providing notification to the shipping generator/storage site that the shipment is acceptable. Read-only access to the WWIS will be provided to NMED. Table C-7 contains a listing of the data fields contained in the WWIS that are required as part of this Permit.

The WWIS will generate the following:

- Waste Emplacement Report

  This report will be added to the operating record to track the quantities of waste, date of emplacement, and location of authorized containers or container assemblies in the repository. The Permittees will document the specific panel room or drift that an individual waste container is placed in as well as the row/column/height coordinates location of the container or containers assembly. This report will be generated on a weekly basis. Locations of containers or container assemblies will also be placed on a map separate from the WWIS. Reports and maps that are included as part of the operating record will be retained at the WIPP site, for the life of the facility.

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- Shipment Summary Report

  This report will contain the container identification numbers (**IDs**) of every container in the shipment, listed by Shipping Package number and by assembly number (for seven-packs, four-packs, and three-packs), for every assembly in the Shipping Package. This report is used by the Permittees to verify containers in a shipment and will be generated on a shipment basis.

- Waste Container Data Report

  This report will be generated on a waste stream basis and will be used by the Permittees during the WSPF review and DOE approval process. This report will contain the data listed in the Characterization Module on Table C-7. This report will be generated and attached to the WSPF for inclusion in the facility operating record and will be kept for the life of the facility.

- Reports of Change Log

  This will consist of a short report that lists the user ID and the fields changed. The report will also include a reason for the change. A longer report will list the information provided on the short report and include a before and after image of the record for each change, a before-record for each deletion, and the new information for added records. These reports will provide an auditable trail for the data in the database.

Access to the WWIS will be controlled by the Permittees' Data Administrator (**DA**) who will control the WWIS users based on approval from management personnel.

The TRU mixed waste generator/storage sites will only have access to data that they have supplied, and only until the data have been formally accepted by the Permittees. After the data have been accepted, the data will be protected from indiscriminate change and can only be changed by an authorized DA.

The WWIS has a Change Log that requires a reason for the change from the DA prior to accepting the change. The data change information, the user ID of the authorized DA making the change, and the date of the change will be recorded in the data change log automatically. The data change log cannot be revised by any user, including the DA. The data change log will be subject to internal and external audits and will provide an auditable trail for all changes made to previously approved data.

C-5a(2) Examination of the Waste Stream Profile Form and Container Data Checks

The Permittees will verify the completeness and accuracy of the Waste Stream Profile Form (Section C3-12b(1)). Figure C-2 includes the waste characterization and waste stream approval process. The assignment of the waste stream description, Waste Matrix Code Group, and Summary Category Groups; the results of waste analyses, as applicable; the acceptable knowledge summary documentation; the methods used for characterization; the DOE certification, and appropriate designation of EPA hazardous waste number(s) will be examined by the Permittees. If the WSPF is inaccurate, efforts will be made to resolve discrepancies by contacting the generator/storage site in order for the waste stream to be eligible for shipment to the WIPP facility. If discrepancies in the waste stream are detected at the generator/storage

site, the generator/storage site will implement a non-conformance program to identify, document, and report discrepancies (Permit Attachment C3).

The WSPF shall pass all verification checks by the Permittees in order for the waste stream to be approved by DOE for shipment to the WIPP facility. The WSPF check against waste container data will occur during the initial WSPF approval process (Section C-5a).

The EPA hazardous waste numbers for the wastes that appear on the Waste Stream Profile Form will be compared to those in Table C-9 to ensure that only approved wastes are accepted for management, storage, or disposal at WIPP. Some of the waste may also be identified by unique state hazardous waste codes or numbers. These wastes are acceptable at WIPP as long as the TSDF-WAC are met. The CIS will be reviewed by the Permittees to verify that the waste has been classified correctly with respect to the assigned EPA hazardous waste numbers. Any analytical method used will be compared to those listed in Tables C-2, C-3, and C-4 to ensure that only approved analytical methods were used for analysis of the waste. The Permittees will verify that the applicable requirements of the TSDF-WAC have been met by the generator/storage site.

Waste data transferred via the WWIS after WSPF approval will be compared with the approved WSPF. Any container from an approved hazardous waste stream with a description different from its WSPF will not be managed, stored, or disposed at WIPP.

The Permittees will also verify that three different types of data specified below are available for every container holding TRU mixed waste before that waste is managed, stored, or disposed at WIPP: 1) an assignment of the waste stream's waste description (by Waste Matrix Codes) and Waste Matrix Code Group; 2) a determination of ignitability, reactivity, and corrosivity; and 3) a determination of compatibility. The verification of waste stream description will be performed by reviewing the WWIS for consistency in the waste stream description and WSPF. The CIS will indicate if the waste has been checked for the characteristics of ignitability, corrosivity, and reactivity. The final verification of waste compatibility will be performed using Appendix C1 of the WIPP RCRA Part B Permit Application (DOE, 1997), the compatibility study.

Any container with unresolved discrepancies associated with hazardous waste characterization will not be managed, stored, or disposed at the WIPP facility until the discrepancies are resolved. If the discrepancies cannot be resolved, DOE will revoke the approval status of the waste stream, suspend shipments of the waste stream, and notify NMED. Waste stream approval will not be reinstated until the generator/storage site demonstrates all corrective actions have been implemented and the generator/storage site waste characterization program is reassessed by DOE.

C-5a(3) Audit and Surveillance Program

An important part of the Permittees' verification process is the Audit and Surveillance Program. The focus of this audit program is compliance with this WAP and the Permit. This audit program addresses all AK implementation and waste sampling and analysis activities, from waste stream classification assignment through waste container certification, and ensures compliance with SOPs and the WAP. Audits will ensure that containers and their associated documentation are adequately tracked throughout the waste handling process. Operator qualifications will be verified, and implementation of QA/QC procedures will be surveyed. A final report that includes generator/storage site or DOE approved laboratory audit results and applicable WAP-related

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corrective action report (**CAR**) resolution will be provided to NMED for approval, and will be kept in the WIPP facility operating record until closure of the WIPP facility.

DOE will perform an initial audit at each generator/storage site performing waste characterization activities prior to the formal acceptance of the WSPFs and/or any waste characterization data supplied by the generator/storage sites. Audits will be performed at least annually thereafter, including the possibility of unannounced audits (i.e., not a regularly scheduled audit). These audits will allow NMED to verify that the Permittees have implemented the WAP and that generator/storage sites have implemented a QA program for the characterization of waste and meet applicable WAP requirements. DOE will also audit annually the DOE approved laboratories performing waste sampling and/or analysis. The accuracy of physical waste description and waste stream assignment provided by the generator/storage site will be verified by review of the radiography results, and visual examination of data records and radiography images (as necessary) during audits conducted by DOE. More detail on this audit process is provided in Permit Attachment C6.

C-5b Phase II Waste Shipment Screening and Verification

As presented in Figure C-3, Phase II of the waste shipment screening and verification process begins with confirmation of the waste pursuant to Permit Attachment C7 after waste shipments are configured. After the waste shipment has arrived, the Permittees will screen the shipments to determine the completeness and accuracy of the EPA Hazardous Waste Manifest and the land disposal restriction notice completeness. The Permittees will verify there are no waste shipment irregularities and the waste containers are in good condition. Only those waste containers that are from shipments that have been confirmed pursuant to Permit Attachment C7 and that pass all Phase II waste screening and verification determinations will be emplaced at WIPP. For each container shipped, the Permittees shall ensure that the generator/storage sites provide the following information:

Hazardous Waste Manifest Information:

Generator/storage site name and EPA ID
Generator/storage site contact name and phone number
Quantity of waste
List of up to six state and/or federal hazardous waste numbers in each line item
Listing of all shipping container IDs (Shipping Package serial number)
- Signature of authorized generator representative

Specific Waste Container information:

Waste Stream Identification Number
List of Hazardous Waste Numbers per Container
Certification Data
- Shipping Data (Assembly numbers, ship date, shipping category, etc.)

This information shall also be supplied electronically to the WWIS. The container-specific information will be supplied electronically as described in Section C-5a(1), and shall be supplied prior to the Permittees' management, storage, or disposal of the waste.

The Permittees will verify each approved shipment upon receipt at WIPP against the data on the WWIS shipment summary report to ensure containers have the required information. A Waste Receipt Checklist will be used to document the verification.

C-5b(1) Examination of the EPA Uniform Hazardous Waste Manifest and Associated Waste Tracking Information

Upon receipt of a TRU mixed waste shipment, the Permittees will make a determination of EPA Uniform Hazardous Waste Manifest completeness and sign the manifest to allow the driver to depart. For CH TRU mixed waste, the Permittees will then make a determination of waste shipment completeness by checking the unique, bar-coded identification number found on each container holding TRU mixed waste against the WWIS database after opening the Shipping Package.

The WWIS links the bar-coded identification numbers of all containers in a specific waste shipment to the waste assembly (for 7-packs, 4-packs, 3-packs and 5-drum carriages) and to the shipment identification number, which is also written on the EPA Hazardous Waste Manifest.

For shipments in the RH-TRU 72B cask, the identification number of the single payload container is read during cask-to-cask transfer in the Transfer Cell and then checked against the WWIS database. For shipments in the CNS 10-160B cask, the Permittees will make a determination of waste shipment completeness by checking the unique identification number found on each container holding TRU mixed waste in the Hot Cell against the WWIS database after unloading the cask.

Generators electronically transmit the waste shipment information to the WWIS before the TRU mixed waste shipment is transported. Once a TRU mixed waste shipment arrives, the Permittees verify the identity of each cask or container (or one container in a bound 7-pack, 4-pack, or 3-pack) using the data already in the WWIS.

The WWIS will maintain waste container receipt and emplacement information provided by the Permittees. It will include, among other items, the following information associated with each container of TRU mixed waste:

- Package inner containment vessel or shipping cask closure date
- Package (container or canister) receipt date
- Overpack identification number (if appropriate)
- Package (container or canister) emplacement date
- Package (container or canister) emplacement location

Manifest discrepancies will be identified during manifest examination and container bar-code WWIS data comparison. A manifest discrepancy is a difference between the quantity or type of hazardous waste designated on the manifest and the quantity or type of hazardous waste the WIPP facility actually receives. The generator/storage site technical contact (as listed on the manifest) will be contacted to resolve the discrepancy. If the discrepancy is identified prior to the containers being removed from the package or shipping cask, the waste will be retained in the parking area. If the discrepancy is identified after the waste containers are removed from the package or cask, the waste will be retained in the Waste Handling Building (**WHB**) until the

discrepancy is resolved. Errors on the manifest can be corrected by the WIPP facility with a verbal (followed by a mandatory written) concurrence by the generator/storage site technical contact. All discrepancies that are unresolved within fifteen (15) days of receiving the waste will be immediately reported to NMED in writing. Notifications to NMED will consist of a letter describing the discrepancies, discrepancy resolution, and a copy of the manifest. If the manifest discrepancies have not been resolved within thirty (30) days of waste receipt, the shipment will be returned to the generator/storage facility. If it becomes necessary to return waste containers to the generator/storage site, a new EPA Uniform Hazardous Waste Manifest may be prepared by the Permittees.

Documentation of the returned containers will be recorded in the WWIS. Changes will be made to the WWIS data to indicate the current status of the container(s) The reason for the WWIS data change and the record of the WWIS data change will be maintained in the change log of the WWIS, which will provide an auditable record of the returned shipment.

The Permittees will be responsible for the resolution of discrepancies, notification of NMED, as well as returning the original copy of the manifest to the generator/storage site.

C-5b(2) Examination of the Land Disposal Restriction (**LDR**) Notice

TRU mixed waste designated by the Secretary of Energy for disposal at WIPP is exempt from the LDRs by the WIPP Land Withdrawal Act Amendment (Public Law 104-201). This amendment states that WIPP "Waste is exempted from treatment standards promulgated pursuant to section 3004(m) of the Solid Waste Disposal Act (42 U.S. C. 6924(m)) and shall not be subjected to the Land Disposal prohibitions in section 3004(d), (e), (f), and (g) of the Solid Waste Disposal Act." Therefore, with the initial shipment of a TRU mixed waste stream, the generator shall provide the Permittees with a one time written notice. The notice must include the information listed below:

Land Disposal Restriction Notice Information:

- EPA Hazardous Waste Number(s) and Manifest Numbers of first shipment of a mixed waste stream
- Statement: this waste is not prohibited from land disposal
- Date the waste is subject to prohibition

This information is the applicable information taken from column "268.7(a)(4)" of the "Generator Paperwork Requirements Table" in 20.4.1.800 NMAC (incorporating 40 CFR §268.7(a)(4)). Note that item "5" from the "Generator Paperwork Requirements Table" is not applicable since waste analysis data are provided electronically via the WWIS and item "7" is not applicable since waste designated by the Secretary of Energy for disposal at WIPP is exempted from the treatment standards.

The Permittees will review the LDR notice for accuracy and completeness. The generator will prepare this notice in accordance with the applicable requirements of 20.4.1.800 NMAC (incorporating 40 CFR §268.7(a)(4)).

C-5b(3) Verification

The Permittees will make a determination of TRU mixed waste shipment irregularities. The following items will be inspected for each TRU mixed waste shipment arriving at the WIPP facility:

- Whether the number and type of containers holding TRU mixed waste match the information in the WWIS
- Whether the containers are in good condition

The Permittees will verify that the containers (as identified by their container ID numbers) are the containers for which accepted data already exists in the WWIS. A check will be performed by the Permittees comparing the data on the WWIS Shipment Summary Report for the shipment to the actual shipping papers (including the EPA Hazardous Waste Manifest). This check also verifies that the containers included in the shipment are those for which approved shipping data already exist in the WWIS Transportation Data Module (Table C-7). For standard waste boxes (**SWBs**) and ten drum overpacks (**TDOPs**), this check will include comparing the barcode on the container with the container number on the shipping papers and the data on the WWIS Shipment Summary Report. For 7-pack assemblies, one of the seven container barcodes will be read by the barcode reader and compared to the assembly information for this container on the WWIS Shipment Summary Report. This will automatically identify the remaining six containers in the assembly. This process enables the Permittees to identify all of the containers in the assembly with minimum radiological exposure. If all of the container IDs and the information on the shipping papers agree with the WWIS Shipment Summary Report, and the shipment was subject to waste confirmation by the Permittees prior to shipment to WIPP pursuant to Permit Attachment C7, the containers will be approved for storage and disposal at the WIPP facility.

C-6 Permittees' Waste Shipment Screening QA/QC

Waste shipment screening QA/QC ensures that TRU mixed waste received is that which has been approved for shipment during the Phase I and Phase II screening. This is accomplished by maintaining QA/QC control of the waste shipment screening process. The screening process will be controlled by administrative processes which will generate records documenting waste receipt that will become part of the waste receipt record. The waste receipt record documents that container identifications correspond to shipping information and approved TRU mixed waste streams. The Permittees will extend QA/QC practices to the management of all records associated with waste shipment screening determinations.

C-7 Records Management and Reporting

As part of the WIPP facility's operating record, data and documents associated with waste characterization and waste confirmation are managed in accordance with standard records management practices.

All waste characterization data for each TRU mixed waste container transmitted to WIPP shall be maintained by the Permittees for the active life of the WIPP facility plus two years. The active life of the WIPP facility is defined as the period from the initial receipt of TRU mixed waste at the facility until NMED receives certification of final closure of the facility. After their active life, the

records shall be retired to the WIPP Records Archive facility and maintained for 30 years. These records will then be offered to the National Archives. However, this disposition requirement does not preclude the inclusion of these records in the permanent marker system or other requirements for institutional control.

The storage of the Permittees' copy of the manifest, LDR information, waste characterization data, WSPFs, waste confirmation activity records, and other related records will be identified on the appropriate records inventory and disposition schedule.

The following records will be maintained for waste characterization and waste confirmation purposes as part of the WIPP facility operating record:

- Completed WIPP WSPFs and accompanying CIS, including individual container data as transferred on the WWIS (or received as hard-copy) and any discrepancy-related documentation as specified in Section C-5a
- Radiography and visual examination records (data sheets, packaging logs, and video and audio recordings) of waste confirmation activities
- Completed Waste Receipt Checklists and discrepancy-related documentation as specified in Section C-5b
- WIPP WWIS Waste Emplacement Report as specified in Section C-5a(1)
- Audit reports and corrective action reports from the Audit and Surveillance Program audits as specified in Section C-5a(3) and Permit Attachment C6
- CARs and closure information for corrective actions taken due to nonconforming waste being identified during waste confirmation by the Permittees

These records will be maintained for all TRU mixed waste managed at the WIPP facility.

Waste characterization and waste confirmation data and documents related to waste characterization that are part of the WIPP facility operating record are managed in accordance with the following guidelines:

C-7a General Requirements

Records shall be legible

Corrections shall be made with a single line through the incorrect information, and the date and initial of the person making the correction shall be added

Black ink is encouraged, unless a copy test has been conducted to ensure the other color ink will copy

Use of highlighters on records is discouraged

Records shall be reviewed for completeness

- Records shall be validated by the cognizant manager or designee

C-7b Records Storage

Active records shall be stored when not in use

Quality records shall be kept in a one-hour (certified) fire-rated container or a copy of a record shall be stored separately (sufficiently remote from the original) in order to prevent destruction of both copies as a result of a single event such as fire or natural disaster

- Unauthorized access to the records is controlled by locking the storage container or controlling personnel access to the storage area

C-8 Reporting

The Permittees will provide a biennial report in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.75) to NMED that includes information on actual volume and waste descriptions received for disposal during the time period covered by the report.

C-9 List of References

U.S. Department of Energy (DOE), 2009, "Waste Data System User's Manual", DOE/WIPP 09-3427, U.S. Department of Energy.

U.S. Department of Energy (DOE), 1997, Resource Conservation and Recovery Act Part B Permit Application for the Waste Isolation Pilot Plant", Revision 6.5, U.S. Department of Energy.

U.S. Department of Energy Carlsbad Field Office, Office of the National TRU Program, 2010, "Performance Demonstration Program Plan for Analysis of Simulated Headspace Gases," DOE/CBFO-95-1076, Current Revision, Carlsbad, New Mexico, Carlsbad Field Office, U.S. Department of Energy.

U.S. Department of Energy Carlsbad Field Office, Office of the National TRU Program, 2010, "Performance Demonstration Program Plans for RCRA Constituent Analysis of Solidified Wastes," DOE/CBFO-95-1077, Current Revision, Carlsbad, New Mexico, Carlsbad Field Office, U.S. Department of Energy.

U.S. Environmental Protection Agency (EPA), April 1994, "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Waste, a Guidance Manual," OSWER 9938.4-03, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), April 1980. "A Method for Determining the Compatibility of Hazardous Wastes," EPA-600/2-80-076, California Department of Health Services and the U.S. Environmental Protection Agency, Office of Research and Development.

U.S. Environmental Protection Agency (EPA), 1996. "Test Methods for Evaluating Solid Waste," Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

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TABLES

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Table C-1
Summary of Hazardous Waste Characterization Requirements for Transuranic Mixed Waste [a]

Parameter	Techniques and Procedure
Physical Waste Form Summary Category — Names S3000 — Homogeneous Solid S4000 — Soil/Gravel S5000 — Debris Wastes	**Waste Inspection Procedures** Radiography Visual Examination (Permit Attachment C1)
Headspace Gases **Volatile Organic Compounds** Benzene Bromoform Carbon tetrachloride Chlorobenzene Chloroform 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethylene (trans)-1,2-Dichloroethylene Ethyl benzene Ethyl ether Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene 1,1,2-Trichloro-1,2,2-trifluoroethane Xylenes Alcohols and Ketones Acetone Butanol Methanol Methyl ethyl ketone Methyl isobutyl ketone	**Gas Analysis [f]** Gas Chromatography /Mass Spectroscopy (GC/MS), EPA TO-14A or TO-15, or modified SW-846 8260 (Permit Attachment C3) GC/Flame Ionization Detector (FID), for alcohols and ketones, SW-846 8015 (Permit Attachment C3) Fourier Transform Infrared Spectroscopy (FTIRS), SW-846
Total Volatile Organic Compounds Acetone Benzene Bromoform Butanol Carbon disulfide Carbon tetrachloride Chlorobenzene Chloroform 1,4-Dichlorobenzene[d] 1,2-Dichlorobenzene[d] 1,2-Dichloroethane 1,1-Dichloroethylene Ethyl benzene Ethyl ether Formaldehyde[b] Hydrazine[c] Isobutanol Methanol Methyl ethyl ketone Methylene chloride Pyridine[d] 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,2-Trichloro-1,2,2-trifluoroethane Trichlorofluoromethane 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethylene Vinyl chloride Xylenes (trans)-1,2-Dichloroethylene	**Total Volatile Organic Compound Analysis [g]** TCLP, SW-846 1311 GC/MS, SW-846 8260 GC/FID, SW-846 8015 (Permit Attachment C3) HPLC, SW-846 8315A Acceptable Knowledge for Summary Category S5000 (Debris Wastes)

Table C-1
Summary of Hazardous Waste Characterization Requirements for Transuranic Mixed Waste [a]

Parameter	Techniques and Procedure
Total Semivolatile Organic Compounds Cresols 1,4-Dichlorobenzene[e] 1,2-Dichlorobenzene[e] 2,4-Dinitrophenol 2,4-Dinitrotoluene Hexachlorobenzene Hexachloroethane Nitrobenzene Pentachlorophenol Pyridine[e]	**Total Semivolatile Organic Compound Analysis [g]** TCLP, SW-846 1311 GC/MS, SW-846 8270 (Permit Attachment C3) Acceptable Knowledge for Summary Category S5000 (Debris Wastes)
Total Metals Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc	**Total Metals Analysis [g]** TCLP, SW-846 1311 ICP- MS, SW-846 6020 , ICP Emission Spectroscopy, SW-846 6010 Atomic Absorption Spectroscopy , SW-846 7000 (Permit Attachment C3) Acceptable Knowledge for Summary Category S5000 (Debris Wastes)

[a] Permit Attachment C

[b] Required only for homogeneous solids and soil/gravel waste from Savannah River Site to resolve the assignment of EPA hazardous waste numbers.

[c] Required only for homogeneous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site to resolve the assignment of EPA hazardous waste numbers.

[d] Can also be analyzed as a semi-volatile organic compound.

[e] Can also be analyzed as a volatile organic compound.

[f] Required only to resolve the assignment of EPA hazardous waste numbers to debris waste streams.

[g] Required only to resolve the assignment of EPA hazardous waste numbers to homogeneous solid and soil/gravel waste streams.

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Table C-2
Headspace Target Analyte List and Methods [b]

Parameter	EPA Specified Analytical Method
Benzene Bromoform Carbon tetrachloride Chlorobenzene Chloroform 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethylene (trans)-1,2-Dichloroethylene Ethyl benzene Ethyl ether Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene 1,1,2-Trichloro-1,2,2-trifluoroethane Xylenes	EPA: Modified TO-14A, TO-15[a]; Modified 8260 EPA – Approved FTIRS
Acetone Butanol Methanol Methyl ethyl ketone Methyl isobutyl ketone	EPA: Modified TO-14 A, TO-15[a]; Modified 8260 Method 8015 EPA - Approved FTIRS

[a] U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air – Second Edition (EPA/625/R-96/010b). The most current revision of the specified methods may be used.

[b] Required only for debris waste when required to resolve the assignment of EPA hazardous waste numbers.

Table C-3
Required Organic Analyses and Test Methods Organized by Organic Analytical Groups [e]

Organic Analytical Group	Required Organic Analyses	EPA Specified Analytical Method [a,d]
Nonhalogenated Volatile Organic Compounds (VOCs)	Acetone Benzene n-Butanol Carbon disulfide Ethyl benzene Ethyl ether Formaldehyde Hydrazine[b] Isobutanol Methanol Methyl ethyl ketone Toluene Xylenes	8015 8260 8315A
Halogenated VOCs	Bromoform Carbon tetrachloride Chlorobenzene Chloroform 1,2-Dichloroethane 1,1-Dichloroethylene (trans)-1,2-Dichloroethylene Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene 1,1,2-Trichloroethane 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane 1,1,2-Trichloro-1,2,2-trifluoroethane Vinyl Chloride	8015 8260
Semivolatile Organic Compounds (SVOCs)	Cresols (o, m, p) 1,2-Dichlorobenzene[c] 1,4-Dichlorobenzene[c] 2,4-Dinitrophenol 2,4-Dinitrotoluene Hexachlorobenzene Hexachloroethane Nitrobenzene Pentachlorophenol Pyridine[c]	8270

[a] U.S. Environmental Protection Agency (EPA), 1996, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition.

[b] Generator/Storage Sites will have to develop an analytical method for hydrazine. This method will be submitted to DOE for approval.

[c] These compounds may also be analyzed as VOCs by SW-846 Method 8260.

[d] TCLP (SW-846 1311) may be used to determine if compounds in 20.4.1.200 NMAC (incorporating 40 CFR §261, Subpart C) exhibit a toxicity characteristic.

[e] Required only to resolve the assignment of EPA hazardous waste numbers.

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Table C-4
Summary of Sample Preparation and Analytical Methods for Metals

Parameters	EPA-Specified Analytical Methods[a,b,c]
Sample Preparation	3051, or equivalent, as appropriate for analytical method
Total Antimony	6010, 6020, 7000, 7010, 7062
Total Arsenic	6010, 6020, 7010, 7061, 7062
Total Barium	6010, 6020, 7000, 7010
Total Beryllium	6010, 6020, 7000, 7010
Total Cadmium	6010, 6020, 7000, 7010
Total Chromium	6010, 6020, 7000, 7010
Total Lead	6010, 6020, 7000, 7010
Total Mercury	7471
Total Nickel	6010, 6020, 7000, 7010
Total Selenium	6010, 7010, 7741, 7742
Total Silver	6010, 6020, 7000, 7010
Total Thallium	6010, 6020, 7000, 7010
Total Vanadium	6010, 7000, 7010
Total Zinc	6010, 6020, 7000, 7010

[a] U.S. Environmental Protection Agency (EPA), 1996. "Test Methods for Evaluating Solid Waste," Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

[b] TCLP (SW-846 1311) may be used to determine if compounds in 20.4.1.200 NMAC (incorporating 40 CFR §261, Subpart C) exhibit a toxicity characteristic.

[c] Required only for homogeneous solids and soil/gravel to resolve the assignment of EPA hazardous waste numbers.

Table C-5
Summary of Parameters, Characterization Methods, and Rationale for Transuranic Mixed Waste

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
Stored Waste				
S3000-Homogeneous Solids	• Solidified inorganics • Salt waste • Solidified organics	Physical waste form	Acceptable knowledge, radiography, and/or visual examination	• Determine waste matrix • Demonstrate compliance with waste acceptance criteria (e.g., no liquid in excess of TSDF-WAC limits, no incompatible wastes, no compressed gases)
S4000-Soil/Gravel	• Contaminated soil/debris	Hazardous constituents • Listed • Characteristic	Acceptable knowledge or statistical sampling[a] (see Tables C-3 and C-4)	• Determine characteristic metals and organics • Resolve the assignment of EPA hazardous waste numbers
S5000–Debris Waste	• Uncategorized metal (metal waste other than lead/cadmium) • Lead/cadmium waste • Inorganic nonmetal waste • Combustible waste • Graphite waste • Heterogeneous debris waste • Composite filter waste	Physical waste form	Acceptable knowledge, radiography, and/or visual examination	• Determine waste matrix • Demonstrate compliance with waste acceptance criteria (e.g., no liquid in excess of TSDF-WAC limits, no incompatible wastes, no compressed gases)
		Hazardous constituents • Characteristic • Listed	Statistical gas sampling and analysis[a] (see Table C-2)	• Resolve the assignment of EPA hazardous waste numbers
		Hazardous constituents • Characteristic	Acceptable knowledge	• Determine characteristic metals and organics

Table C-5
Summary of Parameters, Characterization Methods, and Rationale for Transuranic Mixed Waste (Continued)

Waste Matrix Code Summary Categories	Waste Matrix Code Groups	Characterization Parameter	Method	Rationale
Newly Generated Waste				
S3000-Homogeneous Solids	• Solidified inorganics • Salt waste • Solidified organics	Physical waste form	Acceptable knowledge, radiography, and/or visual examination	• Determine waste matrix • Demonstrate compliance with waste acceptance criteria (e.g., no liquid in excess of TSDF-WAC limits, no incompatible wastes, no compressed gases)
S4000-Soil/Gravel	• Contaminated soil/debris	Hazardous constituents • Listed • Characteristic	Statistical sampling[a] (see Tables C-3 and C-4)	• Determine characteristic metals and organics • Resolve the assignment of EPA hazardous waste numbers
S5000–Debris Waste	• Uncategorized metal (metal waste other than lead/cadmium) • Lead/cadmium waste • Inorganic nonmetal waste • Combustible waste • Graphite waste • Heterogeneous debris waste • Composite filter waste	Physical waste form	Acceptable knowledge, radiography, and/or visual examination	• Determine waste matrix • Demonstrate compliance with waste acceptance criteria (e.g., no liquid in excess of TSDF-WAC limits, no incompatible wastes, no compressed gases)
		Hazardous constituents • Characteristic • Listed	Statistical gas sampling and analysis [a] (see Table C-2)	• Resolve the assignment of EPA hazardous waste numbers
		Hazardous constituents • Characteristic	Acceptable knowledge	• Determine characteristic metals and organics

[a] Applies to waste streams that require sampling.

Table C-6
Required Program Records Maintained in Generator/Storage Site Project Files

Lifetime Records • Field sampling data forms • Field and laboratory chain-of-custody forms • Test facility and laboratory batch data reports • Waste Stream Characterization Package • Sampling Plans • Data reduction, validation, and reporting documentation • Acceptable knowledge documentation • Waste Stream Profile Form and Characterization Information Summary
Non-Permanent Records • Nonconformance documentation • Variance documentation • Assessment documentation • Gas canister tags • Methods performance documentation • Performance Demonstration Program documentation • Sampling equipment certifications • Calculations and related software documentation • Training/qualification documentation • QAPjPs (generator/storage sites) documentation (all revisions) • Calibration documentation • Analytical raw data • Procurement documentation • QA procedures (all revisions) • Technical implementing procedures (all revisions) • Audio/video recording (radiography, visual, etc.)

1
2

Table C-7
WIPP Waste Information System Data Fields[a]

Characterization Module Data Fields [b]	
Container ID [c] Generator EPA ID Generator Address Generator Name Generator Contact Hazardous Code Headspace Gas Sample Date Headspace Gas Analysis Date Layers of Packaging Liner Exists Liner Hole Size Filter Model Number of Filters Installed Headspace Gas Analyte [d] Headspace Gas Concentration [d] Headspace Gas Char. Method [d] Total VOC Char. Method [d] Total Metals Char. Method [d] Total Semi-VOC Char. Method [d] Item Description Code Haz. Manifest Number NDE Complete [e]	Total VOC Sample Date Total VOC Analysis Date Total VOC Analyte Name [d] Total VOC Analyte Concentration [d] Total Metal Sample Date Total Metal Analysis Date Total Metal Analyte Name [d] Total Metal Analyte Concentration [d] Semi-VOC Sample Date Semi-VOC Analysis Date Semi-VOC Analyte Name [d] Semi-VOC Concentration [d] Transporter EPA ID Transporter Name Visual Exam Container [e] Waste Material Parameter [d] Waste Material Weight [d] Waste Matrix Code Waste Matrix Code Group Waste Stream Profile Number
Certification Module Data Fields	
Container ID [c] Container type Container Weight Contact Dose Rate Container Certification date Container Closure Date	Handling Code
Transportation Data Module	
Contact Handled Package Number Assembly Number[f] Container IDs [c,d] ICV Closure Date	Ship Date Receive Date
Disposal Module Data	
Container ID [c] Disposal Date Disposal Location	

[a] This is not a complete list of the WWIS data fields.

[b] Some of the fields required for characterization are also required for certification and/or transportation.

[c] Container ID is the main relational field in the WWIS Database.

[d] This is a multiple occurring field for each analyte, nuclide, etc.

[e] These are logical fields requiring only a yes/no.

[f] Required for 7-packs of 55-gal drums, 4-packs of 85-gal drums, or 3-packs of 100-gal drums to tie all of the drums in that assembly together. This facilitates the identification of waste containers in a shipment without need to breakup the assembly.

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Table C-8
Waste Tanks Subject to Exclusion

Hanford Site - 177 Tanks	
A-101 through A-106	C-201 through C-204
AN-101 through AN-107	S-101 through S-112
AP-101 through AP-108	SX-101 through SX-115
AW-101 through AW-106	SY-101 through SY-103
AX-101 through AX-104	T-101 through T-112
AY-101 through AY-102	T-201 through T-204
B-101 through B-112	TX-101 through TX-118
B-201 through B-204	TY-101 through TY-106
BX-101 through BX-112	U-101 through U-112
BY-101 through BY-112	U-201 through U-204
C-101 through C-112	
Savannah River Site - 51 Tanks	
Tank 1 through 51	
Idaho National Engineering and Environmental Laboratory - 15 Tanks	
WM-103 through WM-106	WM-180 through 190

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Table C-9
Listing of Permitted Hazardous Waste Numbers

EPA Hazardous Waste Numbers			
F001	D019	D043	U079
F002	D021	P015	U103
F003	D022	P030	U105
F004	D026	P098	U108
F005	D027	P099	U122
F006	D028	P106	U133*
F007	D029	P120	U134*
F009	D030	U002*	U151
D004	D032	U003*	U154*
D005	D033	U019*	U159*
D006	D034	U037	U196
D007	D035	U043	U209
D008	D036	U044	U210
D009	D037	U052	U220
D010	D038	U070	U226
D011	D039	U072	U228
D018	D040	U078	U239*

* Acceptance of U-numbered wastes listed for reactivity, ignitability, or corrosivity characteristics is contingent upon a demonstration that the wastes no longer exhibit the characteristic of reactivity, ignitability, or corrosivity.

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FIGURES

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WASTE STREAM PROFILE FORM

Waste Stream Profile Number: _____
Generator Site Name: _____ Technical Contract: _____
Generator Site EPA ID: _____ Technical Contact Phone Number: _____
Date of audit report approval by NMED: _____
Title, version number and date of documents used for WAP Certification: _____
_____
Did your facility generate this waste? ☐Yes ☐No
If no, provide the name and EPA ID of the original generator: _____
_____
WIPP ID: _____ Summary Category Group: _____
Waste Stream Name: _____
Description from the WTWBIR: _____
_____
Defense Waste: ☐Yes ☐No Check one: ☐CH ☐RH
Number of SWBs _____ Number of Drums _____ Number of Canisters _____
Batch Data Report numbers supporting this waste stream characterization: _____
List applicable EPA Hazardous Waste Numbers [2] _____
Applicable TRUCON Content Numbers: _____

Acceptable Knowledge Information[1]
(For the following, enter supporting documentation used (i.e., references and dates))

Required Program Information

- Map of site: _____
- Facility mission description: _____
- Description of operations that generate waste: _____
  _____
- Waste identification/categorization schemes: _____
- Types and quantities of waste generated: _____
- Correlation of waste streams generated from the same building and process, as applicable: _____
  _____
- Waste certification procedures: _____

Required Waste Stream Information

- Area(s) and building(s) from which waste stream was generated: _____
- Waste stream volume and time period of generation: _____
- Waste generating process description for each building: _____
- Waste process flow diagrams: _____
  _____
- Material inputs or other information identifying chemical/radionuclide content and physical waste form: _____
  _____
- Waste material parameter estimates per unit of waste: _____
- Which Defense Activity generated the waste: (check one)
  - ☐ Weapons activities including defense inertial confinement fusion
  - ☐ Naval reactors development
  - ☐ Verification and control technology
  - ☐ Defense research and development
  - ☐ Defense nuclear waste and material by products management
  - ☐ Defense nuclear material production
  - ☐ Defense nuclear waste and materials security and safeguards and security investigations

Figure C-1
WIPP Waste Stream Profile Form (Example Only)

WASTE STREAM PROFILE FORM

Supplemental Documentation
Process design documents: _____
Standard operating procedures: _____
Safety Analysis Reports: _____
Waste packaging logs: _____
Test plans/research project reports: _____
Site data bases: _____
Information from site personnel: _____
Standard industry documents: _____
Previous analytical data: _____
Material safety data sheets: _____
Sampling and analysis data from comparable/surrogate waste: _____
Laboratory notebooks: _____

Confirmation Information[2]
(For the following, when applicable, enter procedure title(s), number(s), and date(s))

Radiography: _____

Visual Examination: _____

Waste Stream Profile Form Certification

I hereby certify that I have reviewed the information in this Waste Stream Profile Form, and it is complete and accurate to the best of my knowledge. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

_____ _____ _____
Signature of Site Project Manager | Printed Name and Title | Date

NOTE: (1) Use back of sheet or continuation sheets, if required.

(2) If, radiography, visual examination were used to confirm EPA Hazardous Waste Numbers, attach signed Characterization Information Summary documenting this determination.

Figure C-1
WIPP Waste Stream Profile Form (Example Only – Continued)

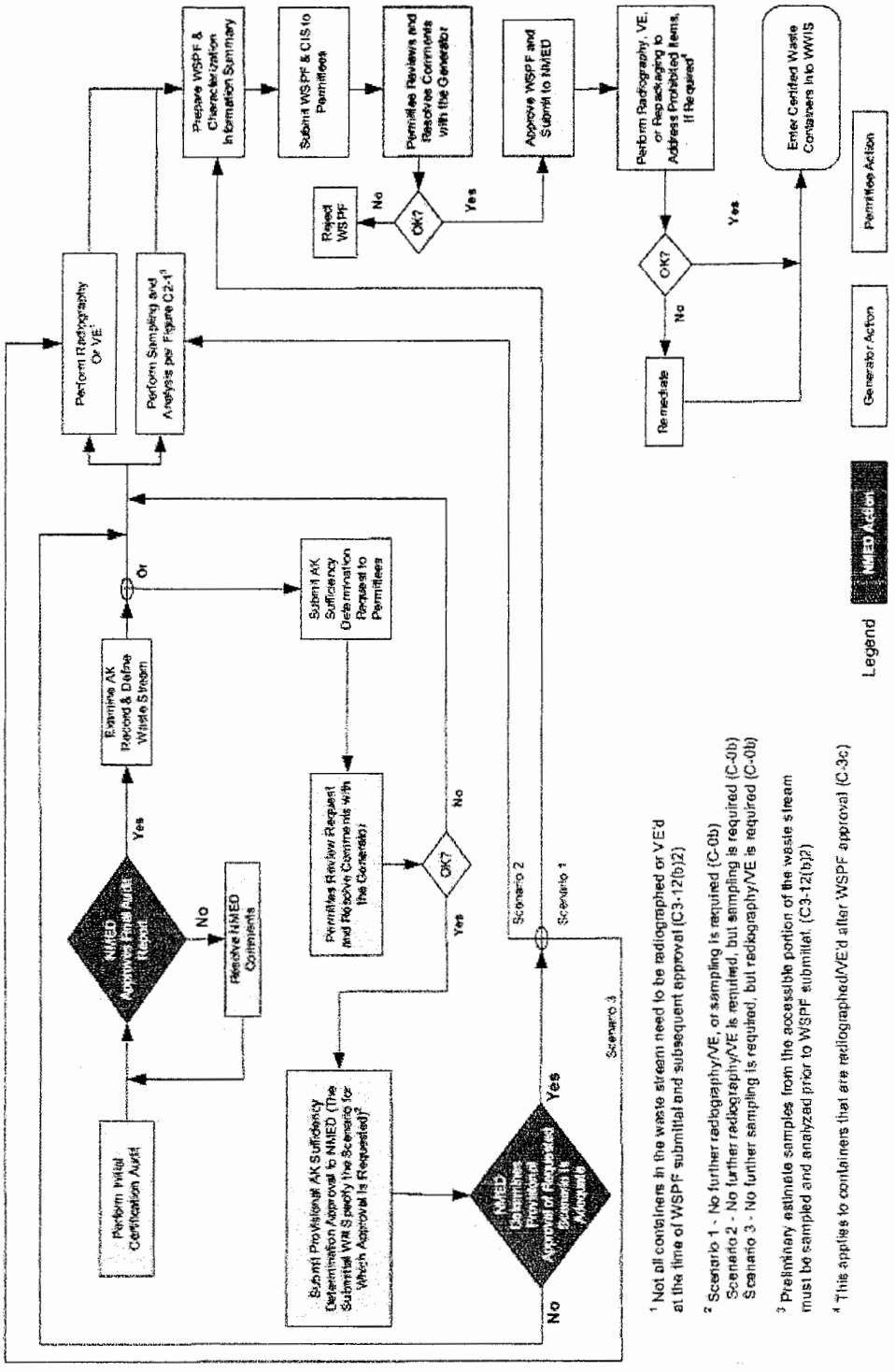

Figure C-2
Waste Characterization Process

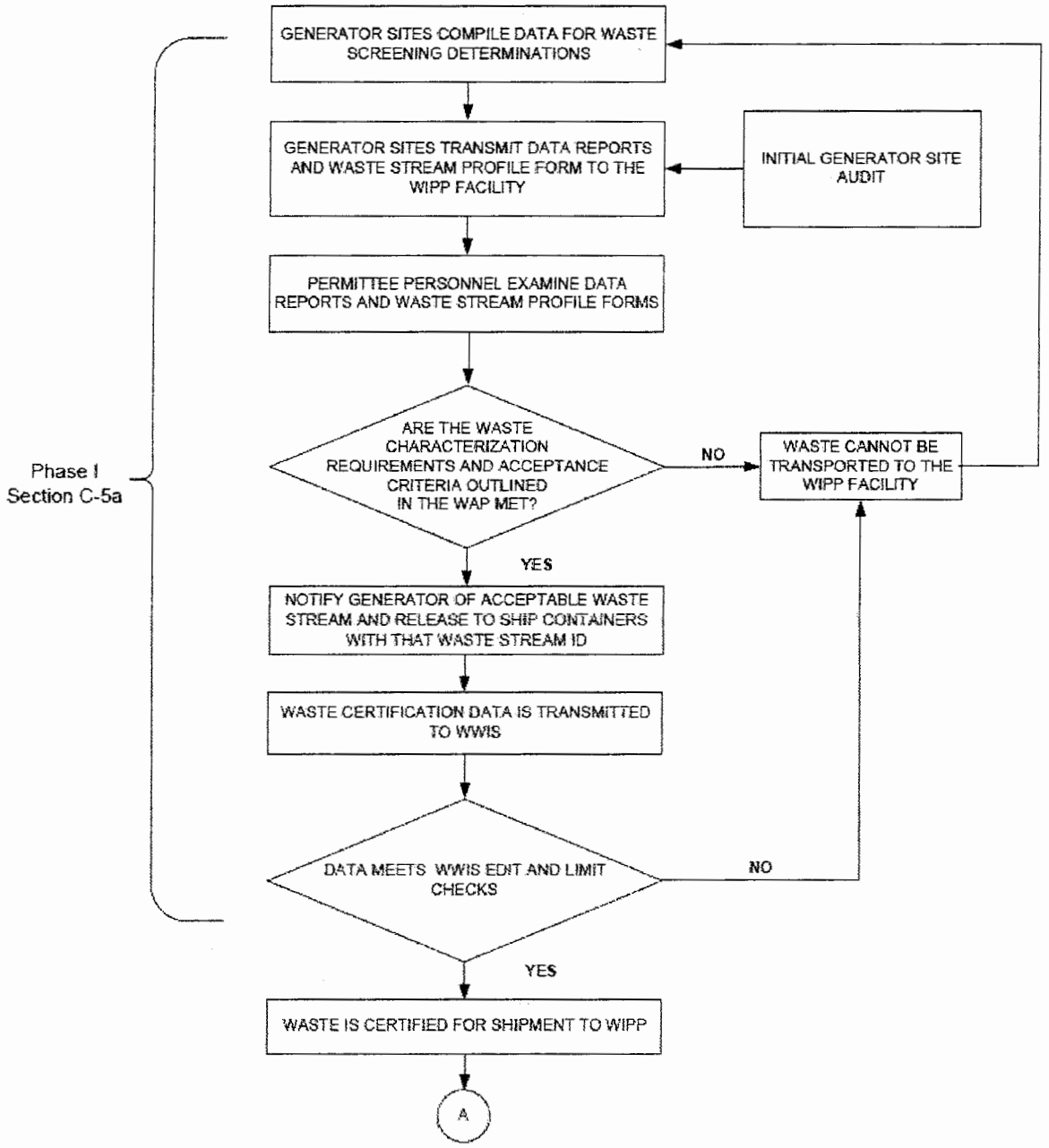

Figure C-3
TRU Mixed Waste Screening and Verification

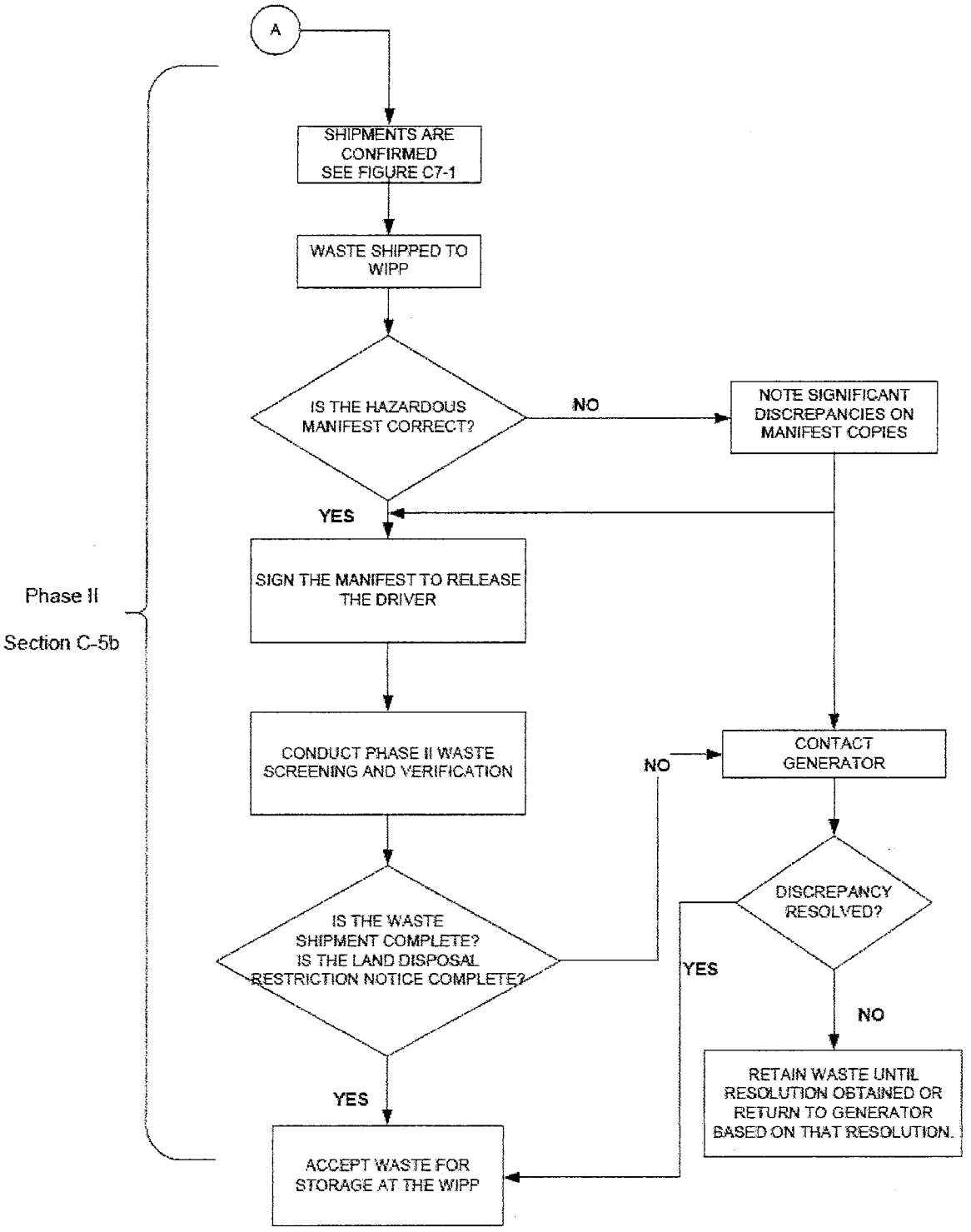

Figure C-3
TRU Mixed Waste Screening and Verification (Continued)

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

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ATTACHMENT C1

WASTE CHARACTERIZATION SAMPLING METHODS

Introduction

The Permittees will require generator/storage sites (**sites**) to use the following methods, as applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at WIPP. These methods include requirements for headspace-gas sampling, sampling of homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this Attachment provides quality control, sample custody, and sample packing and shipping requirements.

C1-1 Sampling of Debris Waste (Summary Category S5000)

Headspace gas sampling and analysis shall be used to resolve the assignment of Environmental Protection Agency (**EPA**) hazardous waste numbers to debris waste streams.

C1-1a Method Requirements

The Permittees shall require all headspace-gas sampling be performed in an appropriate radiation containment area on waste containers that are in compliance with the container equilibrium requirements (i.e., 72 hours at 18° C or higher).

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by the U.S. Department of Energy (**DOE**), containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table C1-5 and depicted in Figure C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table C1-7 shall be determined using footnotes "a" and "b" in Table C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment C, Section C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for Standard Waste Boxes (**SWBs**) ten-drum overpacks (**TDOPs**), and standard larged box 2s (**SLB2s**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, SLB2s, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) shall be determined using

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the default conditions in footnote "b" in Table C1-9.The DAC for Scenario 3 containers that contain filters that are either undocumented or are other than those listed in Table C1-9 shall be determined using footnote 'a' in Table C1-9. Each of the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table C1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB, TDOP, and SLB2 requirements apply when the 85-gallon drum, 100-gallon drum, SWB, TDOP, or SLB2 is used for the direct loading of waste).

C1-1a(1) General Requirements

The determination of packaging configuration consists of identifying the number of confinement layers and the identification of rigid poly liners when present. Generator/storage sites shall use either the default conditions specified in Tables C1-7 through C1-9 for retrievably stored waste or the data documented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]) for determining the appropriate DAC for each container from which a headspace gas sample is collected. These drum age criteria are to ensure that the container contents have reached 90 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling documents for each container from which a headspace gas sample is collected:

- sampling scenario from Table C1-5 and associated information from Tables C1-6 and/or Table C1-7;
- the packaging configuration from Table C1-8 and associated information from Table C1-9, including the diameter of the rigid liner vent hole, the number of inner bags, the number of liner bags, the presence/absence of drum liner, and the filter hydrogen diffusivity,
- the permit-required equilibrium time,
- the drum age,
- for supercompacted waste, both
  - the absence of rigid liners in the compacted 55-gallon drums which have not been headspace gas sampled in accordance with this permit prior to compaction, and
  - the absence of layers of confinement must be documented in the WWIS if Packaging Configuration Group 7 is used.

For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to be 0.3 inches unless a different size is documented during drum venting or repackaging. For all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the most restrictive unless container-specific information clearly identifies a filter model and/or diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that have not been repackaged, acceptable knowledge shall not be used to justify any packaging configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-gallon drums and shielded containers, 6 for SWBs TDOPs, and SLB2s, and 8 for 85-gallon and

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100-gallon drums). For information reporting purposes listed above, sites may report the default packaging configuration for retrievably stored waste without further verification.

All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly liners) shall be subject to innermost layer of containment sampling or shall be vented prior to initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a representative sample is collected (using a sampling needle connected to the sampling head to pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies this requirement). The configuration of the containment area and remote-handling equipment at each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the analytes listed in Table C3-2 of Permit Attachment C3. If additional packaging configurations are identified, an appropriate Permit Modification will be submitted to incorporate the DAC using the methodology in BWXT (2000). Consistent with footnote "a" in Table C1-8, any waste container selected for headspace gas sampling that cannot be assigned a packaging configuration specified in Table C1-8 shall be assigned a conservative default packaging configuration..

Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, SLB2s, and shielded containers. Drum age criteria for all other container types must be established through permit modification prior to performing headspace gas sampling.

The Permittees shall require site personnel to collect samples in SUMMA® or equivalent canisters using standard headspace-gas sampling methods that meet the general guidelines established by the EPA in the Compendium Method TO-14A or TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by using on-line integrated sampling/analysis systems. Samples will be directed to an analytical instrument instead of being collected in SUMMA® or equivalent canisters if a single-sample on-line integrated sampling/analysis system is used. If a multi-sample on-line integrated sampling/analysis system is used, samples will be directed to an integrated holding area that meets the cleaning requirements of Section C1-1c(1). The leak proof and inert nature of the integrated holding area interior surface must be demonstrated and documented. Samples are not transported to another location when using on-line integrated sampling/analysis systems; therefore, the sample custody requirements of Section C1-4 and C1-5 do not apply. The same sampling manifold and sampling heads are used with on-line integrated sampling/analysis systems and all of the requirements associated with sampling manifolds and sampling heads must be met. However, when using an on-line integrated sampling/analysis system, the sampling batch and analytical batch quality control (**QC**) samples are combined as on-line batch QC samples as outlined in Section C1-1b.

C1-1a(2) Manifold Headspace Gas Sampling

This headspace-gas sampling protocol employs a multiport manifold capable of collecting multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be used to collect samples in SUMMA® or equivalent canisters or as part of an on-line integrated sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to first use and as needed thereafter. The manifold and sample canisters will be evacuated to 0.0039 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet valve is opened. The manifold inlet valve will be attached to a changeable filter connected to either a side port needle sampling head capable of forming an airtight seal (for penetrating a

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filter or rigid poly liner when necessary), a drum punch sampling head capable of forming an airtight seal (capable of punching through the metal lid of a drum for sampling through the drum lid), or a sampling head with an airtight fitting for sampling through a pipe overpack container filter vent hole. Refer to Section C1-1a(4) for descriptions of these sampling heads.

The manifold shall also be equipped with a purge assembly that allows applicable QC samples to be collected through all sampling components that may affect compliance with the quality assurance objectives (**QAOs**). The Permittees shall require the sites to demonstrate and document the effectiveness of the sampling equipment design in meeting the QAOs. Field blanks shall be samples of room air collected in the sampling area in the immediate vicinity of the waste container to be sampled. If using SUMMA® or equivalent canisters, field blanks shall be collected directly into the canister, without the use of the manifold.

The manifold, the associated sampling heads, and the headspace-gas sample volume requirements shall be designed to ensure that a representative sample is collected. The manifold internal volume must be calculated and documented in a field logbook dedicated to headspace-gas sample collection. The total volume of headspace gases collected during each sampling operation will be determined by adding the combined volume of the canisters attached to the manifold and the internal volume of the manifold. The sample volume should remain small in comparison to the volume of the waste container. When an estimate of the available headspace gas volume in the drum can be made, less than 10 percent of that volume should be withdrawn.

As illustrated in Figure C1-2, the sampling manifold must consist of a sample side and a standard side. The dotted line in Figure C1-2 indicates how the sample side shall be connected to the standard side for cleaning and collecting equipment blanks and field reference standards. The sample side of the sampling manifold shall consist of the following major components:

- An applicable sampling head that forms a leak-tight connection with the headspace sampling manifold.

- A flexible hose that allows movement of the sampling head from the purge assembly (standard side) to the waste container.

- A pressure sensor(s) that must be pneumatically connected to the manifold. This manifold pressure sensor(s) must be able to measure absolute pressure in the range from 0.002 in. (0.05 mm) Hg to 39.3 in. (1,000 mm) Hg. Resolution for the manifold pressure sensors must be ±0.0004 in. (0.01 mm) Hg at 0.002 in. (0.05 mm) of Hg. The manifold pressure sensor(s) must have an operating range from approximately 59°F (15°C) to 104°F (40°C).

- Available ports for attaching sample canisters. If using canister-based sampling methods, a sufficient number of ports shall be available to allow simultaneous collection of headspace-gas samples and duplicates for VOC analyses. If using an on-line integrated sampling/analysis system, only one port is necessary for the collection of comparison samples. Ports not occupied with sample canisters during cleaning or headspace-gas sampling activities require a plug to prevent ambient air from entering the system. In place of using plugs, sites may choose to install valves that can be closed to prevent intrusion of ambient air into the manifold. Ports shall have VCR®

fittings for connection to the sample canister(s) to prevent degradation of the fittings on the canisters and manifold.

- Sample canisters, as illustrated in Figure C1-3, are leak-free, stainless steel pressure vessels, with a chromium-nickel oxide (**Cr-NiO**) SUMMA®-passivated interior surface, bellows valve, and a pressure/vacuum gauge. Equivalent designs, such as Silco Steel canisters, may be used so long as the leak proof and inert nature of the canister interior surface is demonstrated and documented. All sample canisters must have VCR® fittings for connection to sampling and analytical equipment. The pressure/vacuum gauge must be mounted on each manifold. The canister must be helium-leak tested to 1.5×10^{-7} standard cubic centimeters per second (cc/s), have all stainless steel construction, and be capable of tolerating temperatures to 125°C. The gauge range shall be capable of operating in the leak test range as well as the sample collection range.

- A dry vacuum pump with the ability to reduce the pressure in the manifold to 0.05 mm Hg. A vacuum pump that requires oil may be used, but precautions must be taken to prevent diffusion of oil vapors back to the manifold. Precautions may include the use of a molecular sieve and a cryogenic trap in series between the headspace sampling ports and the pump.

- A minimum distance, based upon the design of the manifold system, between the tip of the needle and the valve that isolates the pump from the manifold in order to minimize the dead volume in the manifold.

- If real-time equipment blanks are not available, the manifold must be equipped with an organic vapor analyzer (**OVA**) that is capable of detecting all analytes listed in Table C3-2 of Permit Attachment C3. The OVA shall be capable of measuring total VOC concentrations below the lowest headspace gas PRQL. Detection of 1,1,2-trichloro-1,2,2-trifluoroethane may not be possible if a photoionization detector is used. The OVA measurement shall be verified by the collection of equipment blanks at the frequency specified in Section C1-1 to check for manifold cleanliness.

The standard side must consist of the following major elements:

- A cylinder of compressed zero air, helium, argon, or nitrogen gas that is hydrocarbon and carbon dioxide (**CO_2**)-free (only hydrocarbon and CO_2-free gases required for Fourier Transform Infrared System [**FTIRS**]) to clean the manifold between samples and to provide gas for the collection of equipment blanks or on-line blanks. These high-purity gases shall be certified by the manufacturer to contain less than one ppm total VOCs. The gases must be metered into the standard side of the manifold using devices that are corrosion proof and that do not allow for the introduction of manifold gas into the purge gas cylinders or generator. Alternatively, a zero air or nitrogen generator may be used, provided a sample of the zero air or nitrogen is collected and demonstrated to contain less than one ppm total VOCs. Zero air or nitrogen from a generator shall be humidified (except for use with FTIRS).

- Cylinders of field-reference standard gases or on-line control sample gases. These cylinders provide gases for evaluating the accuracy of the headspace-gas sampling

process. Each cylinder of field-reference gas or on-line control sample gas shall have a flow-regulating device. The field-reference standard gases or on-line control sample gas shall be certified by the manufacturer to contain analytes from Table C3-2 of Permit Attachment C3 at known concentrations.

- If using an analytical method other than FTIRS a humidifier filled with American Society for Testing and Materials (**ASTM**) Type I or II water, connected, and opened to the standard side of the manifold between the compressed gas cylinders and the purge assembly shall be used. Dry gases flowing to the purge assembly will pick up moisture from the humidifier. Moisture is added to the dry gases to condition the equipment blanks and field-reference standards and to assist with system cleaning between headspace-gas sample collection. If using FTIRS for analysis, the sample and sampling system shall be kept dry.

  NOTE: Caution should be exercised to isolate the humidifier during the evacuation of the system to prevent flooding the manifold. In lieu of the humidifier, the compressed gas cylinders (e.g., zero air and field-reference standard gas) may contain water vapor in the concentration range of 1,000 to 10,000 parts per million by volume (**ppmv**).

- A purge assembly that allows the sampling head (sample side) to be connected to the standard side of the manifold. The ability to make this connection is required to transfer gases from the compressed gas cylinders to the canisters or on-line analytical instrument. This connection is also required for system cleaning.

- A flow-indicating device or a pressure regulator that is connected to the purge assembly to monitor the flow rate of gases through the purge assembly. The flow rate or pressure through the purge assembly shall be monitored to assure that excess flow exists during cleaning activities and during QC sample collection. Maintaining excess flow will prevent ambient air from contaminating the QC samples and allow samples of gas from the compressed gas cylinders to be collected near ambient pressure.

In addition to a manifold consisting of a sample side and a standard side, the area in which the manifold is operated shall contain sensors for measuring ambient pressure and ambient temperature, as follows:

- The ambient-pressure sensor must have a sufficient measurement range for the ambient barometric pressures expected at the sampling location. It must be kept in the sampling area during sampling operations. Its resolution shall be 0.039 in. (1.0 mm) Hg or less, and calibration performed by the manufacturer shall be based on National Institute of Standards and Technology (**NIST**), or equivalent, standards.

- The temperature sensor shall have a sufficient measurement range for the ambient temperatures expected at the sampling location. The measurement range of the temperature sensor must be from 18°C to 50°C. The temperature sensor calibration shall be traceable to NIST, or equivalent, standards.

C1-1a(3) Direct Canister Headspace Gas Sampling

This headspace-gas sampling protocol employs a canister-sampling system to collect headspace-gas samples for analysis and QC purposes without the use of the manifold

described above. Rather than attaching sampling heads to a manifold, in this method the sampling heads are attached directly to an evacuated sample canister as shown in Figure C1-4.

Canisters shall be evacuated to 0.0039 in. (0.10 mm) Hg prior to use and attached to a changeable filter connected to the appropriate sampling head. The sampling head(s) must be capable of either punching through the metal lid of the drums (and/or the rigid poly liner when necessary) while maintaining an airtight seal when sampling through the drum lid, penetrating a filter or the septum in the orifice of the self-tapping screw, or maintaining an airtight seal for sampling through a pipe overpack container filter vent hole to obtain the drum headspace samples. Field duplicates must be collected at the same time, in the same manner, and using the same type of sampling apparatus as used for headspace-gas sample collection. Field blanks shall be samples of room air collected in the immediate vicinity of the waste-drum sampling area prior to removal of the drum lid. Equipment blanks and field-reference standards must be collected using a purge assembly equivalent to the standard side of the manifold described above. These samples shall be collected from the needle tip through the same components (e.g., needle and filter) that the headspace-gas samples pass through.

The sample canisters, associated sampling heads, and the headspace-sample volume requirements ensure that a representative sample is collected. When an estimate of the available headspace-gas volume of the waste container can be made, less than 10 percent of that volume should be withdrawn. A determination of the sampling head internal volume shall be made and documented. The total volume of headspace gases collected during each headspace gas sampling operation can be determined by adding the volume of the sample canister(s) attached to the sampling head to the internal volume of the sampling head. Every effort shall be made to minimize the internal volume of sampling heads.

Each sample canister used with the direct canister method shall have a pressure/vacuum gauge capable of indicating leaks and sample collection volumes. Canister gauges are intended to be gross leak-detection devices not vacuum-certification devices. If a canister pressure/vacuum gauge indicates an unexpected pressure change, determination of whether the change is a result of ambient temperature and pressure differences or a canister leak shall be made. This gauge shall be helium-leak tested to 1.5×10^{-7} standard cc/s, have all stainless steel construction, and be capable of tolerating temperatures to 125°C.

The SUMMA® or equivalent sample canisters as specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) shall be used when sampling each drum. These heads shall form a leak-tight connection with the canister and allow sampling through the drum-lid filter, through the drum lid itself and/or rigid poly liner when necessary (by use of a punch or self-tapping screw), using an airtight fitting to collect the sample through the filter vent hole of a pipe overpack container, or using a hollow side port needle. Figure C1-4 illustrates the direct canister-sampling equipment.

C1-1a(4) Sampling Heads

A sample of the headspace gas directly under the container lid, pipe overpack filter vent hole, or rigid poly liner shall be collected. Several methods have been developed for collecting a representative sample: sampling through the filter, sampling through the drum lid by drum punching, sampling through a pipe overpack container filter vent hole, and sampling through the rigid poly liner. The chosen sampling method shall preserve the integrity of the drum to contain

radionuclides (e.g., replace the damaged filter, replace set screw in filter housing, seal the punched drum lid).

C1-1a(4)(i) Sampling Through the Filter

To sample the drum-headspace gas through the drum's filter, a side-port needle (e.g., a hollow needle sealed at the tip with a small opening on its side close to the tip) shall be pressed through the filter and into the headspace beneath the drum lid. This permits the gas to be drawn into the manifold or directly into the canister(s). To assure that the sample collected is representative, all of the general method requirements, sampling apparatus requirements, and QC requirements described in this section shall be met in addition to the following requirements that are pertinent to drum headspace-gas sampling through the filter:

- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If the sample is collected by removing the drum lid, the sampling device shall form an airtight seal with the rigid poly liner to prevent the intrusion of outside air into the sample (using a sampling needle connected to the sampling head to pierce the rigid poly liner satisfies this requirement). If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.

- For sample collection, the drum's filter shall be sealed to prevent outside air from entering the drum and diluting and/or contaminating the sample.

The sampling head for collecting drum headspace by penetrating the filter shall consist of a side-port needle, a filter to prevent particles from contaminating the gas sample, and an adapter to connect the side-port needle to the filter. To prevent cross contamination, the sampling head shall be cleaned or replaced after sample collection, after field-reference standard collection, and after field-blank collection. The following requirements shall also be met:

- The housing of the filter shall allow insertion of the sampling needle through the filter element or a sampling port with septum that bypasses the filter element into the drum headspace.

- The side-port needle shall be used to reduce the potential for plugging.

- The purge assembly shall be modified for compatibility with the side-port needle.

C1-1a(4)(ii) Sampling Through the Drum Lid By Drum Lid Punching

Sampling through the drum lid at the time of drum punching or thereafter may be performed as an alternative to sampling through the drum's filter if an airtight seal can be maintained. To sample the drum headspace-gas through the drum lid at the time of drum punching or thereafter, the lid shall be breached using an appropriate punch. The punch shall form an airtight seal between the drum lid and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method requirements,

sampling apparatus requirements, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the drum lid and sampling head shall be designed to minimize intrusion of ambient air.
- All components of the sampling system that come into contact with sample gases shall be purged with humidified zero air, nitrogen, or helium prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the punch that contact the headspace-gas sample.
- Pressure shall be applied to the punch until the drum lid has been breached.
- Provisions shall be made to relieve excessive drum pressure increases during drum-punch operations; potential pressure increases may occur during sealing of the drum punch to the drum lid.
- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum headspace. A representative sample cannot be collected from the drum headspace until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. If headspace-gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit Attachment C3.
- During sampling, the drum's filter, if present, shall be sealed to prevent outside air from entering the drum.
- While sampling through the drum lid using manifold sampling, a flow-indicating device or pressure regulator to verify flow of gases shall be pneumatically connected to the drum punch and operated in the same manner as the flow-indicating device described above in Section C1-1a(2).
- Equipment shall be used to adequately secure the drum-punch sampling system to the drum lid.
- If the headspace gas sample is not taken at the time of drum punching, the presence and diameter of the rigid liner vent hole shall be documented during the punching operation for use in determining an appropriate Scenario 2 DAC.

C1-1a(4)(iii) Sampling Through a Pipe Overpack Container Filter Vent Hole

Sampling through an existing filter vent hole in a pipe overpack container (**POC**) may be performed as an alternative to sampling through the POC's filter if an airtight seal can be maintained. To sample the container headspace-gas through a POC filter vent hole, an appropriate airtight seal shall be used. The sampling apparatus shall form an airtight seal

between the POC surface and the manifold or direct canister sampling equipment. To assure that the sample collected is representative, all of the general method, sampling apparatus, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- The seal between the POC surface and sampling apparatus shall be designed to minimize intrusion of ambient air.
- The filter shall be replaced as quickly as is practicable with the airtight sampling apparatus to ensure that a representative sample can be taken. Sites must provide documentation demonstrating that the time between removing the filter and installing the airtight sampling device has been established by testing to assure a representative sample.
- All components of the sampling system that come into contact with sample gases shall be cleaned according to requirements for direct canister sampling or manifold sampling, whichever is appropriate, prior to sample collection.
- Equipment blanks and field reference standards shall be collected through all the components of the sampling system that contact the headspace-gas sample.
- During sampling, openings in the POC shall be sealed to prevent outside air from entering the container.
- A flow-indicating device shall be connected to sampling system and operated according to the direct canister or manifold sampling requirements, as appropriate.

C1-1b Quality Control

For manifold and direct canister sampling systems, field QC samples shall be collected on a per sampling batch basis. A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding QC samples), all of which shall be collected within 14 days of the first sample in the batch. For on-line integrated sampling/analysis systems, QC samples shall be collected and analyzed on a per on-line batch basis. Holding temperatures and container requirements for gas sample containers are provided in Table C1-1. An on-line batch is the number of headspace-gas samples collected within a 12-hour period using the same on-line integrated analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system. Table C1-2 provides a summary of field QC sample collection requirements. Table C1-3 provides a summary of QC sample acceptance criteria.

For on-line integrated sampling analysis systems, the on-line batch QC samples serve as combined sampling batch/analytical batch QC samples as follows:

- The on-line blank replaces the equipment blank and laboratory blank
- The on-line control sample replaces the field reference standard and laboratory control sample

- The on-line duplicate replaces the field duplicate and laboratory duplicate

The acceptance criteria for on-line batch QC samples are the same as for the sampling batch and analytical batch QC samples they replace. Acceptance criteria are shown in Table C1-3. A separate field blank shall still be collected and analyzed for each on-line batch. However, if the results of a field blank collected through the sampling manifold meets the acceptance criterion, a separate on-line blank need not be collected and analyzed.

The Permittees shall require the site project manager to monitor and document field QC sample results and fill out a nonconformance report if acceptance or frequency criteria are not met. The Permittees shall require the site project manager to ensure appropriate corrective action is taken if acceptance criteria are not met.

C1-1b(1) Field Blanks

Field blanks shall be collected to evaluate background levels of program-required analytes. Field blanks shall be collected prior to sample collection, and at a frequency of one per sampling batch. The Permittees shall require the site project manager to use the field blank data to assess impacts of ambient contamination, if any, on the sample results. Field blank results determined by gas chromatography/mass spectrometry and gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the method detection limit (**MDL**) listed in Table C3-2 in Permit Attachment C3. Field blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2. A nonconformance report shall be initiated and resolved if the final reported QC sample results do not meet the acceptance criteria.

C1-1b(2) Equipment Blanks

Equipment blanks shall be collected to assess cleanliness prior to first use after cleaning of all sampling equipment. On-line blanks will be used to assess equipment cleanliness as well as analytical contamination. After the initial cleanliness check, equipment blanks collected through the manifold shall be collected at a frequency of one per sampling batch for VOC analysis or one per day, whichever is more frequent. If the direct canister method is used, field blanks may be used in lieu of equipment blanks. The Permittees shall require the site project manager to use the equipment blank data to assess impacts of potentially contaminated sampling equipment on the sample results. Equipment blank results determined by gas chromatography/mass spectrometry or gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the MDL listed in Table C3-2 in Permit Attachment C3. Equipment blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table C3-2.

C1-1b(3) Field Reference Standards

Field reference standards shall be used to assess the accuracy with which the sampling equipment collects VOC samples into SUMMA® or equivalent canisters prior to first use of the sampling equipment. The on-line control sample will be used to assess the accuracy with which the sampling equipment collects VOC samples as well as an indicator of analytical accuracy for the on-line sampling system. Field reference standards shall contain a minimum of six of the

analytes listed in Table C3-2 in Permit Attachment C3 at concentrations within a range of 10 to 100 ppmv and greater than the MDL for each compound. Field reference standards shall have a known valid relationship to a nationally recognized standard (e.g., NIST), if available. If NIST traceable standards are not available and commercial gases are used, a Certificate of Analysis from the manufacturer documenting traceability is required. Commercial stock gases shall not be used beyond their manufacturer-specified shelf life. After the initial accuracy check, field reference standards collected through the manifold shall be collected at a frequency of one per sampling batch and submitted as blind samples to the analytical laboratory. For the direct canister method, field reference standard collection may be discontinued if the field reference standard results demonstrate the QAO for accuracy specified in Attachment C3. Field reference standard results shall be acceptable if the accuracy for each tested compound has a recovery of 70 to 130 percent.

C1-1b(4) Field Duplicates

Field duplicate samples shall be collected sequentially and in accordance with Table C1-1 to assess the precision with which the sampling procedure can collect samples into SUMMA® or equivalent canisters. Field duplicates will also serve as a measure of analytical precision for the on-line sampling system. Field duplicate results shall be acceptable if the relative percent difference is less than or equal to 25 for each tested compound found in concentrations greater than the PRQL in both duplicates.

C1-1c Equipment Testing, Inspection and Maintenance

All sampling equipment components that come into contact with headspace sample gases shall be constructed of relatively inert materials such as stainless steel or Teflon®. A passivated interior surface on the stainless steel components is recommended.

To minimize the potential for cross contamination of samples, the headspace sampling manifold and sample canisters shall be properly cleaned and leak-checked prior to each headspace-gas sampling event. Procedures used for cleaning and preparing the manifold and sample canisters shall be equivalent to those provided in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). Cleaning requirements are presented below.

C1-1c(1) Headspace-Gas Sample Canister Cleaning

SUMMA® or equivalent canisters used in these methods shall be subjected to a rigorous cleaning and certification procedures prior to use in the collection of any samples. Guidance for the development of this procedure has been derived from Method TO-14A or TO-15 (EPA 1999). Specific detailed instructions shall be provided in laboratory standard operating procedures (**SOPs**) for the cleaning and certification of canisters.

Canisters shall be cleaned and certified on an equipment cleaning batch basis. An equipment cleaning batch is any number of canisters cleaned together at one time using the same cleaning method. A cleaning system, capable of processing multiple canisters at a time, composed of an oven (optional) and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump shall be used to clean SUMMA® or equivalent canisters. Prior to cleaning, a positive or negative pressure leak test shall be performed on all canisters. The duration of the leak test must be greater than or equal to the time it takes to collect a sample,

but no greater than 24 hours. For a leak test, a canister passes if the pressure does not change by a rate greater than ±2 psig per 24 hours. Any canister that fails shall be checked for leaks, repaired, and reprocessed. One canister per equipment cleaning batch shall be filled with humid zero air or humid high purity nitrogen and analyzed for VOCs. The equipment cleaning batch of canisters shall be considered clean if there are no VOCs above three times the MDLs listed in Table C3-2 of Permit Attachment C3. After the canisters have been certified for leak-tightness and found to be free of background contamination, they shall be evacuated to 0.0039 in. (0.10 mm) Hg or less for storage prior to shipment. The Permittees shall require the laboratory responsible for canister cleaning and certification to maintain canister certification documentation and initiate the canister tags as described in Permit Attachment C3.

C1-1c(2) Sampling Equipment Initial Cleaning and Leak Check

The surfaces of all headspace-gas sampling equipment components that will come into contact with headspace gas shall be thoroughly inspected and cleaned prior to assembly. The manifold and associated sampling heads shall be purged with humidified zero air, nitrogen, or helium, and leak checked after assembly. This cleaning shall be repeated if the manifold and/or associated sampling heads are contaminated to the extent that the routine system cleaning is inadequate.

C1-1c(3) Sampling Equipment Routine Cleaning and Leak Check

The manifold and associated sampling heads which are reused shall be cleaned and checked for leaks in accordance with the cleaning and leak check procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). The procedures shall be conducted after headspace gas and field duplicate collection; after field blank collection, after field blanks are collected through the manifold; and after the additional cleaning required for field reference standard collection has been completed. The protocol for routine manifold cleaning and leak check requires that sample canisters be attached to the canister ports, or that the ports be capped or closed by valves, and requires that the sampling head be attached to the purge assembly.

VOCs shall be removed from the internal surfaces of the headspace sampling manifold to levels that are less than or equal to three times the MDLs of the analytes listed in Table C3-2 of Permit Attachment C3, as determined by analysis of an equipment blank or through use of an OVA. It is recommended that the headspace sampling manifold be heated to 150° Centigrade and periodically evacuated and flushed with humidified zero air, nitrogen, or helium. When not in use, the manifold shall be demonstrated clean before storage with a positive pressure of high purity gas (i.e., zero air, nitrogen, or helium) in both the standard and sample sides.

Sampling shall be suspended and corrective actions shall be taken when the analysis of an equipment blank indicates that the VOC limits have been exceeded or if a leak test fails. The Permittees shall require the site project manager to ensure that corrective action has been taken prior to resumption of sampling.

C1-1c(4) Manifold Cleaning After Field Reference Standard Collection

The sampling system shall be specially cleaned after a field reference standard has been collected, because the field reference standard gases contaminate the standard side of the headspace sampling manifold when they are regulated through the purge assembly. This

cleaning requires the installation of a gas-tight connector in place of the sampling head, between the flexible hose and the purge assembly. This configuration allows both the sample and standard sides of the sampling system to be flushed (evacuated and pressurized) with humidified zero air, nitrogen, or helium which, combined with heating the pneumatic lines, should sweep and adequately clean the system's internal surfaces. After this protocol has been completed and prior to collecting another sample, the routine system cleaning and leak check (see previous section) shall also be performed.

C1-1c(5) Sampling Head Cleaning

To prevent cross contamination, the needle, airtight fitting or airtight seal, adapters, and filter of the sampling heads shall be cleaned in accordance with the cleaning procedures described in EPA's Compendium Method TO-14A or TO-15 (EPA 1999). After sample collection, a sampling head shall be disposed of or cleaned in accordance with EPA's Compendium Method TO-14A or TO-15 (EPA1999), prior to reuse. As a further QC measure, the needle, airtight fitting or airtight seal, and filter, after cleaning, should be purged with zero air, nitrogen, or helium and capped for storage to prevent sample contamination by VOCs potentially present in ambient air.

C1-1d Equipment Calibration and Frequency

The manifold pressure sensor shall be certified prior to initial use, then annually, using NIST traceable, or equivalent, standards. If necessary, the pressure indicated by the pressure sensor(s) shall be temperature compensated. The ambient air temperature sensor, if present, shall be certified prior to initial use, then annually, to NIST traceable, or equivalent, temperature standards.

The OVA shall be calibrated once per day, prior to first use, or as necessary according to the manufacturer's specifications. Calibration gases shall be certified to contain known analytes from Table C3-2 of Permit Attachment C3 at known concentrations. The balance of the OVA calibration gas shall be consistent with the manifold purge gas when the OVA is used (i.e., zero air, nitrogen, or helium).

C1-2 Sampling of Homogeneous Solids and Soil/Gravel (Summary Categories S3000/S4000)

For those waste streams without an AK Sufficiency Determination approved by DOE, randomly selected containers of homogeneous solid and/or soil/gravel waste streams (S3000/S4000) shall be sampled and analyzed to resolve the assignment of EPA hazardous waste numbers. For example, analytical results may be useful to resolve uncertainty regarding hazardous constituents used in a process that generated the waste stream when the hazardous constituents are not documented in the acceptable knowledge information for the waste.

C1-2a Method Requirements

The methods used to collect samples of transuranic (**TRU**) mixed waste, classified as homogeneous solids and soil/gravel from waste containers, shall be such that the samples are representative of the waste from which they were taken. To minimize the quantity of investigation-derived waste, laboratories conducting the analytical work may require no more sample than is required for the analysis, based on the analytical methods. However, a sufficient number of samples shall be collected to adequately represent waste being sampled. For those

waste streams defined as Summary Category Groups S3000 or S4000 in Attachment C, debris that may also be present within these wastes need not be sampled.

Samples of retrievably stored waste containers will be collected using appropriate coring equipment or other EPA approved methods to collect a representative sample. Newly generated wastes that are sampled from a process as it is generated may be sampled using EPA approved methods, including scoops and ladles, that are capable of collecting a representative sample. All sampling and core sampling will comply with the QC requirements specified in C1-2b.

C1-2a(1) Core Collection

Coring tools shall be used to collect cores of homogeneous solids and soil/gravel from waste containers, when possible, in a manner that minimizes disturbance to the core. A rotational coring tool (i.e., a tool that is rotated longitudinally), similar to a drill bit, to cut, lift the waste cuttings, and collect a core from the bore hole, shall be used to collect sample cores from waste containers. For homogeneous solids and soil/gravel that are relatively soft, non-rotational coring tools may be used in lieu of a rotational coring tool.

To provide a basis for describing the requirements for core collection, diagrams of a rotational coring tool (i.e., a light weight auger) and a non-rotational coring tool (i.e., a thin-walled sampler) are provided in Figures C1-5 and C1-6, respectively.

The following requirements apply to the use of coring tools:

- Each coring tool shall contain a removable tube (liner) that is constructed of fairly rigid material unlikely to affect the composition and/or concentrations of target analytes in the sample core. Materials that are acceptable for use for coring device sleeves are polycarbonate, teflon, or glass for most samples, and stainless steel or brass if samples are not to be analyzed for metals. The Permittees shall require site quality assurance project plans (**QAPjPs**) to document that analytes of concern are not present in liner material. The Permittees shall also require sites to document that the materials are unlikely to affect sample results through the collection and analysis of an equipment blank prior to first use as specified in the 'Equipment Blanks' section of this appendix. Liner outer diameter is recommended to be no more than 2 in. and no less than one in. Liner wall thickness is recommended to be no greater than 1/16 in. Before use, the liner shall be cleaned in accordance the requirements in Section C1-2b. The liner shall fit flush with the inner wall of the coring tool and shall be of sufficient length to hold a core that is representative of the waste along the entire depth of the waste. The depth of the waste is calculated as the distance from the top of the sludge to the bottom of the drum (based on the thickness of the liner and the rim at the bottom of the drum). The liner material shall have sufficient transparency to allow visual examination of the core after sampling. If sub-sampling is not conducted immediately after core collection and liner extrusion, then end caps constructed of material unlikely to affect the composition and/or concentrations of target analytes in the core (e.g., Teflon®) shall be placed over the ends of the liner. End caps shall fit tightly to the ends of the liner. The Permittees shall require site specific QAPjPs to indicate the acceptable materials for core liners and end caps.

- A spring retainer, similar to that illustrated in Figures C1-5 and C1-6, shall be used with each coring tool when the physical properties of the waste are such that the waste may fall out of the coring tool's liner during sampling activities. The spring retainer shall be constructed of relatively inert material (e.g., stainless steel or Teflon®) and its inner diameter shall not be less than the inner diameter of the liner. Before use, spring retainers shall be cleaned in accordance with the requirements in Section C1-2b.

- Coring tools may have an air-lock mechanism that opens to allow air inside the liners to escape as the tool is pressed into the waste (e.g., ball check valve). If used, this air-lock mechanism shall also close when the core is removed from the waste container.

- After disassembling the coring tool, a device (extruder) to forcefully extrude the liner from the coring tool shall be used if the liner does not slide freely. All surfaces of the extruder that may come into contact with the core shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- Coring tools shall be of sufficient length to hold the liner and shall be constructed to allow placement of the liner leading edge as close as possible to the coring tools leading edge.

- All surfaces of the coring tool that have the potential to contact the sample core or sample media shall be cleaned in accordance with the requirements in Section C1-2(b) prior to use.

- The leading edge of the coring tools may be sharpened and tapered to a diameter equivalent to, or slightly smaller than, the inner diameter of the liner to reduce the drag of the homogeneous solids and soil/gravel against the internal surfaces of the liner, thereby enhancing sample recovery.

- Rotational coring tools shall have a mechanism to minimize the rotation of the liner inside the coring tool during coring activities, thereby minimizing physical disturbance to the core.

- Rotational coring shall be conducted in a manner that minimizes transfer of frictional heat to the core, thereby minimizing potential loss of VOCs.

- Non-rotational coring tools shall be designed such that the tool's kerf width is minimized. Kerf width is defined as one-half of the difference between the outer diameter of the tool and the inner diameter of the tool's inlet.

C1-2a(2) Sample Collection

Sampling of cores shall be conducted in accordance with the following requirements:

- Sampling shall be conducted as soon as possible after core collection. If a substantial delay (i.e., more than 60 minutes) is expected between core collection and sampling, the core shall remain in the liner and the liner shall be capped at each end. If the liner containing the core is not extruded from the coring tool and capped, then two alternatives are permissible: 1) the liner shall be left in the coring tool and the coring

tool shall be capped at each end, or 2) the coring tool shall remain in the waste container with the air-lock mechanism attached.

- Samples of homogeneous solids and soil/gravel for VOC analyses shall be collected prior to extruding the core from the liner. These samples may be collected by collecting a single sample from the representative subsection of the core, or three sub-samples may be collected from the vertical core to form a single 15-gram composite sample. Smaller sample sizes may be used if method PRQL requirements are met for all analytes. The sampling locations shall be randomly selected. If a single sample is used, the representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). If the three sub-sample method is used, the sampling locations shall be randomly selected within three equal-length subsections of the core along the long axis of the liner and access to the waste shall be gained by making a perpendicular cut through the liner and the core. The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. A sampling device such as the metal coring cylinder described in EPA's SW-846 Manual (1996), or equivalent, shall be immediately used to collect the sample once the core has been exposed to air. Immediately after sample collection, the sample shall be extruded into 40-ml volatile organics analysis (**VOA**) vials (or other containers specified in appropriate SW-846 methods), the top rim of the vial visually inspected and wiped clean of any waste residue, and the vial cap secured. Sample handling requirements are outlined in Table C1-4. Additional guidance for this type of sampling can be found in SW-846 (EPA 1996).

- Samples of the homogeneous solids and soil/gravel for semi-volatile organic compound and metals analyses shall be collected. These samples may be collected from the same sub-sample locations and in the same manner as the sample collected for VOC analysis, or they may be collected by splitting or compositing the representative subsection of the core. The representative subsection is chosen by randomly selecting a location along the portion of the core (i.e. core length). The Permittees shall require sites to develop documented procedures to select, and record the selection, of random sampling locations. True random sampling involves the proper use of random numbers for identifying sampling locations. The procedures used to select the random sampling locations will be subject to review as part of annual audits by DOE. Guidance for splitting and compositing solid materials can be found in SW-846 (EPA 1996). All surfaces of the sampling tools that have the potential to come into contact with the sample shall be constructed of materials unlikely to affect the composition or concentrations of target analytes in the waste (e.g., Teflon®). In addition, all surfaces that have the potential to come into contact with core sample media shall either be disposed or decontaminated according to the procedures found in Section C1-2(b). Sample sizes and handling requirements are outlined in Table C1-4.

Newly generated waste samples may be collected using methods other than coring, as discussed in Section C1-2a. Newly generated wastes samples will be collected as soon as possible after sampling, but the spatial and temporal homogeneity of the waste stream dictate

whether a representative grab sample or composite sample shall be collected. As part of the site audit, DOE shall assess waste sampling to ensure collection of representative samples.

C1-2b Quality Control

QC requirements for sampling of homogeneous solids and soil/gravel include collecting co-located samples from cores or other sample types to determine precision; equipment blanks to verify cleanliness of the sampling and coring tools and sampling equipment; and analysis of reagent blanks to ensure reagents, such as deionized or high pressure liquid chromatography (**HPLC**) water, are of sufficient quality. Coring and sampling of homogeneous solids and soil/gravel shall comply, at minimum, with the following QC requirements.

C1-2b(1) Co-located Samples

In accordance with the requirement to collect field duplicates required by the EPA methods found in SW-846 (EPA 1996), samples shall be collected to determine the combined precision of the coring and sampling procedures. The co-located core methodology is a duplicate sample collection methodology intended to collect samples from a second core placed at approximately the same location within the drum when samples are collected by coring. Waste may not be amenable to coring in some instances. In this case, a co-located sample may be collected from a sample (e.g. scoop) collected from approximately the same location in the waste stream. A sample from each co-located core or waste sample collected by other means shall be collected side by side as close as feasible to one another, handled in the same manner, visually inspected through the transparent liner (if cored), and sampled in the same manner at the same randomly selected sample location(s). If the visual examination detects inconsistencies such as color, texture, or waste type in the waste at the sample location, another sampling location may be randomly selected, or the samples may be invalidated and co-located samples or cores may again be collected. Co-located samples, from either core or other sample type, shall be collected at a frequency of one per sampling batch or once per week, whichever is more frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

C1-2b(2) Equipment Blanks

In accordance with SW-846 (EPA 1996), equipment blanks shall be collected from fully assembled sampling and coring tools (i.e., at least those portions of the sampling equipment that contact the sample) prior to first use after cleaning at a frequency of one per equipment cleaning batch. An equipment cleaning batch is the number of sampling equipment items cleaned together at one time using the same cleaning method. The equipment blank shall be collected from the fully assembled sampling or coring tool, in the area where the sampling or coring tools are cleaned, prior to covering with protective wrapping and storage. The equipment blank shall be collected by pouring clean water (e.g., deionized water, HPLC water) down the inside of the assembled sampling or coring tool. The water shall be collected in a clean sample container placed at the leading edge of the sampling or coring tool and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the analysis indicates no analyte at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 or in the Program Required Detection Limits (**PRDL**) in Table C3-8 of Permit Attachment C3. If analytes

are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling or coring tools shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Equipment blanks for coring tools shall be collected from liners that are cleaned separately from the coring tools. These equipment blanks shall be collected at a frequency of one per equipment cleaning batch. The equipment blanks shall be collected by randomly selecting a liner from the equipment cleaning batch, pouring clean water (e.g., deionized water or HPLC water) across its internal surface, collecting the water in a clean sample container, and analyzing the water for the analytes listed in Tables C3-4, C3-6, and the PRDLs in Table C3-8 of Permit Attachment C3. The results of the equipment blank analysis will be considered acceptable if the results indicate no analyte at a concentration greater than three times the MDLs listed in Tables C3-4, C3-6, or C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of liners shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

Sampling equipment (e.g., bowls, spoons, chisel, VOC sub-sampler) shall also be cleaned. Equipment blanks shall be collected for the sampling equipment at a frequency of one per equipment cleaning batch. After the sampling equipment has been cleaned, one item from the equipment cleaning batch is randomly selected, water (e.g., deionized water, HPLC water) is passed over its surface, collected in a clean container, and analyzed for the analytes listed in Tables C3-4, C3-6, and C3-8 of Permit Attachment C3. The results of the equipment blank will be considered acceptable if the results indicate no analyte present at a concentration greater than three times the MDLs listed in Tables C3-4 and C3-6 and in the PRDLs in C3-8 of Permit Attachment C3. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank. The above equipment blanks may be performed on a purchased batch basis for sampling equipment purchased sterile and sealed in protective packaging. Equipment blanks need not be performed for equipment purchased in sealed protective packaging accompanied by a certificate certifying cleanliness.

The results of equipment blanks shall be traceable to the items in the equipment cleaning batch that the equipment blank represents. All sampling items should be identified, and the associated equipment cleaning batch should be documented. The method of documenting the connection between equipment and equipment cleaning batches shall be documented. Equipment blank results for the coring tools, liners, and sampling equipment shall be reviewed prior to use. A sufficient quantity of these items should be maintained in storage to prevent disruption of sampling operations.

The Permittees may require a site to use certified clean disposable sampling equipment and discard liners and sampling tools after one use. In this instance, cleaning and equipment blank collection is not required.

C1-2b(3) Coring Tool and Sampling Equipment Cleaning

Coring tools and sampling equipment shall be cleaned in accordance with the following requirements:

- All surfaces of coring tools and sampling equipment that will come into contact with the samples shall be clean prior to use. All sampling equipment shall be cleaned in the same manner. Immediately following cleaning, coring tools and sampling equipment shall be assembled and sealed inside clean protective wrapping.

- Each reusable sampling or coring tool shall have a unique identification number. Each number shall be referenced to the waste container on which it was used. This information shall be recorded in the field records. One sampling or coring tool from each equipment cleaning batch shall be tested for cleanliness in accordance with the requirements specified above. The identification number of the sampling or coring tool from which the equipment blank was collected shall be recorded in the field records. The results of the equipment blank analysis for the equipment cleaning batch in which each sampling or coring tool was cleaned shall be submitted to the sampling facility with the identification numbers of all sampling or coring tools in the equipment cleaning batch. If analytes are detected at concentrations greater than three times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be cleaned again and another equipment blank collected. Equipment from an equipment cleaning batch may not be used until analytical results have been received verifying an adequately low level of contamination in the equipment blank.

- Sample containers shall be cleaned in accordance with SW-846 (EPA 1996).

C1-2c Equipment Testing, Inspection and Maintenance

Prior to initiation of sampling or coring activities, sampling and coring tools shall be tested in accordance with manufacturer specifications to ensure operation within the manufacturer's tolerance limits. Other specifications specific to the sampling operations (e.g., operation of containment structure and safety systems) should also be tested and verified as operating properly prior to initiating coring activities. Coring tools shall be assembled, including liners, and tested. Air-lock mechanisms and rotation mechanisms shall be inspected for free movement of critical parts. Sampling and coring tools found to be malfunctioning shall be repaired or replaced prior to use.

Coring tools and sample collection equipment shall be maintained in accordance with manufacturer's specifications. Clean sampling and coring tools and sampling equipment shall be sealed inside clean protective wrapping and maintained in a clean storage area prior to use. Sampling equipment shall be properly maintained to avoid contamination. A sufficient supply of spare parts should be maintained to prevent delays in sampling activities due to equipment down time. Records of equipment maintenance and repair shall be maintained in the field records in accordance with site SOPs.

Inspection of sampling equipment and work areas shall include the following:

- Sample collection equipment in the immediate area of sample collection shall be inspected daily for cleanliness. Visible contamination on any equipment (e.g., waste on

floor of sampling area, hydraulic fluid from hoses) that has the potential to contaminate a waste core or waste sample shall be thoroughly cleaned upon its discovery.

- The waste coring and sampling work areas shall be maintained in clean condition to minimize the potential for cross contamination between waste (including cores) and samples.

- Expendable equipment (e.g., plastic sheeting, plastic gloves) shall be visually inspected for cleanliness prior to use and properly discarded after each sample.

- Prior to removal of the protective wrapping from a coring tool designated for use, the condition of the protective wrapping shall be visually assessed. Coring tools with torn protective wrapping should be returned for cleaning. Coring tools visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Sampling equipment shall be visually inspected prior to use. All sampling equipment that comes into contact with waste samples shall be stored in protective wrapping until use. Prior to removal of the protective wrapping from sampling equipment, the condition of the protective wrapping shall be visually assessed. Sampling equipment with torn protective wrapping should be discarded or returned for cleaning. Sampling equipment visibly contaminated after the protective wrapping has been removed shall not be used and shall be returned for cleaning or properly discarded.

- Cleaned sampling and coring equipment will be physically segregated from all equipment that has been used for a sampling event and has not been decontaminated.

C1-2d Equipment Calibration and Frequency

The scale used for weighing sub-samples shall be calibrated as necessary to maintain its operation within manufacturer's specification, and after repairs and routine maintenance. Weights used for calibration shall be traceable to a nationally recognized standard. Calibration records shall be maintained in the field records.

C1-3 Radiography

Radiography has been developed by the Permittees specifically to aid in the examination and identification of containerized waste. The Permittees shall require that sites describe all activities required to achieve the radiography objectives in site QAPjPs and SOPs. These SOPs should include instructions specific to the radiography system(s) used at the site. For example, to detect liquids, some systems require the container to be rotated back and forth while other systems require the container to be tilted.

A radiography system (e.g., real time radiography, digital radiography/computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, an audio/video recording system, and an operator control and data acquisition station. Although these six components are required, it is expected there will be some variation within a given component between sites. The radiography system shall have controls or an equivalent process which allow the operator to control image quality. On some radiography systems, it should be possible to vary the voltage, typically

between 150 to 400 kilovolts (**kV**), to provide an optimum degree of penetration through the waste. For example, high-density material should be examined with the X-ray device set on the maximum voltage. This ensures maximum penetration through the waste container. Low-density material should be examined at lower voltage settings to improve contrast and image definition. The imaging system typically utilizes either a fluorescent screen and a low-light television camera or x-ray detectors to generate the image.

To perform radiography, the waste container is scanned while the operator views the television screen. A video and audio recording is made of the waste container scan and is maintained as a non-permanent record. A radiography data form is also used to document the Waste Matrix Code to ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary. Containers whose contents prevent full examination of the remaining contents shall be subject to visual examination unless the site certifies that visual examination would provide no additional relevant information for that container based on the acceptable knowledge information for the waste stream. Such certification shall be documented in the generator/storage site's record.

For containers which contain classified shapes and undergo radiography, the radiography video and audio recording will be considered classified. The radiography data forms will not contain classified information.

The radiography system involves qualitative and semiquantitative evaluations of visual displays. Operator training and experience are the most important considerations for ensuring quality controls in regard to the operation of the radiography system and for interpretation and disposition of radiography results. Only trained personnel shall be allowed to operate radiography equipment.

Standardized training requirements for radiography operators shall be based upon existing industry standard training requirements.

The Permittees shall require each site to develop a training program that provides radiography operators with both formal and on-the-job (**OJT**) training. Radiography operators shall be instructed in the specific waste generating practices, typical packaging configurations, and associated waste material parameters expected to be found in each Waste Matrix Code at the site. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography operator prior to qualification of the training candidate. The training programs will be site-specific due to differences in equipment, waste configurations, and the level of waste characterization efforts. For example, certain sites use digital radiography equipment, which is more sensitive than real-time radiography equipment. In addition, the particular physical forms and packaging configurations at each site will vary; therefore, radiography operators shall be trained on the types of waste that are generated, stored, and/or characterized at that particular site.

Although the Permittees shall require each site to develop its own training program, all of the radiography QC requirements specified in this WAP shall be incorporated into the training programs and radiography operations. In this way data quality and comparability will not be affected.

Radiography training programs will be the subject of the Audit and Surveillance Program (Permit Attachment C6).

One or more training containers with items (including prohibited items) common to the waste streams to be characterized and internal containers of various sizes shall be scanned semiannually by each operator. The audio and video media shall then be reviewed by a supervisor to ensure that operators' interpretations remain consistent and accurate. Imaging system characteristics shall be verified on a routine basis.

Independent replicate scans and replicate observations of the video output of the radiography process shall be performed under uniform conditions and procedures. Independent replicate scans shall be performed on one waste container per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. Independent observations of one scan (not the replicate scan) shall also be made once per day or once per testing batch, whichever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container. A testing batch is a suite of waste containers undergoing radiography using the same testing equipment. A testing batch can be up to 20 waste containers without regard to waste matrix.

Oversight functions include periodic audio/video media reviews of accepted waste containers and shall be performed by qualified radiography operators that were not involved in the original scans of the waste containers. The results of this independent verification shall be available to the radiography operators who performed the original scans. The Permittees shall require the site project manager to be responsible for monitoring the quality of the radiography data and calling for corrective action, when necessary.

C1-4 Visual Examination

The waste container contents may be verified directly by visual examination (**VE**) of the waste container contents. Visual examination may be performed by physically examining the contents of waste containers to verify the Waste Matrix Code and to verify that the container is properly included in the appropriate waste stream. Visual examination shall be conducted on a waste container to identify and describe all waste items, packaging materials, and waste material parameters in the waste container. Visual examination activities shall be documented on video/audio media, or by using a second operator to provide additional verification by reviewing the contents of the waste container to ensure correct reporting. When VE is performed using a second operator, each operator performing the VE shall observe for themselves the waste being placed in the waste container or the contents within the examined waste container when waste is not removed. The results of all VE shall be documented on VE data forms, which are used to document the Waste Matrix Code, ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented in the AK Summary.

Visual examination recorded on video/audio media shall meet the following minimum requirements:

- The video/audio media shall record the waste packaging event for the container such that all waste items placed into the container are recorded in sufficient detail and shall

contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.

- The video/audio media shall capture the waste container identification number.
- The personnel loading the waste container shall be identified on the video/audio media or on packaging records traceable to the loading of the waste container.
- The date of loading of the waste container will be recorded on the video/audio media or on packaging records traceable to the loading of the waste container.

Visual examination performed using two generator site personnel shall meet the following minimum requirements:

- At least two generator site personnel who witnessed the packaging of the waste shall approve the data forms or packaging records attesting to the contents of the waste container.
- The data forms or packaging records shall contain an inventory of waste items in sufficient detail that another trained VE operator can identify the associated waste material parameters.
- The waste container identification number shall be recorded on the data forms or packaging records.

Visual examination video/audio media of containers which contain classified shapes shall be considered classified information. Visual examination data forms or packaging records will not contain classified information.

Waste container packaging records may be used to meet the VE data quality objectives (**DQOs**) (Permit Attachment C, Section C-4a(1)). These records must meet the minimum requirements listed above for either VE recorded on video/audio media or VE performed by two generator/storage site personnel, and shall be reviewed by operators trained and qualified to the requirements listed below. The operators will prepare data forms based on the visual examination records. Visual examination batch data reports will be prepared, reviewed, and approved as described in Permit Attachment C, Section C-4, and Permit Attachment C3.

Standardized training for VE shall be developed. Visual examination operators shall be instructed in the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code at the site. The training shall be site specific to include the various waste configurations generated/stored at the site. For example, the particular physical forms and packaging configurations at each site will vary so operators shall be trained to examine the types of waste that are generated, stored, and/or characterized at that particular site. Training will include the following regardless of Summary Category Group:

- Identifying and describing the contents of a waste container by examining all items in waste containers of previously packaged waste
- Identifying when VE cannot be used to meet the DQOs

Visual examination personnel shall be requalified once every two years.

Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste generating processes that have taken place at that site and also be familiar with all of the types of waste being characterized at that site. The VE expert shall be responsible for the overall direction and implementation of the VE at that facility. The Permittees shall require site QAPjPs to specify the selection, qualification, and training requirements of the VE expert.

C1-5 Custody of Samples

Chain-of-Custody on field samples (including field QC samples) will be initiated immediately after sample collection or preparation. Sample custody will be maintained by ensuring that samples are custody sealed during shipment to the laboratory. After samples are accepted by the analytical laboratory, custody is maintained by assuring the samples are in the possession of an authorized individual, in that individual's view, in a sealed or locked container controlled by that individual, or in a secure controlled access location. Sample custody will be maintained until the sample is released by the site project manager or until the sample is expended. The Permittees shall require that site QAPjPs or site-specific procedures include a copy of the sample chain-of-custody form and instructions for completing sample chain-of-custody forms in a legally defensible manner. This form will include provisions for each of the following:

- Signature of individual initiating custody control, along with the date and time.
- Documentation of sample numbers for each sample under custody. Sample numbers will be referenced to a specific sampling event description that will identify the sampler(s) through signature, the date and time of sample collection, type/number containers for each sample, sample matrix, preservatives (if applicable), requested methods of analysis, place/address of sample collection and the waste container number.
- For off-site shipping, method of shipping transfer, responsible shipping organization or corporation, and associated air bill or lading number.
- Signatures of custodians relinquishing and receiving custody, along with date and time of the transfer.
- Description of final sample container disposition, along with signature of individual removing sample container from custody.
- Comment section.
- Documentation of discrepancies, breakage or tampering.

All samples and sampling equipment will be identified with unique identification numbers. Sampling Coring tools and equipment will be identified with unique equipment numbers to ensure that all sampling equipment, coring tools, and sampling canisters are traceable to equipment cleaning batches.

All samples will be uniquely identified to ensure the integrity of the sample and can be used to identify the generator/storage site and date of collection. Sample tags or labels will be affixed to all samples and will identify at a minimum:

- Sample ID number
- Sampler initials and organization
- Ambient temperature and pressure (for gas samples only)
- Sample description
- Requested analyses
- Data and time of collection
- QC designation (if applicable)

C1-6 Sample Packing and Shipping

In the event that the analytical facilities are not at the generator/storage site, the samples shall be packaged and shipped to an off-site laboratory. Sample containers shall be packed to prevent any damage to the sampling container and maintain the preservation temperature, if necessary. Department of Transportation (**DOT**) regulations shall be adhered to for shipment of the package.

When preparing SUMMA® or equivalent canisters for shipment, special care shall be taken with the pressure gauge and the associated connections. Metal boxes which have separate compartments, or cardboard boxes with foam inserts are standard shipping containers. The chosen shipping container shall meet selected DOT regulations. If temperatures shall be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package.

Glass jars are wrapped in bubble wrap or another type of protection. The wrapped jar should be placed in a plastic bag inside of the shipping container, so that if the jar breaks, the inside of the shipping container and the other samples will not be contaminated. The plastic bag will enable the receiving analytical lab to prevent contamination of their shipping and receiving area. Plastic jars do not present a problem for shipping purposes. All shipping containers will contain appropriate blank samples to detect any VOC cross-contamination. A DOT approved cooler, or similar package may be used as the shipping container. If temperatures must be maintained, an adequate number of cold packs necessary to maintain the preservation temperature shall be added to the package. If fill material is needed, compatibility between the samples and the fill should be evaluated prior to use.

All sample containers should be affixed with signed tamper-proof seals or devices so that it is apparent if the sample integrity has been compromised and that the identity of the seal or device is traceable to the individual who affixed the seal. A seal should also be placed on the outside of the shipping container for the same reason. Sample custody documentation shall be placed inside the sealed or locked shipping container, with the current custodian signing to release custody. Transfer of custody is completed when the receiving custodian opens the shipping container and signs the custody documentation. The shipping documentation will serve to track the physical transfer of samples between the two custodians.

A Uniform Hazardous Waste Manifest is not required, since samples are exempted from the definition of hazardous waste under RCRA. All other shipping documentation specified in the

site specific SOP for sample shipment (i.e., bill of lading, site-specific shipping documentation) is required.

C1-7 List of References

Bechtel BWXT Idaho, LLC (BWXT), 2000, Determination of Drum Age Criteria and Prediction Factors Based on Packaging Configurations, INEEL/EXT-2000-01207, October 2000, Liekhus, K.J., S.M. Djordjevic, M. Devarakonda, and M.J. Connolly, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

Lockheed Idaho Technologies Company, 1995, Position for Determining Gas Phase Volatile Organic Compound Concentrations in Transuranic Waste Containers, INEL-95/0109/Revision 1, M.J. Connolly, et. al.

U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/10b, January 1999).

U.S. Environmental Protection Agency (EPA), 1996. Test Methods for Evaluating Solid Waste, "Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. EPA, OSW and ER, Washington D.C.

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TABLES

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Table C1-1
Gas Sample Requirements

Parameter	Container [a]	Minimum Drum Headspace Sample Volume [b]	Holding Temperatures
VOCs	SUMMA® Canister	250 ml	0-40 °C

[a] Alternately, canisters that meet QAOs may be used.

[b] Alternatively, if available headspace is limited, a single 100 ml sample may be collected for determination of VOCs.

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Table C1-2
Summary of Drum Field QC Headspace Sample Frequencies

QC Samples	Manifold	Direct Canister	On-Line Systems
Field blanks [a]	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]
Equipment blanks [b]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field reference standards [c]	1 per sampling batch [d]	once [e]	1 per on-line batch [f]
Field duplicates	1 per sampling batch [d]	1 per sampling batch [d]	1 per on-line batch [f]

[a] Analysis of field blanks for VOCs (Table C3-2 of Attachment C3), only, is required. For on-line integrated sampling/analysis systems, if field blank results meet the acceptance criterion, a separate on-line blank is not required.

[b] One equipment blank or on-line sample shall be collected, analyzed for VOCs (Table C3-2), and demonstrated clean prior to first use of the headspace gas sampling equipment with each of the sampling heads, then at the specified frequency, for VOCs only thereafter. Daily, prior to work, the sampling manifold, if in use, shall be verified clean using an OVA.

[c] One field reference standard or on-line control sample shall be collected, analyzed, and demonstrated to meet the QAOs specified in Permit Attachment C3 prior to first use, then at the specified frequency thereafter.

[d] A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.

[e] One equipment blank and field reference standard shall be collected after equipment purchase, cleaning, and assembly.

[f] An on-line batch is the number of samples collected within a 12-hour period using the same on-line integrated sampling/analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system.

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Table C1-3
Summary of Sampling Quality Control Sample Acceptance Criteria

QC Sample	Acceptance Criteria	Corrective Action [a]
Field blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any VOC amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Equipment blanks	VOC amounts ≤ 3 × MDLs in Table C3-2 of for GC/MS and GC/FID; < PRQLs in Table C3-2 for FTIRS	Nonconformance if any analyte amount > 3 × MDLs in Table C3-2 for GC/MS and GC/FID; ≥ PRQLs in Table C3-2 for FTIRS
Field reference standards or on-line control sample	70 - 130 %R	Nonconformance if %R < 70 or > 130
Field duplicates or on-line duplicate	RPD ≤ 25	Nonconformance if RPD > 25

[a] Corrective action is only required if the final reported QC sample results do not meet the acceptance criteria.

MDL = Method detection limit

%R = Percent recovery

RPD = Relative percent difference

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Table C1-4
Sample Handling Requirements for Homogeneous Solids and Soil/Gravel

Parameter	Suggested Quantity [a]	Required Preservative	Suggested Container	Maximum Holding Time [b]
VOCs	15 grams	Cool to 4°C	Glass Vial [c]	14 Days Prep/ 40 Days Analyze [d]
SVOCs	50 grams	Cool to 4°C	Glass Jar [e]	14 Days Prep/ 40 Days Analyze [d]
Metals	10 grams	Cool to 4°C	Plastic Jar [f]	180 Days [g]

[a] Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.

[b] Holding time begins at sample collection (holding times are consistent with SW-846 requirements).

[c] 40-ml VOA vial or other appropriate containers shall have an airtight cap.

[d] 40-day holding time allowable only for methanol extract - 14-day holding time for non-extracted VOCs.

[e] Appropriate containers should be used and should have Teflon® lined caps.

[f] Polyethylene or polypropylene preferred, glass jar is allowable.

[g] Holding time for mercury analysis is 28 days.

Note: Preservation requirements in the most recent version of SW-846 may be used if appropriate.

Table C1-5
Headspace Gas Drum Age Criteria Sampling Scenarios

Scenario	Description
1	A. Unvented 55-gallon drums without rigid poly liners are sampled through the drum lid at the time of venting. B1. Unvented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. B2. Vented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. C. Unvented 55-gallon drums with vented rigid poly liners are sampled through the drum lid at the time of venting.
2	55-gallon drums that have met the criteria for Scenario 1 and then are vented, but not sampled at the time of venting. [a]
3	Containers (i.e., 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, SLB2s and pipe components) that are initially packaged in a vented condition and sampled in the container headspace and containers that are not sampled under Scenario 1 or 2.

[a] Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. This requires the additional information required of each container in Scenario 3 (i.e., determination of packaging configuration), and such containers can only be sampled after meeting the appropriate Scenario 3 DAC.

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Table C1-6
Scenario 1 Drum Age Criteria (in days) Matrix

Summary Category Group	DAC (Days)
S5000	53

Note: Containers that are sampled using the Scenario 1 DAC do not require information on the packaging configuration because the Scenario 1 DAC are based on a bounding packaging configuration. In addition, information on the rigid liner vent hole presence and diameter do not apply to containers that are sampled using the Scenario 1 DAC because they are unvented prior to sampling.

1
2

Table C1-7
Scenario 2 Drum Age Criteria (in days) Matrix

	Summary Category Group S5000			
Filter H_2 Diffusivity [a]	Rigid Liner Vent Hole Diameter (in) [b]			
(mol/s/mod fraction)	0.30	0.375	0.75	1.0
1.9×10^{-6}	29	22	13	12
3.7×10^{-6}	25	20	12	11
3.7×10^{-5}	7	6	6	4

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging (Attachment C, Section C-3d(1)), repackaging (Attachment C, Section C-3d(1)), and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

Note: Containers that are sampled using the Scenario 2 DAC do not require information on the packaging configuration because the Scenario 2 DAC are based on a bounding packaging configuration.

3

Table C1-8
Scenario 3 Packaging Configuration Groups

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums [a]	• No layers of confinement, filtered inner lid [b] • No inner bags, no liner bags (bounding case)
Packaging Configuration Group 2, 55-gal drums [a]	• 1 inner bag • 1 filtered inner bag • 1 liner bag • 1 filtered liner bag • 1 inner bag, 1 liner bag • 1 filtered inner bag, 1 filtered liner bag • 2 inner bags • 2 filtered inner bags • 2 inner bags, 1 liner bag • 2 filtered inner bags, 1 filtered liner bag • 3 inner bags • 3 filtered inner bags • 3 filtered inner bags, 1 filtered liner bag • 3 inner bags, 1 liner bag (bounding case)
Packaging Configuration Group 3, 55-gal drums and shielded containers [a]	• 2 liner bags • 2 filtered liner bags • 1 inner bag, 2 liner bags • 1 filtered inner bag, 2 filtered liner bags • 2 inner bags, 2 liner bags • 2 filtered inner bags, 2 filtered liner bags • 3 filtered inner bags, 2 filtered liner bags • 4 inner bags • 3 inner bags, 2 liner bags • 4 inner bags, 2 liner bags (bounding case)
Packaging Configuration Group 4, pipe components	• No layers of confinement inside a pipe component • 1 filtered inner bag, 1 filtered metal can inside a pipe component • 2 inner bags inside a pipe component • 2 filtered inner bags inside a pipe component • 2 filtered inner bags, 1 filtered metal can inside a pipe component • 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)
Packaging Configuration Group 5, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• No layers of confinement • 1 SWB liner bag (bounding case)
Packaging Configuration Group 6, Standard Waste Box, Ten-Drum Overpack, or Standard Large Box 2 [a]	• any combination of inner and/or liner bags that is less than or equal to 6 • 5 inner bags, 1 SWB liner bag (bounding case)

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Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums [a]	• No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case) [b] • No inner bags, no liner bags, no rigid liner
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums [a]	• 4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case) [b]

[a] If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums and shielded containers, 6 for SWBs, TDOPs, and SLB2s, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

[b] A "filtered inner lid" is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs and SLB2s use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

1

Table C1-9
Scenario 3 Drum Age Criteria (In Days) Matrix for S5000 Waste by Packaging Configuration Group

Packaging Configuration Group 1						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b]				No Liner Lid	No Liner
	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole		
1.9×10^{-6}	131	95	37	24	4	4
3.7×10^{-6}	111	85	36	24	4	4
3.7×10^{-5}	28	28	23	19	4	4
Packaging Configuration Group 2						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b]				No Liner Lid	No Liner
	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole		
1.9×10^{-6}	175	138	75	60	30	11
3.7×10^{-6}	152	126	73	59	30	11
3.7×10^{-5}	58	57	52	47	28	8
Packaging Configuration Group 3						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Rigid Liner Vent Hole Diameter [b]				No Liner Lid	No Liner
	0.3-inch Diameter Hole	0.375-inch Diameter Hole	0.75-inch Diameter Hole	1-inch Diameter Hole		
1.9×10^{-6}	199	161	96	80	46	16
3.7×10^{-6}	175	148	93	79	46	16
3.7×10^{-5}	72	72	67	62	42	10
Packaging Configuration Group 4						
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Headspace Sample Taken Inside Pipe Component					
$> 1.9 \times 10^{-6}$	152					
Packaging Configuration Group 5						
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP/SLB2					
$> 7.4 \times 10^{-6}$ (SWB)	15					
3.33×10^{-5} (TDOP)	15					
6.60×10^{-4} (SLB2)	21					

Packaging Configuration Group 6			
Filter H_2 Diffusivity [a, c] (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP/SLB2		
> 7.4×10^{-6} (SWB)	56		
3.33×10^{-5} (TDOP)	56		
6.60×10^{-4} (SLB2)	56		
Packaging Configuration Group 7 [d]			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction) [a]		
	7.4×10^{-6}	1.85×10^{-5}	9.25×10^{-5} [e]
3.7×10^{-6}	13	7	2
7.4×10^{-6}	10	6	2
1.85×10^{-5}	6	4	2
Packaging Configuration Group 8			
Filter H_2 Diffusivity [a] (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H_2 Diffusivity (mol/s/mol fraction)		
	7.4×10^{-6}		
3.7×10^{-6}	21		

[a] The documented filter H_2 diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H_2 diffusivity (e.g., a container with a filter H_2 diffusivity of 4.2×10^{-6} must use a DAC for a filter with a 3.7×10^{-6} filter H_2 diffusivity). If a filter H_2 diffusivity for a container is undocumented or unknown or is less than 1.9×10^{-6} filter H_2 diffusivity, a filter of known H_2 diffusivity that is greater than or equal to 1.9×10^{-6} filter H_2 diffusivity must be installed prior to initiation of the relevant DAC period.

[b] The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging, repackaging, and/or venting (Section C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

[c] The filter H_2 diffusivity for SWBs, TDOPs, or SLB2s is the sum of the diffusivities for all of the filters on the container because SWBs, TDOPs, and SLB2s have more than 1 filter.

[d] Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable. Packaging Configuration Group 7 DAC values apply to drums with up to two lids.

[e] While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section C1-1a (i.e., 72 hours at 18°C or higher). The equilibrium requirement for headspace gas sampling shall be met separately.

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FIGURES

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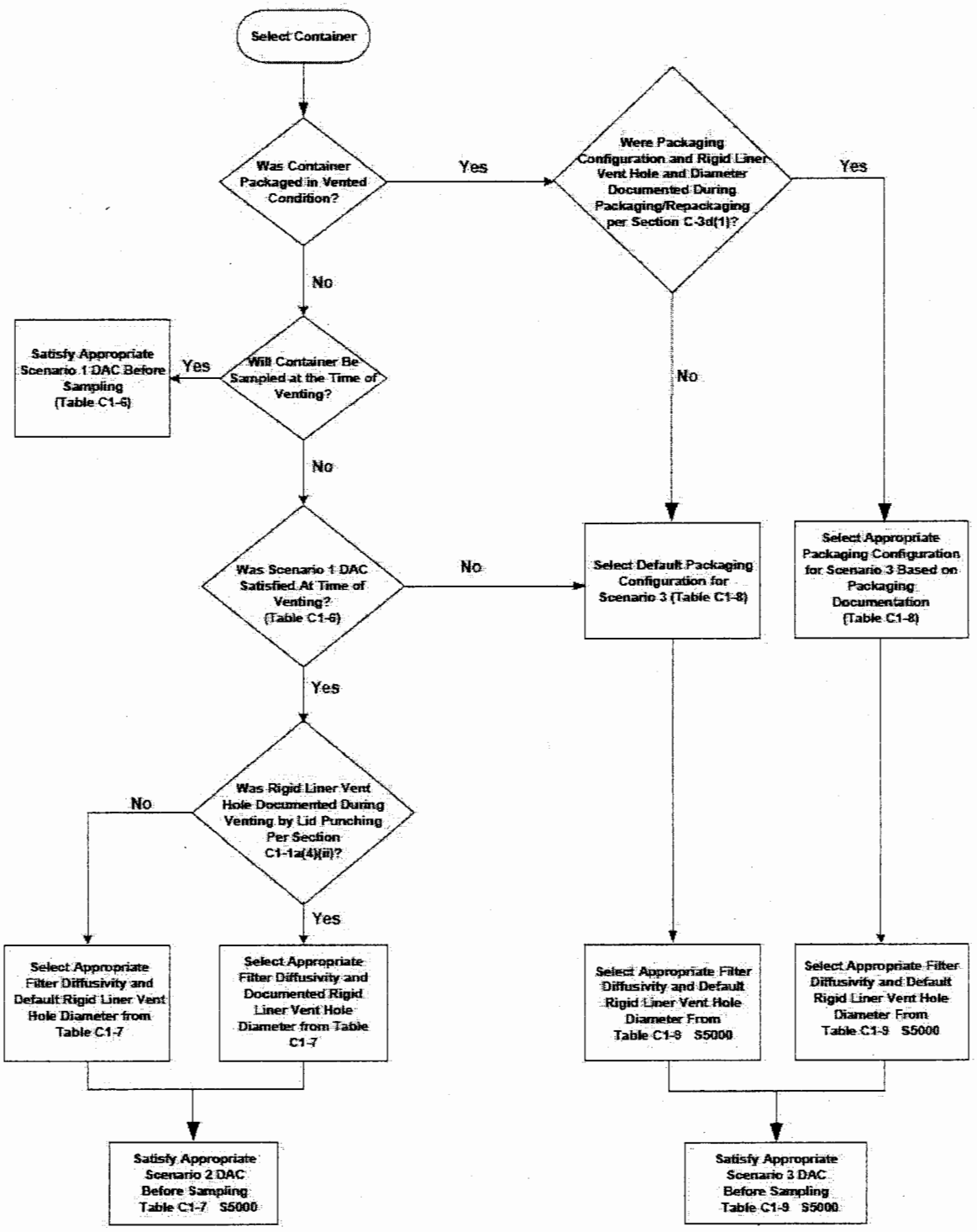

Figure C1-1
Headspace Gas Drum Age Criteria Sampling Scenario Selection Process

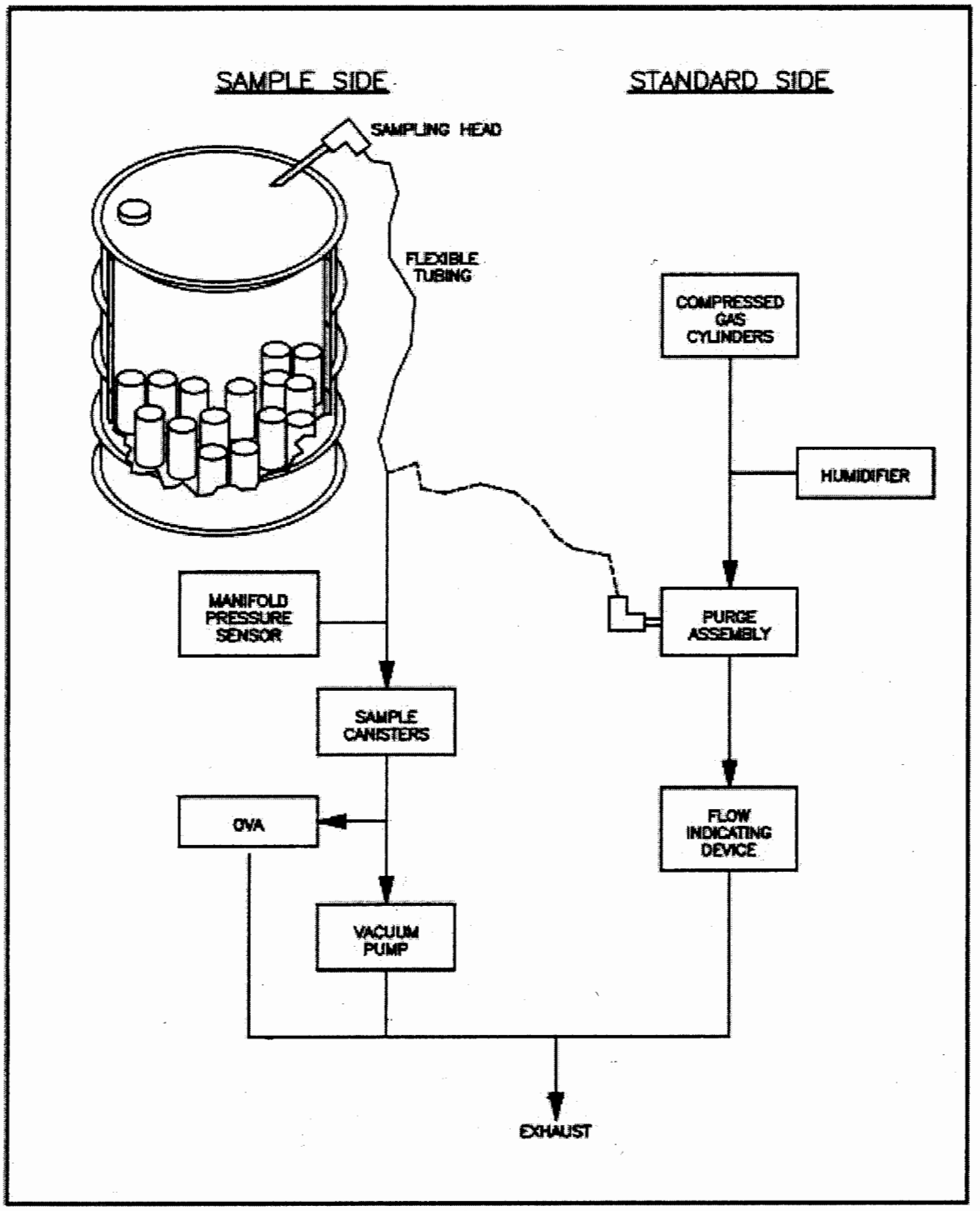

Figure C1-2
Headspace Sampling Manifold

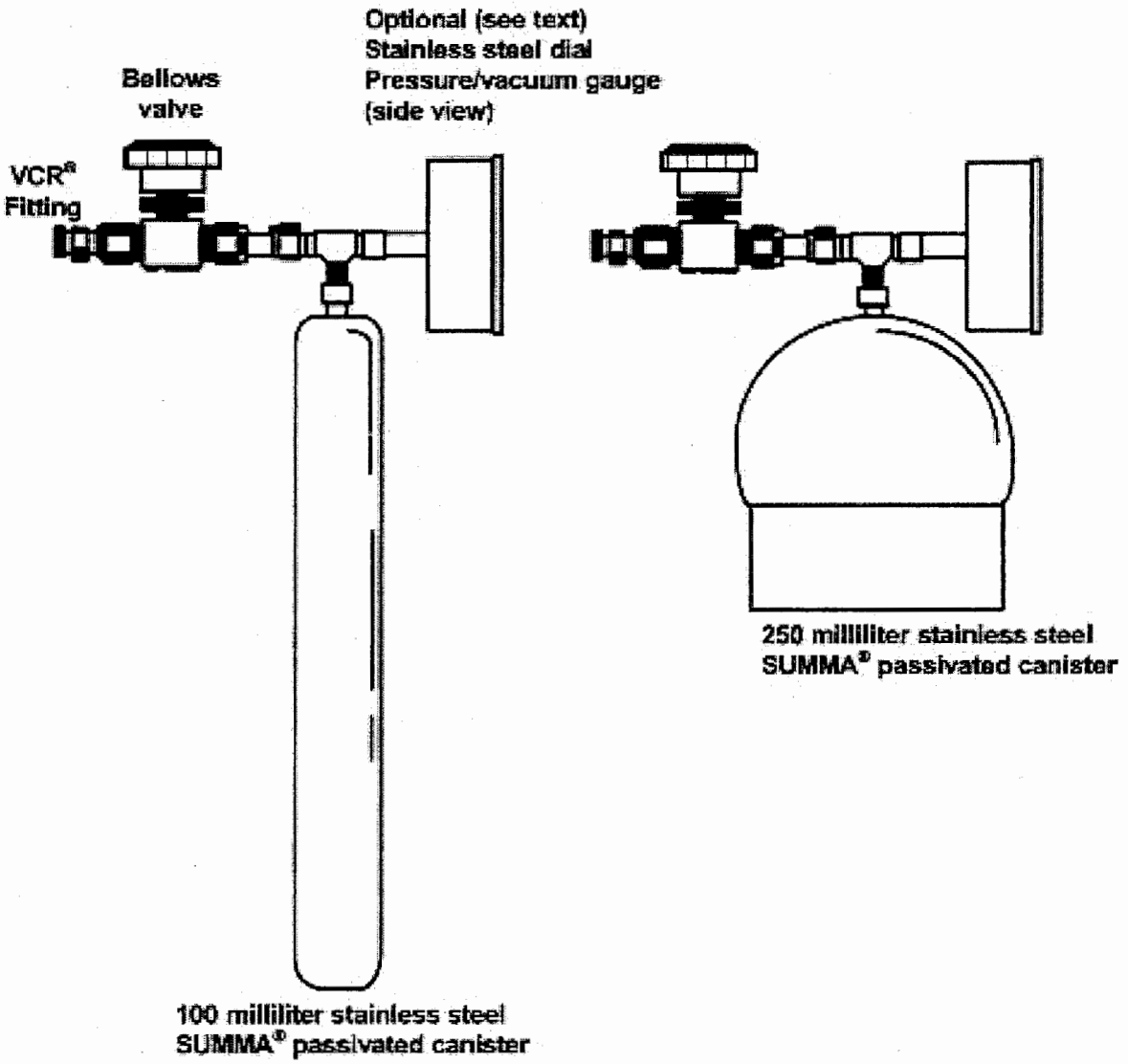

Figure C1-3
SUMMA® Canister Components Configuration (Not to Scale)

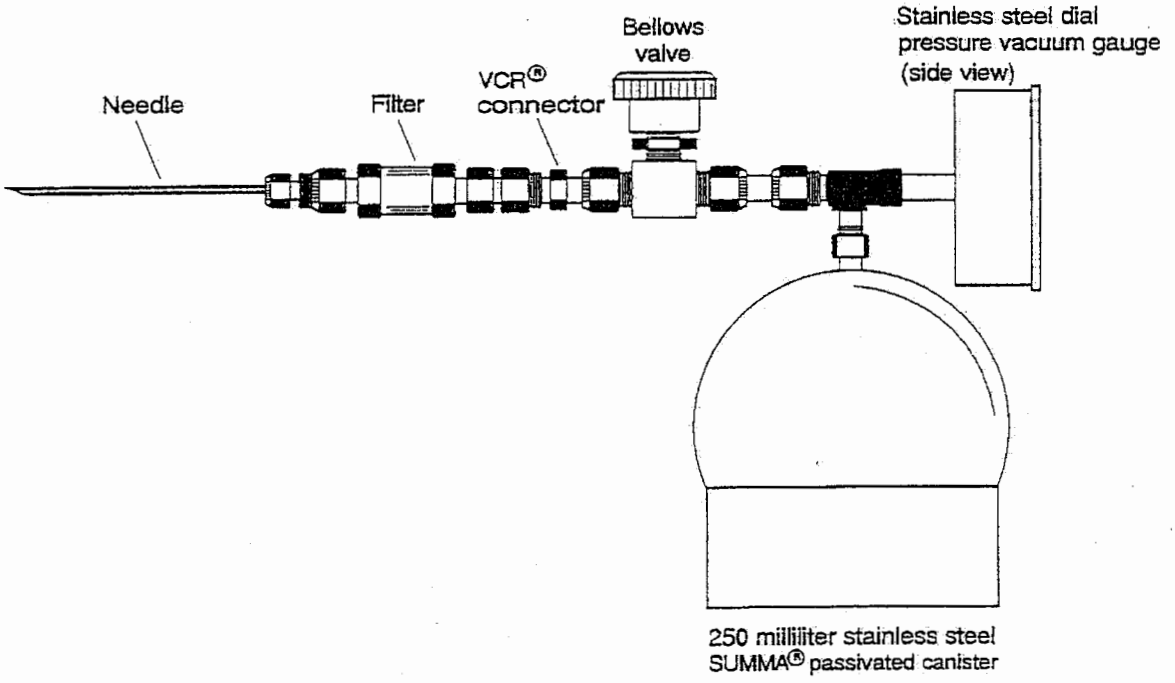

Figure C1-4
Schematic Diagram of Direct Canister with the Poly Bag Sampling Head

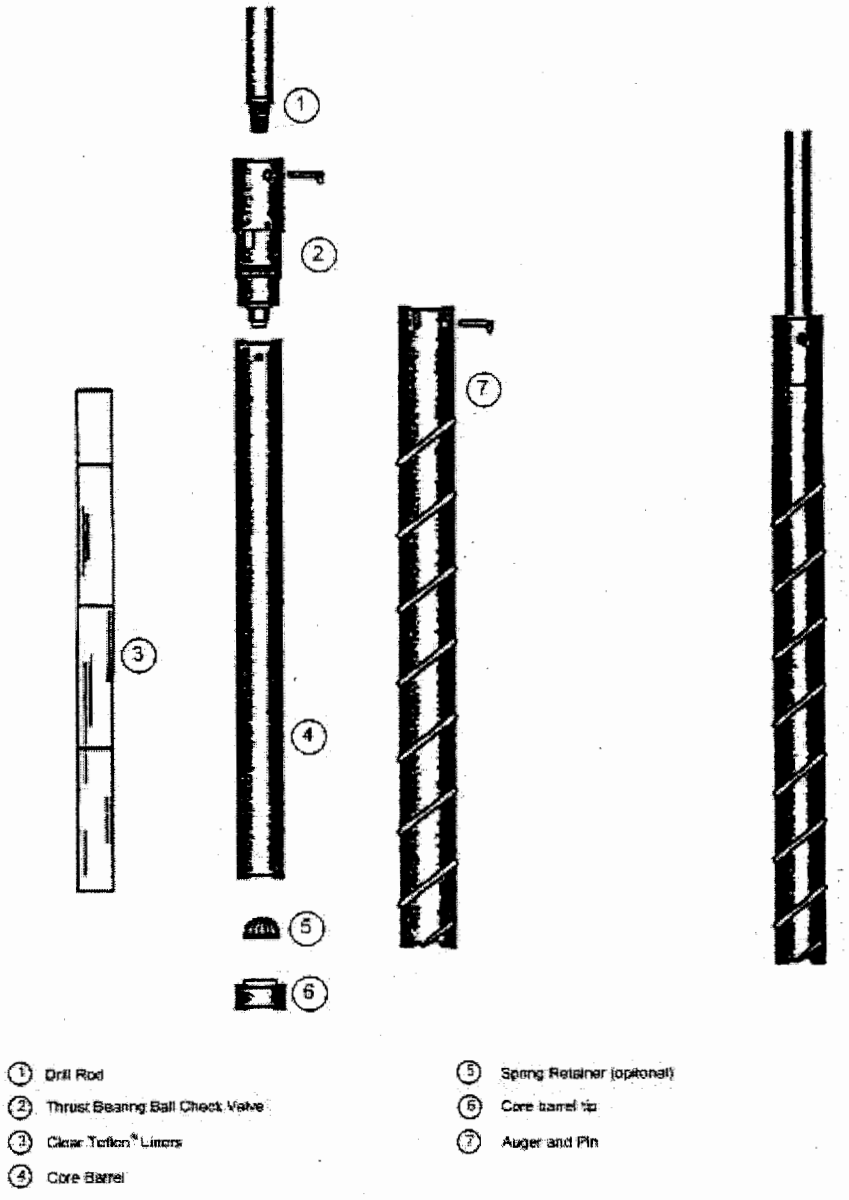

Figure C1-5
Rotational Coring Tool (Light Weight Auger)

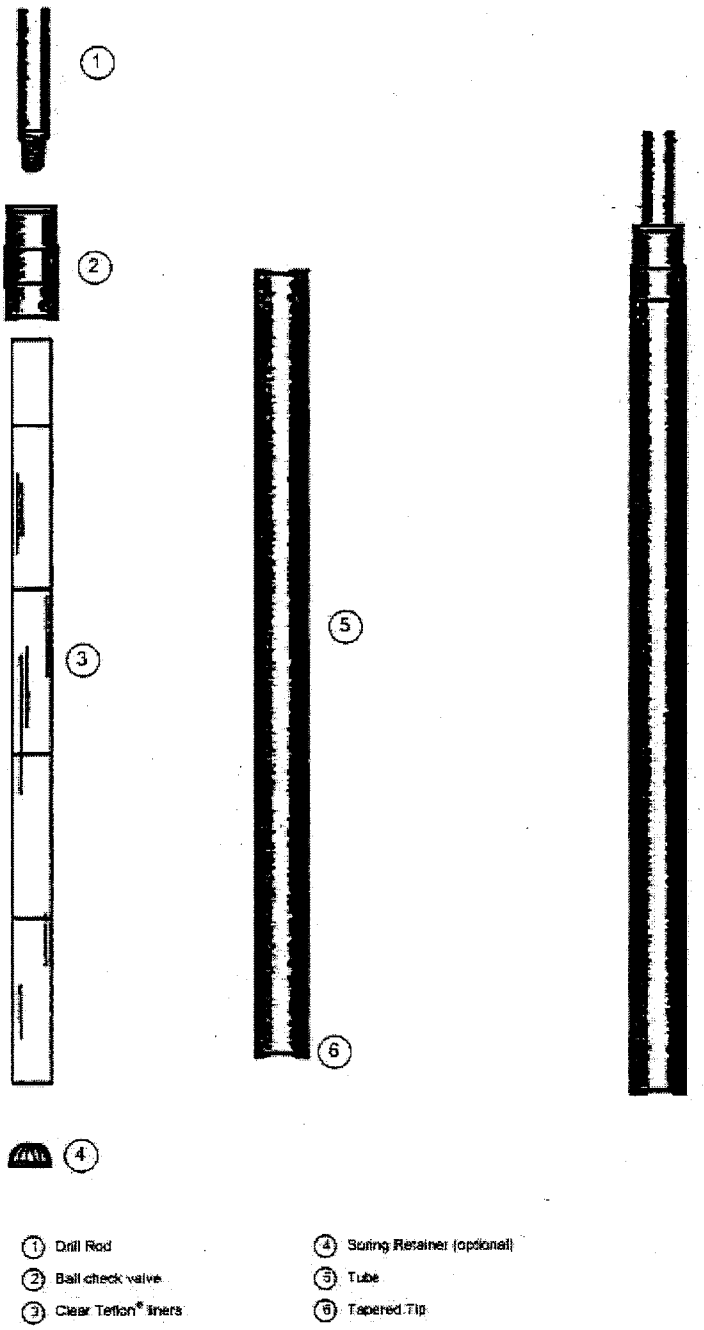

Figure C1-6
Non-Rotational Coring Tool (Thin Walled Sampler)

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ATTACHMENT C2

STATISTICAL METHODS USED IN SAMPLING AND ANALYSIS

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ATTACHMENT C2

STATISTICAL METHODS USED IN SAMPLING AND ANALYSIS

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Figure C2-1	Approach for Solid and Headspace Gas Sampling and Analysis to Obtain Additional Waste Characterization Information

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ATTACHMENT C2

STATISTICAL METHODS USED IN SAMPLING AND ANALYSIS

Introduction

The Permittees shall require generator/storage sites (**sites**) to use the following statistical methods for sampling and analysis of TRU mixed waste which is managed, stored, or disposed at WIPP, unless determined unnecessary by the U.S. Department of Energy (**DOE**) as a result of an Acceptable Knowledge (AK) Sufficiency Determination. These statistical methods include methods for selecting waste containers for totals analysis, selecting waste containers for headspace gas sampling and analysis, and setting the upper confidence limit.

C2-1 Approach for Selecting Waste Containers for Statistical Sampling

C2-1a Statistical Selection of Containers for Totals Analysis

The statistical approach for characterizing retrievably stored and newly generated homogeneous solids (S3000) and soil/gravel (S4000) waste and repackaged or treated S3000 waste relies on using acceptable knowledge to segregate waste containers into relatively homogeneous waste streams. Using acceptable knowledge, generator/storage sites will classify the entire waste stream as hazardous or nonhazardous rather than individual waste containers. Individual waste containers serve as convenient units for characterizing the combined mass of waste from the waste stream of interest. Once segregated by waste stream, random selection and sampling of the waste containers followed by analysis of the waste samples shall be performed to ensure that the resulting mean contaminant concentration provides an unbiased representation of the true mean contaminant concentration for each waste stream. The Permittees shall require each site project manager to verify that the samples collected from within a waste stream were selected randomly.

An end use of analytical results for retrievably stored homogeneous solids and soil/gravel is for assigning the Environmental Protection Agency (**EPA**) hazardous waste numbers associated with toxicity characteristic waste (D-numbers) that apply to each mixed waste stream. The toxicity characteristic D-numbers are indicators that the waste exhibits the toxicity characteristic for specific contaminants under the Resource Conservation and Recovery Act (**RCRA**). The RCRA-toxicity determination is made on the basis of sampling and analysis of waste streams and on whether or not the waste stream includes F-number wastes. If a waste stream includes one or more RCRA F-numbers identified via acceptable knowledge, toxicity characteristic contaminants associated with the F-number waste(s) are not included in the RCRA-toxicity characteristic determination. That is, the F-numbers take precedence over RCRA-toxicity D-number, and the waste stream is assumed hazardous regardless of the concentration. Therefore, toxicity characteristics contaminants associated with F-numbers for a waste stream shall be omitted from all calculations for determining the number of containers to sample because these wastes streams are assumed to be hazardous. In addition, each toxicity characteristic contaminant associated with the F-number(s) shall be excluded from evaluation of analytical results to determine D-numbers. Contaminants of interest for the sampling, analysis, and RCRA-toxicity determination of a waste stream, then, excludes contaminants associated with F-numbers that have been assigned to the waste stream.

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The sampling and analysis strategy is illustrated in Figure C2-1. Preliminary estimates of the mean concentration and variance of each RCRA regulated contaminant in the waste will be used to determine the number of waste containers to select for sampling and analysis. Preliminary estimates will be based on a minimum of five samples selected randomly from the waste stream. If the entire waste stream is not accessible for sampling then a minimum of five preliminary samples will be selected randomly from the accessible population. As the rest of the waste stream is retrieved or generated, additional selected containers will be sampled as provided below and the analytical results will be reported to the Permittees. Samples collected to establish preliminary estimates that are selected, sampled, and analyzed using a DOE approved laboratory in accordance with applicable provisions of the WAP may be used as part of the required number of samples to be collected. The applicability of the preliminary estimates to the waste stream to be sampled shall be justified and documented. The preliminary estimates will be determined in accordance with the following equations:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad \text{(C2-1)}$$

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2 \qquad \text{(C2-2)}$$

Where:

$\bar{x}$ = the calculated mean.
s^2 = the calculated concentration variance.
n = the number of samples analyzed.
x_i = the concentration determined in the *ith* sample.
i = an index from 1 to n.

Based upon the preliminary estimates of $\bar{x}$ and s^2 for each chemical contaminant of concern, estimate the appropriate minimum number of samples (*n*) to be collected for each contaminant using the following formula from SW-846 (EPA 1996):

$$n = \frac{t^2_{\alpha,n_0-1}\, s^2}{\left(RT - \bar{x}\right)^2} \qquad \text{(C2-3)}$$

Where:

n_0 = the initial number of samples used to calculate the preliminary estimates.
n = the calculated minimum number of samples to be collected.
$t_{\alpha,n-1}$ = the 90th percentile for the *t* distribution with n_0-1 degrees of freedom.
RT = the Regulatory Threshold of the contaminant (TC limit for toxicity characteristic wastes, PRQL for listed wastes)

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The number of samples to be collected will be based upon the largest *n* calculated for each of the contaminants of concern. The actual number of samples collected shall be adjusted as necessary to ensure that an adequate number of samples are collected to allow for acceptable levels of completeness.

Non-integer results of calculations for the required sample size should be rounded up to the next integer. A minimum of five containers shall be sampled and analyzed in each waste stream. If there are fewer containers than the minimum or required number of samples in a waste stream, one or more randomly selected containers shall be sampled more than once to obtain the number of needed samples of the waste. Otherwise any one container may be selected for sampling only once.

The calculated total number of required waste containers will then be randomly sampled and analyzed using a DOE approved laboratory. Waste container samples from the preliminary mean and variance estimates may be counted as part of the total number of calculated required samples if and only if:

- There is documented evidence that the waste containers for the preliminary estimate samples were selected in the same random manner as is chosen for the required samples.

- There is documented evidence that the method of sample collection in the preliminary estimate samples were identical to the methodology to be employed for the required samples.

- There is documented evidence that the method of sample analysis in the preliminary estimate samples were identical to the analytical methodology employed for the required samples.

- There is documented evidence that the validation of the sample analyses in the preliminary estimate samples were comparable to the validation employed for the required samples. In addition, the validated samples results shall indicate that all sample results were valid according to the analytical methodology.

If only a portion of a waste stream is accessible for sampling (e.g., the remainder of the waste stream will be recovered from storage at the generator/storage site, or only a portion of the waste stream has been repackaged, treated, or generated), the calculated number of samples will be randomly selected from the accessible portion of the waste stream. A minimum of five randomly selected samples will be obtained and analyzed from the accessible portion of the waste stream. DOE may approve the WSPF and authorize the generator/storage site to begin shipping the waste stream to WIPP once the analytical data for the randomly selected samples from the accessible portion of the waste stream have been obtained.

The generator/storage site will also randomly select the calculated number of sample locations from the waste stream as a whole. A minimum of five randomly selected sample locations will be selected from the waste stream as a whole. As those randomly selected locations (e.g., buried or newly generated waste containers) become accessible for sampling, samples will be obtained and analyzed.

For those waste streams where the population of the waste stream as a whole is indeterminate (e.g., continually generated waste streams from ongoing processes) or to facilitate waste processing, the generator/storage site may divide the waste stream into lots. In this case, a minimum of five randomly selected sample locations will be selected from within each subsequent lot. As those randomly selected locations (e.g., buried or newly generated waste containers) become accessible, samples will be obtained and analyzed. As with sampling from the waste stream as a whole, the generator/storage site may ship waste from the lot being generated or retrieved prior to completing sampling and analysis of the lot.

The generator/storage site will use the data to update the UCL_{90} values for the waste stream as described in Section C2-2a and assign EPA hazardous waste numbers as appropriate. The generator/storage sites will submit the analytical data from subsequent sampling to the Permittees for inclusion in the WIPP facility operating record upon completion of project level data validation in Permit Attachment C3, Section C3-10b. If changes to EPA hazardous waste numbers are required as a result of subsequent sampling, the generator/storage site will notify the Permittees and shipments of the affected waste stream shall be suspended until DOE approves a revised WSPF for the affected waste stream.

Upon collection and analysis of the preliminary samples, or at any time after the preliminary samples have been analyzed, the generator/storage site may presumptively assign hazardous waste numbers to a waste stream even if the calculated number of required samples is greater than the preliminary number of samples collected. For waste streams with calculated upper confidence limits below the regulatory threshold, the site shall collect the required number of samples if the site intends to establish that the constituent is below the regulatory threshold.

C2-1b Statistical Selection of Containers for Headspace Gas Analysis

Headspace gas sampling of a waste stream may be done on a randomly selected portion of containers in the waste stream. The minimum number of containers, *n*, that must be sampled is determined by taking an initial VOC sample from ten randomly selected containers. These samples are analyzed for all the target analytes analytes using a DOE approved laboratory. The standard deviation, *s*, is calculated for each of the nine VOCs in Part 4, Table 4.4.1. The value of *n* is determined as the largest number of samples (not to exceed the number of containers in the waste stream or waste stream lot) calculated using the following equation:

$$n_{voc_i} = \frac{t^2_{\alpha,n-1}{}^3 \, e_{voc_i}}{E^2_{voc_i}} \qquad \text{(C2-4)}$$

Where:

n_{voci} = the number of samples needed to representatively sample the waste stream for the VOC_i from Table 4.4.1
$t_{\alpha,n-1}$ = the 90th percentile of the *t* distribution with *n*-1 degrees of freedom
s_{evoci} = the estimated standard deviation, based on the initial *n* samples, for VOC_i from Table 4.4.1
E_{voci} = the allowable error determined as 1 percent of the limiting concentration for VOC_i from Table 4.4.1

Non-integer results of calculations for the required sample size should be rounded up to the next integer. A minimum of ten containers shall be sampled and analyzed in each waste stream. If there are fewer containers than the minimum or required number of samples in a waste stream, then each container should be sampled once.

The calculated total number of required waste containers will then be randomly sampled and analyzed. Waste container samples from the preliminary mean and variance estimates may be counted as part of the total number of calculated required samples if and only if:

- There is documented evidence that the waste containers for the preliminary estimate samples were selected in the same random manner as is chosen for the required samples.

- There is documented evidence that the method of sample collection in the preliminary estimate samples were identical to the methodology to be employed for the required samples.

- There is documented evidence that the method of sample analysis in the preliminary estimate samples were identical to the analytical methodology employed for the required samples.

- There is documented evidence that the validation of the sample analyses in the preliminary estimate samples were comparable to the validation employed for the required samples. In addition, the validated samples results shall indicate that all sample results were valid according to the analytical methodology.

The mean and standard deviation calculated after sampling *n* containers can be used to calculate a UCL_{90} for each of the headspace gas VOCs using the methodology presented in Section C2-2b.

If only a portion of a waste stream is accessible for sampling (e.g., the remainder of the waste stream will be recovered from storage at the generator/storage site or only a portion of the waste stream has been repackaged or treated), the calculated number of samples will be randomly selected from the accessible portion of the waste stream. A minimum of ten randomly selected samples will be obtained and analyzed from the accessible portion of the waste stream. DOE may approve the WSPF and authorize the generator/storage site to begin shipping the waste stream to WIPP once the analytical data for the randomly selected samples from the accessible portion of the waste stream has been obtained.

The generator/storage site will also randomly select the calculated number of sample locations from the waste stream as a whole. A minimum of ten randomly selected sample locations will be selected from the waste stream as a whole. As those randomly selected locations (e.g., buried or newly generated waste containers) become accessible for sampling, samples will be obtained and analyzed.

For those waste streams where the population of the waste stream as a whole is indeterminate (e.g., continually generated waste streams from ongoing processes) or to facilitate waste processing, the generator/storage site may divide the waste stream into lots. In this case, a minimum of ten randomly selected containers will be selected from within each subsequent lot. As those randomly selected containers (e.g., buried or newly generated waste containers)

become accessible, samples will be obtained and analyzed. As with sampling from the waste stream as a whole, the generator/storage site may ship waste from the lot being generated or retrieved prior to completing sampling and analysis of the lot.

The generator/storage site will use the data to update the UCL_{90} values for the waste stream as described in Section C2-2b and assign EPA hazardous waste numbers as appropriate. The generator/storage sites will submit the analytical data from subsequent sampling to the Permittees for inclusion in the WIPP facility operating record upon completion of project level data validation in Permit Attachment C3, Section C3-10b. If changes to EPA hazardous waste numbers are required as a result of subsequent sampling, the generator/storage site will notify the Permittees, and shipments of the affected waste stream shall be suspended until DOE approves a revised WSPF for the affected waste stream.

Upon collection and analysis of the preliminary samples, or at any time after the preliminary samples have been analyzed, the generator/storage site may presumptively assign hazardous waste numbers to a waste stream even if the calculated number of required samples is greater than the preliminary number of samples collected. For waste streams with calculated upper confidence limits below the regulatory threshold, the site shall collect the required number of samples if the site intends to establish that the constituent is below the regulatory threshold.

C2-2 Upper Confidence Limits for Statistical Sampling

C2-2a Upper Confidence Limit for Statistical Solid Sampling

Upon completion of the required sampling, final mean and variance estimates and the UCL_{90} for the mean concentration for each contaminant shall be determined. The observed sample n^* shall be checked against the preliminary estimate for the number of samples (n) to be collected before proceeding, where n* is:

$$n^* = \frac{t^2_{\alpha,n-1}\, s^2}{\left(RT - \bar{x}\right)^2} \qquad \text{(C2-5)}$$

and the right-side terms in the equation are as defined in Section C2-1a.

If the observed sample n^* estimate results in greater than 20 percent or more required samples than were originally calculated, then the additional samples required to fulfill the revised sample estimate shall be collected and analyzed. The determination of n^* is an iterative process that follows the collection and analysis of any additional samples and continues until the difference between n^* and the previous sample size determination is less than 20 percent.

Once sufficient sampling and analysis has occurred, the waste characterization will proceed. The assessment will be made at the 90 percent confidence level. The UCL_{90} for the mean concentration of each contaminant will be calculated using the following equation from OSWER 9285.6-10 (EPA 2002):

$$UCL_{90} = \bar{x} + \frac{t_{\alpha,n-1}s}{\sqrt{n}} \quad \text{(C2-6)}$$

If the UCL_{90} for the mean concentration is less than the regulatory threshold limit, the waste stream is not required to be assigned the hazardous waste number for the associated contaminant. If the UCL_{90} is greater than or equal to the regulatory threshold limit, the waste stream will be assigned the hazardous waste number for the associated contaminant.

C2-2b Upper Confidence Limit for Statistical Headspace Gas Sampling

A UCL_{90} concentration for each of the headspace gas VOCs must be calculated from the sample data collected. The observed sample n^* shall be checked against the estimate for the number of samples (n) to be collected before proceeding, where n* is:

$$n^* = \frac{t^2{}_{\alpha,n-1}\, s^2}{E^2} \quad \text{(C2-7)}$$

where E is as defined in Section C2-1b and the remaining right-side terms in the equation are defined in Section C2-1a. When composite headspace gas sample results are used, the mean, standard deviation, and t-statistic are based on the number of composite samples analyzed, rather than the number of containers sampled.

If the observed sample n^* estimate results in greater than 20 percent or more required samples than were originally calculated, then the additional samples required to fulfill the revised sample estimate shall be collected and analyzed. The determination of n^* is an iterative process that follows the collection and analysis of any additional samples and continues until the difference between n^* and the previous sample size determination is less than 20 percent. The UCL_{90} is then calculated using equation C2-6. In this case, UCL_{90} is the 90 percent upper confidence limit for the mean VOC concentration, $\bar{x}$ is the calculated sample mean VOC concentration and s is the calculated sample standard deviation. The value of $t_{(\alpha,n-1)}$ is found in Table 9-2 of Chapter 9 of SW-846 (EPA, 1996).

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References

U.S. EPA, 1996. *Test Methods for Evaluating Solid Waste.* SW-846, Office of Solid Waste and Emergency Response, Washington DC.

U.S. EPA, 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* OSWER 9285.6-10, Office of Emergency and Remedial Response, Washington DC.

FIGURES

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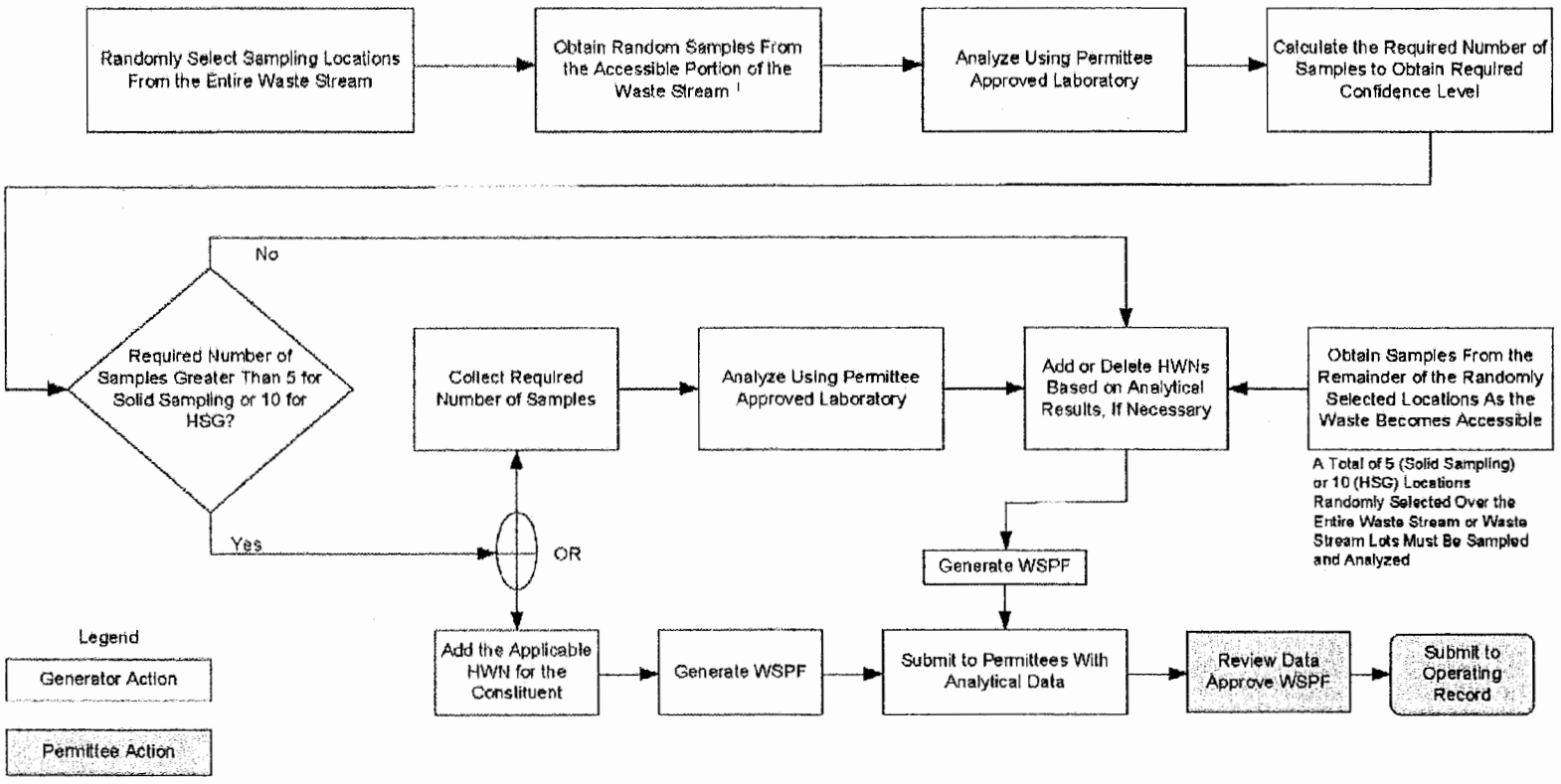

[1] Samples Are Obtained From the First Five Accessible Random Locations for Solid Sampling and the First Ten Accessible Random Locations for Headspace Gas Sampling

Figure C2-1
Approach for Solid and Headspace Gas Sampling and Analysis to Obtain Additional Waste Characterization Information

ATTACHMENT C3

QUALITY ASSURANCE OBJECTIVES AND DATA VALIDATION TECHNIQUES FOR WASTE CHARACTERIZATION SAMPLING AND ANALYTICAL METHODS

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ATTACHMENT C3

QUALITY ASSURANCE OBJECTIVES AND DATA VALIDATION TECHNIQUES FOR WASTE CHARACTERIZATION SAMPLING AND ANALYTICAL METHODS

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ATTACHMENT C3

QUALITY ASSURANCE OBJECTIVES AND DATA VALIDATION TECHNIQUES FOR WASTE CHARACTERIZATION SAMPLING AND ANALYTICAL METHODS

C3-1 Validation Methods

The Permittees shall require the generator/storage sites (**sites**) to perform validation of all data (qualitative as well as quantitative) so that data used for Waste Isolation Pilot Plant (**WIPP**) compliance programs will be of known and acceptable quality. Validation includes a quantitative determination of precision, accuracy, completeness, and method detection limits (as appropriate) for analytical data (headspace Volatile Organics Compounds (**VOC**), total VOCs, Semivolatile Organic Compounds (**SVOC**), and metals data). Quantitative data validations shall be performed according to the conventional methods outlined below (equations C3-1 through C3-8). These quantitative determinations will be compared to the Quality Assurance Objectives (**QAOs**) specified in Sections C3-2 through C3-9. A qualitative determination of comparability and representativeness will also be performed.

The qualitative data or descriptive information generated by radiography and visual examination is not amenable to statistical data quality analysis. However, radiography and visual examination are complementary techniques yielding similar data for determining the waste matrix code. The waste matrix code is determined to ensure that the container is properly included in the appropriate waste stream.

Data validation will be used to assess the quality of waste characterization data collected based upon project precision, accuracy, completeness, comparability, and representativeness objectives. These objectives are described below:

Precision

Precision is a measure of the mutual agreement among multiple measurements of a single analyte, either by the same method or by different methods. Precision is either expressed as the relative percent difference (**RPD**) for duplicate measurements or as the percent relative standard deviation (**%RSD**) for three or more replicate measurements. For duplicate measurements, the precision expressed as the RPD is calculated as follows:

$$RPD = \frac{C_1 - C_2}{\frac{(C_1 + C_2)}{2}} \times 100 \qquad \text{(C3-1)}$$

where C_1 and C_2 are the two values obtained by analyzing the duplicate samples. C_1 is the larger of the two observed values.

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For three or more replicate measurements, the precision expressed as the %RSD is calculated as follows:

$$\%RSD = \frac{s}{y_{mean}} \times 100 \quad \text{(C3-2)}$$

where s is the standard deviation and y_{mean} is the mean of the replicate sample analyses.

The standard deviation, s, is calculated as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (y_i - y_{mean})^2}{n - 1}} \quad \text{(C3-3)}$$

where y_i is the measured value of the *i*th replicate sample analysis measurement, and n equals the number of replicate analyses.

Another aspect of precision is associated with analytical equipment calibration. In these instances, the percent difference (**%D**) between multiple measurements of an equipment calibration standard shall be calculated as follows:

$$\%D = \frac{|C_1 - C_2|}{C_1} \times 100 \quad \text{(C3-4)}$$

where C_1 is the initial measurement and C_2 is the second or other additional measurement.

Accuracy

Accuracy is the degree of agreement between a measured analyte concentration (or the average of replicate measurements of a single analyte concentration) and the true or known concentration. Accuracy is determined as the percent recovery (**%R**).

For situations where a standard reference material is used, the %R is calculated as follows:

$$\%R = \frac{C_m}{C_{srm}} \times 100 \quad \text{(C3-5)}$$

where C_m is the measured concentration value obtained by analyzing the sample and C_{srm} is the "true" or certified concentration of the analyte in the sample.

For measurements where matrix spikes are used, the %R is calculated as follows:

$$\%R = \frac{S - U}{C_{SC}} \times 100 \quad \text{(C3-6)}$$

where S is the measured concentration in the spiked aliquot, U is the measured concentration in the unspiked aliquot, and C_{SC} is the actual concentration of the spike added.

Method Detection Limit

The method detection limit (**MDL**) is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The MDL for all quantitative measurements (except for those using Fourier Transform Infrared Spectroscopy [**FTIRS**]) is defined as follows:

$$MDL = t_{(n-1,1-\alpha=.99)} \times s \qquad \text{(C3-7)}$$

where $t_{(n-1,1-\alpha=.99)}$ is the t-distribution value corresponding to a 99 percent confidence level with n-1 degrees of freedom, n is the number of observations, and s is the standard deviation of replicate measurements.

For headspace-gas analysis using FTIRS, MDL is defined as follows:

$$MDL = 3s \qquad \text{(C3-8)}$$

where s is the standard deviation. Initially, a minimum of seven samples spiked at a level of three to five times the estimated MDL and analyzed on non-consecutive days must be used to establish the MDLs. MDLs should be updated using the results of the laboratory control sample or on-line control samples.

Completeness

Completeness is a measure of the amount of valid data obtained from the overall measurement system compared to the amount of data collected and submitted for analysis. Completeness must be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. Completeness, expressed as the percent complete (**%C**), is calculated as follows:

$$\%C = \frac{V}{n} \times 100 \qquad \text{(C3-9)}$$

where V is the number of valid sampling or analytical results obtained and n is the number of samples submitted for analysis.

Comparability

Comparability is the degree to which one data set can be compared to another. Comparability of data generated at different sites will be ensured through the use of standardized, approved testing, sampling, preservation, and analytical techniques and by meeting the QAOs specified in Sections C3-2 through C3-9.

The comparability of waste characterization data shall be ensured through the use of generator/storage site data usability criteria. The Permittees shall ensure that data usability

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criteria are consistently established and used by the generator/storage sites to assess the usability of analytical and testing data. The criteria shall address. as appropriate, the following:

Definition or reference of criteria used to define and assign data qualifier flags based on Quality Assurance Objective results,

Criteria for assessing the usability of data impacted by matrix interferences,

Criteria for assessing the usability of data based upon positive and negative bias as indicated by quality control data, of data qualifiers, and qualifier flags,

Criteria for assessing the usability of data due to

Severe matrix effects,
Misidentification of compounds,
Gross exceedance of holding times,
Failure to meet calibration or tune criteria

Criteria for assessing the usability of data that does not meet minimum detection limit requirements.

The Permittees shall be responsible for evaluating generator/storage site data usability and the U.S. Department of Energy (**DOE**) shall assess implementation through the generator/storage site audit.

Representativeness

Representativeness is the degree to which sample data represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that concerns the proper design of the sampling program.

Representativeness of waste containers from waste streams subjected to headspace gas, homogeneous solids, and soil/gravel sampling and analysis will be validated, through documentation, that a true random sample with an adequate population was identified and collected consistent with Permit Attachment C2, Section C2-1. Since representativeness is a quality characteristic that expresses the degree to which a sample or group of samples represents the population being studied, the random selection of waste containers ensures representativeness on a Program level. The Permittees shall require the Site Project Manager to document that the selected waste containers from within a waste stream were randomly selected. Sampling personnel shall verify that proper procedures are followed to ensure that samples are representative of the waste contained in a particular waste container or a waste stream.

Identification of Tentatively Identified Compounds

In accordance with SW-846 convention, identification of compounds detected by gas chromatography/mass spectrometry methods that are not on the list of target analytes shall be reported. Both composited and individual container headspace gas, volatile analysis (TCLP/Totals), and semi-volatile (TCLP/Totals) shall be subject to tentatively identified

compound (**TIC**) reporting. These TICs for GC/MS Methods are identified in accordance with the following SW-846 criteria:

Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

The relative intensities of the major ions should agree within ± 20 percent.

Molecular ions present in the reference spectrum should be present in the sample spectrum.

Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks.

The reference spectra used for identifying TICs shall include, at minimum, all of the available spectra for compounds that appear in the 20.4.1.200 NMAC (incorporating 40 CFR Part 261) Appendix VIII list. The reference spectra may be limited to VOCs when analyzing headspace gas samples.

TICs for headspace gas analyses that are performed through FTIRS analyses shall be identified in accordance with the specifications of SW-846 Method 8410.

TICs shall be reported as part of the analytical batch data reports for GC/MS Methods in accordance with the following minimum criteria:

a TIC in an individual container headspace gas or solids sample shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 10% of the area of the nearest internal standard.

a TIC in a composited headspace gas sample that contains 2 to 5 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 2% of the area of the nearest internal standard.

a TIC in a composited headspace gas sample that contains 6 to 10 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 1% of the area of the nearest internal standard.

a TIC in a composited headspace gas sample that contains 11 to 20 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 0.5% of the area of the nearest internal standard.

TICs that meet the SW-846 identification criteria, are reported in 25 percent of all waste containers sampled from a given waste stream, and that appear in the 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII list, will be compared to acceptable knowledge data to determine if the TIC is a listed waste in the waste stream. TICs identified through headspace gas analyses that meet the Appendix VIII list criteria and the 25 percent reporting criteria for a waste stream will be added to the headspace gas waste stream target list regardless of the hazardous waste listing associated with the waste stream. TICs reported from the Totals VOC or SVOC analyses may be excluded from the target analyte list for a waste stream if the TIC is a constituent in an F-listed waste whose presence is attributable to waste packaging materials or radiolytic degradation from acceptable knowledge documentation. If a listed waste constituent TIC cannot be attributed to waste packaging materials, radiolysis, or other origins, the constituent will be added to the target analyte list and new hazardous waste numbers will be assigned, if appropriate. TICs subject to inclusion on the target analyte list that are toxicity characteristic parameters shall be added to the target analyte list regardless of origin because the hazardous waste designation for these numbers is not based on source. However, for toxicity characteristic and non-toxic F003 constituents, the site may take concentration into account when assessing whether to add a hazardous waste number. If a target analyte list for a waste stream is expanded due to the presence of TICs, all subsequent samples collected from that waste stream will be analyzed for constituents on the expanded list.

C3-2 Headspace-Gas Sampling

Quality Assurance Objectives

The precision and accuracy of the container headspace-gas sampling operations must be assessed by analyzing field QC headspace-gas samples. These samples must include equipment blanks, field reference standards, field blanks, and field duplicates. If the QAOs described below are not met, a nonconformance report must be prepared, submitted, and resolved (Section C3-13).

Precision

The precision of the headspace-gas sampling and analysis operation must be assessed by sequential collection of field duplicates for manifold sampling operations or simultaneous collection of field duplicates for direct canister sampling operations for VOCs determination. Corrective actions must be taken if the RPD exceeds 25 percent for any analyte found greater than the PRQL in both of the duplicate samples.

Accuracy

A field reference standard must be collected using headspace-gas sampling equipment to assess the accuracy of the headspace-gas sampling operation at a frequency of one field reference standard for every 20 containers sampled or per sampling batch. Corrective action must be taken if the %R of the field-reference standard is less than 70 or greater than 130.

Field blanks must also be collected at a frequency of 1 field blank for every 20 containers or sampling batch sampled to assess possible contamination in the headspace gas sampling method. Equipment blanks must also be collected at a frequency of 1 equipment blank for each equipment cleaning batch to assess possible contamination in the equipment cleaning method.

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Corrective actions must be taken if the blank exceeds three times the MDLs listed for any of the compounds listed in Table C3-2.

Completeness

Sampling completeness shall be expressed as the number of valid samples collected as a percent of the total number of samples collected for each waste stream A valid sample is defined as a sample collected in accordance with approved sampling methods and the container was properly prepared for sampling (e.g., the polyliner was vented to the container headspace). The Permittees shall require participating sampling facilities to achieve a minimum 90 percent completeness. The amount and type of data that may be lost during the headspace-gas sampling operation cannot be predicted in advance. The Permittees shall require the Site Project Manager to evaluate the importance of any lost or contaminated headspace-gas samples and take corrective action as appropriate.

Comparability

Consistent use and application of uniform procedures and equipment, as specified in Permit Attachment C1 and application of data usability criteria, should ensure that headspace gas sampling operations are comparable when sampling headspace at the different sampling facilities. The Permittees shall require each site to take corrective actions if uniform procedures, equipment, or operations are not followed without approved and justified deviations. In addition, laboratories analyzing samples must successfully participate in the Performance Demonstration Program (**PDP**) (DOE, 2003).

Representativeness

Specific headspace-gas sampling steps to ensure samples are representative include:

- Selection of the correct Drum Age Criteria (**DAC**) Scenario and waste packaging configuration and meeting DAC equilibrium times.
- A sample canister cleaning and leak check after assembly
- Sampling equipment cleaning or disposal after use
- Sampling equipment leak check after sample collection
- Use of sample canisters with passivated internal surfaces
- Use of low-internal-volume sampling equipment
- Collection of samples with a low-sample volume to available headspace volume ratio (less than 10 percent of the headspace when the headspace can be determined)
- Careful and documented pressure regulation of all activities specified in Attachment C1, Section C1-1
- Performance audits

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Collection of equipment blanks, field reference standard, field blanks, and field duplicates at the specified frequencies.

Manifold pressure sensors and temperature sensors calibrated before initial use and annually using NIST, or equivalent standards.

OVA calibrated daily, prior to first use, or as necessary according to manufacturer's specifications.

Failure to perform the checks at the prescribed frequencies would result in corrective actions.

C3-3 Sampling of Homogeneous Solids and Soils/Gravel

Quality Assurance Objectives

To ensure that sampling is conducted in a representative manner on a waste-stream basis for waste containers containing homogeneous solids and soil/gravel, samples must be collected randomly in both the horizontal and vertical planes of each container's waste. For waste containers that contain homogeneous solids and soil/gravel in smaller containers (e.g., 1 gal [4.0 L] poly bottles) within the waste container, one randomly chosen smaller container must be sampled from each container.

Precision

Sampling precision must be determined by collecting and sampling field duplicates (e.g., co-located cores or co-located samples as described in Permit Attachment C1-2b(1)) once per sampling batch or once per week during sampling operations, whichever is more frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which must be collected within 14 days of the first sample in the batch. The Permittees shall require the Site Project Manager to calculate and report the RPD between co-located core/samples.

The recommended method for establishing acceptance criteria for co-located cores and co-located samples is the F-test method because the F-Test: 1) does not require potentially arbitrary groupings into batches, 2) is based on exact distributions, and 3) is more likely to detect a change in the process. When a sufficient number of samples are collected (25 to 30 pairs of co-located cores or samples), control charts of the RPD will be developed for each constituent and for each waste matrix or waste type (e.g., pyrochemical salts or organic sludges). The limits for the control chart will be three standard deviations above or below the average RPD. Once constructed, RPDs for additional co-located pairs will be compared with the control chart to determine whether or not the co-located cores are acceptable. Periodically, the control charts will be updated using all available data.

The statistical test will involve calculating the variance for co-located cores and samples by pooling the variances computed for each pair of duplicate results. The variance for the waste stream will be computed excluding any data from containers with co-located cores, because the test requires the variance estimates to be independent. All data must be transformed to normality prior to computing variances and performing the test. The test hypothesis is evaluated using the F distribution and the method for testing the difference in variances.

Accuracy

Sampling accuracy through the use of standard reference materials shall not be measured. Because waste containers containing homogeneous solids and soil/gravel with known quantities of analytes are not available, sampling accuracy cannot be determined. However, sampling methods and requirements described are designed to minimize sample degradation and hence maximize sampling accuracy.

Sampling accuracy as a function of sampling cross-contamination will be measured. Equipment blanks will be collected at a frequency of once per equipment cleaning batch. Corrective actions must be taken if the blank exceeds three times the MDLs (PRDLs for metals) listed for any of the compounds or analytes listed in Tables C3-4, C3-6, and C3-8. Equipment blanks will be collected from the following equipment types:

Fully assembled coring tools
Liners cleaned separately from coring tools
Miscellaneous sampling equipment that is reused (bowls, spoons, chisels)

Completeness

Sampling completeness shall be expressed as the number of valid samples collected as a percent of the total number of samples collected for each waste stream. A valid sample is any sample that is collected from a randomly selected container using randomly selected horizontal and vertical planes in accordance with approved sampling methods. The Permittees shall require participating sampling facilities to achieve a minimum 90 percent completeness.

Comparability

Consistent use and application of uniform procedures, sampling equipment, and measurement units must ensure that sampling operations are comparable. Consistent application of data usability criteria will also ensure comparability. In addition, the Permittees shall require laboratories analyzing samples to successfully participate in the PDP (DOE, 2005).

Representativeness

Specific steps to ensure the representativeness of samples include the following for both waste containers and smaller containers:

Coring tools and sampling equipment must be clean prior to sampling.

The entire depth of the waste minus a site defined approved safety factor must be cored, and the core collected must have a length greater than or equal to 50 percent of the depth of the waste. This is called the core recovery and is calculated as follows:

$$\textit{Core recovery (percent)} = \frac{y}{x} \times 100 \qquad \text{(C3-10)}$$

where

x = the depth of the waste in the container

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y = the length of the core collected from the waste.

Coring operations and tool selection should be designed to minimize alteration of the in-place waste characteristics. Minimal waste disturbance must be verified by visually examining the core and describing the observation (e.g., undisturbed, cracked, or pulverized) in the field logbook.

If core recovery is less than 50 percent of the depth of the waste, a second coring location shall be randomly selected. The core with the best core recovery shall be used for sample collection.

One randomly selected container within a container will be chosen if the container contains individual waste containers.

C3-4 Non Destructive Examination Methods

Quality Assurance Objectives

The QAOs for non destructive examination (**NDE**) are detailed in this section. NDE can be either radiography or visual examination (**VE**). If the QAOs described below are not met, then corrective action shall be taken. It should be noted that NDE does not have a specific MDL because it is primarily a qualitative determination. The objective of NDE for the program is to determine the physical waste form, the absence of prohibited items, and additional waste characterization techniques that may be used based on the Summary Category Groups (i.e., S3000, S4000, S5000). The Permittees shall require each site to describe all activities required to achieve these objectives in the site quality assurance project plan (**QAPjP**) and standard operating procedures (**SOP**).

C3-4a Radiography

Data to meet these objectives must be obtained from a video and audio recorded scan provided by trained radiography operators at the sites. Results must also be recorded on a radiography data form. The precision, accuracy, completeness, and comparability objectives for radiography data are presented below.

Precision

Precision is maintained by reconciling any discrepancies between two radiography operators with regard to identification of the waste matrix code, liquids in excess of TSDF-WAC limits, and compressed gases through independent replicate scans and independent observations. Additionally, the precision of radiography is verified prior to use by tuning precisely enough to demonstrate compliance with QAOs through viewing an image test pattern.

Accuracy

Accuracy is obtained by using a target to tune the image for maximum sharpness and by requiring operators to successfully identify 100 percent of the items required to meet the DQOs for radiography specified in Permit Attachment C, Section C-4a(1) in a training container during their initial qualification and subsequent requalification.

Completeness

A video and audio media recording of the radiography examination and a validated radiography data form will be obtained for 100 percent of the waste containers subject to radiography. All video and audio media recordings and radiography data forms will be subject to validation as indicated in Section C3-10.

Comparability

The comparability of radiography data from different operators shall be enhanced by using standardized radiography procedures and operator qualifications.

C3-4b Visual Examination

Results must be recorded on a VE data form. The precision, accuracy, completeness, and comparability objectives for VE data are presented below.

Precision

Precision is maintained by reconciling any discrepancies between the operator and the independent technical reviewer with regard to identification of waste matrix code, liquids in excess of TSDF-WAC limits, and compressed gases.

Accuracy

Accuracy is maintained by requiring operators to pass a comprehensive examination and demonstrate satisfactory performance in the presence of the VE expert during their initial qualification. VE operators shall be requalified every two years.

Completeness

A validated VE data form will be obtained for 100 percent of the waste containers subject to VE.

Comparability

The comparability of VE data from different operators shall be enhanced by using standardized VE procedures and operator qualifications.

C3-5 Gas Volatile Organic Compound Analysis

Quality Assurance Objectives

The development of data quality objective (**DQOs**) specifically for this program has resulted in the QAOs listed in Table C3-2. The specified QAOs represent the required quality of data necessary to draw valid conclusions regarding program objectives. WAP-required limits, such as the program required quantitation limits (**PRQL**) associated with VOC analysis, are specified to ensure that the analytical data collected satisfy the requirements of all data users. A summary of the Quality Control Samples and the associated acceptance criteria is included in Table C3-3. Key data-quality indicators for laboratory measurements are defined below.

Precision

Precision shall be assessed by analyzing laboratory duplicates and replicate analyses of laboratory-control samples and PDP blind-audit samples. Results from measurements on these samples must be compared to the criteria listed in Table C3-2. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Accuracy

Accuracy as %R shall be assessed for the laboratory operations by analyzing PDP blind-audit samples and laboratory-control samples. Results from these measurements must be compared to the criteria listed in Table C3-2. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Calibration

GC/MS Tunes, Initial Calibrations, and Continuing Calibration will be performed and evaluated using the procedures and criteria specified in Table C3-3. These criteria will be used to demonstrate acceptable calibration and to trigger corrective action when control limits are exceeded.

Method Detection Limit

MDLs shall be expressed in nanograms for VOCs and must be less than or equal to those listed in Table C3-2. MDLs shall be determined based on the method described in Section C3-1. The detailed procedures for MDL determination shall be included in site SOPs.

Program Required Quantitation Limit

Laboratories must demonstrate the capability to quantitate analytes at or below the PRQLs given in Table C3-2. Laboratories shall set the concentration of at least one calibration standard below the PRQL. The detailed procedures for PRQL demonstration shall be included in laboratory SOPs.

Completeness

Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. A composited sample is treated as one sample for the purposes of completeness, because only one sample is run through the analytical instrument. Valid results are defined as results that meet the data usability criteria based on application of the Quality Control Criteria specified in Tables C3-2 and C3-3; and meet the detection limit, calibration representativeness, and comparability criteria within this section. The Permittees shall require that participating laboratories meet the completeness criteria specified in Table C3-2.

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Comparability

For VOC analysis, data generated through analysis of samples from different sites shall be comparable. The Permittees shall require each site to achieve comparability by using standardized methods and traceable standards and by requiring all sites to successfully participate in the PDP (DOE, 2003).

Representativeness

Representativeness for VOC analysis shall be achieved by collecting sufficient numbers of samples using clean sampling equipment that does not introduce sample bias. Samples must be collected as described in Permit Attachment C1.

C3-6 Total Volatile Organic Compound Analysis

Quality Assurance Objectives

The development of DQOs specifically for this program has resulted in the QAOs listed in Table C3-4. The specified QAOs represent the required quality of data necessary to draw valid conclusions regarding program objectives. WAP-required limits, such as the PRQL associated with VOC analysis, are specified to ensure that the analytical data collected satisfy the requirements of all data users. Key data-quality indicators for laboratory measurements are defined below.

Precision

Precision shall be assessed by analyzing laboratory duplicates or matrix spike duplicates, replicate analyses of laboratory control samples, and PDP blind-audit samples. Results from measurements on these samples must be compared to the criteria listed in Table C3-4. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Accuracy

Accuracy as %R shall be assessed for the laboratory operations by analyzing laboratory control samples, matrix spikes, surrogate compounds, and PDP blind-audit samples. Results from these measurements for matrix spikes samples must be compared to the %R criteria listed in Table C3-4. Results for surrogates and internal standards are evaluated as specified in the SW-846 method (EPA 1996) or Table C3-5. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Laboratory blanks shall be assessed to determine possible laboratory contamination and are evaluated as specified in Table C3-5. These QC measurements will be used to demonstrate acceptable levels of laboratory contamination and to trigger corrective action when control limits are exceeded.

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Calibration

GC/MS Tunes, Initial Calibrations, and Continuing Calibration will be performed and evaluated using the procedures and criteria specified in Table C3-5 and the SW-846 method (EPA 1996). These criteria will be used to demonstrate acceptable calibration and to trigger corrective action when control limits are exceeded.

Method Detection Limit

MDLs shall be expressed in milligrams per kilogram (mg/kg) for VOCs and must be less than or equal to those listed in Table C3-4. The detailed procedures for MDL determination shall be included in site SOPs.

Program Required Quantitation Limit

Laboratories must demonstrate the capability to quantitate analytes in samples at or below the PRQLs given in Table C3-4. Laboratories shall set the concentration of at least one calibration standard below the PRQL. The detailed procedures for PRQL demonstration shall be included in laboratory SOPs.

Completeness

Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. Valid results are defined as results that meet the data usability criteria based upon application of the Quality Control Criteria specified in Tables C3-4 and C3-5 and meet the calibration, detection limit, representativeness, and comparability criteria within this section. Participating laboratories must meet the completeness criteria specified in Table C3-4.

Comparability

For VOC analysis, data generated through analysis of samples from different sites shall be comparable. The Permittees shall require sites to achieve comparability by using standardized SW-846 sample preparation and methods that meet the QAO requirements in Tables C3-4 and C3-5, traceable standards, and by requiring all sites to successfully participate in the PDP (DOE, 2005). Generator/storage sites may use the most recent version of SW-846. Any changes to SW-846 methodology that results in the elimination of sample preparation or analytical methods in use at generator/storage sites must be addressed as a corrective action to address the comparability of data before and after the SW-846 modification.

Representativeness

Representativeness for VOC analysis shall be achieved by collecting unbiased samples. Samples must be collected as described in Permit Attachment C1.

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C3-7 Total Semivolatile Organic Compound Analysis

Quality Assurance Objectives

The development of DQOs specifically for this program has resulted in the QAOs listed in Table C3-6. The specified QAOs represent the required quality of data necessary to draw valid conclusions regarding program objectives. WAP-required limits, such as the PRQLs, are specified to ensure that the analytical data collected satisfy the requirements of all data users. A summary of Quality Control Samples and associated acceptance criteria for this analysis is included in Table C3-7. Key data-quality indicators for laboratory measurements are defined below.

Precision

Precision shall be assessed by analyzing laboratory duplicates or matrix spike duplicates, replicate analyses of laboratory control samples, and PDP blind-audit samples. Results from measurements on these samples must be compared to the criteria listed in Table C3-6. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Accuracy

Accuracy as %R shall be assessed for the laboratory operations by analyzing laboratory control samples, matrix spikes, surrogate compounds, and PDP blind-audit samples. Results from these measurements for matrix spikes samples must be compared to the %R criteria listed in Table C3-6. Results for surrogates and internal standards are evaluated as specified in the SW-846 method (EPA 1996) or Table C3-7. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Laboratory blanks shall be assessed to determine possible laboratory contamination and are evaluated as specified in Table C3-7. These QC measurements will be used to demonstrate acceptable levels of laboratory contamination and to trigger corrective action when control limits are exceeded.

Calibration

GC/MS Tunes, Initial Calibrations, and Continuing Calibration will be performed and evaluated using the procedures and criteria specified in Table C3-7 and the SW-846 method (EPA 1996). These criteria will be used to demonstrate acceptable calibration and to trigger corrective action when control limits are exceeded.

Method Detection Limit

MDLs shall be expressed in mg/kg for SVOCs and must be less than or equal to those listed in Table C3-6. The detailed procedures for MDL determination shall be included in site SOPs.

Program Required Quantitation Limit

Laboratories must demonstrate the capability to quantitate analytes in samples at or below the PRQLs given in Table C3-6. Laboratories shall set the concentration of at least one calibration standard below the PRQL. The detailed procedures for PRQL demonstration shall be included in laboratory SOPs.

Completeness

Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. Valid results are defined as results that meet the data usability criteria based on application of the Quality Control Criteria specified in Tables C3-6 and C3-7 and meet the detection limit, calibration, representativeness, and comparability criteria within this section. The Permittees shall require participating laboratories to meet the level of completeness specified in Table C3-6.

Comparability

For SVOC analysis, data generated through analysis of samples from different sites shall be comparable. The Permittees shall require sites to achieve comparability by using standardized SW-846 sample preparation and methods that meet the QAO requirements in Tables C3-6 and C3-7, traceable standards, and by requiring all sites to successfully participate in the PDP (DOE, 2005). Generator/storage sites may use the most current version of SW-846 if the methods are consistent with QAO requirements. Any changes to SW-846 methodology that results in the elimination of sample preparation or analytical methods in use at generator/storage sites must be addressed as a corrective action to address the comparability of data before and after the SW-846 modification.

Representativeness

Representativeness for SVOC analysis shall be achieved by collecting unbiased samples. Samples must be collected as described in Permit Attachment C1.

C3-8 Total Metal Analysis

Quality Assurance Objectives

The development of DQOs for the program has resulted in the QAOs listed in Table C3-8. The specified QAOs represent the required quality of data necessary to draw valid conclusions regarding program objectives. WAP-required limits, such as the PRQLs associated with metal analysis, are specified to ensure that the analytical data collected satisfy the requirements of all data users. A summary of Quality Control Samples and the associated acceptance criteria for this analysis is provided in Table C3-9. Key data-quality indicators for laboratory measurements are defined below.

Precision

Precision shall be assessed by analyzing laboratory sample duplicates or laboratory matrix spike duplicates, replicate analyses of laboratory-control samples, and PDP blind-audit samples. Results from measurements on these samples must be compared to the criteria listed

in Table C3-8. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Accuracy

Accuracy shall be assessed through the analysis of laboratory matrix spikes, PDP blind-audit samples, serial dilutions, interference check samples, and laboratory-control samples. Results from these measurements must be compared to the criterion listed in Table C3-8 and C3-9. These QC measurements will be used to demonstrate acceptable method performance and to trigger corrective action when control limits are exceeded.

Laboratory blanks and calibration blanks shall be assessed to determine possible laboratory contamination and are evaluated as specified in Table C3-9. These QC measurements will be used to demonstrate acceptable levels of laboratory contamination and to trigger corrective action when control limits are exceeded.

Calibration

Mass Tunes (for ICP MS only), Standards Calibration, Initial Calibration verifications, and Continuing Calibrations will be performed and evaluated using the procedures and criteria specified in Table C3-9 and the SW-846 method (EPA 1996). These criteria will be used to demonstrate acceptable calibration and to trigger corrective action when control limits are exceeded.

Program Required Detection Limits

PRDLs, expressed in units of micrograms per L (µg/L), are the maximum values for instrument detection limits (**IDL**) permissible for program support under the WAP. IDLs must be less than or equal to the PRDL for the method used to quantitate a specific analyte. Any method listed in Table C-5 of the Waste Analysis Plan (Permit Attachment C) may be used if the IDL meets this criteria. For high concentration samples, an exception to the above requirements may be made in cases where the sample concentration exceeds five times the IDL of the instrument being used. In this case, the analyte concentration may be reported even though the IDL may exceed the PRDL. IDLs shall be determined semiannually (i.e., every six months). Detailed procedures for IDL determination shall be included in laboratory SOPs.

Program Required Quantitation Limit

The Permittees shall require participating laboratories to demonstrate the capability of analyte quantitation at or below the PRQLs in units of mg/kg wet weight (given in Table C3-8). The PRDLs are set an order of magnitude less than the PRQLs (assuming 100 percent solid sample diluted by a factor of 100 during preparation). The Permittees shall require participating laboratories to set the concentration of at least one QC or calibration standard at or below the solution concentration equivalent of the PRQL. Detailed calibration procedures shall be included in site SOPs.

Completeness

Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. Valid results are

defined as results that meet the data usability criteria based upon application of the Quality Control Criteria specified in Tables C3-8 and C3-9 and meet the detection limit, calibration, representativeness, and comparability criteria within this section. The Permittees shall require participating laboratories to meet the completeness specified in Table C3-8.

Comparability

For metals analysis, data generated through analysis of samples from different sites shall be comparable. Comparability will be achieved by using standardized SW-846 sample preparation and methods that meet QAO requirements in Tables C3-8 and C3-9, demonstrating successful participation in the PDP (DOE, 2005), and use of traceable standards. Generator/storage sites may use the most recent SW-846 update. Any changes to SW-846 methodology that results in the elimination of sample preparation or analytical methods in use at generator/storage sites must be addressed as a corrective action to address the comparability of data before and after the SW-846 modification.

Representativeness

Representativeness for metals analysis shall be achieved by the collection of unbiased samples and the preparation of samples in the laboratory using representative and unbiased methods. Samples must be collected as described in Permit Attachment C1.

C3-9 Acceptable Knowledge

Acceptable knowledge documentation provides primarily qualitative information that cannot be assessed according to specific data quality goals that are used for analytical techniques. QAOs for analytical results are described in terms of precision, accuracy, completeness, comparability, and representativeness. Appropriate analytical and testing results may be used to augment the characterization of wastes based on acceptable knowledge. To ensure that the acceptable knowledge process is consistently applied, The Permittees shall require sites to comply with the following data quality requirements for acceptable knowledge documentation:

Precision - Precision is the agreement among a set of replicate measurements without assumption of the knowledge of a true value. The qualitative determinations, such as compiling and assessing acceptable knowledge documentation, do not lend themselves to statistical evaluations of precision. However, the acceptable knowledge information will be addressed by the independent review of acceptable knowledge information during internal and external audits.

Accuracy - Accuracy is the degree of agreement between an observed sample result and the true value. The percentage of waste containers which require reassignment to a new waste matrix code and/or designation of different hazardous waste numbers based on sampling and analysis data and discrepancies identified by the Permittees during waste confirmation will be reported as a measure of acceptable knowledge accuracy.

Completeness - Completeness is an assessment of the number of waste streams or number of samples collected to the number of samples determined to be useable through the data validation process. The acceptable knowledge record must contain

100 percent of the required information (Permit Attachment C4-3). The usability of the acceptable knowledge information will be assessed for completeness during audits.

Comparability - Data are considered comparable when one set of data can be compared to another set of data. Comparability is ensured through sites meeting the training requirements and complying with the minimum standards outlined for procedures that are used to implement the acceptable knowledge process. All sites must assign hazardous waste numbers in accordance with Permit Attachment C4-3b and provide this information regarding its waste to other sites who store or generate a similar waste stream.

Representativeness - Representativeness expresses the degree to which sample data accurately and precisely represent characteristics of a population. Representativeness is a qualitative parameter that will be satisfied by ensuring that the process of obtaining, evaluating, and documenting acceptable knowledge information is performed in accordance with the minimum standards established in Permit Attachment C4. Sites also must assess and document the limitations of the acceptable knowledge information used to assign hazardous waste numbers (e.g., purpose and scope of information, date of publication, type and extent to which waste parameters are addressed).

The Permittees shall require each generator/storage site to comply with the nonconformance notification and reporting requirements of Section C3-13 if the results of sampling and analysis specified in Permit Attachment C are inconsistent with acceptable knowledge documentation.

The Permittees shall require each site to address quality control by tracking its performance with regard to the use of acceptable knowledge by: 1) assessing the frequency of inconsistencies among information, and 2) documenting acceptable knowledge inconsistencies identified through radiography, visual examination, headspace-gas analyses, and solidified waste analyses. In addition, the acceptable knowledge process and waste stream documentation must be evaluated through internal assessments by generator/storage site quality assurance organizations and assessments by auditors external to the organization (i.e., the Permittees).

C3-10 Data Review, Validation, and Verification Requirements

Procedures shall be developed for the review, validation, and verification of data at the data generation level; the validation and verification of data at the project level; and the verification of data at the Permittee level. Data review determines if raw data have been properly collected and ensures raw data are properly reduced. Data validation verifies that the data reported satisfy the requirements of this WAP and is accompanied by signature release. Data verification authenticates that data as presented represent the sampling and analysis activities as performed and have been subject to the appropriate levels of data review. The requirements presented in this section ensure that WAP records furnish documentary evidence of quality.

The Permittees shall require the sites to generate the following Batch Data Reports for data validation, verification, and quality assurance activities:

A Testing Batch Data Report or equivalent includes all data pertaining to radiography or visual examination for up to 20 waste containers without regard to waste matrix. Table C3-11 lists all of the information required in Testing Batch Data Reports (identified with

an "X") and other information that is necessary for data validation, but is optional in Testing Batch Data Reports (identified with an "O").

A Sampling Batch Data Report or equivalent includes all sample collection data pertaining to a group of no more than 20 headspace gas or homogeneous waste samples that were collected for chemical analysis. Table C3-12 lists all of the information required in Sampling Batch Data Reports (identified with an "X") and other information that is necessary for data validation, but is optional in Sampling Batch Data Reports (identified with an "O").

An Analytical Batch Data Report or equivalent includes analytical data from the analysis of TRU-mixed waste for up to 20 headspace gas or homogeneous waste samples. Analytical Batch Data Reports or equivalent that contain results for composited headspace gas samples must contain sufficient information to identify the containers that were composited for each composite sample and the sample volume that was taken from each waste container. Because Analytical Batch Data Reports are generated based on the number of samples analyzed, an Analytical Batch Data Report may contain results that are applicable to more than 20 containers depending on how many composite samples are part of the report, but may not exceed a total of 20 samples analyzed. Table C3-13 lists all of the information required in Analytical Batch Data Reports (identified with an "X") and other information that is necessary for data validation, but is optional in Analytical Batch Data Reports (identified with an "O").

Raw analytical data need not be included in Analytical Batch Data Reports, but must be maintained in the site project files and be readily available for review upon request. Raw data may include all analytical bench sheet and instrumentation readouts for all calibration standard results, sample data, QC samples, sample preparation conditions and logs, sample run logs, and all re-extraction, re-analysis, or dilution information pertaining to the individual samples. Raw data may also include calculation records and any qualitative or semi-quantitative data collected for a sample and that has been recorded on a bench sheet or in a log book.

An On-line Batch Data Report or equivalent contains the combined information from the Sampling Batch Data Report and Analytical Batch Data Report that is relevant to the on-line method used.

C3-10a Data Generation Level

The following are minimum requirements for raw data collection and management which the Permittees shall require for each site:

All raw data shall be signed and dated in reproducible ink by the person generating it. Alternately, unalterable electronic signatures may be used.

All data must be recorded clearly, legibly, and accurately in field and laboratory records (bench sheets, logbooks), and include applicable sample identification numbers (for sampling and analytical labs).

All changes to original data must be lined out, initialed, and dated by the individual making the change. A justification for changing the original data may also be included. Original

data must not be obliterated or otherwise disfigured so as not to be readable. Data changes shall only be made by the individual who originally collected the data or an individual authorized to change the data.

All data must be transferred and reduced from field and laboratory records completely and accurately.

All field and laboratory records must be maintained as specified in Table C-6 of Attachment C.

Data must be organized into a standard format for reporting purposes Batch Data Report), as outlined in specific sampling and analytical procedures.

All electronic and video data must be stored appropriately to ensure that waste container, sample, and associated QC data are readily retrievable. In the case of classified information, additional security provisions may apply that could restrict retrievability. The additional security provisions will be documented in generator/storage site procedures as outlined in the QAPjP in accordance with prevailing classified information security standards.

Data review, validation, and verification at this level involves scrutiny and signature release from qualified independent technical reviewer(s) not involved in the generation or recording of the data under review, as specified below. Individuals conducting this data review, validation, and verification must use checklists that address all of the items included in this section. Checklists must contain or reference tables showing the results of sampling, analytical or on-line batch QC samples, if applicable. Checklists must reflect review of all QC samples and quality assurance objective categories in accordance with criteria established in Tables C3-2 through C3-9 (as applicable to the methods validated). Completed checklists must be forwarded with Batch Data Reports to the project level. Analytical raw data must be available and reviewed by the data generation level reviewer.

C3-10a(1) Independent Technical Review

The independent technical review ensures by review of raw data that data generation and reduction are technically correct; calculations are verified correct; deviations are documented; and QA/QC results are complete, documented correctly, and compared against WAP criteria. This review validates and verifies all of the work documented by the originator.

One hundred percent of the Batch Data Reports must receive an independent technical review by a trained and qualified individual who was not involved in the generation or recording of the data under review. This review shall be performed by an individual other than the data generator who is qualified to have performed the initial work. The independent technical review must be performed as soon as practicably possible in order to determine and correct negative quality trends in the sampling or analytical process. However at a minimum, the independent technical review must be performed before any waste associated with the data reviewed is managed, stored, or disposed at WIPP, unless the data are being obtained from waste sampling and analysis as containers are being retrieved or generated after initial WSPF approval as described in Attachment C2, Section C2-1. The reviewer(s) must release the data as evidenced by signature, and as a consequence ensure the following:

Data generation and reduction were conducted in a technically correct manner in accordance with the methods used (procedure with revision). Data were reported in the proper units and correct number of significant figures.

Calculations have been verified by a valid calculation program, a spot check of verified calculation programs, and/or 100 percent check of all hand calculations. Values that are not verifiable to within rounding or significant difference discrepancies must be rectified prior to completion of independent technical review.

The data have been reviewed for transcription errors.

The testing, sampling, or analytical data QA documentation for Batch Data Reports is complete and includes, as applicable, raw data, DAC and equilibrium calculations and times, calculation records, chain-of-custody (**COC**) forms, calibration records (or references to an available calibration package), QC sample results, and copies or originals of gas canister sample tags. Corrective action will be taken to ensure that all Batch Data Reports are complete and include all necessary raw data prior to completion of the independent technical review.

QC sample results are within established control limits, and if not, the data have been appropriately qualified in accordance with data usability criteria. Data outside of established control limits will be qualified as appropriate, assigned an appropriate qualifier flag, discussed in the case narrative, and included as appropriate in calculations for completeness. QC criteria that were not met are documented.

Reporting flags (Table C3-14) were assigned correctly.

Sample holding time and preservation requirements were met, or exceptions documented.

Radiography tapes have been reviewed (independent observation) on a waste container basis at a minimum of once per testing batch or once per day of operation, whichever is less frequent (Attachment C1, Section C1-3). The radiography tape will be reviewed against the data reported on the radiography form to ensure that the data are correct and complete.

Field sampling records are complete. Incomplete or incorrect field sampling records will be subject to resubmittal prior to completion of the independent technical review.

QAOs have been met according to the methods outlined in Sections C3-2 through C3-9.

C3-10b Project Level

Data validation and verification at this level involves scrutiny and signature release from the Site Project Manager (or designee). The Permittees shall require each site to meet the following minimum requirements for each waste container. Any nonconformance identified during this process shall be documented on a nonconformance report (Section C3-13).

The Site Project Manager shall ensure that a repeat of the data generation level review, validation, and verification is performed on the data for a minimum of one randomly chosen waste container quarterly (every three months). This exercise will document that the data

generation level review, validation, and verification is being performed according to implementing procedures.

C3-10b(1) Site Project Manager Review

The Site Project Manager Review is the final validation that all of the data contained in Batch Data Reports from the data generation level are complete and have been properly reviewed as evidenced by signature release and completed checklists.

One hundred percent of the Batch Data Reports must have Site Project Manager signature release. At a minimum, the Site Project Manager signature release must be performed before any waste associated with the data reviewed is managed, stored, or disposed at WIPP, unless the data are being obtained from waste sampling and analysis as containers are being retrieved or generated as described in Permit Attachment C2, Section C2-1. This signature release must ensure the following:

- The validity of the DAC assignment made at the data generation level based upon an assessment of the data collection and evaluation necessary to make the assignment.
- Testing batch QC checks (e.g., replicate scans, measurement system checks) were properly performed. Radiography data are complete and acceptable based on evidence of videotape review of one waste container per day or once per testing batch, whichever is less frequent, as specified in Permit Attachment C1, Section C1-3.
- Sampling batch QC checks (e.g., equipment blanks, field duplicates, field reference standards) were properly performed, and meet the established QAOs and are within established data usability criteria.
- Analytical batch QC checks (e.g., laboratory duplicates, laboratory blanks, matrix spikes, matrix spike duplicates, laboratory control samples) were properly performed and meet the established QAOs and are within established data usability criteria.
- On-line batch QC checks (e.g., field blanks, on-line blanks, on-line duplicates, on-line control samples) were properly performed and meet the established QAOs and are within established data usability criteria.
- Proper procedures were followed to ensure representative samples of headspace gas and homogeneous solids and soil/gravel were taken.
- Data generation level independent technical review, validation, and verification have been performed as evidenced by the completed review checklists and appropriate signature releases.
- Independent technical reviewers were not involved in the generation or recording of the data under review.
- Batch data review checklists are complete.

Batch Data Reports are complete and data are properly reported (e.g., data are reported in the correct units, with the correct number of significant figures, and with qualifying flags).

Verify that data are within established data assessment criteria and meet all applicable QAOs (Sections C3-2 through C3-9).

C3-10b(2) Prepare Site Project Manager Summary and Data Validation Summary

To document the project-level validation and verification described above, the Permittees shall require each Site Project Manager (or designee) to prepare a Site Project Manager Summary and a Data Validation Summary. These reports may be combined to eliminate redundancy. The Site Project Manager Summary includes a validation checklist for each Batch Data Report. Checklists for the Site Project Manager Summary must be sufficiently detailed to validate all aspects of a Batch Data Report that affect data quality. The Data Validation Summary provides verification that, on a per waste container or sample basis as evidenced by Batch Data Report reviews, all data have been validated in accordance with the site QAPjP. The Data Validation Summary must identify each Batch Data Report reviewed (including all waste container numbers), describe how the validation was performed and whether or not problems were detected (e.g., nonconformance reports), and include a statement indicating that all data are acceptable. Summaries must include release signatures.

Once the data have received project-level validation and verification or when the Site Project Manager decides the sample no longer needs to be retained, the Site Project Manager must ensure that the laboratory is notified. Samples must be retained by the laboratory until this notification is received. Gas sample canisters may then be released from storage for cleaning, recertification, and subsequent reuse. Sample tags must be removed and retained in the project files before recycling the canisters. If the Site Project Manager requests that samples or canisters be retained for future use (e.g., an experimental holding time study), the same sample identification and COC forms shall be used and cross-referenced to a document which specifies the purpose for sample or canister retention.

C3-10b(3) Prepare Waste Stream Characterization Package

In the event the Permittees request detailed information on a waste stream, the Site Project Manager will provide a Waste Stream Characterization Package. The Site Project Manager must ensure that the Waste Stream Characterization Package (Section C3-12b(3)) will support waste characterization determinations.

C3-10c Permittee Level

The final level of data verification occurs at the Permittee level and must, at a minimum, consist of reviewing a sample of the Batch Data Reports during audits of generator/storage sites and DOE approved laboratories to verify completeness. During such audits, DOE is responsible for the verification that Batch Data Reports include the following:

Project-level signature releases

Listing of all waste containers being presented in the report

- Listing of all testing, sampling, and analytical batch numbers associated with each waste container being reported in the package
- Analytical Batch Data Report case narratives
- Site Project Manager Summary
- Data Validation Summary
- Complete summarized qualitative and quantitative data for all waste containers with data flags and qualifiers.

For each Waste Stream Profile Form (**WSPF**) submitted for approval, DOE must verify that each submittal (i.e., WSPF and Characterization Information Summary) is complete and notify the originating site in writing of the WSPF approval. DOE will maintain the data as appropriate for use in the regulatory compliance programs. For subsequent shipments made after the initial WSPF approval, the verification will also include WWIS internal limit checks (Attachment C, Section C-5a(1)).

C3-11 Reconciliation with Data Quality Objectives

Reconciling the results of waste testing and analysis with the DQOs provides a way to ensure that data will be of adequate quality to support the regulatory compliance programs. Reconciliation with the DQOs will take place at both the project level and the Permittees' level. At the project level, reconciliation will be performed by the Site Project Manager, while at the Permittees' level, reconciliation will be performed as described below.

C3-11a Reconciliation at the Project Level

The Permittees shall require each Site Project Manager to ensure that all data generated and used in decision making meet the DQOs provided in Section C-4a(1) of Permit Attachment C. To do so, the Site Project Manager must assess whether data of sufficient type, quality, and quantity have been collected. The Site Project Manager must determine if the variability of the data set is small enough to provide the required confidence in the results. The Site Project Manager must also determine if, based on the desired error rates and confidence levels, a sufficient number of valid data points have been determined (as established by the associated completeness rate for each sampling and analytical process). In addition, the Site Project Manager must document that random sampling of containers was performed for the purposes of waste stream characterization.

For each waste stream characterized, the Permittees shall require each Site Project Manager to determine if sufficient data have been collected to determine the following WAP-required waste parameters, as applicable:

- Waste matrix code
- Waste material parameter weights
- If each waste container of waste contains TRU radioactive waste

- Mean concentrations, UCL_{90} for the mean concentrations, standard deviations, and the number of samples collected for each VOC in the headspace gas of waste containers in the waste stream

- Mean concentrations, UCL_{90} for the mean concentrations, standard deviations, and number of samples collected for VOCs, SVOCs, and metals in the waste stream

- Whether the waste stream exhibits a toxicity characteristic (**TC**) under 40 CFR Part 261, Subpart C

- Whether the waste stream contains listed waste found in 20.4.1.200 NMAC incorporating 40 CFR Part 261, Subpart D

- Whether the waste stream can be classified as hazardous or nonhazardous at the 90-percent confidence level

- Whether an appropriate packaging configuration and DAC were applied and documented in the headspace gas sampling documentation, and whether the drum age was met prior to sampling.

- Whether all TICs were appropriately identified and reported in accordance with the requirements of Section C3-1 prior to submittal of a WSPF for a waste stream or waste stream lot.

- Whether the overall completeness, comparability, and representativeness QAOs were met for each of the analytical and testing procedures as specified in Sections C3-2 through C3-9 prior to submittal of a WSPF for a waste stream or waste stream lot.

- Whether the PRQLs for all analyses were met prior to submittal of a WSPF for a waste stream or waste stream lot.

If the Site Project Manager determines that insufficient data have been collected to make the determinations listed above, additional data collection efforts must be undertaken. The reconciliation of a waste stream shall be performed, as described in Permit Attachment C4, prior to submittal of WSPF and Characterization Information Summary to the Permittees for that waste stream. The Permittees shall not manage, store, or dispose a TRU mixed waste stream at WIPP unless the Site Project Manager determines that the WAP-required waste parameters listed above have been met for that waste stream.

The statistical procedure presented in Permit Attachment C2 shall be used by participating Site Project Managers to evaluate and report waste characterization data from the analysis of homogeneous solids and soil/gravel. The procedure, which calculates UCL_{90} values, shall be used to assess compliance with the DQOs in Attachment C, Section C-4a(1) as well as with RCRA regulations. The procedure must be applied to all laboratory analytical data for total VOCs, total SVOCs, and total metals. For RCRA regulatory compliance (40 CFR §261.24), data from the analysis of the appropriate metals and organic compounds shall be expressed as toxicity characteristic leaching procedure (**TCLP**) values or results may also be compared to the TC levels expressed as total values. These total values will be considered the regulatory threshold limit (**RTL**) values for the WAP. RTL values are obtained by calculating the

weight/weight concentration (in the solid) of a TC analyte that would give the regulatory weight/volume concentration (in the TCLP extract), assuming 100-percent analyte dissolution.

C3-11b Reconciliation at the Permittee Level

The Permittees must also ensure that data of sufficient type, quality, and quantity are collected to meet WAP DQOs. The Permittees will ensure sufficient data have been collected to determine if the waste characterization information is adequate to demonstrate the Permittees' compliance with Attachment C, Section C-4a(1). This is performed during the Permittees' review of the WSPF and Characterization Information Summary and is documented by DOE's approval of the WSPF.

C3-12 Data Reporting Requirements

Data reporting requirements define the type of information and the method of transmittal for data transfer from the data generation level to the project level and from the project level to the Permittees.

C3-12a Data Generation Level

Data shall be transmitted by hard copy or electronically (provided a hard copy is available on demand) from the data generation level to the project level. Transmitted data shall include all Batch Data Reports and data review checklists. The Batch Data Reports and checklists used must contain all of the information required by the testing, sampling, and analytical techniques described in Permit Attachments C1 through C6 , as well as the signature releases to document the review, validation, and verification as described in Section C3-10. All Batch Data Reports and checklists shall be in approved formats, as provided in site-specific documentation.

Batch Data Reports shall be forwarded to the Site Project Manager. All Batch Data Reports shall be assigned serial numbers, and each page shall be numbered. The serial number used for Batch Data Reports can be the same as the testing, sampling, or analytical batch number.

QA documentation, including raw data, shall be maintained in either testing, sampling, and analytical facility files, or site project files for those facilities located on site in accordance with the document storage requirements of site approved site QAPjPs. DOE approved laboratories shall forward testing, sampling, and analytical QA documentation along with Batch Data Reports to the site project office for inclusion in site project files.

C3-12b Project Level

The site project office shall prepare a WSPF for each waste stream certified for shipment to WIPP based on information obtained from acceptable knowledge and Batch Data Reports, if applicable. In addition, the site project office must ensure that the Characterization Information Summary and the Waste Stream Characterization Package (when requested by the Permittees) are prepared as appropriate. The Site Project Manager must also verify these reports are consistent with information found in analytical batch reports. Summarized testing, sampling, and analytical data are included in the Characterization Information Summary. The contents of the WSPF, Characterization Information Summary, and Waste Stream Characterization Package are discussed in the following sections.

After approval of a WSPF and the associated Characterization Information Summary by DOE, the generator/storage site are required to maintain a cross reference of container identification numbers to each Batch Data Report.

A Waste Stream Characterization Package shall be transmitted by hard copy or electronically from the Site Project Manager to the Permittees when requested.

C3-12b(1) Waste Stream Profile Form

The Waste Stream Profile Form (WSPF, Figure C-1) shall include the following information:

- Generator/storage site name
- Generator/storage site EPA ID
- Date of audit report approval by NMED (if obtained)
- Original generator of waste stream
- Whether waste is Contact-Handled or Remote-Handled
- The Waste Stream WIPP Identification Number
- Summary Category Group
- Waste Matrix Code Group
- Waste Material Parameter Weight Estimates per unit of waste
- Waste stream name
- A description of the waste stream
- Applicable EPA hazardous waste numbers
- Applicable TRUCON codes
- A listing of acceptable knowledge documentation used to identify the waste stream
- The waste characterization procedures used and the reference and date of the procedure
- Certification signature of Site Project Manager, name, title, and date signed

C3-12b(2) Characterization Information Summary

The Characterization Information Summary shall include the following elements, if applicable:

- Data reconciliation with DQOs

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Headspace gas summary data listing the identification numbers of samples used in the statistical reduction, the maximum, mean, standard deviation, UCL_{90}, RTL, and associated EPA hazardous waste numbers that must be applied to the waste stream.

Total metal, VOC, and SVOC analytical results for homogeneous solids and soil/gravel (if applicable).

TIC listing and evaluation.

- Radiography and VE summary to document that all prohibited items are absent in the waste (if applicable).

A justification for the selection of radiography and/or/VE as an appropriate method for characterizing the waste.

A complete listing of all container identification numbers used to generate the WSPF, cross-referenced to each Batch Data Report

Complete AK summary, including stream name and number, point of generation, waste stream volume (current and projected), generation dates, TRUCON codes, Summary Category Group, Waste Matrix Code(s) and Waste Matrix Code Group, other TWBIR information, waste stream description, areas of operation, generating processes, RCRA determinations, radionuclide information, all references used to generate the AK summary, and any other information required by Permit Attachment C4, Section C4-2b.

Method for determining Waste Material Parameter Weights per unit of waste.

List of any AK Sufficiency Determinations requested for the waste stream.

Certification through acceptable knowledge or testing and/or analysis that any waste assigned the hazardous waste number of U134 (hydrofluoric acid) no longer exhibits the characteristic of corrosivity. This is verified by ensuring that no liquid is present in U134 waste.

C3-12b(3) Waste Stream Characterization Package

The Waste Stream Characterization Package includes the following information:

Waste Stream Profile Form (WSPF, Section C3-12b(1))

Accompanying Characterization Information Summary (Section C3-12b(2))

Complete AK summary (Section C3-12b(2))

Batch Data Reports supporting the characterization of the waste stream and any others requested by the Permittees

Raw analytical data requested by the Permittees

C3-12b(4) WIPP Waste Information System (**WWIS**) Data Reporting

The WWIS Data Dictionary includes all of the data fields, the field format and the limits associated with the data as established by this WAP. These data will be subjected to edit and limit checks that are performed automatically by the database, as defined in the *Waste Data System User's Manual* (DOE, 2009). If a container was part of a composite headspace gas sample, the analytical results from the composite sample must be assigned as the container headspace gas data results, including associated TICs, for every waste container associated with the composite sample.

C3-13 Nonconformances

The Permittees shall require the status of work and the WAP activities at participating generator/storage sites to be monitored and controlled by the Site Project Manager. This monitoring and control shall include nonconformance identification, documentation, and reporting.

The nonconformances and corrective action processes specified in this section describe procedures between the Permittees and the generator/storage sites.

Nonconformances

Nonconformances are uncontrolled and unapproved deviations from an approved plan or procedure. Nonconforming items and activities are those that do not meet the WAP requirements, procurement document criteria, or approved work procedures. Nonconforming items shall be identified by marking, tagging, or segregating, and the affected generator/storage site(s) notified. Any waste container for which a nonconformance report (**NCR**) has been written will not be shipped to the WIPP facility unless the condition that led to the NCR for that container has been dispositioned in accordance with DOE's Quality Assurance Program Description (**QAPD**). Disposition of nonconforming items shall be identified and documented. The QAPjPs shall identify the person(s) responsible for evaluating and dispositioning nonconforming items and shall include referenced procedures for handling them. For each container selected for confirmation pursuant to Permit Attachment C7, the Permittees will examine the respective NCR documentation to verify NCRs have been dispositioned for the selected container.

Management at all levels shall foster a "no-fault" attitude to encourage the identification of nonconforming items and processes. Nonconformances may be detected and identified by anyone performing WAP activities, including

Project staff - during field operations, supervision of subcontractors, data validation and verification, and self-assessment

Laboratory staff - during the preparation for and performance of laboratory testing; calibration of equipment; QC activities; laboratory data review, validation, and verification; and self-assessment

QA personnel - during oversight activities or audits

A NCR shall be prepared for each nonconformance identified. Each NCR shall be initiated by the individual(s) identifying the nonconformance. The NCR shall then be processed by knowledgeable and appropriate personnel. For this purpose, a NCR including, or referencing as appropriate, results of laboratory analysis, QC tests, audit reports, internal memoranda, or letters shall be prepared. The NCR must provide the following information:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Method(s) or suggestions for correcting the nonconformance (corrective action)
- Schedule for completing the corrective action
- An indication of the potential ramifications and overall usability of the data, if applicable
- Any approval signatures specified in the site nonconformance procedures

The Permittees shall require the Site Project Manager to oversee the NCR process and be responsible for developing a plan to identify and track all nonconformances and report this information to the Permittees. The Site Project Manager is also responsible for notifying project personnel of the nonconformance and verifying completion of the corrective action for nonconformances.

Nonconformance to DQOs

For any non-administrative nonconformance related to applicable requirements specified in this WAP which are first identified at the Site Project Manager signature release level (i.e., a failure to meet a DQO), the Permittees shall receive written notification within seven calendar days of identification and shall also receive a NCR within 30 calendar days of identification of the incident. DOE shall require the generator/storage site to implement a corrective action which remedies the nonconformance prior to management, storage, or disposal of the waste at WIPP. The Permittees shall send NMED a monthly summary of nonconformances identified during the previous month, indicating the number of nonconformances received and the generator/storage sites responsible.

DOE's Corrective Action Process

DOE shall initiate a corrective action process when internal nonconformances and nonconformances at the generator/storage sites are identified. Activities and processes that do not meet requirements are documented as deficiencies.

When a deficiency is identified by the Permittees, the following process action steps are required:

The condition is documented on a Corrective Action Report (**CAR**) by the individual identifying the problem.

DOE has designated the CAR Initiator and Assessment Team Leader to review the CAR, determine validity of the finding (determine that a requirement has been violated), classify the significance of the condition, assign a response due date, and issue the CAR to the responsible party.

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The responsible organization reviews the CAR, evaluates the extent and cause of the deficiency and provides a response to DOE, indicating remedial actions and actions to preclude recurrence that will be taken.

DOE reviews the response from the responsible organization and, if acceptable, communicates the acceptance to the responsible organization.

The responsible organization completes remedial actions and actions to preclude recurrence of the condition.

After all corrective actions have been completed, DOE schedules and performs a verification to ensure that corrective actions have been completed and are effective. When all actions have been completed and verified as being effective, the CAR is closed by the CAR Initiator and Assessment Team Leader on behalf of DOE.

As part of the planning process for subsequent audits and surveillances, past deficiencies are reviewed and the previous deficient activity or process is subject to reassessment.

C3-14 Special Training Requirements and Certifications

Before performing activities that affect WAP quality, all personnel are required to receive indoctrination into the applicable scope, purpose, and objectives of the WAP and the specific QAOs of the assigned task. Personnel assigned to perform activities for the WAP shall have the education, experience, and training applicable to the functions associated with the work. Evidence of personnel proficiency and demonstration of competence in the task(s) assigned must be demonstrated and documented. All personnel designated to work on specific aspects of the WAP shall maintain qualification (i.e., training and certification) throughout the duration of the work as specified in this WAP and applicable QAPjPs/procedures. Job performance shall be evaluated and documented at periodic intervals, as specified in the implementing procedures.

Personnel involved in WAP activities shall receive continuing training to ensure that job proficiency is maintained. If not specified by this WAP, the due date for required continuing training courses and requalification shall be the end of the month of the anniversary date when the training was previously completed. Training includes both education in principles and enhancement of skills. Each participating site shall include in its QAPjP a description of the procedures for implementing personnel qualification and training. All training records that specify the scope of the training, the date of completion, and documentation of job proficiency shall be maintained as QA Records in the site project file.

Analytical laboratory line management must ensure that analytical personnel are qualified to perform the analytical method(s) for which they are responsible. The minimum qualifications for certain specified positions for the WAP are summarized in Table C3-10. QAPjPs, or their implementing SOPs, shall specify the site-specific titles and minimum training and qualification requirements for personnel performing WAP activities. QAPjPs/procedures shall also contain the requirements for maintaining records of the qualification, training, and demonstrations of proficiency by these personnel.

An evaluation of personnel qualifications shall include comparing and evaluating the requirements specified in the job/position description and the skills, training, and experience included in the current resume of the person. This evaluation also must be performed for

personnel who change positions because of a transfer or promotion as well as personnel assigned to short-term or temporary work assignments that may affect the quality of the WAP. QAPjPs/procedures shall identify the responsible person(s) for ensuring that all personnel maintain proficiency in the work performed and identify any additional training that may be required.

C3-15 Changes to WAP-Related Plans or Procedures

Controlled changes to WAP-related plans or procedures shall be managed through the document control process described in the QAPD. The Site Project Manager shall review all non-administrative changes and evaluate whether those changes could impact DQOs specified in the Permit. After site certification, any changes to WAP-related plans or procedures that could positively or negatively impact DQOs (i.e., those changes that require prior approval of DOE as defined in Attachment C5, Section C5-2) shall be reported to DOE within five days of identification by the project level review. The Permittees shall send NMED a monthly summary briefly describing the changes to plans and procedures identified pursuant to this section during the previous month.

C3-16 List of References

DOE, 2009. Waste Data System User's Manual. DOE/WIPP 09-3427, Current Revision, Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy.

DOE. 2003. Performance Demonstration Program Plan for the Analysis of Simulated Headspace Gases. DOE/CAO-95-1076, Current Revision, Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy.

DOE. 2005. Performance Demonstration Program Plan for RCRA Constituent Analysis of Solidified Wastes. DOE/CBFO-95-1077, Current Revision, Carlsbad, New Mexico, Carlsbad Area Office, U.S. Department of Energy.

EPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* SW-846, Fourth Edition, Washington, D.C., Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency.

Fisenne, I. M., et al. 1973. "Least Squares Analysis and Minimum Detection Levels Applied to Multi-Component Alpha Emitting Samples." *Radiochem. Radioanal. Letters,* 16, No. 1: pp. 5-16.

Pasternack B. S. and N. H. Harley. 1971. "Detection Limits for Radionuclides in the Analysis of Multi-Component Gamma-Spectrometric Data." *Nucl. Instr. and Meth,* No. 91: pp. 533-40.

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TABLES

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Table C3-1
Waste Material Parameters and Descriptions

Waste Material Parameter	Description
Iron-based Metals/Alloys	Iron and steel alloys in the waste; does not include the waste container materials
Aluminum-based Metals/Alloys	Aluminum or aluminum-based alloys in the waste materials
Other Metals	All other metals found in the waste materials
Other Inorganic Materials	Nonmetallic inorganic waste including concrete, glass, firebrick, ceramics, sand, and inorganic sorbents
Cellulosics	Materials generally derived from high-polymer plant carbohydrates; (e.g., paper, cardboard, wood, and cloth)
Rubber	Natural or man-made elastic latex materials; (e.g., surgeons' gloves, and leaded rubber gloves)
Plastics (waste materials)	Generally man-made materials, often derived from petroleum feedstock; (e.g., polyethylene and polyvinylchloride)
Organic Matrix	Cemented organic resins, solidified organic liquids and sludges
Inorganic Matrix	Any homogeneous materials consisting of sludge or aqueous-based liquids that are solidified with cement, calcium silicate, or other solidification agents; (e.g., wastewater treatment sludge, cemented aqueous liquids, and inorganic particulates)
Soils/gravel	Generally consists of naturally occurring soils that have been contaminated with inorganic waste materials
Steel (packaging materials)	55-gal (208-L) drums
Plastics (packaging materials)	90-mil polyethylene drum liner and plastic bags

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Table C3-2
Gas Volatile Organic Compounds Target Analyte List and Quality Assurance Objectives

Compound	CAS Number	Precision [a] (%RSD or RPD)	Accuracy [a] (%R)	MDL [b,d] (ng)	FTIRS MDL [b] (ppmv)	PRQL (ppmv)	Completeness (%)
Benzene	71-43-2	≤25	70-130	10	5	10	90
Bromoform	75-25-2	≤25	70-130	10	5	10	90
Carbon tetrachloride	56-23-5	≤25	70-130	10	5	10	90
Chlorobenzene	108-90-7	≤25	70-130	10	5	10	90
Chloroform	67-66-3	≤25	70-130	10	5	10	90
1,1-Dichloroethane	75-34-3	≤25	70-130	10	5	10	90
1,2-Dichloroethane	107-06-2	≤25	70-130	10	5	10	90
1,1-Dichloroethylene	75-35-4	≤25	70-130	10	5	10	90
trans-1,2-Dichloroethylene	156-60-5	≤25	70-130	10	5	10	90
Ethyl benzene [d]	100-41-4	≤25	70-130	10	10	10	90
Ethyl ether	60-29-7	≤25	70-130	10	5	10	90
Methylene chloride	75-09-2	≤25	70-130	10	5	10	90
1,1,2,2-Tetrachloroethane	79-34-5	≤25	70-130	10	5	10	90
Tetrachloroethylene	127-18-4	≤25	70-130	10	5	10	90
Toluene	108-88-3	≤25	70-130	10	5	10	90
1,1,1-Trichloroethane	71-55-6	≤25	70-130	10	5	10	90
Trichloroethylene	79-01-6	≤25	70-130	10	5	10	90
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	≤25	70-130	10	5	10	90
m-Xylene [c]	108-38-3	≤25	70-130	10	5	10	90
o-Xylene	95-47-6	≤25	70-130	10	5	10	90
p-Xylene [c]	106-42-3	≤25	70-130	10	5	10	90
Acetone	67-64-1	≤25	70-130	150	50	100	90
Butanol	71-36-3	≤25	70-130	150	50	100	90
Methanol	67-56-1	≤25	70-130	150	50	100	90
Methyl ethyl ketone	78-93-3	≤25	70-130	150	50	100	90
Methyl isobutyl ketone	108-10-1	≤25	70-130	150	50	100	90

[a] Criteria apply to PRQL concentrations.

[b] Values based on delivering 10 mL to the analytical system.

[c] These xylene isomers cannot be resolved by GC/MS.

[d] The ethyl benzene PRQL for FTIRS is 20 ppm

CAS = Chemical Abstract Service

%RSD = Percent relative standard deviation

RPD = Relative percent difference

%R = Percent recovery

MDL = Method detection limit (maximum permissible value), for GC/MS and GC/FID; total number of nanograms delivered to the analytical system per sample (nanograms); for FTIRS based on 1 m sample cell

PRQL = Program required quantitation limit (parts per million/volume basis)

Table C3-3
Summary of Laboratory Quality Control Samples and Frequencies for Gas Volatile Organic Compound Analysis

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
Method performance samples	Seven (7) samples initially and four (4) semiannually	Meet method QAOs	Repeat until acceptable
Laboratory duplicates or on-line duplicates	One (1) per analytical batch or on-line batch	RPD ≤ 25[b]	Nonconformance if RPD >25
Laboratory blanks or on-line blanks	Daily prior to sample analysis for GC/MS and GC/FID. Otherwise, daily prior to sample analysis and one (1) per analytical batch or on-line	Analyte amounts ≤ 3 × MDLs for GC/MS and GC/FID; ≤ PRQL for FTIRS	Flag Data if analyte amounts > 3 × MDLs for GC/MS and GC/FID; > PRQL for FTIRS
Laboratory control samples or on-line control samples	One (1) per analytical batch or on-line batch	70-130 %R	Nonconformance if %R <70 or >130
GC/MS comparison sample (for FTIRS only)	One (1) per analytical or on-line batch	RPD ≤ 25[b]	Nonconformance if RPD > 25
Blind audit samples	Samples and frequency controlled by the Gas PDP Plan	Specified in the Gas PDP Plan	Specified in the Gas PDP Plan
GC/MS	BFB Tune Every 12 hours	Abundance criteria for key ions are met	Repeat Until Acceptable
GC/MS	Minimum 5-point initial calibration (minimum of 5 standards) Initially and as needed	%RSD of response factor for each target analyte <35	Repeat Until Acceptable
GC/MS	Continuing calibration Every 12 hours	%D for all target analytes ≤ 30 of initial calibration	Repeat Until Acceptable
GC/FID	Minimum 3-point initial calibration (minimum 3 standards) Initially and as needed	Correlation coefficient ≥ 0.99 or %RSD <20 for each target analyte and the retention time of each target analyte within an acceptance criteria defined in the method	Repeat Until Acceptable
GC/FID	Continuing calibration Every 12 hours	%RSD ≤ 15%	Repeat Until Acceptable

[a] Corrective action per Section C3-13 when final reported QC samples do not meet the acceptance criteria.

[b] Applies only to concentrations greater than the PRQLs listed in Table C3-2.

MDL = Method Detection Limit
QAO = Quality Assurance Objective
PDP = Performance Demonstration Program
PRQL = Program Required Quantitation Limit
%R = Percent Recovery
RPD = Relative Percent Difference
BFB = 4-Bromofluorobenzene
%D = Percent difference
%RSD = Percent relative standard deviation

Table C3-4
Volatile Organic Compounds Target Analyte List and Quality Assurance Objectives

Compound	CAS Number	Precision [a] (%RSD or RPD)	Accuracy [a] (%R)	MDL [b] (mg/kg)	PRQL [b] (mg/kg)	Completeness (%)
Benzene	71-43-2	≤45	37-151	1	10	90
Bromoform	75-25-2	≤47	45-169	1	10	90
Carbon disulfide	75-15-0	≤50	60-150	1	10	90
Carbon tetrachloride	56-23-5	≤30	70-140	1	10	90
Chlorobenzene	108-90-7	≤38	37-160	1	10	90
Chloroform	67-66-3	≤44	51-138	1	10	90
1,4-Dichlorobenzene [c]	106-46-7	≤60	18-190	1	10	90
ortho-Dichlorobenzene [c]	95-50-1	≤60	18-190	1	10	90
1,2-Dichloroethane	107-06-2	≤42	49-155	1	10	90
1,1-Dichloroethylene	75-35-4	≤250	D-234[d]	1	10	90
trans-1,2-Dichloroethylene	156-60-5	≤50	60-150	1	10	90
Ethyl benzene	100-41-4	≤43	37-162	1	10	90
Methylene chloride	75-09-2	≤50	D-221[d]	1	10	90
1,1,2,2-Tetrachloroethane	79-34-5	≤55	46-157	1	10	90
Tetrachloroethylene	127-18-4	≤29	64-148	1	10	90
Toluene	108-88-3	≤29	47-150	1	10	90
1,1,1-Trichloroethane	71-55-6	≤33	52-162	1	10	90
1,1,2-Trichloroethane	79-00-5	≤38	52-150	1	10	90
Trichloroethylene	79-01-6	≤36	71-157	1	10	90
Trichlorofluoromethane	75-69-4	≤110	17-181	1	10	90
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	≤50	60-150	1	10	90
Vinyl chloride	75-01-4	≤200	D-251[d]	1	4	90
m-xylene	108-38-3	≤50	60-150	1	10	90
o-xylene	95-47-6	≤50	60-150	1	10	90
p-xylene	106-42-3	≤50	60-150	1	10	90
Acetone	67-64-1	≤50	60-150	10[e]	100	90
Butanol	71-36-3	≤50	60-150	10[e]	100	90
Ethyl ether	60-29-7	≤50	60-150	10[e]	100	90
Formaldehyde [f]	50-00-0	≤50	60-150	10[e]	100	90
Hydrazine [g]	302-01-2	≤50	60-150	10[e]	100	90
Isobutanol	78-83-1	≤50	60-150	10[e]	100	90
Methanol	67-56-1	≤50	60-150	10[e]	100	90
Methyl ethyl ketone	78-93-3	≤50	60-150	10[e]	100	90
Pyridine [c]	110-86-1	≤50	60-150	10[e]	100	90

[a] Applies to laboratory control samples and laboratory matrix spikes. If a solid laboratory control sample material which has established statistical control limits is used, then the established control limits for that material should be used for accuracy requirements.

[b] TCLP MDL and PRQL values are reported in units of mg/l and limits are reduced by a factor of 20.

[c] Can also be analyzed as a semi-volatile organic compound. If analyzed as a semi-volatile compound, the QAOs of Table C3-6 apply.

[d] Detected; result must be greater than zero.

[e] Estimate, to be determined.

[f] Required only for homogeneous solids and soil/gravel waste from Savannah River Site, if analysis is required to resolve assignment of EPA hazardous waste numbers.

[g] Required only for homogeneous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site, if analysis is required to resolve assignment of EPA hazardous waste numbers.

CAS = Chemical Abstract Service

%RSD = Percent relative standard deviation

RPD = Relative percent difference

%R = Percent recovery

MD = Method detection limit (maximum permissible value) (milligrams per kilogram)

PRQL = Program required quantitation limit; calculated from the toxicity characteristic level for benzene assuming a 0.9 oz (25-gram [g]) sample, 0.1 gal (0.5 liter [L]) of extraction fluid, and 100 percent analyte extraction (milligrams per kilogram)

1

Table C3-5
Summary of Laboratory Quality Control Samples and Frequencies for Volatile Organic Compound Analysis

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
Method performance samples	Seven (7) samples initially and four (4) semiannually	Meet Table C3-4 QAOs	Repeat until acceptable
Laboratory duplicates [b]	One (1) per analytical batch	Meet Table C3-4 precision QAOs	Nonconformance if RPDs > values in Table C3-4
Laboratory blanks	One (1) per analytical batch	Analyte concentrations ≤ 3 × MDLs	Nonconformance if analyte concentrations > 3 × MDLs
Matrix spikes [b]	One (1) per analytical batch	Meet Table C3-4 accuracy QAOs	Nonconformance if %Rs are outside the range specified in Table C3-4
Matrix spike duplicates	One (1) per analytical batch	Meet Table C3-4 accuracy and precision QAOs	Nonconformance if RPDs > values and %Rs outside range specified in Table C3-4
Laboratory control samples	One (1) per analytical batch	Meet Table C3-4 accuracy QAOs	Nonconformance if %R < 80 or > 120
GC/MS Calibration	BFB Tune every 12 hours 5-pt. Initial Calibration initially, and as needed	Abundance criteria met as per method Calibrate according to SW-846 Method requirements: %RSD for CCC ≤ 30, %RSD for all other compounds ≤ 15% Average response factor (RRF) used if %RSD ≤ 15, use linear regression if %RSD >15; R or R^2 ≥ 0.990 if using alternative curve System Performance Check Compound (SPCC) minimum RRF as per SW-846 Method; RRF for all other compounds ≥ 0.01	Repeat until acceptable
GC/MS Calibration (continued)	Continuing Calibration every 12 hours	%D ≤ 20 for CCC; SPCC minimum RRF as per SW-846 Method; RRF for all other compounds ≥ 0.01 RT for internal standard must be ± 30 seconds from last daily calibration, internal standard area count must be >50% and <200% of last daily calibration	Repeat until acceptable

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
GC/FID Calibration	3-pt. Initial Calibration initially and as needed Continuing Calibration every 12 hours	Correlation Coefficient ≥ 0.990 or %RSD ≤ 20 for all analytes %D or %Drift for all analytes ≤ 15 of expected values, RT ± 3 standard deviations from initial RT calibration per applicable SW-846 Method	Repeat until acceptable.
Surrogate compounds	Each analytical sample	Average %R from minimum of 30 samples for a given matrix ±3 standard deviations	Nonconformance if %R < (average %R - 3 standard deviation) or > (average %R + 3 standard deviation)
Blind audit samples	Samples and frequency controlled by the Solid PDP Plan	Specified in the Solid PDP Plan	Specified in the Solid PDP Plan

[a] Corrective Action per Section C3-13 when final reported QC samples do not meet the acceptance criteria. Nonconformances do not apply to matrix related exceedances.

[b] May be satisfied using matrix spike duplicate; acceptance criteria applies only to concentrations greater than the PRQLs listed in Table C3-4.

MDL = Method detection limit

QAO = Quality assurance objective

PDP = Performance Demonstration Program

%R = Percent recovery

RPD = Relative percent difference

1

1
2

Table C3-6
Semi-Volatile Organic Compound Target Analyte List and Quality Assurance Objectives

Compound	CAS Number	Precision [a] (%RSD or RPD)	Accuracy [a] (%R)	MDL [b] (mg/kg)	PRQL [b] (mg/kg)	Completeness (%)
Cresols	1319-77-3	≤50	25-115	5	40	90
1,4-Dichlorobenzene [bc]	106-46-7	≤86	20-124	5	40	90
ortho-Dichlorobenzene [c]	95-50-1	≤64	32-129	5	40	90
2,4-Dinitrophenol	51-28-5	≤119	D-172[d]	5	40	90
2,4-Dinitrotoluene	121-14-2	≤46	39-139	0.3	2.6	90
Hexachlorobenzene	118-74-1	≤319	D-152[d]	0.3	2.6	90
Hexachloroethane	67-72-1	≤44	40-113	5	40	90
Nitrobenzene	98-95-3	≤72	35-180	5	40	90
Pentachlorophenol	87-86-5	≤128	14-176	5	40	90
Pyridine [c]	110-86-1	≤50	25-115	5	40	90

CAS = Chemical Abstract Service

%RSD = Percent relative standard deviation

RPD = Relative percent difference

%R = Percent recovery

MDL = Method detection limit (maximum permissible value) (milligrams per kilogram)

PRQL = Program required quantitation limit; calculated from the toxicity characteristic level for nitrobenzene assuming a 100-gram (g) sample, 0.5 gal (2 liter [L]) of extraction fluid, and 100 percent analyte extraction (milligrams per kilograms)

[a] Applies to laboratory control samples and laboratory matrix spikes. If a solid laboratory control sample material which has established statistical control limits is used, then the established control limits for that material should be used for accuracy requirements.

[b] TCLP MDL and PRQL values are reported in units of mg/l and limits are reduced by a factor of 20.

[c] Can also be analyzed as a volatile organic compound

[d] Detected; result must be greater than zero

3

Table C3-7
Summary of Laboratory Quality Control Samples and Frequencies for Semi-Volatile Organic Compounds Analysis

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
Method performance samples	Seven (7) samples initially and four (4) semiannually	Meet Table C3-6 QAOs	Repeat until acceptable
Laboratory duplicates [b]	One (1) per analytical batch	Meet Table C3-6 precision QAOs	Nonconformance if RPDs > values in Table C3-6
Laboratory blanks	One (1) per analytical batch	Analyte concentrations ≤ 3 x MDLs	Nonconformance if analyte concentrations > 3 x MDLs
Matrix spikes	One (1) per analytical batch	Meet Table C3-6 accuracy QAOs	Nonconformance if RPDs > values and %Rs outside range in Table C3-6
GC/MS Calibration	DFTPP Tune every 12 hours 5-pt. Initial Calibration initially, and as needed Continuing Calibration every 12 hours	Abundance criteria met as per method Calibrate according to SW-846 Method requirements: %RSD for CCC ≤ 30, %RSD for all other compounds ≤ 15% Average response factor (RRF) used if %RSD ≤ 15, use linear regression if >15; R or R^2 ≥0.990 if using alternative curve System Performance Check Compound (SPCC) minimum RRF as per SW-846 Method; RRF for all other compounds ≥ 0.01 %D≤ 20 for CCC, SPCC minimum RRF as per SW-846 Method; RRF for all other compounds ≥ 0.01 RT for internal standard must be ± 30 seconds from last daily calibration, internal standard area count must be >50% and <200% of last daily calibration	Repeat until acceptable

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QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
GC/ECD Calibration	5-pt. Calibration initially and as needed Continuing Calibration every 12 hours	Correlation Coefficient ≥ 0.990 or %RSD < 20 for all analytes %D or %Drift for all analytes ≤ 15 of expected values, RT ± 3 standard deviations of initial RT calibration per applicable SW-846 Method	Repeat until acceptable
Matrix spike duplicates	One (1) per analytical batch	Meet Table C3-6 accuracy and precision QAOs	Nonconformance if RPDs > values and %Rs outside range specified in Table C3-6
Laboratory control samples	One (1) per analytical batch	Meet Table C3-6 accuracy QAOs	Nonconformance if %R < 80 or > 120
Surrogate compounds	Each analytical sample	Average %R from minimum of 30 samples from a given matrix ±3 standard deviations	Nonconformance if %R < (average %R - 3 standard deviations) or > (average %R + 3 standard deviations)
Blind audit samples	Samples and frequency controlled by the Solid PDP Plan	Specified in the Solid PDP Plan	Specified in the Solid PDP Plan

[a] Corrective action per Section C3-13 when final reported QC samples do not meet the acceptance criteria. Nonconformances do not apply to matrix related exceedances.

[b] May be satisfied by using matrix spike duplicate; acceptance criteria applies only to concentrations greater than the PRQLs listed in Table C3-6.

MDL = Method Detection Limit
QAO = Quality Assurance Objective
PDP = Performance Demonstration Program
%R = Percent Recovery
RPD = Relative Percent Difference

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Table C3-8
Metals Target Analyte List and Quality Assurance Objectives

Analyte	CAS Number	Precision (%RSD or RPD)[a]	Accuracy (%R)[b]	PRDL[d] (µg/L)	PRQL[c] (mg/kg)	Completeness (%)
Antimony	7440-36-0	≤30	80-120	100	100	90
Arsenic	7440-38-2	≤30	80-120	100	100	90
Barium	7440-39-3	≤30	80-120	2000	2000	90
Beryllium	7440-41-7	≤30	80-120	100	100	90
Cadmium	7440-43-9	≤30	80-120	20	20	90
Chromium	7440-47-3	≤30	80-120	100	100	90
Lead	7439-92-1	≤30	80-120	100	100	90
Mercury	7439-97-6	≤30	80-120	4.0	4.0	90
Nickel	7440-02-0	≤30	80-120	100	100	90
Selenium	7782-49-2	≤30	80-120	20	20	90
Silver	7440-22-4	≤30	80-120	100	100	90
Thallium	7440-28-0	≤30	80-120	100	100	90
Vanadium	7440-62-2	≤30	80-120	100	100	90
Zinc	7440-66-6	≤30	80-120	100	100	90

[a] ≤ 30 percent control limits apply when sample and duplicate concentrations are ≥ 10 × IDL for ICP-AES and AA techniques, and ≥ 100 × IDL for Inductively Coupled Plasma—Mass Spectrometry (ICP-MS) techniques. If less than these limits, the absolute difference between the two values shall be less than or equal to the PRQL.

[b] Applies to laboratory control samples and laboratory matrix spikes. If a solid laboratory control sample material which has established statistical control limits is used, then the established control limits for that material should be used for accuracy requirements.

[c] TCLP PRQL values are reported in units of mg/l and limits are reduced by a factor of 20.

[d] PRDL set such that it is a factor of 10 below the PRQL for 100 percent solid samples, assuming a 100× dilution during digestion.

CAS = Chemical Abstract Service
%RSD = Percent relative standard deviation
RPD = Relative percent difference
%R = Percent recovery
PRDL = Program required detection limit (i.e., maximum permissible value for IDL) (micrograms per liter)
PRQL = Program required quantitation limit (milligrams per kilogram)

Table C3-9
Summary of Laboratory Quality Control Samples and Frequencies for Metals Analysis

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
Method performance samples	Seven (7) samples initially and four (4) semiannually	Meet Table C3-8 QAOs	Repeat until acceptable
Laboratory blanks	One (1) per analytical batch	≤ 3 × IDL (≤ 5 × IDL for ICP-MS)[b]	Redigest and reanalyze any samples with analyte concentrations which are ≤10 × blank value and ≥ 0.5 × PRQL
Matrix spikes	One (1) per analytical batch	Meet Table C3-8 accuracy QAOs	Nonconformance if %R outside the range specified in Table C3-8
Matrix spike duplicates	One (1) per analytical batch	Meet Table C3-8 accuracy and precision QAOs	Nonconformance if RPDs > values and %Rs outside range specified in Table C3-8
ICP-MS Tune (ICP-MS Only)	Daily	4 Replicate %RSD ≤ 5; mass calibration within 0.9 amu; resolution < 1.0 amu full width at 10% peak height	Nonconformance if %RSD > 5; mass calibration > 0.9 amu; resolution > 1.0 amu
Initial Calibration 1 blank, 1 standard (ICP, ICP-MS) 3 standard, 1 blank (GFAA, FLAA) 5 standard, 1 blank (CVAA, HAA)	Daily	90-110 %R (80-120% for CVAA, GFAA, HAA, FLAA) for initial calibration verification solution. Regression coefficient ≥ 0.995 for FLAA, CVAA, GFAA, MAA	Correct problem and recalibrate; repeat initial calibration
Continuing Calibration	Every 10 samples and beginning and end of run	90-110% for continuing calibration verification solution. (80-120% for CVAA, GFAA, HAA, FLAA)	Correct problem and recalibrate; rerun last 10 samples
Internal Standard Area Verification (ICP-MS)	Every Sample	Meet SW-846 Method 6020 criteria	Nonconformance if not reanalyzed at 5 × dilution until criteria are met
Serial Dilution (ICP, ICP-MS)	One (1) per analytical batch	5 × dilution must be ≤10% D of initial value for sample > 50×IDL	Flag Data if >10% and > 50×IDL
Interference Correction Verification (ICP, ICP-MS)	Beginning and end of run or every 12 hours (8 for ICP) whichever is more frequent	80-120% recovery for analytes Note: Acceptance Criteria and Corrective Action apply only if interferents found in samples at levels greater than ICS A Solution	Correct problem and recalibrate, nonconformance if not corrected

QC Sample	Minimum Frequency	Acceptance Criteria	Corrective Action [a]
Laboratory Control Samples	One (1) per analytical batch	Table C3-8 accuracy QAOs	Redigest and reanalyze for affected analytes; non conformance if not reanalyzed
Blind audit samples	Samples and frequency controlled by the Solid PDP Plan	Specified in the Solid PDP Plan	Specified in the Solid PDP Plan

[a] Corrective action per Section C3-13 when final reported QC samples do not meet the acceptance criteria. Nonconformances do not apply to matrix related exceedances.

[b] Applies only to concentrations greater than the PRQLs listed in Table C3-8.

IDL = Instrument Detection Limit

PDP = Performance Demonstration Program

PRQL = Program Required Quantitation Limit

%R = Percent Recovery

RPD = Relative Percent Difference

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Table C3-10
Minimum Training and Qualifications Requirements [a]

Personnel	Requirements [a]
Radiography Operators [c]	Site-specific training based on waste matrix codes and waste material parameters; requalification every 2 years
FTIRS Technical Supervisors [b] FTIRS Operators [c]	Site-specific and on-the-job training based on the site-specific FTIRS system; requalification every 2 years
Gas Chromatography Technical Supervisors [b] Gas Chromatography Operators [c]	B.S. or equivalent experience and 6 months previous applicable experience
Gas Chromatography/Mass Spectrometry Operators [c] Mass Spectrometry Operators [c]	B.S. or equivalent experience and 1 year independent spectral interpretation or demonstrated expertise
Gas Chromatography/Mass Spectrometry Technical Supervisors [b] Mass Spectrometry Technical Supervisors [b] Atomic Absorption Spectroscopy Technical Supervisors [b] Atomic Absorption Spectroscopy Operators [c] Atomic Mass Spectrometry Operators [c] Atomic Emission Spectroscopy Operators [c]	B.S. or equivalent experience and 1 year applicable experience
Atomic Mass Spectrometry Technical Supervisors [b]	B.S. and specialized training in Atomic Mass Spectrometry and 2 years applicable experience
Atomic Emission Spectroscopy Technical Supervisors [b]	B.S. and specialized training in Atomic Emission Spectroscopy and 2 years applicable experience.

[a] Based on requirements contained in *USEPA Contract Laboratory Program Statement of Work for Organics Analysis* (Document Number OLM 01.0) and *Statement of Work for Inorganics Analysis* (Document Number ILM 03.0).

[b] Technical Supervisors are those persons responsible for the overall technical operation and development of a specific laboratory technique. QAPjPs shall include the site-specific title for this position.

[c] Operators are those persons responsible for the actual operation of analytical equipment. QAPjPs shall include the site-specific title for this position.

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Table C3-11
Testing Batch Data Report Contents

Required Information	Radiography	Visual Examination	Comment
Batch Data Report Date	X	X	
Batch number	X	X	
Waste container number	X	X	
Waste stream name and/or number	O	O	
Waste Matrix Code	X	X	Summary Category Group included in waste matrix code
Implementing procedure (specific version used)	X	X	If procedure cited contains more than one method, the method used must also be cited. Can use revision number, date, or other means to track specific version used.
Container type	O	O	Drums, Standard Waste Box, Ten Drum Overpack, etc.
Video media reference	X	X	Reference to Video media applicable to each container. For visual examination of newly generated waste, video media not required if two trained operators review the contents of the waste container to ensure correct reporting.
Imaging check	O		
Camera check		O	
Audio check	O	O	
QC documentation	X	X	
Verification that the physical form matches the waste stream description and Waste Matrix Code.	X	X	Summary Category Group included in waste matrix code
Comments	X	X	
Reference to or copy of associated NCRs, if any	X	X	Copies of associated NCRs must be available.
Verify absence of prohibited items	X	X	
Operator signature and date of test	X	X	Signatures of both operators required for Visual Verification of Acceptable Knowledge
Data review checklists	X	X	All data review checklists will be identified

LEGEND:

X - Required in batch data report.

O - Information must be documented and traceable; inclusion in batch data report is optional.

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Table C3-12
Sampling Batch Data Report Contents

Required Information	Headspace Gas	Solid Sampling	Comment
Batch Data Report Date	X	X	
Batch number	X	X	
Waste stream name and/or number	O	O	
Waste Matrix Code		X	Summary Category Group included in Waste Matrix Code
Procedure (specific version used)	X	X	If procedure cited contains more than one method, the method used must also be cited. Can use revision number, date, or other means to track specific version used.
Container number	X	X	
Container type	O	O	Drums, Standard Waste Box, Ten Drum Overpack, etc.
Sample matrix and type	X	X	
Analyses requested and laboratory	X	X	
Point of origin for sampling	X	X	Location where sample was taken (e.g., building number, room)
Sample number	X	X	
Sample size	X	X	
Sample location	X	X	Location within container where sample is taken. (For HSG, specify what layer of confinement was sampled. For solids, physical location within container.)
Sample preservation	X	X	
Person collecting sample	X	X	
Person attaching custody seal	O	O	May or may not be the same as the person collecting the sample
Chain of custody record	X	X	Original or copy is allowed
Sampling equipment numbers	X	X	For disposable equipment, a reference to the lot

Required Information	Headspace Gas	Solid Sampling	Comment
Drum age	X		Must include all supporting determinative information, including but not limited to packaging date, equilibrium start time, storage temperature, and sampling date/time. If Scenario 3 is used, the packaging configuration, filter diffusivity, liner presence/absence, and rigid liner vent hole diameter used in determining the DAC must be documented. If Scenario 1 and 2 are used together, the filter diffusivity and rigid liner vent hole diameter used in determining the DAC must be documented. If default values are used for retrievably stored waste, these values must clearly be identified as such.
Cross-reference of sampling equipment numbers with associated cleaning batch numbers	O	X	As applicable to the equipment used for the sampling. For disposable equipment, a reference to the lot and procurement records to support cleanliness is sufficient
Drum age	X		
Equilibration time	X		
Verification of rigid liner venting	X		Only applicable to containers with rigid liners
Verification that sample volume taken is small in comparison to the available volume	X		Must include headspace gas volume when it can be estimated
Scale Calibration		O	
Depth of waste		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a representative sample has been taken.
Calculation of core recovery		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a representative sample has been taken.
Co-located core description		X	For newly generated waste, if a sampling method other than coring is used, this is replaced by documentation that a QC sample has been taken.
Time between coring and subsampling		X	Only applicable to coring.
OVA calibration and reading	O		Only applicable to manifold systems. Must be done in accordance with manufacturer's specifications

Required Information	Headspace Gas	Solid Sampling	Comment
Field Records	X	X	Must contain the following as applicable to the sampling method used: Collection problems, Sequence of sampling collection, Inspection of the solids sampling area, Inspection of the solids sampling equipment, Coring tool test, random location of sub-sample, canister pressure, and ambient temperature and pressure.
Reference to or copy of associated NCRs, if any	X	X	Copies of associated NCRs must be available.
Operator Signature and date and time of sampling	X	X	
Data review checklists	X	X	All data review checklists will be identified

LEGEND:

X - Required in batch data report.

O - Information must be documented and traceable; inclusion in batch data report is optional.

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Table C3-13
Analytical Batch Data Report Contents

Required Information	Headspace Gas	Solid Sampling	Comment
Batch Data Report Date	X	X	
Batch number	X	X	
Sample numbers	X	X	
QC designation for sample	X	X	
Implementing procedure (specific version used)	X	X	If procedure cited contains more than one method, the method used must also be cited. Can use revision number, date, or other means to track specific version used.
QC sample results	X	X	
Sample data forms	X	X	Form should contain reduced data for target analytes and TICs
Chain of custody	X	X	Original or copy
Gas canister tags	X		Original or copy
Sample preservation	X	X	
Holding time		X	
Cross-reference of field numbers to laboratory sample numbers	X	X	
Date and time analyzed	X	X	
Verification of spectra used for results	O	O	Analyst must qualitatively evaluate the validity of the results based on the spectra, can be implemented as a check box for each sample
TIC evaluation	X	X	
Reporting flags, if any	X	X	Table C3-14 lists applicable flags
Case narrative	X	X	
Reference to or copy of associated NCRs, if any	X	X	Copies of associated NCRs must be available.
Operator signature and analysis date	X	X	
Data review checklists	X	X	All data review checklists will be identified

LEGEND:

X - Required in batch data report.

O - Information must be documented and traceable; inclusion in batch data report is optional.

Table C3-14
Data Reporting Flags

Data Flag	Indicator
B	Analyte detected in blank (Organics/ Headspace gases)
B	Analyte blank concentration greater than or equal to 20 percent of sample concentration prior to dilution corrections (Metals)
E	Analyte exceeds calibration curve (Organics/ Headspace gases)
J	Analyte less than PRQL but greater than or equal to MDL (Organics/ Headspace gases)
J	Analyte greater than or equal to IDL but less than 5 times the IDL before dilution correction (Metals)
U	Analyte was not detected and value is reported as the MDL (IDL for Metals)
D	Analyte was quantitated from a secondary dilution, or reduced sample aliquot (Organics/ Headspace gases)
Z	One or more QC samples do not meet acceptance criteria
H	Holding time exceeded

FIGURES

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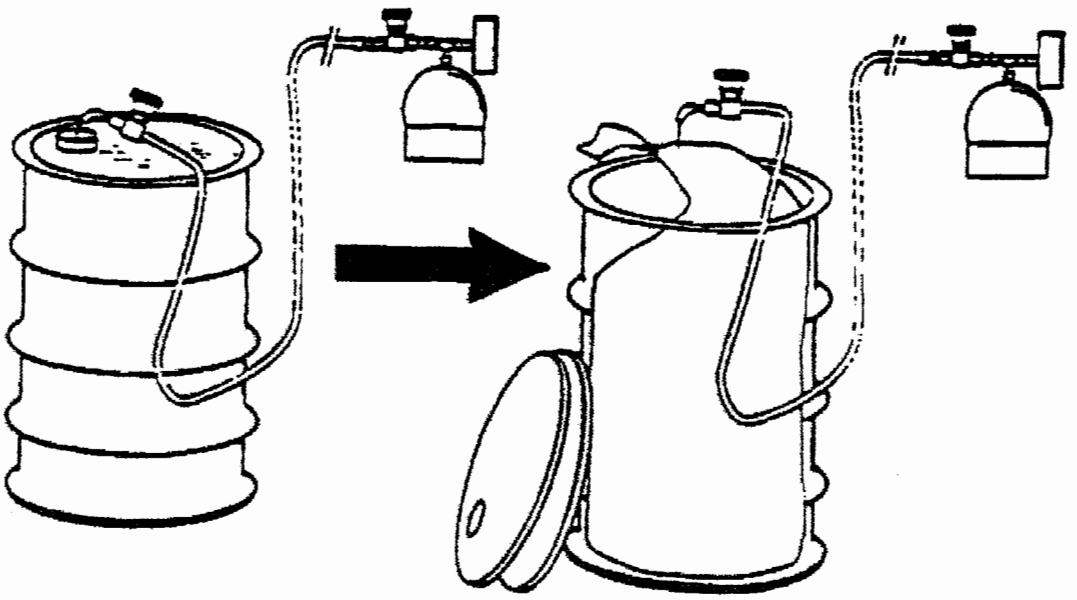

Figure C3-1
Overall Headspace-Gas Sampling Scheme Illustrating Manifold Sampling

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ATTACHMENT C4

TRU MIXED WASTE CHARACTERIZATION USING ACCEPTABLE KNOWLEDGE

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ATTACHMENT C4

TRU MIXED WASTE CHARACTERIZATION USING ACCEPTABLE KNOWLEDGE

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ATTACHMENT C4

TRU MIXED WASTE CHARACTERIZATION USING ACCEPTABLE KNOWLEDGE

C4-1 Introduction

The Resource Conservation and Recovery Act (**RCRA**) regulations codified in 40 CFR Parts 260 through 265, 268, and 270, and the New Mexico Hazardous Waste Management Regulations in 20.4.1 NMAC Subparts 100 through 600, Subpart 800, and Subpart 900, authorize the use of acceptable knowledge (**AK**) in appropriate circumstances by waste generators, or treatment, storage, or disposal facilities to characterize hazardous waste. Acceptable knowledge is described in *Waste Analysis: EPA Guidance Manual for Facilities That Generate, Treat, Store and Dispose of Hazardous Waste* (EPA, 1994). Acceptable knowledge, as an alternative to sampling and analysis, can be used to meet all or part of the waste characterization requirements under the RCRA (EPA, 1994).

EPA's 1994 Waste Analysis Guidance Manual broadly defines the term "acceptable knowledge" to include process knowledge, whereby detailed information on the wastes is obtained from existing published or documented waste analysis data or studies conducted on hazardous waste generated by processes similar to that which generated the waste; facility records of analysis performed before the effective date of RCRA; and waste analysis data obtained from generators of similar wastes that send their wastes off-site for treatment, storage, or disposal (EPA, 1994). If a generator/storage site determines that AK alone is insufficient to accurately characterize a waste, the site may use radiography and/or visual examination, headspace gas sampling and analysis, and homogeneous waste sampling and analysis (specified in Permit Attachment C1) to complete the waste characterization process and satisfy the requirements of the Waste Analysis Plan (**WAP**) specified in Permit Attachment C. Acceptable knowledge is used in TRU mixed waste characterization activities in five ways:

- To delineate TRU mixed waste streams
- To assess whether TRU mixed wastes comply with the applicable requirements of the Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**)
- To assess whether TRU mixed wastes exhibit a hazardous characteristic (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart C)
- To assess whether TRU mixed wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR §261 Subpart D)
- To estimate waste material parameter weights

Sampling and analysis may be performed to augment the characterization of wastes based on acceptable knowledge when an AK Sufficiency Determination has not been requested by the generator/storage site or, if requested, has not been granted by the U.S. Department of Energy (**DOE**) (see Section C4-3d). Sampling and analysis consists of radiography, visual examination, headspace gas, and homogeneous waste sampling and analysis. TRU mixed waste streams

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shall undergo applicable provisions of the acceptable knowledge process prior to management, storage, or disposal by the Permittees at WIPP.

C4-2 Acceptable Knowledge Documentation

The Permittees shall obtain from each DOE TRU mixed waste generator/storage site (**site**) a logical sequence of acceptable knowledge information that progresses from general facility information (TRU Mixed Waste Management Program Information) to more detailed waste-specific information (TRU Mixed Waste Stream Information). Traceability of acceptable knowledge information for a selected container in the audited Waste Summary Category Group(s) will be examined during DOE's audit of a site (Section C4-3g). The consistent presentation of acceptable knowledge documentation among sites in auditable records[1] will allow DOE to verify the completeness and adequacy of acceptable knowledge for TRU mixed waste characterization during the audit process. The Permittees shall require sites to implement the acceptable knowledge process as specified in this Permit to characterize TRU mixed wastes and obtain sufficient waste characterization data to demonstrate compliance with the Permit. The New Mexico Environment Department (**NMED**) may independently validate the implementation of and compliance with applicable provisions of the WAP at each generator/storage site by participation in the Audit and Surveillance Program (Permit Attachment C6). DOE shall provide NMED with current audit schedules and notify NMED in writing no later than thirty (30) calendar days prior to each audit. NMED may choose to accompany DOE on any audit of the WAP implementation.

The following sections include the information the Permittees will require for each site to characterize TRU mixed waste using acceptable knowledge. Because waste generating processes are site-specific, sites shall, as necessary, augment the required acceptable knowledge records with additional supporting information (see Section C4-2c, Additional Acceptable Knowledge Information). If the required information is not available for a particular waste stream, the waste stream will not be eligible for an AK Sufficiency Determination as specified in Section C4-3d.

C4-2a Required TRU Mixed Waste Management Program Information

TRU mixed waste management program information shall clearly define waste categorization schemes and terminology, provide a breakdown of the types and quantities of TRU mixed waste that are generated and stored at the site, and describe how waste is tracked and managed at the site, including historical and current operations. Information related to TRU mixed waste certification procedures and the types of documentation (e.g., waste profile forms) used to summarize acceptable knowledge shall also be provided. The following information shall be included as part of the acceptable knowledge written record:

- Map of the site with the areas and facilities involved in TRU mixed waste generation, treatment, and storage identified

[1] "Auditable records" mean those records which allow the Permittees to conduct a systematic assessment, analysis, and evaluation of the Permittees compliance with the WAP and this Permit.

- Facility mission description as related to TRU mixed waste generation and management (e.g., nuclear weapons research may involve metallurgy, radiochemistry, and nuclear physics operations that result in specific waste streams)
- Description of the operations that generate TRU mixed waste at the site (e.g., plutonium recovery, weapons design, or weapons fabrication)
- Waste identification or categorization schemes used at the facility (e.g., item description codes, content codes)
- Types and quantities of TRU mixed waste generated, including historical generation through future projections
- Correlation of waste streams generated from the same building and process, as appropriate (e.g., sludge, combustibles, metals, and glass)
- Waste certification procedures for retrievably stored and newly generated wastes to be sent to the WIPP facility

C4-2b Required TRU Mixed Waste Stream Information

Sites may use acceptable knowledge to delineate site-specific waste streams. For each TRU mixed waste stream, the Permittees shall require sites to compile all process information and data that support the acceptable knowledge used to characterize that waste stream. The type and quantity of supporting documentation will vary by waste stream, depending on the process generating the waste and site-specific requirements imposed by the Permittees. At a minimum, the waste process information shall include the following written information:

- Area(s) and/or building(s) from which the waste stream was or is generated
- Waste stream volume and time period of generation (e.g., 100 standard waste boxes of retrievable stored waste generated from June 1977 through December 1977)
- Waste generating process described for each building (e.g., batch waste stream generated during decommissioning operations of glove boxes), including processes associated with U134 waste generation, if applicable.
- Documentation regarding how the site has historically managed the waste, including the historical regulatory status of the waste (i.e., TRU mixed versus TRU non-mixed waste)
- Process flow diagrams (e.g., a diagram illustrating glove boxes from a specific building to a size reduction facility to a container storage area). In the case of research/development, analytical laboratory waste, or other similar processes where process flow diagrams cannot be created, a description of the waste generating processes, rather than a formal process flow diagram, may be included if this modification is justified and the justification is placed in the auditable record

- Material inputs or other information that identifies the chemical content of the waste stream and the physical waste form (e.g., glove box materials and chemicals handled during glove box operations; events or processes that may have modified the chemical or physical properties of the waste stream after generation; data obtained through visual examination of newly generated waste that later undergoes radiography; information demonstrating neutralization of U134 [hydrofluoric acid] and waste compatibility)

The acceptable knowledge written record shall include a summary that identifies all sources of waste characterization information used to delineate the waste stream. The basis and rationale for delineating each waste stream, based on the parameters of interest, shall be clearly summarized and traceable to referenced documents. Assumptions made in delineating each waste stream also shall be identified and justified. If discrepancies exist between required information, then sites may consider applying all hazardous waste numbers indicated by the information to the subject waste stream, but must assess and evaluate the information to determine the appropriate hazardous waste numbers consistent with RCRA requirements. The Permittees shall obtain from each site, at a minimum, procedures that comply with the following acceptable knowledge requirements:

- Procedures for identifying and assigning the physical waste form of the waste
- Procedures for delineating waste streams and assigning Waste Matrix Codes
- Procedures for resolving inconsistencies in acceptable knowledge documentation
- Procedures for headspace gas sampling and analysis, visual examination and/or radiography, and homogeneous waste sampling and analysis, if applicable
- For newly generated waste, procedures describing process controls used to ensure prohibited items (specified in the WAP, Permit Attachment C) are documented and managed
- Procedures to ensure radiography and visual examination include a list of prohibited items that the operator shall verify are not present in each container (e.g., liquid exceeding TSDF-WAC limits, corrosives, ignitables, reactives, and incompatible wastes)
- Procedures to document how changes to Waste Matrix Codes, waste stream assignment, and associated Environmental Protection Agency (**EPA**) hazardous waste numbers based on material composition are documented for any waste
- Procedures that ensure the assignment of EPA hazardous waste numbers is appropriate, consistent with RCRA requirements, and considers site historical waste management
- Procedures for estimating waste material parameter weights

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C4-2c Additional Acceptable Knowledge Information

The generator/storage sites shall obtain additional acceptable knowledge information. Sites shall collect information as appropriate to augment required information and provide any other information obtained to further delineate waste streams. Adequacy of this information shall be assessed by DOE during audits (Section C4-3g). Sites will use this information to compile the acceptable knowledge written record.

All additional specific, relevant acceptable knowledge documentation assembled and used in the acceptable knowledge process, whether it supports or contradicts any required acceptable knowledge documentation, shall be identified and an explanation provided for its use (e.g., identification of a toxicity characteristic). Additional documentation may be used to further document the rationale for the hazardous characterization results. The collection and use of additional information shall be assessed by DOE during site audits to ensure that hazardous waste characterization is supported, as necessary, by such information. Similar to required information, if discrepancies exist between additional information and the required information, then sites may consider applying all hazardous waste numbers indicated by the additional information to the subject waste stream, but must assess and evaluate the information to determine the appropriate hazardous waste numbers consistent with RCRA requirements. All information considered must be documented and placed in the auditable record, including applicable discrepancy resolution documentation.

Additional acceptable knowledge documentation includes, but is not limited to, the following information:

- Process design documents (e.g., Title II Design)
- Standard operating procedures that may include a list of raw materials or reagents, a description of the process or experiment generating the waste, and a description of wastes generated and how the wastes are managed at the point of generation
- Preliminary and final safety analysis reports and technical safety requirements
- Waste packaging records
- Test plans or research project reports that describe reagents and other raw materials used in experiments
- Site databases (e.g., chemical inventory database for Superfund Amendments and Reauthorization Act Title III requirements)
- Information from site personnel (e.g., documented interviews)
- Standard industry documents (e.g., vendor information)
- Analytical data relevant to the waste stream, including results from fingerprint analyses, spot checks, routine verification sampling, or other processes that collect information pertinent to the waste stream. This may also include new information

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which augments required information (e.g., visual examination not performed in compliance with the WAP, radiography screening for prohibited items)

- Material Safety Data Sheets, product labels, or other product package information
- Sampling and analysis data from comparable or surrogate waste streams (e.g., equivalent nonradioactive materials)
- Laboratory notebooks that detail the research processes and raw materials used in an experiment

For waste containers that belong to LANL sealed sources waste streams, these containers do not require headspace gas sampling and analysis if the following information is part of the AK documentation:

- Documentation that the waste container contents meet the definition of sealed sources per 10 CFR §30.4 and 10 CFR §835.2 (effective January 1, 2004).
- Documentation of the certification of the sealed sources as U.S. Department of Transportation Special Form Class 7 (Radioactive) Material per 49 CFR §173.403 (effective October 1, 2003).
- Documentation of contamination survey results that validate the integrity of each sealed source per 10 CFR §34.27 (effective January 1, 2004).
- AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources.
- The outer casing of each sealed source must be of a non-VOC bearing material, which must be verified at the time of packaging.
- AK Documentation shall also include but shall not be limited to, as available and as necessary to determine the hazardous constituents associated with sealed sources, the following: source manufacturer's sales catalogues, original purchase records, source manufacturer's fabrication documents, source manufacturer's drawings, source manufacturer's fuel capture assembly reports, source manufacturer's operational procedures for cleanliness requirements, source manufacturer's shipping documents, source manufacturer's welding records, transuranic batch material records, and information from national databases (e.g., NMMSS). All of this information may not and need not be available for each source, but sufficient information must be included in the auditable record to derive an adequate understanding of source construction and history to ensure that no VOCs are present in association with the sealed source itself that would render the source hazardous. If AK data indicate that assignment of a hazardous waste number related to organic materials is required in association with a source, this specific source will be assigned to a separate waste stream and that waste stream will be subject to representative headspace gas sampling unless a separate AK Sufficiency Determination is approved by DOE for the waste stream.

C4-3 Acceptable Knowledge Training, Procedures and Other Requirements

The Permittees shall require consistency among sites in using acceptable knowledge information to characterize TRU mixed waste by the use of the following: 1) compiling the required and additional acceptable knowledge documentation in an auditable record, 2) auditing acceptable knowledge records, and 3) WSPF approval and waste confirmation. This section specifies qualification and training requirements, describes each phase of the process, specifies the procedures that the Permittees shall require all sites to develop to implement the requirements for using acceptable knowledge, and specifies data quality requirements for acceptable knowledge.

C4-3a Qualifications and Training Requirements

Site personnel responsible for compiling acceptable knowledge, assessing acceptable knowledge, and resolving discrepancies associated with acceptable knowledge shall be qualified and trained in the following areas at a minimum:

- WIPP WAP in Permit Attachment C and the TSDF-WAC specified in this permit
- State and Federal RCRA regulations associated with solid and hazardous waste characterization
- Discrepancy resolution and reporting processes
- Site-specific procedures associated with waste characterization using acceptable knowledge

C4-3b Acceptable Knowledge Assembly and Compilation

The Permittees shall obtain from sites acceptable knowledge procedures which require consistent application of the acceptable knowledge process and requirements. Site-specific acceptable knowledge procedures shall address the following:

- Sites shall prepare and implement a written procedure outlining the specific methodology used to assemble acceptable knowledge records, including the origin of the documentation, how it will be used, and any limitations associated with the information (e.g., identify the purpose and scope of a study that included limited sampling and analysis data).
- Sites shall develop and implement a written procedure to compile the required acceptable knowledge record.
- Sites shall develop and implement a written procedure that ensures unacceptable wastes (e.g., reactive, ignitable, corrosive) are identified and segregated from TRU mixed waste populations sent to WIPP.
- Sites shall prepare and implement a written procedure to evaluate acceptable knowledge and resolve discrepancies. For example, if different sources of information indicate different hazardous wastes are present, then sites shall include all sources of information in its records and may choose to either conservatively assign hazardous

waste numbers or assign only those numbers deemed appropriate and consistent with RCRA requirements. All information used to justify assignment of hazardous waste numbers must be placed in the auditable record. Further, the assignment of hazardous waste numbers shall be tracked in the auditable record to all required documentation.

- Sites shall prepare and implement a written procedure to identify hazardous wastes and assign the appropriate hazardous waste numbers to each waste stream. The following are minimum baseline requirements/standards that site-specific procedures shall include to ensure comparable and consistent characterization of hazardous waste:

  - Compile all of the required information in an auditable record.

  - Review the compiled information and delineate waste streams. Delineation of waste streams must comply with the definition in Permit Attachment C, Section C-0a, and justify combining waste historically managed separately as TRU mixed and TRU non-mixed waste streams into a single waste stream.

  - Review the compiled information to determine if the waste stream is compliant with the TSDF-WAC.

  - Review the required information to determine if the waste is listed under 20.4.1.200 NMAC (incorporating 40 CFR §261), Subpart D. Assign all listed hazardous waste numbers unless the sites choose to justify an alternative assignment and document the justification in the auditable record.

  - Review the required information to determine if the waste exhibits a hazardous characteristic or may contain hazardous constituents included in the toxicity characteristics specified in 20.4.1.200 NMAC (incorporating 40 CFR §261), Subpart C. If a toxicity characteristic contaminant is identified and is not included as a listed waste, sites may evaluate available data and assign the toxicity characteristic hazardous waste number consistent with RCRA requirements. All data examined to reach the hazardous waste number determination must be placed in the auditable record and must present a clear justification for the hazardous waste number analyses.

  - Review the compiled information to provide an estimate of material parameter weights for each container to be stored or disposed of at WIPP.

  For newly generated wastes, procedures shall be developed and implemented to characterize hazardous waste using acceptable knowledge prior to packaging the waste.

- Sites shall ensure that results of audits of the TRU mixed waste characterization programs at the site are available in the records.

- Sites shall identify all process controls (implemented to ensure that the waste contains no prohibited items and to control hazardous waste content and/or physical form) that may have been applied to retrievably stored waste and/or may presently be applied to newly generated waste. Process controls are applied at the time of waste

generation/packaging to control waste content, whereas any activities performed after waste generation/packaging to identify prohibited items, hazardous waste content, or physical form are waste characterization activities, not process controls. The AK record must contain specific process controls and supporting documentation identifying when these process controls are used to control waste content. See Permit Attachment C, Section C-2 for programmatic requirements related to process controls.

C4-3c Criteria for Assembling an Acceptable Knowledge Record and Delineating the Waste Stream

Figure C4-1 provides an overview of the process for assembling acceptable knowledge documentation into an auditable record. The first step is to assemble all of the required acceptable knowledge information and any additional information regarding the materials and processes that generate a specific waste stream. The Permittees shall require the sites to implement procedures which comply with the following criteria to establish acceptable knowledge records:

- Acceptable knowledge information shall be compiled in an auditable record, including a road map for all applicable information.
- The overview of the facility and TRU mixed waste management operations in the context of the facility's mission shall be correlated to specific waste stream information.
- Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities shall be clearly described. For newly generated wastes, the rate and quantity of waste to be generated shall be defined.
- A reference list shall be provided that identifies documents, databases, Quality Assurance protocols, and other sources of information that support the acceptable knowledge information.

Container inventories for TRU mixed waste currently in retrievable storage shall be delineated into waste streams by correlating the container identification to all of the required acceptable knowledge information and any additional acceptable knowledge information.

C4-3d AK Sufficiency Determination Request Contents

Generator/storage sites may submit an AK Sufficiency Determination Request (**Determination Request**) to meet all or part of the waste characterization requirements. The Determination Request shall include, at a minimum:

- Identification of the scenario for which the approval is sought (Permit Attachment C, Section C-0b).
- A complete AK Summary that addresses the following technical requirements:
  - Executive Summary;

- Waste Stream Identification Summary, including a demonstration that the waste stream has been properly delineated and meets the Permit definition of waste stream (Permit Attachment C, Introduction);

- Mandatory Program Information (including, but not limited to, facility location and description, mission, defense waste assessment, spent nuclear fuel and high-level waste assessment, description of waste generating processes, research/development [as necessary], facility support operations [as applicable], types and quantities of TRU waste generated, correlation of waste streams to buildings/processes, waste identification and categorization, physical form identifiers);

- Mandatory Waste Stream Information (including, but not limited to, Area and Building of Generation, waste stream volume/period of generation (including, for newly generated waste, the rate and quantity of waste to be generated), waste generating activities, types of waste generated, material input related to physical form and identification of percentage of each waste material parameter in the waste stream, chemical content information including hazardous constituents and hazardous waste identification, prohibited item content (including documented evidence that the waste meets the TSDF-WAC Permit Sections 2.3.3.1 through 2.3.3.10), waste packaging, presence of filter vents, number of layers of confinement);

- Types of additional information gathered;

- Container specific data (if available and relevant); and

- A complete reference list including all mandatory and additional information.

- An AK roadmap (defined as a cross reference between mandatory programmatic and mandatory waste stream information, with references supporting these requirements).

- A complete reference list including all mandatory and additional documentation.

- Additional relevant information for the required programmatic and waste stream data addressed in the AK Summary, examples of which are presented in Permit Attachment C4, Section C4-2c.

- Identification of any mandatory requirements supported only by upper tier documents (i.e., there is insufficient supporting data).

- Description or other means of demonstrating that the AK process described in the Permit was followed (for example, AK personnel were appropriately trained; discrepancies were documented, etc).

- Information showing that the generator/storage site has developed a written procedure for compiling the AK information and assigning hazardous waste numbers as required in Permit Attachment C4-3b.

- Information showing that the generator/storage site has assessed the AK process (e.g. internal audits, Permit Attachment C4-3b).

The Permittees shall evaluate the Determination Request for completeness and technical adequacy as specified in Permit Attachment C.

C4-3e Requirements for Re-evaluating Acceptable Knowledge Information

Acceptable knowledge includes information regarding the physical form of the waste, the base materials composing the waste, and the process that generates the waste. Waste sampling and analysis (i.e., radiography or visual examination, headspace-gas sampling and analysis, and homogeneous waste sampling and analysis) may be used to augment acceptable knowledge information.

The Waste Stream Profile Form (**WSPF**) and Characterization Information Summary (including the acceptable knowledge summary) will be reviewed by the Permittees for each waste stream prior to DOE approval of the WSPF. The Permittees' review will ensure that the submitted AK information was collected under procedures that ensure implementation of the WAP, provides data sufficient to meet the DQOs in Section C-4a(1), and allow the Permittees to demonstrate compliance with the waste analysis requirements of the Permit. A detailed discussion of the Permittees' waste stream review and DOE's WSPF approval process is provided in Section C-1d.

The Permittees shall require sites to establish procedures for reevaluating acceptable knowledge if the results of waste confirmation indicate that the waste to be shipped does not match the approved waste stream, or if data obtained from radiography or visual examination for waste streams without an AK Sufficiency Determination exhibit this discrepancy. Site procedures shall describe how the waste is reassigned, acceptable knowledge reevaluated, and appropriate hazardous waste numbers assigned. If the reevaluation requires that the Waste Matrix Code be changed for the waste stream or the waste does not match the approved waste stream, the following minimum steps shall be taken to reevaluate acceptable knowledge:

- Review existing information based on the container identification number and document all differences in hazardous waste number assignments
- If differences exist in the hazardous waste numbers that were assigned, reassess and document all required acceptable knowledge information (Section C4-3b) associated with the new designation
- Reassess and document all sampling and analytical data associated with the waste
- Verify and document that the reassigned Waste Matrix Code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination
- Record all changes to acceptable knowledge records

- If discrepancies exist in the acceptable knowledge information for the revised Waste Matrix Code, document the segregation of the affected portion of the waste stream, and define the actions necessary to fully characterize the waste

Potential toxicity characteristics for base materials that compose TRU mixed heterogeneous debris (S5000) waste may be determined without destructive sampling and analysis via acceptable knowledge. Sites will assign a Waste Matrix Code and waste stream to each container of waste using acceptable knowledge. Sites shall assign the toxicity characteristic hazardous waste numbers consistent with RCRA requirements. If a toxicity characteristic hazardous constituent is identified during AK, the potential assignment of a hazardous waste number must be evaluated and the results placed in the AK record. Procedures shall describe how additions to hazardous waste numbers based on material composition are documented, as necessary (Section C4-3b).

The Permittees shall require sites to use acceptable knowledge to identify spent solvents associated with each TRU mixed waste stream or waste stream lot. Headspace-gas data will be used to resolve the assignment of EPA F-listed hazardous waste numbers to debris waste streams when waste streams do not have an AK Sufficiency Determination approved by DOE. In this case, sites shall assign F-listed hazardous waste numbers (20.4.1.200 NMAC, incorporating 40 CFR §261.31) by evaluating the average concentrations of each VOC detected in container headspace gas for each waste stream or waste stream lot using the upper 90 percent confidence limit (**UCL_{90}**). The UCL_{90} for the mean concentration shall be compared to the program required quantitation limit (**PRQL**) for the constituent. If the UCL_{90} for the mean concentration exceeds the PRQL, sites shall reevaluate their acceptable knowledge information and determine the potential source of the constituent. Sites shall provide documentation to support any determination that F-listed organic constituents are associated with packaging materials, radiolysis, or other uses not consistent with solvent use. If the source of the detected F-listed solvents can not be identified, the appropriate spent solvent hazardous waste number will be conservatively applied to the waste stream. In the case of applicable toxicity characteristic VOCs and non-toxic F003 constituents, generator/storage sites may assess whether the head space gas concentration would render the waste non-hazardous for those characteristics and change the initial acceptable knowledge determination accordingly.

EPA hazardous waste numbers associated with S3000 and S4000 waste streams will be assigned based on the results of the total/TCLP analysis of a representative homogeneous waste sample when waste streams do not have an AK Sufficiency Determination approved by DOE. As with headspace gas, if the total/TCLP results indicate that the concentration of a characteristic waste or non-toxic constituent of an F003 waste is below regulatory levels, the hazardous waste number assigned initially by acceptable knowledge may be changed. Otherwise, if an F-listed waste constituent is detected, the appropriate hazardous waste number shall be applied.

If the site determines that the source of the F-listed constituent is a spent solvent used in the process or is determined to be the result of mixing a listed waste with a solid waste during waste packaging, or applicable toxicity characteristic or non-toxic F003 wastes are present in excess of regulatory levels, then the site will either: 1) assign the applicable listed hazardous waste number to the entire waste stream, or 2) segregate the drums containing detectable concentrations of the solvent into a separate waste stream and assign applicable hazardous waste numbers. Each site shall document, justify, and consistently delineate waste streams and assign hazardous waste numbers as required in this permit and must consider all generator-

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specific waste streams and hazardous waste number assignments. The site must also consider site-specific permit requirements and other state-enforced agreements in this analysis.

To determine the mean concentration of solvent VOCs, all headspace-gas data or homogeneous waste data for a waste stream or waste stream lot (i.e., the portion of the waste stream that is characterized as a unit) will be used, including data qualified with a 'J' flag (i.e., less than the PRQL but greater than the method detection limit [**MDL**]) or qualified with a 'U' flag (i.e., undetected). For data qualified with a 'U' flag, sites shall use one-half the MDL in calculating the mean concentration. Because listed wastes are not defined based on concentration, sites may not remove hazardous waste numbers assigned using acceptable knowledge if hazardous constituents are not detected in the headspace gas or solids/soil analysis.

TRU mixed headspace gases and homogeneous waste matrices may contain one or two constituents (e.g., carbon tetrachloride and 1,1,1-trichloroethane) at concentrations that are orders of magnitude higher than the other target analytes. In these cases, samples shall be diluted to remain within the instrument calibration range for the elevated constituents. Sample dilution results in elevated MDLs for the constituents with elevated concentrations. Only the concentrations of detected constituents will be used to calculate the mean for the purpose of assigning F-listed hazardous waste numbers. Because the presence or absence of F-listed solvents can not be assigned based on the artificially high MDLs that are caused by sample dilution, data flagged as 'U' and showing an elevated MDL will not be used in calculating the mean concentration.

C4-3f Acceptable Knowledge Data Quality Requirements

The data quality objectives for sampling and analysis techniques are provided in Permit Attachment C3. Analytical results will be used to augment the characterization of wastes based on acceptable knowledge. To ensure that the acceptable knowledge process is consistently applied, the Permittees shall require sites to comply with the data quality requirements for acceptable knowledge documentation in Permit Attachment C3.

Each site shall address quality control by tracking its performance with regard to the use of acceptable knowledge by: 1) assessing the frequency of inconsistencies among information, and 2) documenting the results of waste discrepancies identified by the generator/storage site during waste characterization or the Permittees during waste confirmation using radiography, review of radiography audio/video recordings, visual examination, or review of visual examination records. In addition, the acceptable knowledge process and waste stream documentation shall be evaluated through internal assessments by generator/storage site quality assurance organizations.

C4-3g Audits of Acceptable Knowledge

DOE will conduct an initial audit of each site prior to certifying the site for shipment of TRU mixed waste to the WIPP facility. This initial audit will establish an approved baseline that will be reassessed annually DOE. These audits will verify compliance with the requirements specified in the WAP (Permit Attachment C). The audits will be used to verify compliance with the compilation, application, and interpretation requirements of acceptable knowledge information specified in this Permit at all sites, and to evaluate the completeness and defensibility of site-specific acceptable knowledge documentation related to hazardous waste characterization.

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Permit Attachment C6 gives a description of the overall audit program and a required checklist. Figure C4-2 includes the primary steps associated with the audit process of acceptable knowledge.

Site-specific audit plans will be prepared by DOE and provided to NMED, and will identify the scope of the audit, requirements to be assessed, participating personnel, activities to be audited, organizations to be notified, applicable documents, and schedule. Audits will be performed in accordance with written procedures and site-specific checklists that will be developed by DOE prior to the audit and provided to NMED. The site-specific audit checklists will include items associated with the compilation and evaluation of the required acceptable knowledge information as specified in the checklist required by Permit Attachment C6.

Audit checklists shall include Table C6-3 in Permit Attachment C6, and will include but not be limited to the following elements for review during the audit:

- Documentation of the process used to compile, evaluate, and record acceptable knowledge is available and implemented;
- Personnel qualifications and training are documented;
- All of the required acceptable knowledge documentation specified in Section C4-2 has been compiled in an auditable record;
- All of the required procedures specified in C4-3 have been developed and implemented, including but not limited to:
  - A procedure exists for assigning hazardous waste numbers to waste streams in accordance with Section C4-3;
  - A procedure exists for resolving discrepancies in acceptable knowledge documentation in accordance with Section C4-3; and
- Results of other audits of the TRU mixed waste characterization programs at the site are available in site records.

Members of the audit team will be knowledgeable regarding the required acceptable knowledge information, RCRA regulations and EPA guidance regarding the use of acceptable knowledge for waste characterization, RCRA hazardous waste characterization, and the WAP requirements (Permit Attachment C). Audit team members will be independent of all TRU mixed waste management operations at the site being audited.

Auditors will evaluate acceptable knowledge documentation for at least one waste stream from the Summary Category Group(s) being audited, and will audit acceptable knowledge traceability for at least one container from the audited Summary Category Group(s). For these waste streams, auditors will review all procedures and associated processes developed by the site for documenting the process of compiling acceptable knowledge documentation; correlating information to specific waste inventories; assigning hazardous waste numbers; and identifying, resolving, and documenting discrepancies in acceptable knowledge records. The adequacy of acceptable knowledge procedures and processes will be assessed and any deficiencies in procedures documented in the audit report.

Auditors will review the acceptable knowledge documentation for selected waste streams for logic, completeness, and defensibility. The criteria that will be used by auditors to evaluate the logic and defensibility of the acceptable knowledge documentation include completeness and traceability of the information, consistency of application of information, clarity of presentation, degree of compliance with this Permit Attachment with regard to acceptable knowledge data, nonconformance procedures, and oversight procedures. Auditors will evaluate compliance with written site procedures for developing the acceptable knowledge record. A completeness review will evaluate the availability of all required TRU mixed waste management program information and TRU mixed waste stream information (Section C4-2). Records will be reviewed for correlation to specific waste streams and the basis for characterizing hazardous waste. Auditors will verify that sites include all required information and assigned appropriate hazardous waste numbers as indicated by the acceptable knowledge records and consistent with RCRA requirements. All deficiencies in the acceptable knowledge documentation will be included in the audit report.

Auditors will verify and document that sites use administrative controls and follow written procedures to characterize hazardous waste for newly-generated and retrievably stored wastes. Procedures to document changes in acceptable knowledge documentation and changes to hazardous waste number assignments to specific waste streams also will be evaluated for compliance with the WAP (Permit Attachment C).

After the audit is complete, DOE will provide the site with preliminary results at a close-out meeting. DOE will prepare a final audit report that includes all observations and findings identified during the audit. Sites shall respond to all audit findings and identify corrective actions. Audit results will be included in the final audit report (Permit Attachment C6). If acceptable knowledge procedures do not exist, the required information is not available, or corrective actions (i.e., CARs) are identified associated with acceptable knowledge compilation, and/or hazardous waste characterization, the Permittees will not manage, store, or dispose TRU mixed waste for the subject waste summary category. Management, storage, or disposal of the subject waste summary category at WIPP will not resume until DOE find that all corrective actions have been implemented and the site complies with all applicable requirements of the WAP.

DOE disseminates information regarding TRU mixed waste characterization requirements and program status through the WIPP Home Page. The Permittees will use this web page to disseminate information regarding TRU mixed waste streams, RCRA compliance, and operational and programmatic issues, methods development, and waste characterization information, including the application of acceptable knowledge. DOE is provided the required waste characterization information prior to management, storage, or disposal of that waste at WIPP and also will conduct audits at least annually. The Permittees will maintain an operating record for review during regulatory agency audits. NMED may also review any information relevant to the scope of the audit during site audits. DOE will notify NMED regarding any site's failure to implement corrective actions associated with hazardous waste characterization as specified in Parts 1 and 2 and Permit Attachment C3.

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FIGURES

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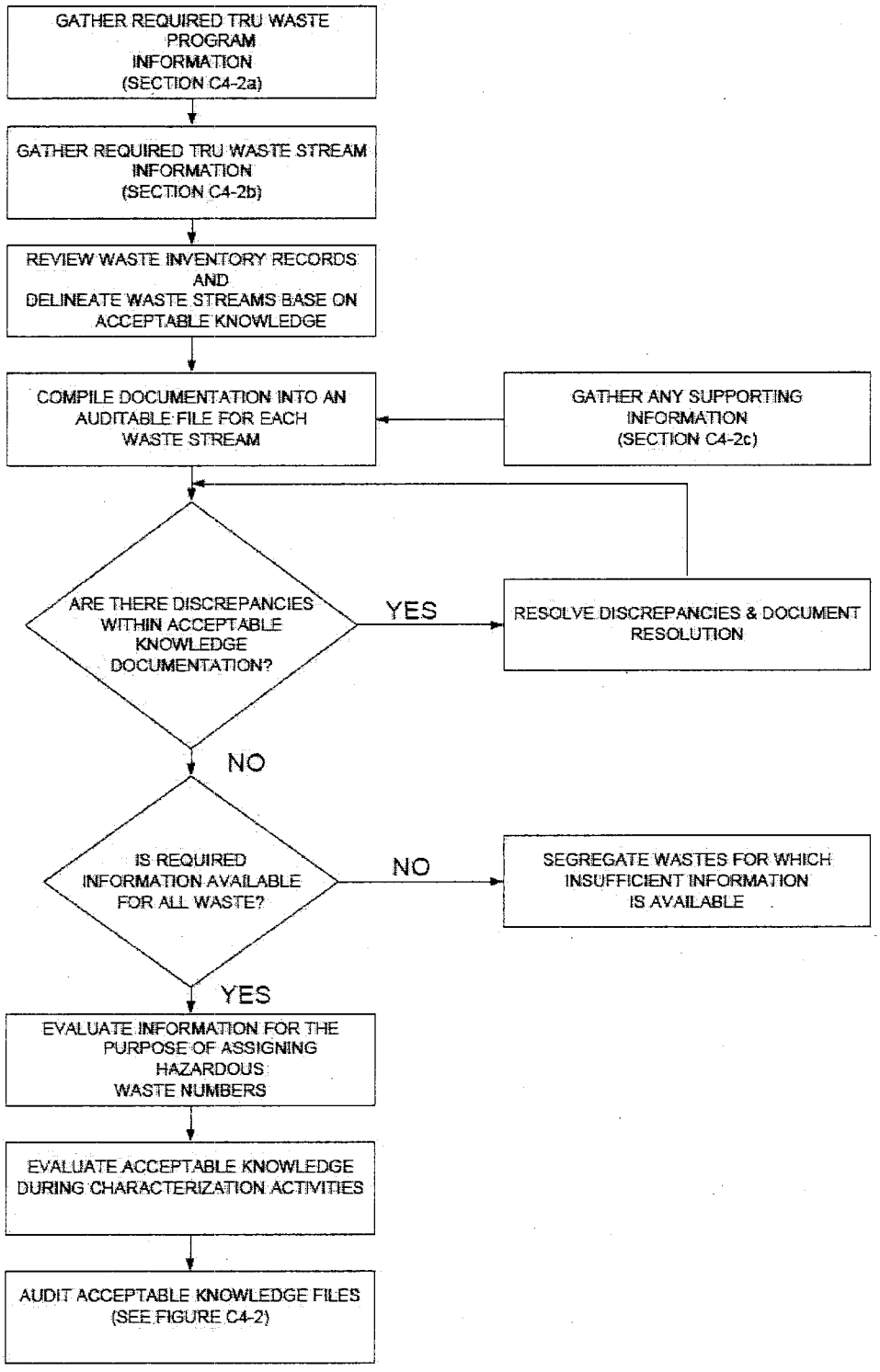

Figure C4-1
Compilation of Acceptable Knowledge Documentation

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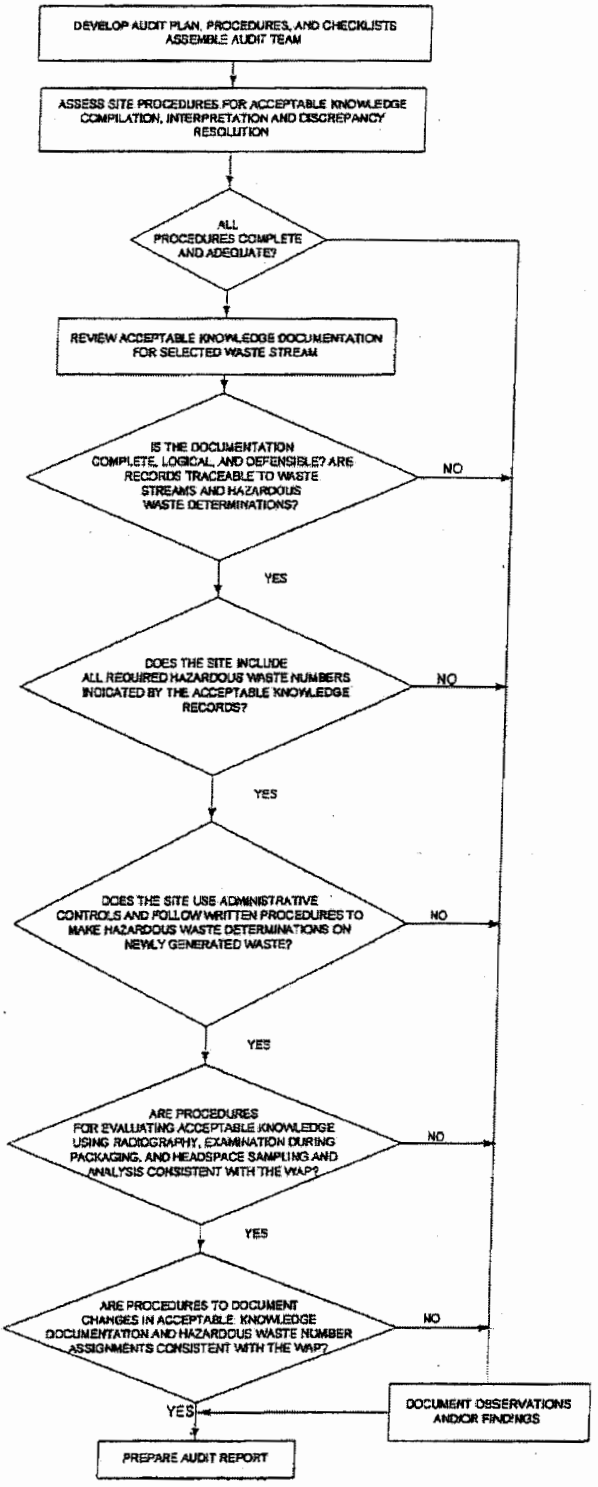

Figure C4-2
Acceptable Knowledge Auditing

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ATTACHMENT C5

QUALITY ASSURANCE PROJECT PLAN REQUIREMENTS

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ATTACHMENT C5

QUALITY ASSURANCE PROJECT PLAN REQUIREMENTS

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ATTACHMENT C5

QUALITY ASSURANCE PROJECT PLAN REQUIREMENTS

C5-1 Quality Assurance Project Plans

Prior to management, storage, or disposal of a generator/storage site's TRU mixed waste at WIPP, the Permittees shall require that each participating site develops and implements a quality assurance project plan (**QAPjP**) that addresses all the applicable requirements specified in Waste Isolation Pilot Plant waste analysis plan (**WAP**) in Permit Attachment C. The U.S. Department of Energy (**DOE**) will approve QAPjPs from all generator/storage sites that intend to send TRU mixed waste to the Waste Isolation Pilot Plant. DOE shall ensure that these QAPjPs include the qualitative or quantitative criteria for determining whether waste characterization program activities are being satisfactorily performed. DOE shall also ensure that QAPjPs identify the organization(s) and position(s) responsible for their implementation. Additionally, the QAPjPs shall also reference site-specific documentation that details how each of the required elements of the characterization program will be performed.

DOE shall ensure that prior to the implementation of characterization activities at participating sites, standard operating procedures (**SOPs**) were developed for all activities which affect the quality of the waste characterization program elements specified in the WAP. For the purposes of the quality assurance program, the term SOP refers to any site-specific implementing document. Compliance with SOPs will ensure that tasks are performed in a consistent manner that results in achieving the quality required for the quality assurance program. The organization, format, content, and designation of SOPs shall be described in the QAPjPs. Site-specific SOPs will be reviewed for consistency with the QAPjP according to the Audit and Surveillance Program specified in Permit Attachment C6.

C5-2 Document Review, Approval, and Control

DOE shall ensure that the preparation, issuance, and change to documents that specify quality requirements or prescribe activities affecting quality for the transuranic mixed waste characterization program elements specified in the WAP be controlled to assure that correct and current documents are used and referenced. The QAPjPs shall include a document control format consisting of a unique document identification number, current revision number, date, and page number which will be placed on the individual pages of the document. All quality documents for the waste characterization program shall be reviewed prior to approval and issuance by qualified and independent individuals. The QAPjP review shall consider the technical adequacy, completeness, and correctness of the QAPjP, and the inclusion of and compliance with the requirements established by the WAP (Permit Attachment C). DOE shall ensure that appropriate QAPjP approval is indicated by a signature and date page included in the front of each document.

At a minimum, DOE shall ensure that revisions to documents that implement the requirements of the WAP are denoted by including the current revision number on the document title page, the revised signature page, and each page that has been revised. Only revised pages need to be reissued. Changes to documents, other than those defined as editorial changes or minor changes, shall be reviewed and approved by the same functional organizations that performed the original review and approval, unless other organizations are specifically designated in

accordance with approved procedures. Editorial or minor changes may be made without the same level of review and approval as the original or otherwise changed document. The following items are considered editorial or minor changes:

- Correcting grammar or spelling (the meaning has not changed)
- Renumbering sections or attachments
- Updating organizational titles
- Changes to nonquality-affecting schedules
- Revised or reformatted forms, providing the original intent of the form has not been altered
- Attachments marked "Example," "Sample," or exhibits that are clearly intended to be representative only

A change in an organizational title accompanied by a change in the responsibilities is not considered an editorial change. Changes to the text shall be clearly indicated in the document. DOE shall provide the QAPjP for each site and all revisions to NMED upon approval by DOE.

DOE shall ensure that QAPjPs include a detailed description of the reporting and approval requirements for changes to approved QA documents and SOPs, including procedures for implementing changes to these documents. All members of the site project staff are responsible for reporting any obsolete or superseded information to the site project manager. All site-specific changes shall be evaluated and approved by the site project manager before implementation. The site project manager shall notify the appropriate personnel and the affected documents shall be revised as necessary. The site project manager shall also be responsible for notifying the DOE field office of the changes. DOE shall ensure that changes that affect performance criteria or data quality, such as sample handling and custody requirements, sampling and analytical procedures, quality assurance objectives, calibration requirements, or QC sample acceptance criteria comply with the WAP (Permit Attachment C) and shall not be made without prior approval of DOE.

ATTACHMENT C6

AUDIT AND SURVEILLANCE PROGRAM

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ATTACHMENT C6

AUDIT AND SURVEILLANCE PROGRAM

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ATTACHMENT C6

AUDIT AND SURVEILLANCE PROGRAM

C6-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) Audit and Surveillance Program shall ensure that: 1) the operators of each generator/storage site (**site**) and U.S. Department of Energy (**DOE**) approved laboratory that plan to transport transuranic (**TRU**) mixed waste to the WIPP facility conduct sampling and analysis of wastes in accordance with the current WIPP Waste Analysis Plan (**WAP**) (Permit Attachment C), and 2) the information supplied by each site to satisfy the waste screening and acceptability requirements of Section C-4 of the WAP is being managed properly. DOE will conduct these audits and surveillances at each site and DOE approved laboratory performing these activities in accordance with a standard operating procedure (**SOP**). NMED personnel may observe these audits and surveillances to validate the implementation of WAP requirements (Permit Attachment C) at each site and DOE approved laboratory. Only personnel with appropriate U.S. Department of Energy clearances will have access to classified information during audits. Classified information will not be included in audit reports and records. The audit SOP will contain steps for selecting audit personnel, reviewing applicable background information, preparing an audit plan, preparing audit checklists, conducting the audit, developing an audit report, and following up audit deficiencies. A deficiency is any failure to comply with an applicable provision of the WAP. The checklists for each site and DOE approved laboratory shall include, at a minimum, the appropriate checklists found in Tables C6-1 through C6-6 for the summary category groups undergoing audit.

C6-2 Audit Procedures

Audit procedures shall establish the responsibilities and methodology for planning, scheduling, performing, reporting, verifying, and closing announced and unannounced audits of sites and DOE approved laboratories. Records of all audit activities shall be part of the WIPP Operating Record and maintained at the WIPP facility until closure. NMED shall be provided unlimited access to these records.

Approved procedures shall be used to describe audit activities and requirements. Procedures define the responsibilities of specific positions necessary to manage this audit program. The DOE manager who oversees the audit program shall ensure that the following tasks are performed:

- Schedule audits
- Designate lead auditor(s)
- Appoint auditor and lead auditor trainees
- Maintain auditor training and qualification records
- Assure that all auditors have been given appropriate training, including training on the WAP

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- Assign auditors and lead auditors to perform annual certification audits
- Review and approve final audit reports
- Oversee tracking and closure of all deficiencies and any observations requiring action
- Assure records are entered into the WIPP Operating Record and are properly maintained until facility closure

C6-3 Audit Position Functions

DOE will approve lead auditors, auditors, and technical specialists based upon the expertise required for the functions being examined according to the audit scope. DOE will supply auditors/technical specialists with expertise in the Resource Conservation and Recovery Act (**RCRA**) requirements and knowledge of the analysis and documentation methods required to verify the hazardous waste characterization performed by the sites. DOE shall identify all audit team members to NMED prior to the audit, and shall provide upon request the qualifications of all audit team members.

The lead auditor assigned to be the audit team leader must perform the following tasks:

- Concur that assigned auditors and technical specialists have the collective experience and training commensurate with the scope, complexity, or special nature of the activities to be audited
- Develop an audit plan and coordinate the preparation of an overall checklist to cover the scope of the audit, with consideration given to all nonconformances reported as specified in Permit Attachment C3 and to previous audit results from that site or DOE approved laboratory
- Assign specific audit areas to individual auditors and technical specialists within their particular specialty and provide guidance on checklist development
- Review individual auditor checklists to assure complete coverage of assigned scope, and approve the checklists
- Conduct the audit at the site or DOE approved laboratory
- Encourage observers to participate according to the protocol established by DOE
- Communicate audit results at the conclusion of the audit, including any deficiencies and observations
- Prepare and sign the audit report
- Maintain complete records of each audit and transfer them to the manager when the audit report is issued

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Auditors and technical specialists assigned to the specific audit will report to the audit team leader for supervision and may perform the following tasks:

- Attend any required specific training and team orientation and planning meetings as directed by the audit team leader
- Prepare specific audit checklists to verify that the WAP Quality Assurance Objectives (**QAO**) are met for the areas being audited
- Obtain audit team leader approval of checklist
- Review acceptable knowledge documentation packages, test report data, and documentation of data verification activities
- Obtain and evaluate objective evidence by means of observation, document reviews, or the conduct of interviews with operators, analysts, technicians, and others necessary to determine the adequacy and effective implementation of the WAP
- Conduct inspection tours of waste generating stations, sampling areas and equipment, analytical laboratories, calibration facilities, administrative, and document control/record facility
- Complete checklist during the audit indicating the objective evidence observed verifies that the site or DOE approved laboratory has met the QAOs for the program elements, methods, and the activities being audited. Add other items to the checklist as they are observed or as needed during the audit
- Prepare narrative statements for all deficiencies, and observations that clearly and concisely identify the conditions involved
- Prepare any portion of the final audit report assigned by the lead auditor.

Audits will be conducted at least annually for each site involved in the waste characterization program. Both announced and unannounced audits will address the following:

- Results of previous audits
- Changes in programs or operations
- New programs or activities being implemented
- Changes in key personnel

Annual certification audits shall address contact-handled (**CH**) and remote-handled (**RH**) waste characterization activities if the site has approval or is seeking approval for such wastes. At a minimum, the audit shall evaluate acceptable knowledge documentation for CH and RH waste separately by Summary Category Group, as applicable.

C6-4 Audit Conduct

The conduct of the audit shall commence with an entrance meeting, conducted by the audit team leader, with site or DOE approved laboratory management. At this meeting, the audit objectives and scope, the specific areas to be audited, the processes or functions to be

observed, and the site or DOE approved laboratory-participation required, including site interfaces, will be identified. The purpose of this meeting is to confirm the audit scope, discuss the audit sequence, establish channels of communication, and confirm the daily and exit meeting. Audits shall be performed using approved audit checklists that include the checklists in Tables C6-1 to C6-6 for the summary category groups undergoing audit. Consistency of evaluation shall be ensured before the audit through site or DOE approved laboratory QAPjP approval (see Permit Attachment C5). QAPjPs for each site or DOE approved laboratory shall incorporate the same requirements from the WAP. Objective evidence shall be examined (to the depth necessary) to determine if the identified activities, procedures, or QAOs are adequate and are being effectively implemented.

Audits may not include all waste summary category groups, and thus some audit checklists or portions of checklists (Tables C6-1 through C6-6) may not be applicable to some sites or DOE approved laboratory (e.g., headspace gas sampling and analysis is not used because debris waste is not being analyzed by the site). In these instances, DOE shall indicate nonapplicability in the appropriate checklist row, and justify the exclusion under the "Comment" column. In addition, in cases where discrepancies exist between the audit checklists in Tables C6-1 through C6-6 and the Permit, Permit requirements take precedence. DOE may add to the checklists as necessary to clarify Permit requirements, but any additions will be clearly designated on the checklists (i.e., redline the additions).

Audits shall include site personnel interviews, document and record reviews, observations of operations, and any other activities deemed necessary by the auditors to meet the objectives of the audit. Observations or deficiencies identified during the audit will be investigated or evaluated, as necessary, to determine if they are isolated conditions or represent a general breakdown of the waste characterization quality assurance program. During audit interviews or audit meetings, site or DOE approved laboratory personnel may be advised of deficiencies identified within their areas of responsibility to establish a clear understanding of the identified condition.

The site or DOE approved laboratory personnel will be given the opportunity to correct any deficiency that can be corrected during the audit period. Deficiencies and observations will be documented and included as part of the final audit report. Those items that have been resolved during the audit (isolated deficiencies that do not require a root cause determination or actions to preclude recurrence), will be verified prior to the end of the audit, and the resolution will be described in the audit report. Those items that affect the quality of the program, and/or the data generated by that program, which are required by the WAP will be documented on a Corrective Action Report (**CAR**) and included as a part of the final audit report. The CAR will be entered into DOE's CAR tracking system and tracked until closure. RCRA-related items will be uniquely identified within the CAR tracking system so that they can be tracked separately. RCRA-related CARs identified by the site or DOE approved laboratory during self-audits will be evaluated during DOE's audit and surveillance program and tracked in DOE's tracking systems.

When a deficiency is identified by the audit team, the audit team member who identified the deficiency prepares the CAR. DOE reviews the CAR, determine validity (assures that a requirement has in fact been violated), classify the significance of the deficiency, assign a response due date, and issue the CAR to the site or DOE approved laboratory. The site or DOE approved laboratory reviews the CAR, evaluates the extent and cause of the deficiency, and provides a response to DOE indicating the remedial actions and actions taken to preclude recurrence. DOE reviews the response from the site or DOE approved laboratory and, if

acceptable, communicate the acceptance to the site or DOE approved laboratory. The site or DOE approved laboratory completes remedial actions and actions to preclude recurrence. After all corrective actions have been completed, DOE may schedule and perform a verification visit to assure that corrective actions have been completed and are effective. NMED personnel may participate as observers in these verification visits. When all actions have been completed and verified as being effective, the CAR is closed by the DOE manager responsible for quality assurance. As part of the planning process for subsequent audits and surveillances, past deficiencies will be reviewed and the previous deficient activity or process is subject to reassessment.

NMED may submit a written Observer Inquiry to DOE if necessary to seek resolution to a question raised or issue posed during the audit. DOE shall be responsible for obtaining a response to the Observer Inquiry and submitting a written response to NMED within 30 days of inquiry submission. NMED will examine the response and consider this information as part of the audit review and approval process.

The sites or DOE approved laboratories shall submit corrective action plans to eliminate the deficiency stated on the CAR, including a resolution of the acceptability of any data generated prior to the resolution of the corrective action.

The corrective action response will include a discussion of the investigation performed to determine the extent and impact of the deficiency, a description of the remedial actions taken, determination of root cause, and actions to preclude recurrence.

An exit meeting will be conducted by the lead auditor prior to departure of the audit team from the site or DOE approved laboratory. This meeting will include site or DOE approved laboratory management personnel, and may include DOE field office personnel. All draft audit results will be presented to the site or DOE approved laboratory management.

The audit report will be prepared, approved, and issued to the site or DOE approved laboratory within 30 days of the completion of the audit by DOE. NMED shall receive a copy of the audit report upon issuance for information purposes. A formal final audit report will be provided to NMED which will include WAP-related CAR resolution results and audit results that will include, as a minimum, sections describing the scope, purpose, summary of deficiencies, and observations in narrative format, completed audit checklists, audited procedures, and other applicable documents which provide evidence of WAP implementation. The report will also include an identification of the organization audited, the dates of the audit, and the requested response date. NMED will make the final audit report available for public review and comment. One copy of the formal final audit report shall be submitted to NMED in hard copy, but any additional copies may be submitted in electronic format. The audited site or DOE approved laboratory will respond to any deficiencies and observations within (30 days after receipt of any CARs and indicate the corrective action taken or to be taken. If the corrective action has not been completed, the response must indicate the expected date the action will be completed. CARs applicable to WAP requirements shall be resolved prior to waste shipment. Subsequent audits or specific verifications, announced or unannounced, will determine if the corrective action has been satisfactorily implemented. Deficiencies (items corrected during the audit [CDAs] and CARs) and observations will be tracked to completion according to established procedure(s). In addition, deficiencies will be trended to determine if similar situations exist system wide. Trend reports will be issued as necessary to provide a "lessons learned" announcement to other sites or DOE approved laboratories who might benefit from program

improvements implemented as a result of resolutions to the specific situations discovered at the performance of these audits.

The final audit report provided to NMED and audit records will be maintained at WIPP as a part of the Operating Record. These records will be included on the Record Inventory and Disposition Schedule and maintained on-site until closure of the WIPP facility. NMED shall be provided unlimited access to these records.

TABLES

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Table C6-1 Waste Analysis Plan (WAP) Checklist

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1

Waste Analysis Plan (WAP) General Checklist for use at DOE'S Generator/Storage Sites

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Waste Stream Identification					
1	Does the generator/storage site define "waste stream" as waste materials that have common physical form, that contain similar hazardous constituents, and that are generated from a single process or activity? (Attachment C Section C-0a)					
2	Are procedures in place to ensure that the generator/storage site assigns one of the Summary Category Groups (S3000-homogeneous solids, S4000-soils/gravel, S5000-debris waste) to each waste stream? (Section C-1b)					
3	Are procedures in place to ensure that the generator/storage site assigns Waste Matrix Code Groups (e.g., solidified inorganics, solidified organics, salt waste, soils, combustible waste, filters, graphite, heterogeneous debris waste, inorganic nonmetal waste, lead/cadmium metal, uncategorized metal) to each waste stream? (Section C-0a)					
4	Are procedures in place to ensure that the generator/storage site assigns a Waste Stream WIPP Identifier (ID) to each waste stream? (Section C3-12b(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
4a	Are procedures in place for generator/storage sites to submit an AK Sufficiency Determination (Determination Request) to the Permittees to meet all or part of the waste characterization requirements including: • All information specified in Permit Attachment C4, Section C4-3d • Identification of relevant hazardous constituents, and correctly identifies all toxicity characteristic and listed hazardous waste numbers • All hazardous waste number assignments must be substantiated by supporting data and, if not, whether this lack of substantiation compromises the interpretation • Resolution of data discrepancies between different AK sources must be technically correct and documented • The AK Summary includes all the identification of waste material parameter weights by percentage of the material in the waste stream, and determinations are technically correct • All prohibited items specified in the TSDF-WAC should be addressed, and conclusions drawn are technically adequate and substantiated by supporting information • If the AK record includes process control information specified in Permit Attachment C4, Section C4-3b, the information should include procedures, waste manifests, or other documentation demonstrating that the controls were adequate and sufficient. • The site must provide the supporting information necessary to substantiate technical conclusions within the Determination Request, and this information must be correctly interpreted. (Section C-0b, Section C4-3d)					
4b	If a generator/storage site does not submit a Determination Request or if the Determination Request is not approved, are procedures in place for the generator/storage site to perform radiography or VE on 100% of the containers in a waste stream and chemical sampling and analysis on a representative sample of the waste stream using headspace gas sampling and analysis (for debris waste) or solids sampling and analysis (for homogeneous solid or soil/gravel waste) as specified in Permit Attachments C1 andC2? (Section C-0b)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
4c	Are procedures in place to ensure that the generator/storage sites complete a Waste Stream Profile Form (WSPF) and Characterization Information Summary (CIS) as specified in Permit Attachment C3, Sections C3-12b(1) and C3-12b(2)? (Section C-0c)					
5	Are procedures in place to ensure that the generator/storage site divides waste streams into waste stream lots if all of the waste within a waste stream is not accessible for sampling and analysis, as required, at one time? If so, is the division of waste streams into waste stream lots based on staging, transportation and handling issues? (Section C-1a)					
6	Are procedures in place to ensure that the generator/storage site assigns EPA hazardous waste numbers associated with the waste? If so, do these assigned EPA hazardous waste numbers correspond to the permitted EPA hazardous waste numbers in Table C-9? Are there any assigned EPA hazardous waste numbers that are not permitted EPA hazardous waste numbers on the Table C-9? If so, did the generator/storage site reject the waste for shipment to and disposal at WIPP? Did the generator assign a state hazardous waste codes or numbers? If so, is it assigned to waste that is permitted at WIPP? (Section C-1b)					
7	Are procedures in place to ensure that Summary Category Groups are defined as follows: S3000- Homogeneous solids are solid material, inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste excluding soils, that do not meet NMED criteria for classification as debris and are at least 50 percent by volume homogeneous solids or comprise the majority of the waste stream S4000- Waste streams that are at least 50 percent by volume soil/gravel, or comprise the majority of the waste stream S5000- Waste streams that are at least 50 percent volume materials that meet the NMED criteria for debris, or comprise the majority matrix of materials. The criteria for debris are solid materials intended for disposal that exceed 2.36 inch particle size and is a manufactured object, plant or animal matter, or natural geologic material. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material. (Section C-0a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
8	Does the generator/storage facility have procedures in place to ensure that the following waste characterization parameters will be obtained : • Determination whether TRU mixed waste streams comply with the applicable provisions of the TSDF-WAC • Determination whether TRU mixed wastes exhibit a hazardous characteristic per 20.4.1.200 NMAC (incorporating 40 CFR 261 Subpart C) • Determination whether TRU mixed wastes are listed per 20.4.1.200 NMAC (incorporating 40 CFR 261 Subpart D) • Estimation of waste material parameter weights (Section C-2)					
9	Are procedures in place to ensure that waste streams identified to contain incompatible materials or materials incompatible with waste containers cannot be shipped unless treated to remove the incompatibility? (Section C-1c)					
10	Are procedures in place to ensure that the generator/storage site uses acceptable knowledge and, as necessary, headspace-gas sampling and analysis, radiography, visual examination, and homogeneous waste sampling and analysis as specified in Table C-5? (Section C-3)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Unacceptable Waste					

12	Are procedures in place to ensure that the generator/storage site ensures, through administrative and operational procedures and characterization techniques, that waste containers do not include the following unacceptable waste:
	• liquid waste is not acceptable at WIPP. Liquid in the quantities delineated below is acceptable
	  • Observable liquid shall be no more than 1 percent by volume of the outermost container at the time of radiography or visual examination
	  • Internal containers with more than 60 milliliters or 3 percent by volume observable liquid, whichever is greater, are prohibited
	  • Containers with Hazardous Waste Number U134 assigned shall have no observable liquid
	  • Overpacking the outermost container that was examined during radiography or visual examination or redistributing untreated liquid within the container shall not be used to meet the liquid volume limits
	• non-radionuclide pyrophoric materials
	• hazardous wastes not occurring as co-contaminants with TRU wastes (non-mixed hazardous wastes)
	• wastes incompatible with backfill, seal and panel closures materials, container and packaging materials, shipping container materials, or other wastes
	• wastes containing explosives or compressed gases (continued below)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
12a	• wastes with polychlorinated biphenyls (PCBs) not authorized under an EPA PCB waste disposal authorization • wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA Hazardous Waste Numbers of D001, D002, or D003) • waste that has ever been managed as high-level waste and waste from tanks specified in Table C-8, unless specifically approved through a Class 3 permit modification • any waste container from a waste stream (or waste stream lot) which has not undergone either radiographic or visual examination of a statistically representative subpopulation of the wastes stream in each shipment pursuant to Permit Attachment C7 • any waste container from a waste stream which has not been preceded by an appropriate, certified Waste Stream Profile Form (see Section C-1d) (Section C-1c)					
	Waste Acceptance Control					
14	Are procedures in place to ensure that the generator/storage site uses a Waste Stream Profile Form (WSPF) which includes, at a minimum, the information indicated on the attached WSPF found in Figure C-1 and a Characterization Information Summary (CIS) prior to waste disposal at the WIPP? (Section C-1d)					
16	Are procedures in place to ensure that additional WSPFs are provided to WIPP and NMED for waste streams or portions of waste streams that are reclassified based upon waste characterization information? (Section C-1d)					
16a	Are criteria in place to determine the specific circumstances under which a WSPF is revised versus when a new WSPF is required? (Section C-1d)					
	Laboratory Qualification					
17	Are procedures in place to ensure that the generator/storage site conduct analyses using laboratories that are qualified through participation in the Performance Demonstration Program (PDP) for headspace gas sampling and analysis, and PDP homogeneous waste sampling and analysis? (Section C-3a(3))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
18	Are procedures in place to ensure that the generator/storage sites conduct analyses using laboratories that implement the analytical methods through laboratory-documented standard operating procedures (SOPs) that ensure that analytical QAOs are met? (Section C-3a(3))					
19	Are procedures in place to ensure that documented laboratory QA/QC programs include the following: • Facility organization • List of equipment/instrumentation • Operating procedures • Laboratory QA/QC procedures • Quality assurance review • Laboratory records management (Section C-4a(4))					
	General Sampling and Analytical Requirements					
20	Are procedures in place to ensure that headspace gas sampling and analysis shall be used to: • Determine the types and concentrations of VOCs in the void volume of waste containers • VOC constituents shall be compared to those assigned by Acceptable Knowledge (Section C-3a(1))					
22	Are procedures in place to ensure that compounds not on the list of target analytes are reported as tentatively identified compounds (TICs) and that the TIC will be added to the target analyte list if it appears in the 20.4.1.200 NMAC (incorporating 40 CFR 261) Appendix VIII list and if they are reported in 25% of the waste containers sampled from a given waste stream? (Section C-3a(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
23	Are procedures in place to ensure that a randomly selected set of samples will be collected through core sampling or other EPA approved sampling from the population of waste containers for homogeneous and soil/gravel waste streams? Are procedures in place that a sufficient number of samples are collected to evaluate the toxicity characteristic of a waste stream at a 90 percent Upper Confidence limit as specified in Attachment C2? (Section C-3a(2))					
24	Are procedures in place to ensure that total analyses or TCLP of VOCs, SVOCs, and RCRA-regulated metals are performed on all core samples to determine if the waste exhibits a toxicity characteristic? (Section C-3a(2))					
25	Are procedures in place to ensure that Acceptable Knowledge is used in waste characterization activities to delineate TRU mixed waste streams, to assess whether TRU mixed wastes comply with the TSDF-WAC, to assess whether TRU mixed waste exhibits a hazardous characteristic (20.4.1.200 NMAC, incorporating 40 CFR 261 Subpart C), and to assess whether TRU wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR 261 Subpart D), and to estimate waste material parameter weights? (Section C-3b)					
26	Are procedures in place to ensure that radiography and/or visual examination are used as necessary to: • Examine a waste container to determine the physical form • Identify observable liquid in excess of TSDF-WAC limits and containerized gases • Verify the physical form matches the waste stream description (Section C-3c)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
27	Are procedures in place to ensure that the following characterization activities shall occur for newly generated wastes: • Acceptable Knowledge for all wastes, with sampling and analysis as necessary to augment AK including; : – Either visual examination during packaging or radiography (or VE in lieu of radiography) after packaging for all waste containers, ensuring this occurs prior to any treatment designed to supercompact waste – Headspace gas analysis for randomly selected containers , except for qualifying waste containers belonging to LANL sealed sources waste streams – Total VOC, SVOC, and Metals analyses for a selected number of homogeneous solids and soil/gravel waste containers as specified in Attachment C2 – Evaluation of any TICs found in headspace gas and totals analyses (Section C-3d(1))					
27a	Are procedures in place to ensure that the visual examination during packaging for all waste containers includes the documentation of packaging configuration, type and number of filters, and rigid liner vent hole presence and diameter necessary to determine the appropriate DAC in accordance with Permit Attachment C1, Section C1-1? (Section C-3d(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
28	Are procedures in place to ensure that the following characterization activities shall occur for retrievably stored wastes: • Acceptable Knowledge for all wastes, with sampling and analysis as necessary to augment AK including; – Visual examination or radiography for all waste containers – Headspace gas analysis for randomly selected containers except for qualifying waste containers belonging to LANL sealed sources waste streams – Total VOC, SVOC, and Metals analyses for a statistically selected number of homogeneous solids and soil/gravel waste containers as specified in Attachment C2 – Evaluation of any TICs found in headspace gas and totals analyses (Section C-3d(2))					
	Data Generation, Verification, Validation, Documentation, and Quality Assurance					
30	Are procedures in place to ensure that the following Data Quality Objectives are met: • Use Acceptable Knowledge to delineate TRU mixed waste streams, assess whether TRU mixed wastes comply with the applicable requirements of the TSDF-WAC, assess whether TRU mixed wastes exhibit a hazardous characteristic, assess whether TRU mixed wastes are listed and to estimate waste material parameter weights • Use Headspace gas sampling and analysis, as necessary, to identify and quantify VOCs in waste containers to resolve the assignment of EPA hazardous waste numbers • Perform totals analyses of homogeneous solids and soils/gravel wastes to establish if the waste is hazardous based on the toxicity characteristics levels in 20.4.1.200 NMAC through a comparison of the upper confidence limits (UCL_{90}) of the mean concentrations to resolve the assignment of hazardous waste numbers • Use radiography or visual examination to determine physical waste form, the absence of prohibited items, and additional waste characterization techniques that may be used based on Summary Category Groups (Section C-4a(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
31	Are procedures in place to ensure that the following Quality Assurance Objectives are adequately defined and assessed for each characterization method: • Precision as a measure of the mutual agreement among multiple measurements. • Accuracy as the degree of agreement between a measurement result and a true or known value. • Completeness is a measure of the amount of valid data obtained from a method compared to the total amount of data obtained that is expressed as a percentage. • Comparability is the degree to which one data set can be compared to another data set. • Representativeness as an expression of the degree to which data represent characteristics of a population. (Section C-4a(2))					
32	With respect to data generation, are procedures in place to ensure that the generator/storage site's waste characterization program meets the following general requirements: • Analytical data packages and batch data reports must be reported accurately in a pre-approved format, must be maintained in permanent files, and must be traceable? • All data must receive a technical review by another qualified analyst? (Section C3-10a)					
33	Are procedures in place to ensure that the generator/storage site performs validation of waste characterization data for each waste container? (Section C-4)					
34	Are procedures in place to ensure that the generator/storage site has a pre-approved format for reporting waste characterization data? (Section C-4a(4))					
35	Are procedures in place to ensure that the generator/storage site prepares analytical, testing, and sampling batch data reports to meet the requirements of their own site-specific QAPjP and/or SOPs? (Section C-4a(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
36	Are procedures in place to ensure that all raw data is collected and managed at the data generation level in accordance with the following criteria: • All raw data shall be signed and dated in reproducible ink by the individual collecting the data, or signed and dated using electronic signatures • All data shall be recorded clearly, legibly, and accurately in field and laboratory records and include applicable sample identification numbers • All changes to original data shall be lined out, initialed, and dated by the individual making the change. Original data may not be obliterated or otherwise be made unreadable • All data shall be transferred and reduced from field and laboratory records completely and accurately • All field and laboratory records shall be maintained as specified in Table C- 6 of Attachment C • Data shall be organized into standard reporting formats for reporting purposes. • All electronic and video data must be stored to ensure that waste container, sample and QC data are readily retrievable (Section C3-10a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
37	Are procedures in place to ensure that 100 % of batch data reports are subject to independent technical review by an individual qualified to review the data who was not involved in the generation or recording of the data under review. The reviewer shall release the data through signature with an associated review checklist prior to characterization of the associated waste and shipment to the WIPP. The review shall ensure the following, as applicable: • Data generation and reduction were conducted according to the methods used and reported in the proper units and significant figures • Calculations have been verified by a valid calculation program, a spot check of verified calculation programs, and/or a 100 percent check of all hand calculations • The data have been reviewed for transcription errors • The testing, sampling, and analytical QA documentation for BDRs is complete and includes, as applicable, raw data, DAC and equilibrium calculations and times, calculation records, chain of custody forms, calibration records, QC sample results and copies or originals of gas canister sample tags. • All QC sample results are within established control limits, and if not, the data has been appropriately qualified. • Reporting flags were assigned correctly • Sample holding times and preservation requirements were met, or exceptions documented • Radiography tapes are reviewed on a waste container basis at a minimum of once per testing batch or once per day of operation, whichever is less frequent. The radiography tape will be reviewed against the data on the radiography form to ensure that data are complete and correct • Field sampling records are complete • QAOs have been met (Section C3-10a(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
40	Are procedures in place to ensure that 100 percent of all batch data reports receive a Site Project Manager signature release with an associated review checklist prior to characterization of the associated waste and shipment to the WIPP. This release shall ensure the following: • The Site Project Manager or designee shall determine the validity of the drum age criteria (DAC) assignment made at the data generation level based upon an assessment of the data collection and evaluation necessary to make the assignment. • Testing batch QC checks were properly performed. Radiography data are complete and acceptable based on evidence of videotape review of one waste container per day or once per testing batch, whichever is less frequent • Sampling batch QC checks were properly performed, and meet the established QAOs and are within established data usability criteria • Analytical batch QC checks were properly performed and meet the established QAOs and are within established data usability criteria • Online batch QC checks were properly performed and meet the established QAOs and are within established data usability criteria • Proper procedures were followed to ensure representative samples of headspace gas and homogeneous solids and soil/gravel were taken • Data generation level independent technical review, validation, and verification have been performed as evidenced by the completed review checklists and appropriate signature releases. • Independent technical reviewers were not involved in the generation or recording of the data under review. • Batch Data review checklists are complete • Batch Data Reports are complete and data properly reported • Verify that data are within established data assessment criteria and meet all applicable QAOs (Section C3-10b(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
42	Are procedures in place to ensure that a repeat of the data review process at the data generation level will be performed on a minimum of one randomly chosen waste container every quarter to determine if the verification and validation is performed according to documented procedures? (Section C3-10b)					
43	Are procedures in place and checklists are available to prepare a Site Project Manager (SPM) Summary and a Data Validation Summary (the summaries may be in the same document)? The SPM Summary includes a validation checklist for each batch that is of sufficient detail to document all aspects of a batch data report that could affect data quality. The Data Validation Summary must identify each Batch Data Report reviewed , describe how the validation was performed, identify all problems, and identify all acceptable and unacceptable data. Summaries must include release signatures. (Section C3-10b(2))					
44	Are procedures in place to ensure that non-administrative, WAP-related nonconformances first identified at the site project manager level are reported to the Permittees within seven calendar days of identification, that nonconformance reports are prepared within 30 calendar days, and that corrective action is implemented prior to waste shipment? (Section C3-13)					
45	Are procedures in place to ensure that any waste container for which a nonconformance report (NCR) has been written will not be shipped to the WIPP facility unless the condition that led to the NCR for that container is appropriately identified, reconciled, corrected, and documented? Are nonconformance reports prepared for nonconformances identified? Are nonconformances identified and tracked, and does the Site Project Manager oversee the nonconformance report process? (Section C3-13)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Control					
46	Are procedures in place to ensure that the site's sample handling and control program includes the following: • Field documentation of samples including point of origin, date of sample, container identification, sample type, analysis requested, and chain-of-custody (COC) number? • Proper labeling and/or tagging including proper sample numbering, sample identification, sample date, sampling conditions, and analysis requested? • COC record including name of sample relinquisher, sample receiver, and date and time of sample transfer? and • Proper sample handling and preservation? (Section C-4a(3))					
47	Are procedures in place to ensure that the site's QAPjP or site-specific procedures includes COC forms to control the sample from the point of origin to the final analysis result reporting? (Section C-4a(3))					
	Data Transmittal					
48	Are procedures in place to ensure that the generator/storage site transmits data by hard copy or electronic copy from the data generation level to the site project level? If electronic, does the generator/site have a hard copy available on demand? (Section C-4a(6))					
50	Are procedures in place to ensure that the generator/storage site inputs the data into the WWIS manually or electronically? (Section C-4a(6))					
51	Are procedures in place to ensure that the generator/storage site enters the data into the WWIS in the exact format required by the database? (Section C-4a(6))					
51a	Are procedures in place to ensure that if a container was part of a composite headspace gas sample, the analytical results from the composite sample must be assigned as the container headspace gas data results, including associated TICs, for every waste container associated with the composite sample in the WWIS? (Section C3-12b(4))					
52	Are procedures in place to ensure all of the data presented on Table C- 7 of the Permit is transmitted to the WWIS? (Table C-7)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Records and Record Management					
55	Are procedures in place to ensure that the generator/storage site's hard copy and/or electronic data reports follow the Permittees' format requirements? (Section C-4a(4))					
56	Are procedures in place to ensure that hard copy or electronic Waste Stream Profile Form will include the following • Generator/storage site name • Generator/storage site EPA ID • Date of audit report approval by NMED (if obtained) • Original generator of waste stream • Whether waste is Contact-Handled or Remote-Handled • Waste Stream WIPP Identification Number • Summary Category Group • Waste Matrix Code Group • Waste Material Parameter Weight Estimates per unit of waste • Waste stream name • A description of the waste stream • Applicable EPA hazardous waste numbers • Applicable TRUCON codes • A listing of acceptable knowledge documentation used to identify the waste stream • The waste characterization procedures used and the reference and date of the procedure • Certification signature of Site Project Manager, name, title, and date signed (Section C3-12b(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
56a	Are procedures in place to ensure that hard copy or electronic Characterization Information Summary will include the following: • Data reconciliation with DQOs • Headspace gas summary data listing the identification numbers of samples used in the statistical reduction, the maximum, mean, standard deviation, UCL_{90}, RTL, and associated EPA hazardous waste numbers that must be applied to the waste stream. • Total metal, VOC, and SVOC analytical results for homogeneous solids and soil/gravel (if applicable), • TIC listing and evaluation, • Radiography and visual examination summary to document that all prohibited items are absent in the waste (if applicable) • A complete listing of all container identification numbers used to generate the Waste Stream Profile Form, cross-referenced to each Batch Data Report • Complete AK summary, including stream name and number, point of generation, waste stream volume (current and projected), generation dates, TRUCON codes, Summary Category Group, Waste Matrix Code(s) and Waste Matrix Code Group, other TWBIR information, waste stream description, areas of operation, generating processes, RCRA determinations, radionuclide information, all references used to generate the AK summary, and any other information required by Permit Attachment C4, Section C4-2b. • Method for determining Waste Material Parameter Weights per unit of waste. • List of any AK Sufficiency Determinations requested for the waste stream. • Certification through acceptable knowledge or testing and/or analysis that any waste assigned the hazardous waste number of U134 (hydrofluoric acid) no longer exhibits the characteristic of corrosivity. This is verified by ensuring that no liquid is present in U134 waste. • A justification for the selection of radiography and/or VE as an appropriate method of characterizing the waste. (Section C3-12b(2))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
56b	Are procedures in place to assure that ongoing container characterization results are cross referenced to Batch Data Reports? Section C3-12b					
58	Are procedures in place to ensure that project level reports are compiled into Characterization Information Summaries (Section C3-12b)					
59	Are procedures in place to ensure that the generator/storage site uses forms for data reporting that are pre-approved forms in site-specific documentation? (Section C3-12)					
60	Are procedures in place to ensure that the generator/storage site's site project manager submits to the WIPP facility a summary of the waste stream information and reconciliation with data quality objectives (DQOs) once a waste stream is characterized? (Section C-4a(6))					
61	Are procedures in place to ensure that the generator/storage site project office completes a WSPF based on the Batch Data Reports? C3-12b)					
62	Are procedures in place to ensure that the generator/storage Site Project Manager submits the WSPF to the Permittees for DOE's approval along with the accompanying Characterization Information Summary for that waste stream? (Section C-4a(6))					
63	Are procedures in place to ensure that the generator/storage site maintains records related to waste characterization sampling and analysis activities in the testing, sampling or analytical facilities files, or site project files for those facilities located on-site? (Section C-4a(7))					
64	Are procedures in place to ensure that the appropriate documented training and indoctrination is performed for all individuals and that procedures are documented in site specific QAPjPs and procedures? (Section C3-14)					
65	Are procedures in place to ensure that the generator/storage site requires contract waste analytical facilities to forward testing, sampling and analytical records along with testing, sampling and analytical batch data reports to the site project office for inclusion in the sites project files? (Section C-4a(7))					
66	Are procedures in place to ensure that the generator/storage site has an appropriate records inventory and disposition schedule (RIDS) or equivalent that was prepared and approved by appropriate site personnel? (Section C-4a(7))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
67	Are procedures in place to ensure that the generator/storage site maintains all records relevant to an enforcement action, regardless of disposition, until they are no longer needed for enforcement action, and then dispositioned per the approved RIDS? (Section C-4a(7))					
68	Are procedures in place to ensure that the generator/storage site maintains records that are designated as Lifetime Records for the life of the waste characterization program plus six years, or that the records have been transferred for permanent archival storage to the WIPP Records Archive facility? Lifetime Records include: • Field sampling data forms, • Field and laboratory COC forms, • Test facility and laboratory Batch Data Reports, • Waste Stream Characterization Package, • Sampling plans, • Data reduction, validation, and reporting documentation, • Acceptable knowledge documentation, • WSPF and Characterization Information Summary (Section C-4a(7), Table C-6)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
69	Are procedures in place to ensure that the generator/storage site maintains records that are designated as Non-Permanent Records for ten years from the date of record generation, and then dispositioned according per the approved RIDS or transferred to the WIPP Records Archive facility? Non-Permanent Records include: • Nonconformance documentation, • Variance documentation, • Assessment documentation, • Gas canister tags, • Methods performance documentation, • PDP documentation, • Sampling equipment certifications, • Calculations and related software documentation, • Training/qualification documentation, • QAPjP documentation (all revisions), • Calibration documentation, • Analytical raw data, • Procurement documentation, • QA procedures (all revisions), • Technical implementing procedures (all revisions), and • Audio/video recording (radiography, visual, etc.). (Section C-4a(7), Table C-6)					
70	Are procedures in place to ensure that the generator/storage site has raw data that is identifiable and legible, and provides documentary evidence of quality? (Section C-4a(7))					
71	Are procedures in place to ensure that if the generator/storage site ceases to operate, that all records be transferred before closeout? (Section C-4a(7))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Shipment					
72	Are procedures in place to ensure that the generator/storage site accurately completes an EPA Hazardous Waste Manifest prior to shipping the waste to WIPP that contains the following information: • Generator/storage site name and EPA ID • Generator/storage site contact name and phone number • Quantity of waste • List of up to six state and/or federal hazardous waste numbers in each line item • Listing of all container IDS • Signature of authorized generator representative (Section C-5b)					
73	Are procedures in place to ensure that the generator/storage site accurately completes the following container specific information: • Waste stream identification number • List of hazardous waste numbers per container • Certification data • Shipping data (Section C-5b)					

1. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to ask whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met

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Table C6-2 Solids and Soils/Gravel Sampling Checklist

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Solids and Soils/Gravel Sampling Checklist

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	General Solids Sampling Requirements					
75	Are procedures documented that adequately ensure that when a Determination Request has not been approved, sampling and analysis of newly generated homogeneous solid and soil/gravel waste streams shall be conducted in accordance with the requirements specified in Attachment C1, Section C1-2. (Section C-3d(1)(a))					
76	Are procedures in place to ensure that the number of newly generated soils/gravel waste containers to be randomly sampled will be determined using the procedure specified in Section C2-1, wherein a statistically selected portion of the waste will be sampled? (Section C-3d(1)(a))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
77	Are procedures in place to ensure that the following sample collection requirements for retrievably stored and newly generated waste streams are met: • The number of random samples collected for characterization of retrievably homogeneous solid and soil/gravel stored waste is performed by developing preliminary mean and variance estimates for each analyte to define the number of required random samples; and that the sample selection process is adequately documented. • A minimum of 5 waste containers in a retrievably stored waste streams are sampled to establish the preliminary estimate for the number of samples. • Based on the number of samples required by the preliminary estimate, the subsequent sample means and deviations for each analyte are evaluated against the regulatory threshold for each constituent to determine if additional samples shall be collected. • Samples (the number of which is statistically determined) are collected to verify that a TRU mixed waste is below the regulatory threshold, where the regulatory threshold is the toxicity limit for toxicity characteristics and the PRQL for listed waste constituents. • Samples from preliminary estimates counted as required samples were randomly selected and were collected, analyzed, and validated using representative methods (Section C2-1a)					
80	Are procedures in place that allow toxicity characteristic contaminants associated with F-numbers for a waste stream to be omitted from sampling requirements? (Section C2-1a)					
	Solids Sampling Procedures					
81	Do procedures ensure that samples for retrievably stored waste are collected using appropriate coring tools or other EPA approved methods, and that newly generated wastes that are sampled from a process as it is generated are sampled using EPA approved methods, including scoops and ladles, that are capable of collecting a representative sample? (Section C1-2a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
82	Do site specific procedures, QAPjPs, and/or SOPs indicate that rotational coring tools are available for the collection of cores and non-rotational coring tools available for collection of cores in relatively soft media. The method used shall be appropriate to retrieve the maximum core amount. The coring tools will include the following features: • Removable tube liners constructed of rigid materials unlikely to affect the composition and/or concentration of target analytes in the sample core (Teflon®) and sufficiently transparent to allow visual examination of the core. The liner outer diameters are between 1-2 inches and the liner wall thickness is no greater than 1/16 inch. The liner shall fit flush with the coring tool inner wall and be of sufficient length to hold a core representative of the waste along the entire depth of the waste. • Sleeves composed of polycarbonate, Teflon, or glass for most samples and brass or stainless steel for non-metal samples • Liner end caps shall fit tightly around the ends of the liner and shall be composed of materials unlikely to affect the composition and/or concentration of analytes in the core (Teflon®) • Spring retainers shall be used when the physical properties of the sampling media may cause the sample to fall out of the liner. The retainer shall be composed of inert materials and the inner diameter shall not be less than the inner diameter of the liner • Coring tools may have an air lock mechanism. The air lock shall also close when the core is removed from the waste container • Core extruders shall be used to extrude the liner if the liner does not slide freely • Coring tools shall be of sufficient length to hold the liner and shall be constructed to allow placement of the liner leading edge as close as possible to the coring tools leading edge					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
82a	• All surfaces of the coring tool that have the potential to contact the sample core or sample media shall be cleaned prior to use • Rotational coring tools shall have a mechanism to minimize inner liner rotation and shall be designed to minimize frictional heat transfer to the sample core • The leading edge of the coring tool may be sharpened and tapered to a diameter equivalent or slightly smaller than the inner diameter of the liner. • Non-Rotational coring tools shall be designed to minimize the kerf width (½ the difference between the outer diameter of the tool and the tools inlet inner diameter) (Section C1-2a(1))					
83	Does the site adequately document that the liner material and retainers are not likely to contain any analytes of concern? (Section C1-2a(1))					
84	Are procedures in place to ensure that equipment blanks are collected and evaluated to verify that liner material, retainers, or other sampling equipment in contact with the sample do not contain analytes of concern? (Section C1-2b(2))					
	Sample Collection					
85	Are procedures in place to ensure that sampling is completed in a timely manner, within 60 minutes of core collection, or that the core shall remain in the capped liner, or the coring tool shall remain in the waste container with the air lock mechanism attached? (Section C1-2a(2))					
86	Are procedures in place to ensure that VOC samples are sampled prior to extruding the core from the liner and that the sample locations are documented? These samples may be collected by choosing a single sample from the representative subsection of the core, or three equal length VOC sample locations on the core are selected randomly along the long axis of the core to form a single 15-gram composite sample. Smaller sample sizes may be used if method PRQL requirements are met for all analytes. (Section C1-2a(2))					
87	Are procedures documented to ensure that a VOC sample is collected using a metal coring cylinder or equivalent equipment as described in SW-846 and that the sample is immediately extruded into a 40 mL VOA vial (or other containers specified in appropriate SW-846 methods)? (Section C1-2a(2))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
88	Are procedures in place to ensure that SVOC and Metals sample location(s) on the core are selected randomly along the long axis of the core and that the sample locations are documented, or that samples are collected at the same locations as VOC samples? Samples may be collected by splitting or compositing the representative subsection of the core. The representative subsections are chosen by randomly selecting a location along the portion of the core from which the sample was taken. (Section C1-2a(2))					
89	Are procedures in place to ensure that the SVOC and Metals sample s are collected using equipment constructed of materials unlikely to affect the composition or concentrations of the samples? (Section C1-2a(2))					
90	Are procedures in place to ensure that newly generated waste samples collected by means other than coring are collected as soon as possible and that spatial and temporal homogeneity is evaluated to determine if composite or grab samples are appropriate? (Section C1-2a(2))					
91	Are procedures in place to ensure sample volumes, preservatives, containers, and holding times meet the following specifications: **Minimum sample quantity** VOC 15 grams SVOC 50 grams Metals 10 grams (Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.) **Preservative** VOC Cool to 4C SVOC Cool to 4C Metals Cool to 4C **Sample Container** VOC 40 mL VOA glass vial (or other appropriate containers) cap SVOC glass jar with Teflon® lined cap Metals polyethylene or polypropylene bottle **Holding Time from Date of Collection** VOC 14 days prep/40 days analyze SVOC 14 days prep/40 days analyze Metals 180 days/ 28 days Hg (Table C1-4)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Quality Control Sample Collection					
92	Are procedures in place to ensure that sampling precision will be determined through the collection of co-located core field duplicate samples for core samples and through the collection of co-located samples for samples collected using alternate methods at the frequency of once per 20 sample batch collected over 14 days or once per week, whichever is more frequent? (Section C1-2b(1))					
93	Are procedures in place to ensure that co-located cores are collected side by side as close as feasible to each other, that the cores are collected and handled in the same manner? (Section C1-2b(1))					
94	Are procedures in place to ensure that an additional sampling location is found or new co-located cores are collected if the visual examination of the original co-located cores detects inconsistency in the sample color, texture, or waste type? (Section C1-2b(1))					
95	Are procedures in place to ensure that all surfaces of sampling tools that have the potential to come into contact with the sample, including tube liners, endcaps, spring retainers, extruders, coring tool surfaces, or any other sampling equipment, are either thoroughly decontaminated or disposed of after each sampling event? (Sections C1-2b(2), C1-2b(3))					
96	Are procedures in place to ensure that equipment blanks are collected from randomly selected fully assembled coring tools or randomly selected liners (if they are cleaned separately) and from randomly selected sampling equipment (e.g. VOC subsampler, spoons, bowls) at a frequency of once per equipment cleaning batch and that the sample is collected prior to first use? (Section C1-2b(2))					
97	Are procedures in place to ensure that equipment blanks will be collected in the area where sampling equipment coring tools are cleaned, prior to covering the coring tools with protective wrapping and storage? (Section C1-2b(2))					
99	Are procedures in place to ensure that miscellaneous sampling tool equipment blanks will be collected by pouring deionized or HPLC water over the surface of the equipment and into a clean sample container appropriate for the requested analysis? (Section C1-2b(2))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
100	Are procedures in place to ensure that equipment blanks are analyzed for VOC, SVOC, and Metals and that the entire equipment batch will be re-cleaned and re-sampled if any analytes are detected at levels greater than 3 times the MDL or PRDL (Section C1-2b(2))					
101	Are procedures and processes in place to ensure that equipment blanks are traceable to a specific equipment cleaning batch and that the equipment cleaning batch is traceable to specific identified sampling equipment? Are sampling equipment or coring tools labeled with unique identification numbers that are referenced in field records? (Section C1-2b(3))					
102	Are procedures in place to ensure that disposable sampling equipment is certified as clean prior to use? (Section C1-2b(2))					
	Sample Equipment Testing, Inspection and Maintenance					
103	Are procedures in place to ensure that all sampling and coring tools are tested prior to use in accordance with manufacturers specification to ensure that the air-lock mechanism and rotation mechanism are in working order? (Section C1-2c)					
104	Are procedures in place to ensure that malfunctioning sampling and coring tools are repaired or replaced prior to use? (Section C1-2c)					
105	Are procedures in place to ensure that all equipment is cleaned, sealed inside a protective wrapping and stored in a clean area? (Section C1-2c)					
106	Are procedures in place to ensure that an adequate spare part inventory is available? (Section C1-2c)					
107	Are procedures in place to ensure that all equipment maintenance and repair is documented in field records and that field record logbooks are available to document equipment maintenance and repair activities? (Section C1-2c)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
108	Are procedures in place to ensure that inspection of equipment and work area cleanliness will encompass the following: • Sample collection equipment in the immediate area of sample collection shall be inspected daily for cleanliness and that any visible contamination that has a potential to contaminate a waste sample shall be thoroughly cleaned upon discovery • The waste coring and sampling work areas shall be maintained in clean condition • Expendable equipment shall be visually inspected for cleanliness prior to use and properly discarded after use • Protective wrapping on coring tools and other sampling equipment are visually inspected prior to unwrapping. Coring tools or other equipment with torn protective wrappers or with visible contamination are returned to be cleaned or properly discarded prior to use. • All sampling equipment shall be visually inspected prior to use to determine if protective wrapping is torn or if equipment is contaminated after unwrapping. Equipment with torn wrapping or signs of contamination will be returned for cleaning or properly discarded. • Clean sampling and coring equipment is segregated from all equipment that has not been decontaminated. (Section C1-2c)					
109	Are procedures documented to ensure that scales used for weighing sub-samples are calibrated as necessary to maintain its operation within manufacturer's specification, that the calibration is documented, that calibration is verified using NIST traceable weights upon each day of use, and that all calibration verification is documented in field records? (Section C1-2d)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Handling and Custody					
111	Do formats for field logs and custody records specify documentation of the following information: • Signature of individual initiating custody control, along with the date and time • Documentation of sample numbers for each sample under custody. Sample numbers will be referenced to a specific sampling event description that will identify the sampler(s) through signature, date and time of sample collection, type/number containers for each sample, sample matrix, preservatives (if applicable), requested methods of analysis, place/address of sample collection and the waste container number • For off-site shipping, method of shipping transfer, responsible shipping organization or corporation, and associated air bill or lading number.					
111a	• Signatures of custodians relinquishing and receiving custody of samples including date and time of transfer. • Description of final sample container disposition, along with signature of individual removing sample container from custody • Comments section • Documentation of discrepancies, breakage or tampering (Section C1-5)					
112	Are procedures in place to ensure that samples and sampling equipment are identified with unique identification numbers? (Section C1-5)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
113	Do sample tags or labels contain the following information: • Sample ID number • Sampler initials and organization • Ambient temperature and pressure (for gas samples only) • Sample description • Requested analysis • Date and time of collection • QC designation (if applicable) (Section C1-5)					
114	Are procedures in place to ensure waste containers and samples are sealed with intact custody seals and that one or more of the following custody conditions are met: • It is in the possession of an authorized individual • It is in the view of an authorized individual, after being in the possession of that individual • It was in the possession of an authorized individual and access to the sample was controlled by locking or placement of signed custody seals that prevent undetected access • It is in a designated secure area, such as a controlled access location with complete documentation of personnel access or a radiological containment area (hot cell or glove box) (Section C1-5)					
117	Are procedures in place to ensure that sample custody is maintained until the sample is released by the SPM or is expended. (Section C1-5)					
118	Are procedures in place to ensure that samples in glass jars are wrapped in plastic to prevent breakage and placed in appropriate containers, such as coolers, for shipment? (Section C1-6)					
119	Are procedures in place to ensure that adequate cold packs are included in the sample shipping container to ensure that all temperature requirements are met? (Section C1-6)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
120	Are procedures in place to ensure that sample COC forms are secured for shipment to the inside of the sealed and locked shipping container and that samples and shipping containers are affixed with tamper proof seals? (Section C1-6)					
121	Are procedures in place to ensure that appropriate blank samples are included with each shipment container containing VOC samples? (Section C1-6)					
122	Are procedures in place to ensure that a custody seal or device is securely affixed across the lid and body of each sample and shipment container, and is traceable to the individual who affixed the seal or device? (Section C1-5)					
	Laboratory Operations					
123	Are procedures in place to ensure that only laboratories that are qualified through participation in the Performance Demonstration Program are eligible to analyze waste samples? (Section C-3a(3))					
124	Are procedures available from all participating laboratories that adequately document that custody is maintained until the sample is released by the site project manager or until the sample is expended? (Section C1-5)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Volatile and Semi-Volatile Analysis of Core Samples					
125	Are procedures documented to ensure that all VOC and SVOC analyses are evaluated using the following criteria: • GC/MS Tunes, Initial Calibrations and Continuing Calibration will be performed and evaluated using criteria in Table C3-5 (VOCs) or Table C3-7 (SVOCs) and SW-846 methods • Precision shall be assessed through analyzing laboratory duplicates or matrix spike duplicates, LCS replicates, and PDP blind-audit samples in comparison to Table C3-4 (VOCs) and Table C3-6 (SVOCs) • Accuracy as %R shall be assessed through evaluation of LCS , Matrix spikes, PDP blind-audit samples, and surrogate compounds in comparison to criteria in Table C3-4 and Table C3-5 (VOCs) and Table C3-6 and Table C3-7(SVOCs) or the SW-846 method. • Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples collected. • Comparability is assessed through use of standardized SW-846 methods sample preparation and methods that meet the QAO requirements in Tables C3-4 and C3-5 (VOCs) and Tables C3-6 and C3-7(SVOCs), traceable standards, and by requiring participation in the PDP. • Representativeness is assured through the use of unbiased sample collection • Results and method detection limits are expressed in Mg/Kg • All method detection limits and program required quantitation limits shall be less than or equal to the limits listed in Table C3-4 or Table C3-6 and the detection limit study procedures shall be documented in SOPs (Section C3-6 and C3-7)					
126	Are procedures documented to ensure that Tentatively Identified Compounds shall be added to the target analyte list if detected in a given waste stream if they are reported in 25% of the waste containers sampled from a given waste stream, and if they appear in the 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII list? (Section C-3a(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
126a	Are procedures documented to ensure that the following criteria are met with regard to the recognition and reporting of TICS for GC/MS Methods for homogeneous solids and soils and gravels in accordance with SW-846 criteria: • Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum. • The relative intensities of the major ions should agree within ± 20 percent. • Molecular ions present in the reference spectrum should be present in the sample spectrum. • Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds. • Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks. • The reference spectra used for identifying TICs shall include, at minimum, all of the available spectra for compounds that appear in the 20.4.1.200 NMAC (incorporating 40 CFR Part 261) Appendix VIII list. The reference spectra may be limited to VOCs when analyzing headspace gas samples. • TICs for headspace gas analyses that are performed through FTIR analyses shall be identified in accordance with the specifications of SW-846 Method 8410. (Section C3-1)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
126b	TICs shall be reported as part of the analytical batch data reports for GC/MS Methods in accordance with the following minimum criteria: • a TIC in an individual container headspace gas or solids sample shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 10% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 2 to 5 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 2% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 6 to 10 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 1% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 11 to 20 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 0.5% of the area of the nearest internal standard. (Section C3-1)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Metals Analysis of Core Samples					
127	Are procedures in place to ensure that all Metals analyses are evaluated using the following criteria: • Precision shall be assessed by analyzing of laboratory sample duplicates or laboratory matrix spike duplicates, LCS replicates, and PDP blind audit samples in comparison to Table C3-8 • Accuracy shall be assessed through analysis of laboratory matrix spikes, PDP blind-audit samples, serial dilutions, interference check samples, and laboratory control samples in comparison to criteria in Tables C3-8 and C3-9 • Instrument detection limits are expressed in ug/L and results are listed in Mg/Kg. • All instrument detection limits and program required detection limits shall be less than the limits listed in Table C3-8 and the detection limit study procedures shall be documented in laboratory SOPs. The Instrument detection limits shall be less than the associated PRDL for each analyte *(This requirement is not mandatory if the sample concentrations are greater than 5 times the instrument detection limit (IDL) for a method)* • Instrument detection limits shall be determined semiannually using procedures documented in laboratory SOPs					
127a	• Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. • Comparability is assessed through use of standardized SW-846 sample preparation and methods that meet the QAO requirements in Tables C3-8 and C3-9, demonstrating successful participation in the PDP and use of traceable standards. • Representativeness is assured through the use of unbiased sample collection and preparation of samples using unbiased methods. • Results PRQLs are expressed in Mg/Kg wet weight (Section C3-8)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Quality Assurance Objectives					
128	Are procedures in place to ensure that the sample completeness rate is expressed as the number of valid samples collected as a percentage of the total samples collected for each waste stream? The rate must be greater than 90 percent for all compounds in a waste stream. (Section C3-3)					
129	Are procedures in place to ensure that sampling operations are comparable through the use of standardized procedures, sampling equipment, and measurement units participation in the PDP? (Section C3-3)					
130	Are procedures in place to ensure that sampling precision shall be determined through the collection of field duplicates at a rate of 1 per sampling batch (up to 20 samples) or 1 per week, whichever is more frequent? (Section C3-3)					
131	Are procedures in place to ensure that the variance measured between co-located core samples is compared to the variance within the waste stream using the F-test? (Section C3-3)					
132	Are procedures in place to ensure that sampling accuracy as a result of equipment blank evaluation is determined through the collection of equipment blanks at a frequency of once per equipment cleaning batch (Section C3-3)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
133	Are procedures in place to ensure that the representativeness of samples is demonstrated through the following requirements: • Use of coring tools and sampling equipment that are clean prior to use • The entire depth of the waste minus a documented safety factor shall be cored and the core collected shall have a core length greater than or equal to 50 percent • The core recovery is calculated as the length of the core collected over the depth of the waste in the container • Coring operations and tools should be designed to minimize alteration of the in-place waste characteristics and the minimum waste disturbance shall be verified by visually examining the core and documenting the observation in field logbooks (Note: if core recovery is less than 50 percent, a second core shall be randomly selected. The core with the best recovery shall be used for sample collection) (Section C3-3)					

1. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to determine whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met.

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Table C6-3 Acceptable Knowledge (AK) Checklist

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Acceptable Knowledge (AK) Checklist[1]

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	General Requirements					
134	Are the primary document(s) required in Permit Attachment C4 containing acceptable knowledge information available? (Section C4-2)					
135	Has the generator developed a methodology whereby a logical sequence of acceptable knowledge information that progresses from general facility to more detailed waste-specific information can be acquired? (Section C4-2)					
136	Does the site have adequate procedures in place to ensure that the Acceptable Knowledge process is adequately implemented? Do these procedures facilitate the mandatory traceability analysis performed for each Summary Waste Category Group examined during the audit? (Section C4-2)					
137	Does the generator site's TRU mixed waste management program information clearly define (or provide a methodology for defining) waste categorization schemes and terminology, provide a breakdown of the types and quantities of TRU mixed waste generated/stored at the site, and describe how waste is tracked and managed at the generator site (including historical and current operations? Do procedures ensure that waste streams are adequately identified? (Section C4-2a)					
138	Does site documentation procedures indicate that the site will document, justify, and consistently define waste streams and assign EPA hazardous waste numbers? (Section C4-2b)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Required and Additional Information					
140	Does the generator site document that the following must be included in the acceptable knowledge record: • Map of the site with the areas and facilities involved in TRU waste generation, treatment, and storage identified • Facility mission description as related to TRU waste generation and management (e.g., nuclear weapons research may involve metallurgy, radiochemistry, and nuclear physics operations that result in specific waste streams) • Description of the operations that generate TRU waste at the site (e.g., plutonium recovery, weapons design, or weapons fabrication) • Waste identification or categorization schemes used at the facility (e.g., item description codes, content codes) • Types and quantities of TRU mixed waste generated, including historical generation through future projections • Correlation of waste streams generated from the same building and process, as appropriate (e.g., sludge, combustibles, metals, and glass) • Waste certification procedures for retrievably stored and newly generated wastes to be sent to the WIPP facility (Section C4-2a)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
141	Does the generator site document that the following shall be collected for each waste stream: A. Area(s) and/or building(s) from which the waste stream was or is generated B. Waste stream volume and time period of generation (e.g., 100 standard waste boxes of retrievable stored waste generated from June 1977 through December 1977) C. Waste generating process described for each building (e.g., batch waste stream generated during decommissioning operations of glove boxes), including processes associated with U134 waste generation, if applicable. D. Documentation demonstrating how the site has historically managed the waste, including the historical regulatory status of the waste (i.e., TRU mixed versus TRU non-mixed waste) E. Process flow diagrams (e.g., a diagram illustrating glove boxes from a specific building to a size reduction facility to a container storage area). In the case of research/development, analytical laboratory waste, or the similar processes where process flow diagrams cannot be created, a description of the waste generating processes, rather than a formal process flow diagram, may be included if this modification is justified and the justification is placed in the auditable record F. Material inputs or other information that identifies the chemical content of the waste stream and the physical waste form (e.g., glove box materials and chemical handled during glove box operations, events or processes that may have modified the chemical or physical properties of the waste stream after generation, data obtained through visual examination of newly generated waste that later undergoes radiography; information demonstrating neutralization of U134 [hydrofluoric acid] and waste compatibility) (Section C4-2b)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
142	Do site documents/procedures require that the facility will provide a summary to the Permittees that summarizes all information collected, including basis and rationale for all waste stream designations? Is an example of this summary available for audit review? If discrepant hazardous waste data exist in required information, do sites consider applying all hazardous waste numbers, but assess and evaluate the information to determine the appropriate hazardous waste numbers consistent with RCRA requirements? (Section C4-2b)					
143	Do site procedures indicate that if the required AK information is not available for a particular waste stream, that the waste stream will not be eligible for an AK Sufficiency Determination? (Section C4-2)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
144	Have the following procedures been prepared? A. Procedures for identifying and assigning the physical waste form of the waste B. Procedures for delineating waste streams and assigning Waste Matrix Codes C. Procedures for resolving inconsistencies in acceptable knowledge documentation D. Procedures for headspace gas sampling and analysis, visual examination and/or radiography, and homogeneous waste sampling and analysis, if applicable E. For newly generated waste, procedures describing process controls used to ensure prohibited items (specified in the WAP, Permit Attachment C) are documented and managed F. Procedures to ensure radiography and visual examination include a list of prohibited items that the operator shall verify are not present in each container (e.g. liquid exceeding TSDF-WAC limits, corrosives, ignitables, reactives, and incompatible wastes) G. Procedures to document how changes to Waste Matrix Codes, waste stream assignment, and associated Environmental Protection Agency hazardous waste numbers based on material composition are documented for any waste H. Procedures that ensure the assignment of EPA hazardous waste numbers is appropriate, consistent with RCRA requirements, and adequately considers site historical waste management I. Procedures for estimating waste material parameter weights (Section C4-2b)					
145	Does the generator provide procedures or written commitment to collect additional acceptable knowledge information, as available and as necessary to augment mandatory information? (Section C4-2c)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
145a	For waste containers that belong to LANL sealed sources waste streams, and for which headspace gas sampling and analysis is not required, are there procedures in place to assure the collection of the following additional AK? A. Documentation that the waste container contents meet the definition of sealed sources per 10 CFR §30.4 and 10 CFR §835.2 (effective January 1, 2004) B. Documentation of the certification of the sealed sources as U.S. Department of Transportation Special Form Class 7 (Radioactive) Material per 49 CFR §173.403 (effective October 1, 2003) C. Documentation of contamination survey results that validate the integrity of each sealed source per 10 CFR §34.27 (effective January 1, 2004). D. AK documentation does not indicate the use of VOCs or VOC-bearing materials as constituents of the sealed sources. E. The outer casing of each sealed source must be of a non-VOC bearing material, which must be verified at the time of packaging. F. AK documentation that includes but is not limited to, as available and as necessary to determine the hazardous constituents associated with sealed sources, the following: source manufacturer's sales catalogues, original purchase records, source manufacturer's fabrication documents, source manufacturer's drawings, source manufacturer's fuel capture assembly reports, source manufacturer's operational procedures for cleanliness requirements, source manufacturer's shipping documents, source manufacturer's welding records, transuranic batch material records, and information from national databases (e.g., NMMSS). All of this information may not and need not be available for each source, but sufficient information must be included in the auditable record to derive an adequate understanding of source construction and history to ensure that no VOCs are present in association with the sealed source itself that would render the source hazardous. If AK data indicate that assignment of a hazardous waste number related to organic materials is required in association with a source, this specific source will be assigned to a separate waste stream and that waste stream will be subject to headspace gas sampling unless a separate AK Sufficiency Determination is approved for the waste stream. (Section C4-2c)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
146	Does the generator site document that all additional specific, relevant information used in the acceptable knowledge process will be identified and its use explained? Is all necessary additional information assembled and has it been appropriately used? (Section C4-2c)					
147	Does the generator site discrepancy analysis documentation (for acceptable knowledge additional and required documentation) indicate that if discrepancies are detected, the site may consider applying all hazardous waste numbers indicated in the required and additional information, but must assess and evaluate the information to determine the appropriate hazardous waste numbers consistent with RCRA requirements? (Section C4-2c)					
	Training					
148	Does the generator site have procedures to ensure that all personnel involved with acceptable knowledge waste characterization have the following training, and is this training documented? A. WIPP WAP in Permit Attachment C and the TSDF-WAC specified in this permit B. State and Federal RCRA regulations associated with solid and hazardous waste characterization C. Discrepancy resolution and reporting D. Site-specific procedures associated with waste characterization using acceptable knowledge (Section C4-3a)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Procedures					
149	Has the generator site developed the following procedures, and are these procedures technically sufficient? A. Sites must prepare and implement a written procedure outlining the specific methodology used to assemble acceptable knowledge records, including the origin of the documentation, how it will be used, and any limitations associated with the information (e.g., identify the purpose and scope of a study that included limited sampling and analysis data). B. Sites must develop and implement a written procedure to compile the required acceptable knowledge record. C. Sites must develop and implement a written procedure that ensures unacceptable wastes (e.g., reactive, ignitable, corrosive) are identified and segregated from TRU mixed waste populations sent to WIPP. D. Sites must prepare and implement a written procedure to evaluate acceptable knowledge and resolve discrepancies. For Example if different sources of information indicate different hazardous wastes are present, then sites must include all sources of information in its records and may choose to either conservatively assign hazardous waste numbers or assign only those numbers deemed appropriate and consistent with RCRA requirements. All information used to justify assignment of hazardous waste numbers must be placed in the auditable record. Further, the assignment of hazardous waste numbers shall be tracked in the auditable record to all required documentation.					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
149a	E. Sites must prepare and implement a written procedure to identify hazardous wastes and assign the appropriate hazardous waste numbers to each waste stream. The following are minimum baseline requirements/standards that site-specific procedures must include to ensure comparable and consistent characterization of hazardous waste: 1. Compile all of the required information in an auditable record. 2. Review the compiled information and delineate waste streams. Delineation of waste streams must comply with the definition in Permit Attachment C, Section C-0a, and justify combining waste historically managed separately as TRU mixed and TRU non-mixed waste streams into a single waste stream. 3. Review the compiled information to determine if the waste stream is compliant with the TSDF-WAC 4. Review the required information to determine if the waste is listed under 20.4.1.200 NMAC (incorporating 40 CFR § 261), Subpart D. Assign all listed hazardous waste numbers, unless the site chooses to justify an alternative assignment and document the justification in the auditable record. 5. Review the required information to determine if the waste exhibits a hazardous characteristic or may contain hazardous constituents included in the toxicity characteristics specified in 20.4.1.200 NMAC (incorporating 40 CFR § 261, Subpart C. If a toxicity characteristic contaminant is identified and is not included as a listed waste, sites may evaluate available data and assign the toxicity characteristic hazardous waste number consistent with RCRA requirements. All data examined to reach the hazardous waste number determination must be placed in the auditable record and must present a clear justification for the hazardous waste number analyses. 6. Review the compiled information to provide an estimate of the material parameter weights for each container to be stored or disposed of at WIPP. For newly generated waste, procedures shall be developed and implemented to characterize hazardous waste using acceptable knowledge prior to packaging.					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
149b	F. Sites shall ensure that results of audits of the TRU mixed waste characterization programs at the site are available in the records. G. Sites shall identify all process controls (implemented to ensure that the waste contains no prohibited items and to control hazardous waste content and/or physical form) that have been applied to retrievably stored waste and/or may presently be applied to newly generated waste. Process controls are applied at the time of waste generation/packaging to control waste content, whereas any activities performed after waste generation/packaging to identify prohibited items, hazardous waste content, or physical form are waste characterization activities, not process controls. The AK record must contain specific process control and supporting documentation identifying when these process controls are used to control waste content. See Permit Attachment C, Section C-2 for programmatic requirements related to process controls. (Section C4-3b)					
150	Does the site have implemented procedures which comply with the following criteria to establish acceptable knowledge records: A. Acceptable knowledge information shall be compiled in an auditable record, including a road map for all applicable information. B. The overview of the facility and TRU mixed waste management operations in the context of the facility's mission shall be correlated to specific waste stream information. C. Correlations between waste streams, with regard to time of generation, waste generating processes, and site-specific facilities shall be clearly described. For newly generated wastes, the rate and quantity of waste to be generated shall be defined. D. A reference list shall be provided that identifies documents, databases, Quality Assurance protocols, and other sources of information that support the acceptable knowledge information. E. Container inventories for TRU mixed waste in retrievable storage shall be delineated into waste streams by correlating the container identification to all of the required and additional AK information (Section C4-3c)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
151	If the generator site submitted an AK Sufficiency Determination Request for a specific waste stream, did the site provide all of the requisite information including the identification of the applicable scenario for which approval is sought? (Section C-0b)					
	Re-evaluating Acceptable Knowledge					
152	Does the generator site have written procedures for the augmentation of all acceptable knowledge information using sampling and analysis. Sampling and analysis consists of radiography, visual examination, headspace gas, and homogeneous waste sampling and analysis. Do site procedures indicate that the following sampling and analysis will be conducted based upon the results of the Determination Request Any scenario denied - 100% RTR or VE and statistical HSG or solids S&A Scenario 1 Granted -No sampling and analysis radiography/visual examination is required Scenario 2 Granted-Radiography/visual examination is not required but statistical HSG or solids S&A is required Scenario 3 Granted-100% RTR or VE is required, sampling and analysis is not required (Section C4-1, C-0b)					
155	Does the generator site have procedures for reevaluating acceptable knowledge if the results of the waste confirmation indicate that the waste to be shipped does not match the approved waste stream or if the data from radiography or visual examination for waste streams without an AK Sufficiency Determination exhibit this discrepancy? Does this procedure describe how the waste is reassigned, acceptable knowledge reevaluation, and appropriate hazardous waste numbers are assigned? (Section C4-3e)					
156	Do site procedures indicate that debris wastes are assigned toxicity characteristic EPA numbers based on AK regardless of the quantity or concentration? (C4-3e)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Criteria for Assembling an Acceptable Knowledge Record Delineating the Waste Stream					
158	If wastes are reassigned to a different waste matrix code based on site visual examination or radiography or Permittee confirmation activities, does the generator site have written documentation to ensure that the following steps are followed: F. Review existing information based on the container identification number and document all differences in hazardous waste number assignments G. If differences exist in the hazardous waste numbers that were assigned, reassess and document all required acceptable knowledge information (Section C3-b) associated with the new designation H. Reassess and document all sampling and analytical data associated with the waste I. Verify and document that the reassigned waste matrix code was generated within the specified time period, area and buildings, waste generating process, and that the process material inputs are consistent with the waste material parameters identified during radiography or visual examination J. Record all changes to acceptable knowledge records K. If discrepancies exist in the acceptable knowledge information for the revised waste matrix code, document the segregation of the affected portion of the waste stream, and define the actions necessary to fully characterize the waste (Section C4-3e)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
161	Do site procedures ensure that headspace gas and solid/soil analytical data are used to resolve AK assignments for hazardous waste, as necessary? If a constituent is detected in headspace gas that the site believes isn't from the waste process, the site must provide documentation to support any determination that organic constituents are associated with packaging materials, radiolysis, or other uses not consistent with solvent use. If the source of the detected headspace gas solvents cannot be identified, the appropriate F listing will be assigned. If a constituent in a listed waste is present in solid/soil analytical results, the appropriate listed waste shall be added to the waste stream. F-listed waste assigned by acceptable knowledge shall not be removed based on headspace gas or solids analysis. In the case of totals/TCLP analysis, do procedures reflect the allowance for concentration assessments, wherein sites may add or remove total/TCLP and non-toxic F003 constituents found in headspace and solid/soil analyses? (Section C4-3e)					
162	If sampling and analysis conducted to augment AK determines that a hazardous constituent as identified in headspace gas sampling or soil/homogeneous waste sampling is present in the waste, does the generator site indicate that they will: 1) assign the hazardous waste number to the entire waste stream as applicable, or 2) segregate drums containing detectable concentrations of solvent into a separate waste stream, and assign applicable hazardous waste numbers? (Section C4-3e)					
163	Does the generator site document, justify, and consistently delineate waste streams and assign hazardous waste numbers based on site specific permit requirements or state-enforced agreements? (Section C4-3e)					
164	Does the generator site have written methodologies for determining the mean concentration of solvent VOCs detected by either headspace gas analysis or homogeneous waste sampling for each waste stream or waste stream lot, and are all data ("U" flags designated as one half the MDL and "J" flags, which are less than the PRQL but greater than the MDL)? (Section C4-3e)					
165	Do procedures ensure that spent solvent assignments are made by using the UCL_{90} (of mean concentration), and comparing this with the PRQLs? If the UCL_{90} exceeds the PRQL, is acceptable knowledge reevaluated and determine potential source of the constituent? (Section C4-3e)					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
167	Does the site have written procedures for situations where concentrations of some VOCs are orders of magnitude higher than other target analytes? In these cases, elevated MDLs may be generated, and those constituents with an elevated MDL but "U" designation will not be used in mean calculations. (Section C4-3e)					
	Data Quality Requirements					
168	Are acceptable knowledge processes consistently applied among all generator sites, and does each generator site comply with the following data quality requirements for acceptable knowledge documentation: A. Precision - Precision is the agreement among a set of replicate measurements without assumption of the knowledge of a true value. The qualitative determinations, such as compiling and assessing acceptable knowledge documentation, do not lend themselves to statistical evaluations of precision. However, the acceptable knowledge information will be addressed by the independent review of acceptable knowledge information during internal and external audits. B. Accuracy - Accuracy is the degree of agreement between an observed sample result and the true value. The percentage of waste containers which require reassignment to a new waste matrix code and/or designation of different hazardous waste numbers based on sampling and analysis data and discrepancies identified by the Permittees during waste confirmation will be reported as a measure of acceptable knowledge accuracy. C. Completeness - Completeness is an assessment of the number of waste streams or number of samples collected to the number of samples determined to be useable through the data validation process. The acceptable knowledge record must contain 100 percent of the information (Permit Attachment C4-3). The usability of the acceptable knowledge information will be assessed for completeness during audits.					

	WAP Requirement[2]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
168a	D. Comparability - Data are considered comparable when one set of data can be compared to another set of data. Comparability is ensured through sites meeting the training requirements and complying with the minimum standards outlined for procedures that are used to implement the acceptable knowledge process. All sites must assign hazardous waste numbers in accordance with Permit Attachment C4-4 and provide this information regarding its waste to other sites who store or generate a similar waste stream. E. Representativeness - Representativeness expresses the degree to which sample data accurately and precisely represent characteristics of a population. Representativeness is a qualitative parameter that will be satisfied by ensuring that the process of obtaining, evaluating, and documenting acceptable knowledge information is performed in accordance with the minimum standards established in Permit Attachment C4. Sites also must assess and document the limitations of the acceptable knowledge information used to assign hazardous waste numbers (e.g., purpose and scope of information, date of publication, type and extent to which waste parameters are addressed). (Section C3-9)					
169	Does the generator site address quality control by tracking its performance with regard to the use of acceptable knowledge by: 1) assessing the frequency of inconsistencies among information, and 2) documenting the results of waste discrepancies identified by the generator/storage site during waste characterization or the Permittees during waste confirmation using radiography, review of radiography audio/video recordings, visual examination, or review of visual examination records. In addition, the acceptable knowledge process and waste stream documentation must be evaluated through internal assessments by generator/storage site quality assurance organizations. (Section C4-3e)					

1. NMED expects a traceability analysis to be performed, the results of which should be presented on this checklist under the "Examples of Implementation" column. Further, the traceability analysis process and results should be discussed in the Final Audit Report.
2. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to determine whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met.

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Table C6-4 Headspace Gas Checklist

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Headspace Gas Checklist

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Headspace Gas Sampling Frequency					
182	Are procedures in place to ensure that randomly selected retrievably stored and newly generated waste containers will undergo headspace gas sampling and analysis as required to augment AK? (Section C-3a)					
183	Are procedures in place to ensure that randomly selected containers will be allowed to equilibrate to sampling room temperature for 72 hours prior to sampling (18° C or higher) and that the drum ages specified in accordance with Section C1-1a(1) are met? All information necessary to determine drum age criteria must be determined, including but not limited to: • Scenario Determination • Packaging Configuration • Filter Diffusivity • Liner/Lid Opening Diameter ? (Section C1-1a)					
	Headspace Gas Sampling General Requirements					
184	Are procedures in place to ensure all containers of waste are vented through filters to ensure that gases are adequately vented preventing over pressurization or development of conditions that would lead to the development of ignitable, corrosive, reactive, or other characteristic waste? (Section C-1c)					
186	Are procedures in place to ensure that the following gas sample container and holding time requirements are met: • The minimum sample volume for VOC. sample collection is 250 mL. (Note: a single 100 mL sample may be collected if the headspace is limited) • Holding temperatures shall be between 0° C and 40° C (Table C1-1)					
187	Are procedures in place to ensure that all sampling is performed in an appropriate radiation containment area? (Section C1-1a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
188	Are procedures in place to ensure that headspace gas is analyzed for the analytes listed in Table C3-2 of the Attachment C3? (Section C1-1a(1))					
189	Are procedures in place to ensure that all headspace gas analyses utilize either SUMMA® or equivalent canisters or on-line integrated sampling/analysis systems? (Section C1-1a(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Manifold Sampling					
190	Are procedures, processes, and equipment in place to ensure that the following sampling procedures are implemented: • The sampling equipment is leak checked and cleaned upon first use and as needed • The manifold and sample canisters are evacuated to 0.1 mm Hg prior to sample collection • Cleaned and evacuated sample canisters are attached to the evacuated manifold before the manifold inlet valve is opened • The manifold inlet valve is attached to a changeable filter connected to either a side port needle sampling head capable of forming an airtight seal (for penetrating a filter or rigid poly liner when necessary), a drum punch sampling head capable of forming an airtight seal (capable of punching through the metal lid of a drum while maintaining and airtight seal for sampling through the drum lid), or a sampling head with an airtight fitting for sampling through a pipe overpack container filter vent hole. Refer to Section C1-1a(4) for descriptions of these sampling heads. • Field blanks are collected using samples of room air collected in the sampling area in the immediate vicinity of the waste container. *(Note: field blanks for SUMMA® canisters are collected directly into the canister without the use of the manifold.)* • Manifold equipped with purge assembly that allows QC samples to be collected through all sampling components that affect compliance with QAOs • The manifold internal volume is calculated and documented in a field logbook • The total volume of headspace gas collected is calculated by adding the canister volume and internal manifold volume and should be less than 10 percent of the available headspace volume when a volume estimate is available (Section C1-1a(2))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
191	Are procedures, processes, and equipment in place to ensure that the following manifold sample side conditions are met: • The sampling head forms a leak-tight connection with the sampling manifold • A flexible hose allowing movement from the purge assembly to the waste container • Pressure sensors that are pneumatically connected to the manifold and must be able to measure absolute pressure from 0.05 mm Hg to 1000 mm Hg with a resolution that must be 0.01 mm Hg at 0.05 mm of Hg. The pressure sensors shall have an operating range of 15°C to 40°C. • Sufficient canister ports shall be available to allow simultaneous collection of headspace gas samples and duplicates for VOC analysis. • Ports not occupied with sample canisters require a plug to prevent ambient air from entering the system • Ports shall have VCR® fittings for connection to the sample canisters to prevent degradation of the fitting on the canister and manifold. • Sample canisters are leak-free, stainless steel pressure vessels, with a Cr-NiO SUMMA®-passivated interior surface or canisters with equivalently inert surfaces, bellows valve, and a pressure/vacuum gauge. All canisters shall have VCR® fittings to sampling and analytical equipment • The pressure/vacuum gauge must be mounted on each manifold and shall be helium-leak tested to 1.5×10^{-7} cc/s, have all stainless steel construction, and be capable of operating at temperatures to 125°C					

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	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
191a	• A dry vacuum pump capable of reducing the manifold pressure to 0.05 mm Hg. (Note: If an oil vacuum pump is used precautions such as a molecular sieve or cryogenic trap shall be used to prevent diffusion of oil vapors back into the manifold) • A minimum distance between the needle and the valve that isolates the pump from the manifold in order to minimize the dead volume in the manifold. • If real time equipment blanks are not available, the manifold shall be equipped with an OVA capable of detecting all analytes listed in Table C3-2 and is capable of measuring total VOC concentrations below the lowest headspace gas PRQL (Section C1-1a(2))					
192	Are procedures, processes, and equipment in place to ensure that the following manifold standard side conditions are met: • A cylinder of compressed zero air, helium, argon, or nitrogen that is hydrocarbon and CO_2 free air (only hydrocarbon and CO_2-free gases required for FTIRS) and certified by the manufacturer to contain less than one ppm VOCs. The gas is used to clean the manifold between samples and to provide gas for the collection of equipment and on-line blanks *(Note: a zero air or nitrogen generator may be used, provided a sample of air is collected and found to contain less than 1 ppm total VOCs and the air is humidified)* • Cylinders of reference gas with known concentrations of analytes from Table C3-2 certified by the manufacturer to provide gases for evaluating the accuracy of the headspace gas sampling process • All cylinders of reference gases and zero air shall be connected to flow regulating devices • A humidifier filled with ASTM Type I or II water, connected, and opened to the standard side of the manifold between the compressed gas cylinders and the purge assembly shall be used, if the Fourier Transform Infrared System (FTIRS) is not used. No humidifier if the FTIRS is used *(Note: Compressed gas may include water vapor between 1000 and 10000 ppmv in lieu of a humidifier)* • The humidifier is off-line during system evacuation to prevent manifold flooding					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
192a	• A purge assembly that allows the sampling head to be connected to the standard side of the manifold. • A flow indicating device or pressure regulator that is connected downstream of the purge assembly to monitor the flow rate or pressure of gases through the purge assembly to ensure that excess flow is available to prevent ambient air from contaminating the QC samples and allow sample of gas from the compress gas cylinders to be collected near ambient pressure. (Section C1-1a(2))					
193	Do procedures ensure that NIST Certified (or equivalent) ambient pressure sensors maintained in the sampling area must have a sufficient measurement range for the expected ambient barometric pressures and a resolution shall be 1.0 mm Hg or less? (Section C1-1a(2))					
194	Do procedures ensure that the NIST traceable (or equivalent) temperature sensor in the sampling location shall have a sufficient measurement range for the ambient temperatures 18 to 50°C? (Section C1-1a(2))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Direct Canister Sampling					
195	Are procedures, processes, and equipment in place to ensure that the following operating conditions are in place for direct canister sampling: • Canisters are evacuated to 0.1 mm Hg prior to use and attached to a changeable filter connected to the sampling head • Sampling heads are capable of either punching through the metal lid of the drums while maintaining an airtight seal for sampling through the drum lid, penetrating a filter or the septum in the orifice of a self-tapping screw, or maintaining an airtight seal for sampling through a pipe overpack container filter vent hole. • Field duplicates are collected in the same manner and at the same time and using the same type of sampling apparatus as used for headspace gas sample collection. • Field blanks shall be samples of room air collected in the immediate vicinity of the waste drum sampling area prior to removal of the drum lid. • Equipment blanks and field reference standards shall be collected using a purge assembly equivalent to the standard side of the manifold • Less than 10 percent of the headspace is withdrawn when a headspace estimate is available (Note: The total volume withdrawn can be determined by adding the canister volume and the internal volume of the sampling head) • Each sample canister shall be equipped with a pressure/vacuum gauge capable of indicating leaks and sample collection volumes. The gauge shall be helium leak tested to 1.5×10^{-7} cc/s, have all stainless steel construction and be capable of tolerating temperatures to 125°C • Summa® canisters or equivalent are used to collect samples (Section C1-1a(3))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sampling Heads Under Drum Lids: Sampling Through a Carbon Filter					
196	Are procedures, process, and equipment adequate to ensure that samples collected through a filter meet the following requirements: • The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum • That non-vented drums are not sampled until an internal nonconformance report is prepared, submitted, and resolved in order to obtain a representative sample • The filter shall be sealed to prevent outside air from entering the drum • The sampling head for collecting drum headspace gas shall consist of a side-port needle, a filter to prevent particle contamination of the sample, and an adapter to connect the side-port needle to the filter • The sampling head is cleaned or replaced after each use • The housing of the filter shall allow insertion of the sampling needle through the filter element or a sampling port with septum that bypasses the filter element into the drum headspace • The side port needle shall be used to reduce the potential for plugging • The purge assembly shall be modified for compatibility with the side port needle. (Section C1-1a(4)(i))					
	Sampling Heads Under Drum Lids: Sampling Through the Drum Lid					
197	Are procedures in place to establish the criteria for sampling through the drum lid as opposed to sampling through a filter? (Section C1-1a(4)(ii))					
197a	If sampling through a pipe overpack container filter vent hole with an airtight device is used, are procedures in place to ensure that a sampling head with an airtight seal for sampling through a pipe overpack container filter vent hole are available? (Section C1-1a(4)(iii))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
197b	If sampling through a pipe overpack container filter vent hole is used, are the following criteria met? • The seal between the pipe overpack container surface and sampling apparatus shall be designed to minimize intrusion of ambient air. • The filter shall be replaced as quickly as is practicable with the airtight sampling apparatus to ensure that a representative sample can be taken. • All components of the sampling system that come into contact with sample gases shall be cleaned according to requirements for direct canister sampling or manifold sampling, whichever is appropriate, prior to sample collection. • Equipment blanks and field reference standards shall be collected through all the components of the sampling system that contact the headspace-gas sample. • During sampling, openings in the pipe overpack container shall be sealed to prevent outside air from entering the container. • A flow-indicating device shall be connected to sampling system and operated according to the direct canister or manifold sampling requirements, as appropriate. (Section C1-1a(4)(iii))					
197c	If sampling through a pipe overpack container filter vent hole is used, are the following criteria met? • The site has documentation that demonstrates that they have determined through testing the appropriate length of time for exchanging the filter with the sampling device to assure representative samples are collected. (Section C1-1a(4)(iii))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
198	Are procedures, process, and equipment adequate to ensure that samples collected through the drum lid by punching meet the following requirements: • The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum. If the DAC for Scenario 1 is met, a sample may be collected from inside the 90-mil rigid poly liner. • If headspace gas samples are collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a nonconformance report shall be prepared, submitted, and resolved. • The drum lid shall be breached using a punch that forms an airtight seal between the drum lid and the manifold or canister • The seal between the drum lid and the sampling head shall be designed to minimize the intrusion of ambient air • All components of the sampling system that come in contact with sample gases shall be purged with humidified zero air, nitrogen, or helium prior to sample collection • Equipment blanks and field reference standards shall be collected through all components of the punch that contact the headspace gas sample • Pressure shall be applied to the punch until the drum lid has been breached • Provisions shall be made to relieve excessive drum pressure increases during drum punch operations; potential pressure increases may occur during sealing of the drum punch to the drum lid • The filter is sealed to prevent outside air from entering the drum (Section C1-1a(4)(ii))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
198a	• A flow indicating device or pressure regulator to verify flow of gases shall be pneumatically connected to the drum punch and operated in the same manner as the flow indicating device • Equipment are used to secure the drum punch sampling system to the drum lid • If the headspace gas sample is not taken at the time of drum punching, the presence and diameter of the rigid liner vent hole is documented during the punching operation for use in determining an appropriate Scenario 2 DAC. (Section C1-1a(4)(ii))					
	Quality Control Sample Collection					
199	Are procedures in place to ensure that the following QC sample requirements are met: • Field QC samples are collected on per sample batch basis for manifold and direct canister sampling. A sampling batch is defined as up to 20 samples collected within 14 days of the first sample • Field samples are collected and analyzed on a per on-line batch basis for on-line sampling/analysis systems. An on-line batch is defined as the number of headspace gas samples that are collected within a 12 hour period from the same on-line integrated analysis system • For the manifold sampling method, field blanks, equipment blanks, field duplicates, and field reference samples are collected prior to sample collection on a per sampling batch basis or one per day, whichever is more frequent • For the direct canister sampling method field blanks and field duplicates are collected on a per sampling batch basis prior to sample collection; while equipment blanks and field reference samples are collected after equipment purchase, cleaning, and assembly					
199a	• For the On-line sampling method, field blanks, equipment blanks, field duplicates, and field reference samples are collected on a per on-line batch basis. *(Note: The on-line blank replaces the laboratory and equipment blanks, the on-line duplicate replaces the field duplicate and the laboratory duplicate, and the on-line sample control replace the field reference standard and the laboratory control sample.)* (Section C1-1b, C1-1b(1), C1-1b(2), C1-1b(3), C1-1b(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
200	Do procedures adequately assign the site project manager with the responsibility of monitoring field QC results and initiate the nonconformance report process in the event the following acceptance criteria are not met or sample collection frequencies are not met: • Field and equipment blanks shall be less than 3 times the detection limits specified in Table C3-2 and equipment blank results determined by FTIR shall be less than the PRQL specified in Table C3-2 (Section C1-1b(1) and C1-1b(2)) • Field reference standards shall have a recovery of between 70 and 130% (Table C1-3) • Field Duplicates shall have an RPD of less than or equal to 25 (Sections C1-1b and C1-1b(4); Table C1-3)					
201	Are procedures in place to ensure that field reference standards meet the following criteria: • Field reference standards shall contain a minimum of 6 analytes listed in Table C3-2 at a range of between 10 and 100 ppmv and at concentrations greater than the MDL • Field reference standards shall be traceable to a nationally recognized standard, if available • If commercial gases are used, they shall be accompanied by a Certificate of Analysis and all field reference standards are traceable to certificates. • Commercial gases are not used past the manufacturer specified shelf life. • Field reference samples are submitted blind to the laboratory at a frequency of one per sampling batch. (Note: Field reference standards may be discontinued for direct canister method if QAO accuracy objectives are met) (Section C1-1b(3))					
202	Are procedures in place to ensure that field duplicate samples are collected sequentially and in accordance with Table C1-1. (Section C1-1b(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Equipment Testing, Inspection and Maintenance					
203	Are procedures in place to ensure that sample containers are cleaned in accordance with the following specifications: • All sampling components that contact sample gases are constructed of inert materials such as stainless steel or Teflon® • The sampling manifold and canisters are properly cleaned and leak checked prior to each sampling event in accordance to or equivalent with TO-14A or TO-15 methodology • SUMMA® canisters or equivalent are cleaned on an equipment cleaning batch basis. An equipment cleaning batch is defined as the number of canisters that can be cleaned together at one time using the same cleaning method • The cleaning system consists of an optional oven and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump • Prior to cleaning a 24 hour leak check shall be performed (+/- 2 psig) on all canisters • Canisters that shall be checked for leaks, repaired, and reprocessed • One canister per equipment cleaning batch is filled with humid zero air or humid high purity nitrogen and analyzed for VOCs • A batch is considered clean if VOC concentrations are less than 3 times the MDLs specified in Table C3-2 • Certified leak-free canisters are evacuated to 0.1 mm Hg or less for storage • Canister cleaning certification documentation is available at the cleaning facility and the cleaning facility initiates canister tags. (Section C1-1c, C1-1c(1))					
204	Are procedures in place to ensure that manifold pressure sensors and ambient air temperature sensors are certified prior to initial use and annually using NIST traceable standards. In addition OVAs if used shall be calibrated daily using known calibration gases and the balance of the OVA calibration is consistent with the manifold purge gas. (Section C1-1d)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
205	Are procedures in place to ensure that sampling equipment are cleaned and leak checked using the following specifications: • Surfaces of all sampling equipment that will come in contact with sample gases are thoroughly inspected and cleaned prior to assembly • Manifolds and sampling heads shall be purged with humidified zero air, nitrogen, or helium and leak checked after assembly • The cleaning shall be repeated if routine system cleaning is inadequate • Manifolds and sampling heads which are reused shall be cleaned and leak checked according to procedures in the EPA's Compendium Method TO-14A or TO-15 after sample collection, field duplicate collection, field blank collection, and after the additional cleaning require for field reference samples. All manifold ports shall be capped or closed with valves (sample canisters may be attached as well) • Manifolds are cleaned by heating the sample side of the manifold to 150°C and periodically evacuated and flushed with humidified zero air, nitrogen, or helium • Manifolds not in use are demonstrated as clean before storage with a positive pressure of humidified zero air, nitrogen, or helium gas in the sampling and standard sides • Sampling is suspended when the analysis of an equipment blank indicated the VOC limits have been exceeded or if a leak test fails. • Sampling systems are cleaned after field reference standard collection by installing a gas tight connector in place of the sampling head, between the flexible hose and purge assembly. This allows the sample and standard side to be flushed with humidified zero air, nitrogen, or helium in conjunction with heated pneumatic lines • Needles, airtight fitting or seal, adapters, and filters are cleaned in accordance with the EPA Method TO-14A or TO-15 procedures. Sample heads shall be discarded or cleaned according to Method TO-15. In addition, the needle, the airtight fitting and seal, and the filter should be purged with zero air, nitrogen, or helium and capped for storage (Section C1-1c(2) , Section C1-1c(3), Section C1-1c(4), and Section C1-c(5))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Handling and Custody					
207	Do formats for field logs and custody records specify documentation of the following information: • Name of sampling facility • Waste container identification number • Sample identification number of each sample referenced to waste container • Sample matrix • Time and date of sample collection • Type/number and size of sample container(s) • Method of sample preservation • Requested analyses • Sampler(s) name through signature • Signatures of custodians relinquishing and receiving custody of samples including date and time of transfer until time of final disposition • Analytical laboratory • Off-site shipping information (date, time, shipper, mode, air bill or lading number) (Section C1-5)					
208	Are procedures are in place to ensure that samples and sampling equipment are identified with unique identification numbers? (Section C1-5)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
209	Do sample tags or labels contain the following information: • Sample Description • Ambient temperature and pressure • Sample identification number • Analyses requested • Date/Time of collection • QC Designation (if applicable) • Sampler's initials and organization (Section C1- 5)					
210	All sampling equipment, canisters, and samples are identified with unique identification numbers that are traceable to equipment cleaning batches. (Section C1- 5)					
211	Are procedures in place to ensure samples are sealed with intact custody seals and that one or more of the following custody conditions are met: • It is in the possession of an authorized individual • It is in the view of an authorized individual, after being in the possession of that individual • It was in the possession of an authorized individual and access to the sample was controlled by locking or placement of signed custody seals that prevent undetected access • It is in a designated secure area, such as a controlled access location with complete documentation of personnel access or a radiological containment area (hot cell or glove box) (Section C1- 5)					
212	Are procedures in place to ensure that discrepant sample information, indications of damage, or indications of tampering are documented? (Section C1- 5)					
214	Are procedures in place to ensure that sample custody is maintained until the sample is released by the site project manager or expended? (Section C1- 5)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
215	Are procedures in place to ensure that SUMMA canisters are packaged to prevent damage to the pressure gauge or associated connections by packaging in metal boxes with separate compartments or cardboard boxes with foam inserts? (Section C1- 6)					
216	Are procedures in place to ensure that samples are packaged to prevent damage to the sample container and maintain preservation temperature? (Section C1- 6)					
217	Are procedures in place to ensure that adequate cold packs are included in the DOT approved sample shipping container to ensure that all temperature requirements are met? (Section C1- 6)					
218	Are procedures in place to ensure that sample COC forms are secured for shipment to the inside of the sealed or locked shipping container lid and that samples and shipping containers are affixed with tamper proof seals or devices? (Section C1- 6)					

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	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Laboratory Operations					
220	Are procedures in place to ensure that all VOC analyses are evaluated using the following criteria: • Precision is assessed by analyzing laboratory duplicates, Laboratory Control Sample (LCS) , and PDP blind-audit samples in comparison to Table C3- 2 • Accuracy as %R shall be assessed by analyzing LCS samples and PDP blind-audit samples in comparison to criteria in Table C3-3 • MDLs are expressed in nanograms/ for VOCs and must be less than or equal to those listed in Table 3-2 • Laboratory completeness shall be expressed as the number of samples analyzed with valid results as a percent of the total number of samples submitted for analysis. A composited sample is treated as one sample for the purposes of completeness, because only one sample is run through the analytical instrument • Comparability shall be achieved through the use of standardized methods, traceable standards by requiring successful participation in the PDP program • Representativeness will be achieved by collecting sufficient numbers of samples using clean sampling equipment that does not introduce sample bias. • All method detection limits and program required detection limits shall be less than the Program Required Detection Limits listed in Table C3-2 and the detection limit study procedures shall be documented in laboratory SOPs. In addition, the laboratory shall demonstrate that they are capable of meeting the Program Required Detection Limits by analyzing at least one calibration standard below the PRQL (Section C3-5)					
221	Are procedures in place to ensure that only laboratories that are qualified through participation in the Performance Demonstration Program are eligible to analyze waste samples? (Section C-3a(3))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
222	Are procedures in place to ensure that Tentatively Identified Compounds shall be added to the target compound list if they are reported in 25% of the waste containers sampled from a given waste stream and if they appear in the 20 NMAC 4.1.200 (incorporating 40 CFR §261) Appendix VIII list? (Section C-3a(1))					
222a	Are procedures documented to ensure that the following criteria are met with regard to the recognition and reporting of TICS for GC/MS Methods for headspace gas sampling: • Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum. • The relative intensities of the major ions should agree within ± 20 percent. • Molecular ions present in the reference spectrum should be present in the sample spectrum. • Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds. • Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks. • The reference spectra used for identifying TICs shall include, at minimum, all of the available spectra for compounds that appear in the 20.4.1.200 NMAC (incorporating 40 CFR Part 261) Appendix VIII list. The reference spectra may be limited to VOCs when analyzing headspace gas samples. • TICs for headspace gas analyses that are performed through FTIR analyses shall be identified in accordance with the specifications of SW-846 Method 8410. (Section C3-1)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
222b	Are procedures in place to assure that TICs are reported as part of the analytical batch data reports for GC/MS Methods in accordance with the following minimum criteria: • a TIC in an individual container headspace gas or solids sample shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 10% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 2 to 5 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 2% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 6 to 10 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 1% of the area of the nearest internal standard. • a TIC in a composited headspace gas sample that contains 11 to 20 individual container samples shall be reported in the analytical batch data report if the TIC meets the SW-846 identification criteria listed above and is present with a minimum of 0.5% of the area of the nearest internal standard. (Section C3-1)					
	Quality Assurance Objectives					
224	Are procedures in place to ensure that the precision of the headspace gas sampling and analysis must be assessed by the sequential collection of field duplicates for manifold sampling operations or simultaneous collection of field duplicates for direct canister sampling operations for VOCs? (Section C3-2)					
225	Are procedures in place to ensure that corrective action will be taken if the duplicate RPD exceeds 25% for any analyte found greater than the PRQL in both of the duplicate samples? (Section C3-2)					
226	Are procedures in place to ensure that the accuracy of headspace gas sampling is assessed through the collection of field reference standards and at a frequency of one field response standard for every 20 containers sampled or per sampling batch and through the collection of equipment blanks at the frequency of one for every equipment cleaning batch? (Section C3-2)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
227	Are procedures in place to ensure that corrective actions are taken if the field reference standard is less than 70% recovery or greater than 130% and that if the blank concentration for any blank exceeds 3 times the MDL listings in Table C3-2? (Section C3-2)					
228	Are procedures in place to ensure that sampling completeness shall be expressed as the number of valid samples collected as a percent of the total number of samples collected for each waste steam, where a valid sample is defined as a sample collected in accordance with approved sampling methods and the drum was properly prepared for sampling? (Section C3-2)					
229	Are procedures in place to ensure that the minimum sampling completeness percentage for any waste stream is 90 percent? (Section C3-2)					
230	Are procedures in place to ensure that sample comparability is assured through the use and application of uniform procedures and equipment and application of data usability criteria, and that corrective action is taken if the uniform procedures and equipment are not used without approved and justified deviations (Section C3-2)					
231	Are procedures in place to ensure that sample representativeness is maintained (Section C3-2)					

1. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to determine whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met.

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Table C6-5 Radiography Checklist

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Radiography Checklist

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Quality Assurance Objectives					
233	Are process procedures in place to meet the following Quality Assurance Objectives? Precision • Does the site describe in its QAPjP and SOP(s) activities to reconcile any discrepancies between two radiography operators with regard to identification of the waste matrix code, liquids in excess of TSDF-WAC limits, and compressed gases through independent replicate scans and independent observations? And additionally, activities to verify the precision of radiography prior to use by tuning precisely enough to demonstrate compliance with QAOs through viewing an image test pattern? Accuracy • Was accuracy obtained by using a target to tune the image for maximum sharpness and by requiring operators to successfully identify 100 percent of the required items in a training container during their initial qualification and subsequent requalification?					
233a	Completeness • Was an audio/videotape (or equivalent media) of the radiography examination and a radiography data form validated according to the requirements in Section C3-10? • Was an audio/videotape (or equivalent media) of the radiography examination and a radiography data form obtained for 100% of the waste containers subject to radiography? Comparability • Is comparability ensured through the use of standardized radiography procedures and operator training and qualifications (Section C3-4a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Characterization and System Requirements					
234	Does the site have procedures to ensure that radiography is used to identify and verify waste container contents and verify the waste's physical form? Does the site have procedures to identify prohibited materials? (Section C-3c; C1-3)					
235	Do procedures or other supporting documentation ensure that every waste container will undergo radiography and/or VE as necessary to augment AK? (Section C-3c)					
236	Do procedures ensure that containers whose contents prevent full examination are examined by visual examination rather than by radiography unless the site certifies that visual examination would provide no additional relevant information for that container based on the AK information for the waste stream? (Section C1-3)					
237	Do procedures or other supporting documentation ensure that the physical form determined by radiography is compared with the waste stream descriptions? If discrepancies are noted, will a new waste stream be identified? (Section C-3c)					
238	Are there procedures to ensure the data is obtained from an audio/video recorded scan provided by trained radiography operators? (Section C1-3)					
239	Were all activities required to achieve the radiography objective described in site Quality Assurance Project Plans (QAPjPs) and Standard Operating Procedures (SOPs)? (Section C3-4)					
240	Did the radiography system consist of the following equipment or equivalent: • an X-ray producing device? • an imaging system? • an enclosure for radiation protection? • a waste container handling system? • an audio/video recording system or equivalent? • an operator control and data acquisition station? (Section C1-3)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
241	Did the X-ray producing device have controls which allow the operator to vary voltage, thereby controlling image quality? Was it possible to vary the voltage, typically between 150-400 kV, to provide an optimum degree of penetration through the waste? Was high-density material examined with the X-ray device set on the maximum voltage? Was low-density material examined at lower voltage settings to improve contrast and image definition? (Section C1-3)					
242	Do procedures or other documentation ensure that an audio/videotape or equivalent is made of the waste container scan and maintained as a non-permanent record? (Section C1-3)					
	Data Compilation					
243	Are there procedures to ensure that a radiography data form is used to document the waste matrix code, ensure the waste container contains no ignitable, corrosive or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented on the WSPF? (Section C1-3)					
245	If radiography indicates that the waste does not match the waste stream description, do procedures ensure that the appropriate corrective action was taken? (Section C-3c)					
246	If a discrepancy is noted, do procedures ensure that the proper waste stream assignment is determined, the correct hazardous waste numbers assigned, and the resolution documented? (Section C-3c)					
	Training					
247	Do site procedures ensure that only trained personnel are allowed to operate radiography equipment? (Section C1-3)					
248	Do site procedures ensure that training requirements for radiography operators is based upon existing industry standard training requirements? (Section C1-3)					
249	Does the documented training program provide radiography operators with both formal and on-the-job training (OJT)? (Section C1-3)					

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	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
250	Does the documented training program ensure that the radiography operators are instructed in the specific waste generating practices and typical packaging configurations expected to be found in each waste stream at the site? (Section C1-3)					
251	Does the documented training program ensure that the OJT and apprenticeship are conducted by an experienced, qualified radiography operator prior to qualification of the candidate? (Section C1-3)					
252	Is the documented training program site specific? (Section C1-3)					
262	Does the documented training program ensure that a training drum with various container sizes is scanned by each operator on a semiannual basis? Is the videotape reviewed by a supervisor to ensure that operators' interpretations remain consistent and accurate? (Section C1-3)					
263	Do site procedures ensure that the site prepares Testing Batch Data Reports or equivalent which includes all data pertaining to radiography for up to 20 waste containers without regard to waste matrix? (Section C3-10)					
	Quality Assurance					
265	Does the documented training program ensure that the imaging system characteristics are verified on a routine basis? (Section C1-3)					
266	Do procedures ensure that independent replicate scans and replicate observations of the video output of the radiography process are performed under uniform conditions and procedures? Are independent replicate scans performed on one waste container per day or per testing batch of 20 samples, which ever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container? Are independent observations of one scan (not the replicate scan) performed once per day or per testing batch, which ever is less frequent, by a qualified radiography operator that was not involved in the original scan of the waste container? (Section C1-3)					
267	Do procedures ensure that oversight functions include periodic audio/video media reviews of accepted waste containers, are performed by qualified radiography operators that were not involved in the original scans of the waste containers? (Section C1-3)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
268	Is the site project manager responsible for monitoring the quality of the radiography data and calling for corrective action, when necessary? (Section C1-3)					
	Data Validation, Review, Verification and Reporting					
277	Do procedures ensure that all applicable data generation review verification and validation activities specified in C3-10 are followed, including all signatory releases? (Section C3-10)					
278	Do procedures ensure that radiography tapes have been reviewed at a frequency of one waste container per day or once per testing batch, whichever is less frequent, to ensure data are correct and completed? (Section C1-3)					
279	Do procedures ensure that all applicable project-level signatory releases and DQOs (Section C3-11) as specified in the WAP are performed? (Section C3-10b)					
282	At the data generation level, do procedures ensure that all electronic and video data stored appropriately to ensure that waste container, sample, and associated QA data are readily retrievable? Are radiography tapes reviewed, at a frequency of one waste container per day or once per testing batch, whichever is less frequent, against the data reported on the radiography form? (Section C3-10a, C3-10a(1))					
283	At the project level, do procedures require the Site Project Manager to certify that the radiography data are complete and acceptable based on the videotape review of at least one waste container per testing batch or daily, whichever is less frequent? (Section C3-10b(1))					

1. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to determine whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met.

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Table C6-6 Visual Examination (VE) Checklist

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Visual Examination (VE) Checklist

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Training					
296	Is there documentation which shows that a standardized training program for visual examination operators has been developed? Is it specific to the site and include the various waste configurations generated/stored at the site? (Section C1-4)					
297	Is there documentation which shows that the visual examination operators receive training on the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code at the site? (Section C1-4)					
298	Are the visual examination personnel requalified once every two years? (Section C1-4)					
298a	Does the training include the following regardless of Summary Category Group? • Identifying and describing the contents of a waste container by examining all items in waste containers of previously packaged waste. • Identifying when VE cannot be used to meet the DQOs. (Section C1-4)					
	Visual Examination Expert Requirements					
300	Does documentation ensure that the site has designated a visual examination expert? Is the visual examination expert familiar with the waste generating processes that have taken place at the site? Is the visual examination expert familiar with all of the types of waste being characterized at that site? (Section C1-4)					
301	Does documentation ensure that the visual examination expert shall be responsible for the overall t direction and implementation of the visual examination aspects of the program? Does the site's QAPjP specify the selection, qualification, and training requirements of the visual examination expert? (Section C1-4)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Visual Examination Procedures					
304	Do procedures indicate that all visual examination activities are documented on video/audio media or VE performed by using a second operator to provide additional verification by reviewing the contents of the waste container to ensure correct reporting? (Section C1-4)					
304a	Are procedures in place to ensure that when VE is performed using a second operator, each operator performing VE shall observe for themselves the waste being placed in the container or the contents within the examined waste container when waste is not removed? (Section C1-4)					
313	Do site procedures ensure that when liquid is found, the non-transparent internal container holding the liquid will be assumed to be filled with liquid and this volume will be added to the total liquid in the container being characterized using VE? The container being characterized using VE would then be rejected and/or repackaged to exclude the internal container if it is over the TSDF-WAC limits. (Section C-3c)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Quality Assurance Objectives					
314	Are process procedures in place to meet the following Quality Assurance Objectives? Precision • Precision is maintained by reconciling any discrepancies between the operator and the independent technical reviewer with regard to identification of waste matrix code, liquids in excess of TSDF-WAC limits, and compressed gases. Accuracy • Accuracy is maintained by requiring operators to pass a comprehensive examination and demonstrate satisfactory performance in the presence of the VE expert during their initial qualification and subsequent requalification. Completeness • A validated VE data form will be obtained for 100 percent of the waste containers subject to VE. Comparability • The comparability of VE data from different operators shall be enhanced by using standardized VE procedures and operator qualifications. (Section C3-4b)					

1. The WAP requirements should be presented in documents, such as procedures. Each of the questions posed under WAP requirements are meant to determine whether procedures are in place or whether documents are evident which demonstrate that the specific WAP requirement is or can be met.

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ATTACHMENT C7

TRU WASTE CONFIRMATION

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ATTACHMENT C7

TRU WASTE CONFIRMATION

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ATTACHMENT C7

TRU WASTE CONFIRMATION

Introduction

The Permittees demonstrate compliance with the Permit by ensuring that the waste characterization processes performed by generator/storage sites (**sites**) produce data compliant with the WAP and through the waste screening and verification processes. Verification occurs at three levels: 1) the data generation level, 2) the project level, and 3) the Permittee level. The Permittees also examine a representative subpopulation of waste prior to shipment to confirm that the waste contains no ignitable, corrosive or reactive waste; and that assigned Environmental Protection Agency (**EPA**) hazardous waste numbers are allowed by the Permit. The waste confirmation activities described herein occur prior to shipment of the waste from the generator/storage site to WIPP.

C7-1 Permittee Confirmation of TRU Mixed Waste

Waste confirmation is defined in Part 1 as the activities performed by the Permittees or the co-Permittee the U.S. Department of Energy (**DOE**), pursuant to this Permit Attachment, to satisfy the requirements specified in Section 310 of Pub. L. 108-447. Waste confirmation occurs after waste containers have been certified for disposal at WIPP. The general confirmation process for WIPP waste is presented in Figure C7-1.

C7-1a Confirmation of a Representative Subpopulation of the Waste

The Permittees shall confirm that the waste contains no ignitable, corrosive, or reactive waste through radiography (Section C7-1b) or the use of visual examination (Section C7-1c) of a statistically representative subpopulation of the waste. Prior to shipment to WIPP, waste confirmation will be performed on randomly selected containers from each CH and RH TRU mixed waste stream shipment. Figure C7-1 presents the overall waste verification and confirmation process.

Waste confirmation encompasses ensuring that the physical characteristics of the TRU mixed waste correspond with its waste stream description and that the waste does not contain liquid in excess of TSDF-WAC limits or compressed gases. These techniques can detect liquid that exceeds 1 percent volume of the container and containerized gases, which are prohibited from storage or disposal at the WIPP facility. The prohibition of liquid in excess of TSDF-WAC limits and containerized gases prevents the storage or disposal of ignitable, corrosive, or reactive wastes. Radiography and/or visual examination will ensure that the physical form of the waste matches its waste stream description (i.e., Homogeneous Solids, Soil/Gravel, or Debris Waste). The results of waste confirmation activities, including radiography and visual examination records (data sheets, packaging logs, and/or video and audio recordings) will be maintained in the WIPP facility operating record. Noncompliant waste identified during waste confirmation will be managed as described in Section C7-2.

The Permittees shall randomly select at least 7 percent of each waste stream shipment for waste confirmation. This equates to a minimum of one container from each fourteen containers in each waste stream in each designated shipment. If there are less than fourteen containers

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from a waste stream in a particular shipment, a minimum of one container from the waste stream shipped will be selected. If the random selection of containers in a shipment occurs prior to loading the waste containers into the Shipping Package, the randomly selected containers may be consolidated into a single Type B package consistent with transportation requirements. Documentation of the random selection of containers for waste confirmation will be placed in the WIPP facility operating record.

For each container selected for confirmation in accordance with the process above, the Permittees will examine the respective nonconformance report (**NCR**) documentation to verify NCRs have been dispositioned for the selected container as required by Permit Attachment C3, Section C3-13.

C7-1a(1) Confirmation Training Requirements

Waste confirmation may be completed by performing actual radiography/visual examination on the waste container(s) or by a review of radiography/visual examination media and records.

Waste confirmation personnel may be trained to either review of radiography/visual examination media and records (Level 1) or to perform actual radiography/visual examination on the waste container(s) (Level 2). Level 2 personnel may also perform waste confirmation by review of media and records.

C7-1b Radiography Methods Requirements

Radiography has been developed by the Permittees specifically to aid in the examination and identification of containerized waste. The Permittees shall describe all activities required to achieve the radiography objectives in standard operating procedures (**SOPs**). These SOPs shall include instructions specific to the radiography system(s) used by the Permittees at an off-site facility (e.g., the generator/storage site). For example, to detect liquid, some systems require the container to be rotated back and forth while other systems require the container to be tilted.

A radiography system (e.g., real time radiography, digital radiography/computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, a video and audio recording system, and an operator control and data acquisition station. Although these six components are required, it is expected there will be some variation within a given component between radiography systems. The radiography system shall have controls or an equivalent process which allow the operator to control image quality. On some radiography systems, it should be possible to vary the voltage, typically between 150 to 400 kilovolts (**kV**), to provide an optimum degree of penetration through the waste. For example, high-density material should be examined with the X-ray device set on the maximum voltage. This ensures maximum penetration through the waste container. Low-density material should be examined at lower voltage settings to improve contrast and image definition. The imaging system typically utilizes either a fluorescent screen and a low-light television camera or x-ray detectors to generate the image.

To perform radiography, the waste container is scanned while the operator views the television screen. A video and audio recording is made of the waste container scan and is maintained in the WIPP facility operating record as a non-permanent record. A radiography data form is also used to document the Waste Matrix Code, ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquid in excess of TSDF-

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WAC limits or compressed gases, and verify that the physical form of the waste is consistent with the waste stream description documented on the WSPF. Containers whose contents prevent full examination of the remaining contents shall be subject to visual examination unless the Permittees certify that visual examination would provide no additional relevant information for that container based on the acceptable knowledge information for the waste stream. Such certification shall be documented in the WIPP facility operating record.

For containers that have been characterized using radiography by the generator/storage sites in accordance with the method in Attachment C1, Section C1-3, the Permittees may perform confirmation by review of the generator/storage site's radiography audio/video recordings.

For containers which contain classified shapes and undergo radiography, the radiography will occur at a facility with appropriate security provisions and the video and audio recording will be considered classified. The radiography data forms will not contain classified information.

C7-1b(1) Radiography Training

The radiography system involves qualitative and semiquantitative evaluations of visual displays. Operator training and experience are the most important considerations for ensuring quality controls in regard to the operation of the radiography system and for interpretation and disposition of radiography results. Only trained personnel shall be allowed to operate radiography equipment.

The Permittee radiography operators performing waste confirmation shall be trained in accordance with the requirements of Permit Attachment F1.

C7-1b(2) Radiography Oversight

The Permittees shall be responsible for monitoring the quality of the radiography data and calling for corrective action, when necessary.

A training drum with internal containers of various sizes shall be scanned biennially by each Level 2 operator. The video and audio media shall then be reviewed by a radiography subject matter expert to ensure that operators' interpretations remain consistent and accurate. Imaging system characteristics shall be verified on a routine basis.

Independent replicate scans and replicate observations of the video output of the radiography process shall be performed under uniform conditions and procedures. Independent replicate scans shall be performed on one waste container per day or once per shipment, whichever is less frequent. Independent observations of one scan (not the replicate scan) shall also be made once per day or once per shipment, whichever is less frequent, by a qualified radiography operator other than the individual who performed the first examination. When confirmation is performed by review of audio/video recorded scans produced by the generator/storage site as specified in Permit Attachment C1, Section C1-3, independent observations shall be performed on two waste containers per shipment or two containers per day, whichever is less frequent.

C7-1c Visual Examination Methods Requirements

Visual examination (**VE**) may also be used as a waste confirmation method. VE shall be conducted by the Permittees in accordance with written SOPs to describe the contents of a

waste container. Visual examination shall be conducted to identify and describe all waste items, packaging materials, and waste material parameters. VE may be used to examine a statistically representative subpopulation of the waste certified for shipment to WIPP to confirm that the waste contains no ignitable, corrosive, or reactive waste. This is achieved by confirming that the waste contains no liquid in excess of TSDF-WAC limits or compressed gases, and that the physical form of the waste matches the waste stream description documented on the WSPF. During packaging, the waste container contents are directly examined by trained personnel. This form of waste confirmation may be performed by the Permittees at a generator/storage site. The VE may be documented on video and audio media, or by using a second operator to provide additional verification by reviewing the contents of the waste container to ensure correct reporting. When VE is performed using a second operator, each operator performing the VE shall observe for themselves the waste being placed in the waste container or the contents within the examined waste container when waste is not removed. The results of all VE shall be documented on VE data forms, which are used to document (1) the Waste Matrix Code, (2) that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and (3) that the physical form of the waste is consistent with the waste stream description documented on the WSPF.

In order to keep radiation doses as low as reasonably achievable at generator/storage sites, the Permittees may use their own trained VE operators to perform VE for waste confirmation by reviewing generator/storage site VE data, which includes VE data forms, waste packaging records, and may also include audio/video media. The Permittees shall document their review of generator/storage site VE data on confirmation data forms.

If the generator/storage site documented VE using audio/video media in accordance with Permit Attachment C1, Section C1-4, the Permittees must use the audio/video media to perform confirmation. If the Permittees perform waste confirmation by review of audio/video media, the audio/video record of the VE must be sufficiently complete for the Permittees to confirm the Waste Matrix Code and waste stream description, and verify the waste contains no liquid in excess of TSDF-WAC limits or compressed gases. Generator/storage site VE video/audio media subject to review by the Permittees shall meet the following minimum requirements:

- The video/audio media shall record the waste packaging event for the container such that all waste items placed into the container are recorded in sufficient detail and shall contain an inventory of waste items in sufficient detail that a trained Permittee VE operator can identify the associated waste material parameter.

- The video/audio media shall capture the waste container identification number.

- The personnel loading the waste container shall be identified on the video/audio media or on packaging records traceable to the loading of the waste container.

- The date of loading of the waste container will be recorded on the video/audio media or on packaging records traceable to the loading of the waste container.

VE audio/video media of containers that contain classified shapes shall be considered classified information.

If the generator/storage site did not document VE using audio/video media, the Permittees may use their own trained VE operators to perform VE for waste confirmation by reviewing VE data forms or packaging records prepared by the generator/storage site. To be acceptable, the generator/storage site VE data forms or packaging records must be signed by two generator/storage site personnel who witnessed the packaging of the waste and must provide sufficient information for the Permittees to determine that the waste container contents match the waste stream description on the WSPF and the waste contains no liquids in excess of TSDF-WAC limits or compressed gases. Generator/storage site VE forms or packaging records subject to review by the Permittees shall meet the following minimum requirements:

- At least two generator site personnel shall approve the data forms or packaging records attesting to the contents of the waste container.
- The data forms or packaging records shall contain an inventory of waste items in sufficient detail that a trained Permittee VE operator can identify the associated waste material parameters.
- The waste container identification number shall be recorded on the data forms or packaging records.

Visual examination video media of containers which contain classified shapes shall be considered classified information. Visual examination data forms will not contain classified information.

C7-1c(1) Visual Examination Training

The Permittees 's VE operators performing waste confirmation shall be trained in accordance with the requirements of Permit Attachment F1.

C7-1c(2) Visual Examination Oversight

The Permittees shall designate at least one VE expert. The VE expert shall be familiar with the processes that were used to generate the waste streams being confirmed using VE. The VE expert shall be responsible for the overall direction and implementation of the Permittees 's VE program. The Permittees shall specify the selection, qualification, and training requirements of the visual examination expert in an SOP.

C7-1d Quality Assurance Objectives (**QAOs**) for Radiography and Visual Examination

The QAOs the Permittees must meet for radiography and visual examination are detailed in this section. If the QAOs described below are not met, then corrective action as specified in Permit Attachment C3, Section C3-13 shall be taken.

C7-1d(1) Radiography QAOs

The QAOs for radiography are detailed in this section. If the QAOs described below are not met, then corrective action shall be taken.

Data to meet these objectives must be obtained from a video and audio recorded scan provided by trained radiography operators. Results must also be recorded on a radiography data form.

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The precision, accuracy, representativeness, completeness, and comparability objectives for radiography data are presented below.

Precision

Precision is maintained by reconciling any discrepancies between two radiography operators with regard to the waste stream waste confirmation, identification of liquid in excess of TSDF-WAC limits, and identification of compressed gases through independent replicate scans and independent observations.

Accuracy

Accuracy is obtained by using a target to tune the image for maximum sharpness and by requiring operators to successfully identify 100 percent of the required items in a training container during their initial qualification and subsequent requalification.

Representativeness

Representativeness is ensured by performing radiography on a random sample of waste containers from each waste stream in each shipment.

Completeness

A video and audio media recording of the radiography examination and a validated radiography data form will be obtained for 100 percent of the waste containers subject to radiography.

Comparability

The comparability of radiography data from different operators shall be enhanced by using standardized radiography procedures and operator qualifications.

C7-1d(2) Visual Examination QAOs

Results must be recorded on a VE data form. The precision, accuracy, representativeness, completeness, and comparability objectives for VE data are presented below.

Precision

Precision is maintained by reconciling any discrepancies between the operator and the independent technical reviewer with regard to the waste stream waste confirmation, identification of liquid in excess of TSDF-WAC limits, and identification of compressed gases.

Accuracy

Accuracy is maintained by requiring operators to pass a comprehensive examination and demonstrate satisfactory performance in the presence of the VE expert during their initial qualification. VE operators shall be requalified as specified in Permit Attachment F2.

Representativeness

Representativeness is ensured by performing VE on a random sample of waste containers within each waste stream in each shipment.

Completeness

A validated VE data form will be obtained for 100 percent of the waste containers subject to VE.

Comparability

The comparability of VE data from different operators shall be enhanced by using standardized VE procedures and operator qualifications.

C7-1e Review and Validation of Radiography and Visual Examination Data Used for Waste Examination

This section describes the requirements for review and validation of radiography and VE data by the Permittees.

C7-1e(1) Independent Technical Review

The radiography and/or VE confirmation data for each shipment shall receive an independent technical review. This review will be performed before the affected waste shipment is shipped to the WIPP facility. The review shall be performed by an individual other than the data generator who is qualified to have performed the work. The review will be performed in accordance with approved Permittee SOPs and will be documented on a review checklist. The reviewer(s) must approve the data as evidenced by signature, and as a consequence, ensure the following:

- Data generation and reduction were conducted in a technically correct manner in accordance with the methods used (procedure with revision). Data were reported in the proper units and correct number of significant figures.
- The data have been reviewed for transcription errors.
- Radiography video and audio media recordings have been reviewed (independent observation) on a waste container basis at a minimum of once per shipment or once per day of operation, whichever is less frequent. The radiography video/audio recording will be reviewed against the data reported on the Permittees 's radiography form to ensure that the data are correct and complete. If review of radiography scans recorded by the generator/storage site was used to perform confirmation, two observations must be performed for each shipment or two observations per day, whichever is less frequent.

C7-1e(2) DOE Management Representative Review

The radiography and/or visual examination data forms and independent technical review checklist (confirmation data package) for each shipment shall receive a DOE management review. This review will be performed before the affected waste shipment is disposed of at the WIPP. The review shall be performed by a designated representative of DOE management. The

review will be performed in accordance with approved DOE SOPs and will be documented on a review checklist. The reviewer(s) must approve the confirmation data package as evidenced by signature, and as a consequence, ensure the following:

- The data are technically reasonable based on the technique used.
- The data have received independent technical review.
- The data indicate that the waste examined contained no ignitable, corrosive, or reactive waste and that the physical form of the waste was consistent with the waste stream description in the WSPF.
- QC checks have been performed (e.g., replicate scans, image quality checks).
- The data meet the established QAOs

Upon completion of the DOE management representative review, the waste confirmation data for the shipment shall be submitted to the WIPP facility operating record as non-permanent records. Waste confirmation data includes radiography and VE data forms, video/audio media, and review checklists.

C7-2 Noncompliant Waste Identified During Waste Confirmation

If the Permittees identify noncompliant waste during waste confirmation at a generator/storage site (i.e., the waste does not match the waste stream description documented in the WSPF or there is liquid in excess of TSDF-WAC limits or compressed gases) the waste will not be shipped. DOE will suspend further shipments of the affected waste stream and issue a CAR to the generator/storage site. Shipments of affected waste streams shall not resume until the CAR has been closed. NMED will be notified within 24 hours of any suspension of waste stream shipments due to the identification of noncompliant waste during waste confirmation.

As part of the corrective action plan in response to the CAR, the generator/storage site will evaluate whether the waste characterization information documented in the Characterization Information Summary and/or WSPF for the waste stream must be updated because the results of waste confirmation for the waste stream indicated that the TRU mixed waste being examined did not match the waste stream description. The generator/storage site will thoroughly evaluate the potential impacts on waste that has been shipped to WIPP. DOE will evaluate the potential that prohibited items were shipped to WIPP and what remedial actions should occur, if any. The results of these evaluations will be provided to NMED before shipments of affected waste streams resume. If the Characterization Information Summary or WSPF requires revision, shipments of the affected waste stream shall not resume until the revised waste stream waste characterization information has been reviewed and approved by DOE.

If a generator/storage site certifies noncompliant waste more than once during a running 90-day period, DOE will suspend acceptance of that site's waste until DOE finds that all corrective actions have been implemented and the site complies with all applicable requirements of the WAP.

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FIGURES

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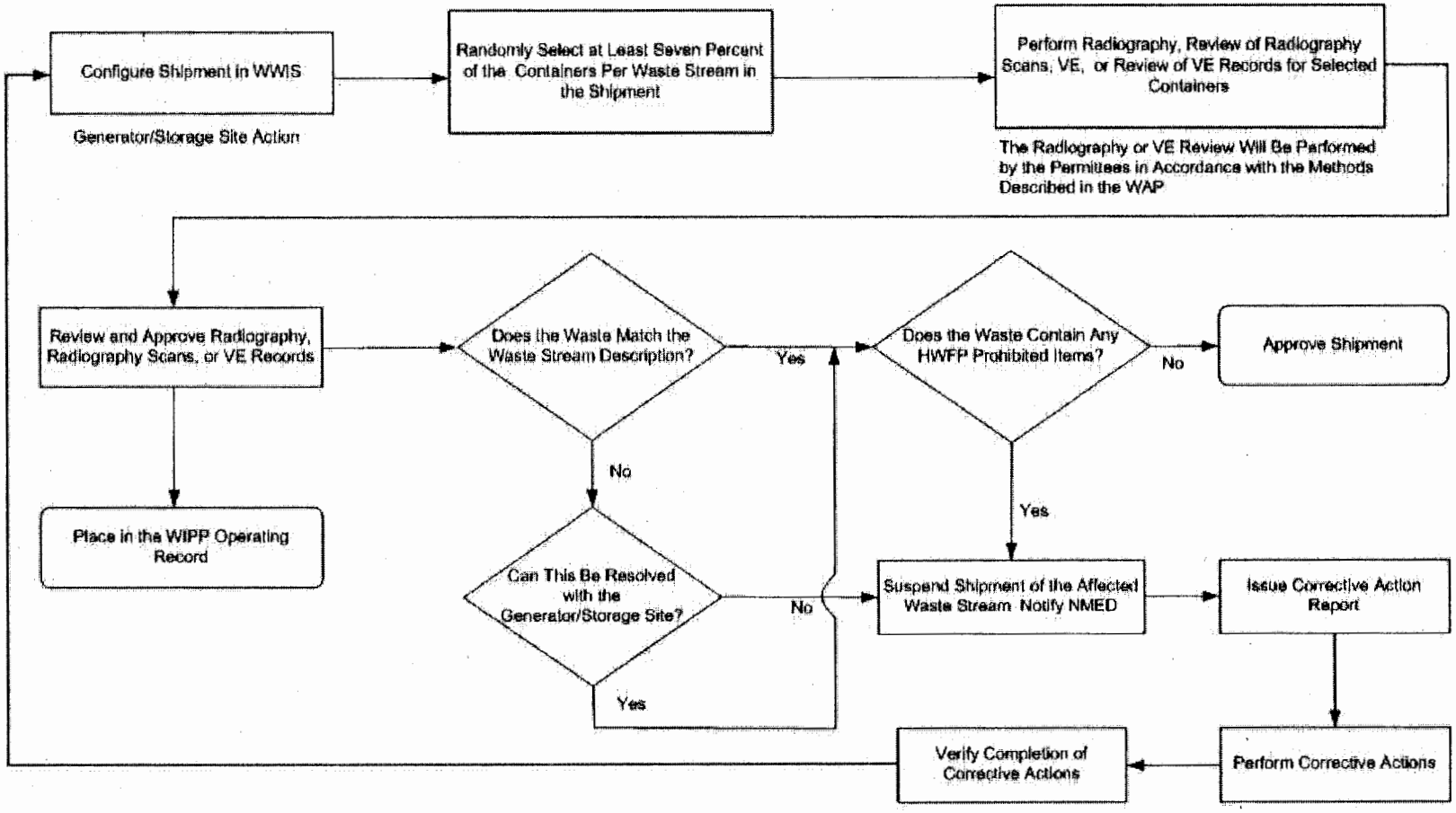

Figure C7-1
Overview of Waste Confirmation

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ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

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ATTACHMENT D

RCRA CONTINGENCY PLAN

Introduction

The WIPP facility is owned and co-operated by the U.S. Department of Energy (**DOE**) and co-operated by its designated Management and Operating Contractor (**MOC**) (Permit Section 1.5.3).

This Contingency Plan was prepared in accordance with the Resource Conservation and Recovery Act (**RCRA**) requirements codified in 20.4.1.500 NMAC (incorporating 40 CFR §264.50 to §264.56), "Contingency Plan and Emergency Procedures," and submitted in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(7)). The purpose of this document is to define responsibilities, to describe coordination of activities, and to minimize hazards to human health and the environment from fires, explosions, or any sudden or nonsudden release of hazardous waste, or hazardous waste constituents to air, soil, or surface water (20.4.1.500 NMAC (incorporating 40 CFR §264.51 [a])). This plan consists of descriptions of processes and emergency responses specific to hazardous substances, contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste and other hazardous waste handled at the WIPP facility.

D-1 General Information

The WIPP facility is located 26 miles (mi) (42 kilometers [km]) east of Carlsbad, in Eddy County in southeastern New Mexico, and includes an area of 10,240 acres (ac) (4,144 hectares [ha]). The facility is located in an area of low-population density, with fewer than 30 permanent residents living within a 10 mi (16 km) radius of the facility. The area surrounding the facility is used primarily for grazing, potash mining, and mineral exploration. Resource development that would affect WIPP facility operations or the long-term integrity of the facility is not allowed within the 10,240 ac (4,144 ha) that have been set aside for the WIPP Project.

The WIPP facility is designed to receive containers of TRU waste, which will be transported to the WIPP facility from the ten major and other minor DOE TRU mixed waste generator and/or storage sites. The waste will be emplaced in the bedded salt of the Salado Formation, 2,150 feet (ft) (655 meters [m]) below ground surface.

As a geologic facility for the management of TRU mixed waste, the WIPP repository is regulated as a "miscellaneous unit," as defined under 20.4.1.500 NMAC (incorporating 40 CFR §264.601 to §264.603). The areas at the WIPP facility subject to this permit include the surface container storage areas in the Waste Handling Building (**WHB**) Container Storage Unit (**WHB Unit**) and the Parking Area Container Storage Unit (**Parking Area Unit**), located south of the WHB, and the areas below ground in which waste will be emplaced.

The WIPP facility includes other surface structures, shafts, and underground areas (Figures D-1, D-2, and D-3). Surface structures other than the WHB, that support TRU mixed waste management include:

Exhaust Filter Building - houses the filter banks to which the underground ventilation can be diverted in the unlikely event of an underground release of radionuclides.

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Guard and Security Building - houses the facility security personnel and communications equipment necessary for them to perform their duties. Section D-4a specifies the duties of the security officers relative to contingency actions.

Safety and Emergency Services Building - houses the surface emergency response vehicles (fire truck, rescue truck, ambulance), Health Services (first aid), Emergency Operations Center, and the Dosimetry Laboratory. The Hazardous Material Response Trailer is staged at the WIPP facility in an area that is readily accessible to Emergency Services. Emergency Services is located in Building 452. Table D-6 describes emergency equipment and associated locations.

Support Building - houses the Central Monitoring Room (see section D-4a).

Transuranic Package Transporter-II (**TRUPACT-II**) Maintenance Facility - is located west of the CH bay. No TRU mixed waste management activities will occur in this facility.

Surface facilities used for storage of support equipment are identified in Table D-6.

Building 452, Safety and Emergency Services Facility, houses the emergency response vehicles, emergency equipment, the mine rescue room, mine rescue team equipment, and the Emergency Operations Center (**EOC**). The Hazardous Material Response Trailer is staged at the WIPP facility in an area readily accessible to Emergency Services. Emergency Services is located in Building 452.

The RCRA permit addresses TRU mixed waste management activities in the WHB Unit, the Parking Area Unit, and the disposal units. The provisions of this Contingency Plan apply to hazardous waste disposal units (**HWDU**) in the underground waste disposal panels, storage in the WHB Unit and the Parking Area Unit, the Waste Shaft, and supporting TRU mixed waste handling areas. The remainder of the facility will not manage TRU mixed waste. This Contingency Plan has also been designed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR § 262.34(a)(4) - Standards for Generators of Hazardous Waste), and will be implemented whenever there is a fire, explosion, or release of hazardous waste which could threaten human health or the environment. Hazardous substances in the remainder of the facility are included as possible triggers of the Contingency Plan but are outside the scope of the regulations promulgated pursuant to RCRA. This allows WIPP to maintain one emergency response plan which is consistent with the National Response Teams Integrated Contingency Plan Guidance (Federal Register, Vol. 61, No. 109, June 5, 1996). Inclusion is based on their National Fire Protection Association (**NFPA**) ratings in addition to their storage quantities. The majority of hazardous substances on-site are not expected to trigger the Contingency Plan because they are present in the same form and concentration as the product packaged for distribution and use by the general public or are used in a laboratory under the direct supervision of a technically qualified individual. Superfund Amendments and Reauthorization Act (**SARA**) Title III excludes these from emergency planning reporting. The list of hazardous substances in large enough quantities to constitute a Level II incident (Section D-3) is provided in Table D-1. In addition to TRU mixed waste, these are the only hazardous substances currently on site which, if spilled, may be of sufficient impact to cause this Contingency Plan to be implemented. Magnesium Oxide (**MgO**) is stored on-site in large quantities. It is used as backfill in the waste emplacement rooms as a pH buffer. The pH buffer will limit the solubility of radionuclides after the underground rooms are filled and closed. MgO is not a hazardous

substance, a release of MgO will not create hazardous waste and poses no threat to human health or the environment, and is therefore not addressed in the Contingency Plan.

Wastes generated as a result of maintenance or response actions will be categorized into one of three groups and disposed of accordingly. These are: 1) nonhazardous wastes to be disposed of in an approved landfill, 2) hazardous nonradioactive wastes to be disposed of at an off-site RCRA permitted facility, and 3) TRU mixed waste to be disposed of in the underground HWDUs. Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees will demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the HWDUs in the underground, will be met. In addition, the technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178) are applied to the operation of the container storage units in the WHB Unit and in the Parking Area Unit south of the WHB. Liquid wastes that may be generated as a result of the fire fighting water or decontamination solutions will be managed as follows:

Non-Mixed - Hazardous waste liquids contaminated only with hazardous constituents will be placed into containers and managed in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34) requirements. The waste will be shipped to an approved off-site treatment, storage, or disposal facility.

Mixed - Liquids contaminated with TRU mixed waste (inside the WHB Unit) will be solidified as they are placed into containers with cement, Aquaset, or absorbent material in them. The solidified materials will be disposed of in the underground WIPP repository as derived waste.

This chapter of the permit application describes the HWDUs, the TRU mixed waste management facilities and operations, compliance with the environmental performance standards, and with the applicable technical requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.170 to §264.178 and §264.601, respectively). The configuration of the WIPP facility consists of completed structures; including all buildings and systems for the operation of the facility.

D-1a Disposal Phase Overview

The Disposal Phase will consist of receiving CH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations.

The TRU mixed waste that will be disposed at the WIPP facility results primarily from activities related to the reprocessing of plutonium-bearing reactor fuel and fabrication of plutonium-bearing weapons, as well as from research and development. This TRU mixed waste consists largely of such items as paper, cloth, and other organic material; laboratory glassware and utensils; tools; scrap metal; shielding; and solidified sludges from the treatment of wastewater. Much of this TRU mixed waste is also contaminated with substances that are defined as hazardous under 20.4.1.200 NMAC.

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D-1b Waste Description

Waste destined for WIPP are, or were, produced as a byproduct of weapons production and have been identified in terms of waste streams based on the processes that produced them. Each waste stream identified by generators is assigned to a Waste Summary Category to facilitate RCRA waste characterization, and reflect the final waste forms acceptable for WIPP disposal.

These Waste Summary Categories are:

S3000—Homogeneous Solids

Solid process residues defined as solid materials, excluding soil, that do not meet the applicable regulatory criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2[g] and [h])). Included in solid process residues are inorganic process residues, inorganic sludges, salt waste, and pyrochemical salt waste. Other waste streams are included in this Waste Summary Category based on the specific waste stream types and final waste form. This category includes wastes that are at least 50 percent by volume solid process residues.

S4000—Soils/Gravel

This waste summary category includes waste streams that are at least 50 percent by volume soil. Soils are further categorized by the amount of debris included in the matrix.

S5000—Debris Wastes

This waste summary category includes waste that is at least 50 percent by volume materials that meet the criteria for classification as debris (20.4.1.800 NMAC (incorporating 40 CFR §268.2)). Debris is a material for which a specific treatment is not provided by 20.4.1.800 NMAC (incorporating 40 CFR §268 Subpart D), including process residuals such as smelter slag from the treatment of wastewater, sludges or emission residues.

> Debris means solid material exceeding a 2.36 inch (60 millimeter) particle size that is intended for disposal and that is: 1) a manufactured object, 2) plant or animal matter, or 3) natural geologic material.

Included in the S5000 Waste Summary Category are metal debris, lead containing metal debris, inorganic nonmetal debris, asbestos debris, combustible debris, graphite debris, heterogeneous debris, and composite filters, as well as other minor waste streams. Particles smaller than 2.36 inches in size may be considered debris if the debris is a manufactured object and if it is not a particle of S3000 or S4000 material.

Examples of waste that might be included in the S5000 Waste Summary Category are asbestos-containing gloves, fire hoses, aprons, flooring tiles, pipe insulation, boiler jackets, and laboratory tabletops. Also included are combustible debris constructed of plastic, rubber, wood, paper, cloth, graphite, and biological materials. Examples of graphite waste that would be included are crucibles, graphite components, and pure graphite.

Wastes may be generated at the WIPP facility as a direct result of managing the TRU and TRU mixed wastes received from the off-site generators. Such generated waste may occur in either the WHB Unit or the Underground. For example, when TRU mixed wastes are received at the WHB Unit, the CH or RH Package shipping containers and the TRU mixed waste containers are checked for surface contamination. Under some circumstances,[1] if contamination is detected, the shipping container and/or the TRU mixed waste containers will be decontaminated. In the underground, waste may be generated as a result of radiation control procedures used during monitoring activities. The waste generated from radiation control procedures will be assumed to be TRU and/or TRU mixed waste. Throughout the remainder of this plan, this waste is referred to as "derived waste." All such derived waste will be placed in the rooms in HWDUs along with the TRU mixed waste for disposal.

D-1c Containers

The waste containers that will be used at the WIPP facility qualify as "containers," in accordance with 20.4.1.101 NMAC (incorporating 40 CFR §260.10). That is, they are "portable devices in which a material is stored, transported, treated, disposed of, or otherwise handled."

TRU mixed waste containers, containing off-site waste, will not be opened at the WIPP facility. Derived waste containers are kept closed at all times unless waste is being added or removed.

Waste, including "derived waste," containing liquid in excess of TSDF-WAC limits shall not be emplaced in the WIPP (See Permit Attachment C, Section C-1c).

Special requirements for ignitable, reactive, and incompatible waste are addressed in 20.4.1.500 NMAC (incorporating 40 CFR §§264.176 and 177). The RCRA Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) precludes ignitable, reactive, or incompatible TRU mixed waste from being placed into storage or disposed of at WIPP.

D-1d Description of Containers

CH TRU mixed waste containers will be either 55-gallon (gal) (208-liter (L)) drums singly or arranged into seven (7)-packs, 85-gal (322-L) drums (used as singly or arranged into four (4)-packs, 100-gal (379 L) drums singly or arranged into three (3)-packs, ten-drum overpacks (**TDOP**), 66.3 ft^3 (1.88 m^3) SWBs, or standard large box 2s (**SLB2**).

RH TRU mixed waste containers are either canisters or drums. Canisters will be loaded singly in an RH-TRU 72-B cask and drums will be loaded in a CNS 10-160B cask. Drums in the CNS 10-160B cask will be arranged singly or in drum carriage units containing up to five drums each. Canisters and drums are described in Permit Attachment M1.

Remote-Handled TRU mixed waste may arrive in shielded containers with an internal capacity of 4.0 ft^3 (0.11 m^3). Shielded containers will be arranged as three-packs.

[1] Typically contamination that is less than six square feet in area and less than 2000 disintegrations per minute (dpm) alpha or 20,000 dpm beta/gamma, may be decontaminated. Containers that exceed these thresholds will be returned to the point of origin for decontamination.

D-1e Description of Surface Hazardous Waste Management Units

The WHB is the surface facility where waste handling activities will take place. The WHB has a total area of approximately 84,000 square feet (ft^2) (7,804 square meters [m^2]) of which 49,710 ft^2 (4,618 m^2) are designated as the WHB Unit for TRU mixed waste management. Within the WHB Unit, 32,307 ft^2 (3,001 m^2) are designated for the waste handling and container storage of CH TRU mixed waste and 17,403 ft^2 (1,617 m^2) are designated for the handling and storage of RH TRU mixed waste. These areas are being permitted as container storage units. The concrete floors within the WHB Unit are sealed with an impermeable coating that has excellent resistance to the chemicals in TRU mixed waste and, consequently, provide secondary containment for TRU mixed waste. In addition, a Parking Area Unit south of the WHB will be used for storage of waste in sealed shipping containers awaiting unloading. This area is also being permitted as a container storage unit. The sealed shipping containers provide secondary containment in this hazardous waste management unit (**HWMU**).

D-1e(1) CH Bay Operations

Once unloaded from the Contact-Handled Package, CH TRU mixed waste containers (3-pack of shielded containers, 7-packs of 55-gal drums, 3-packs of 100-gal drums, 4-packs of 85-gal drums, SWBs, TDOPs, or one SLB2) are placed on the facility pallet. The waste containers are stacked on the facility pallets (one- or two-high, depending on weight considerations). The use of facility pallets will elevate the waste at least 6 inches (in.) (15 centimeters [cm]) from the floor surface. Pallets of waste will then be stored in the CH bay. This storage area will be clearly marked to indicate the lateral limits of the storage area. This storage area will have a maximum capacity of thirteen facility pallets of waste during normal operations. These pallets will typically be in the CH Bay storage area for a period of up to five days.

In addition, four Contact-Handled Packages, containing up to 640 ft^3 of CH TRU waste in containers, may occupy positions at the TRUPACT-II Unloading Docks (**TRUDOCK**).

Aisle space shall be maintained in all CH Bay waste storage areas. The aisle space shall be adequate to allow unobstructed movement of fire response personnel, spill-control equipment, and decontamination equipment that would be used in the event of an off-normal event. An aisle space between facility and containment pallets will be maintained in all CH TRU mixed waste storage areas.

D-1e(2) RH Complex Operations

Loaded RH TRU casks are received in the RH Bay of the WHB. The RH Bay is served by an overhead bridge crane used for cask handling and maintenance operations. Storage in the RH Bay occurs in the RH-TRU 72-B or CNS 10-160B casks. A maximum of two loaded casks may be stored in the RH Bay and a maximum of one cask in the Cask Unloading Room may be stored at one time. A minimum of 44 inches (1.1 m) will be maintained between loaded casks in the RH Bay. The cask serves as secondary containment in the RH Bay for the RH TRU mixed waste payload container. In addition, the RH Bay has a concrete floor.

Single RH TRU mixed waste canisters are unloaded from the RH-TRU 72-B casks in the Transfer Cell of the RH Complex where they are transferred to facility casks. Drums of RH TRU mixed waste will be transferred remotely from the CNS 10-160B cask, into the Hot Cell, and loaded into a canister. Storage in the Hot Cell occurs in either drums or canisters. A maximum

of 12 55-gallon drums of RH TRU mixed waste and one 55-gallon drum of derived waste (94.9 ft^3 (2.7 m^3)) may be stored in the Hot Cell. Except for the derived waste drum, individual 55-gallon drums may not be stored in the Hot Cell for more than 25 days. The Transfer Cell houses the Transfer Cell Shuttle Car, which is used to facilitate transferring the canister to the facility cask. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Transfer Cell in a shielded insert in the Transfer Cell Shuttle Car or in a RH-TRU 72-B cask.

The Facility Cask Loading Room provides for transfer of a canister to the facility cask for subsequent transfer to the waste shaft conveyance and to the Underground Hazardous Waste Disposal Unit. The Facility Cask Loading Room also functions as an air lock between the waste shaft and the Transfer Cell. Storage in this area typically occurs at the end of a shift or in an off-normal event that results in the suspension of waste handling. A maximum of one canister (31.4 ft^3 (0.89 m^3)) may be stored in the Facility Cask in the Facility Cask Loading Room.

Derived waste will be stored in the RH Bay and in the Hot Cell.

D-1e(3) Parking Area Container Storage Unit (Parking Area Unit)

The area extending south from the WHB within the fenced enclosure identified as the Controlled Area on Figure A1-2 is defined as the Parking Area Container Storage Unit. This area provides storage for up to 6,734 ft^3 (191 m^3) of CH and/or RH TRU mixed waste contained in up to 40 loaded Contact-Handled Packages and 8 Remote-Handled Packages. Secondary containment and protection of the waste containers from standing rainwater are provided by the transportation containers. Up to 12 additional Contact-Handled Packages and four additional Remote-Handled Packages may be stored in the Parking Area Surge Area so long as the requirements of Permit Sections 3.1.2.3 and 3.1.2.4 are met. No more than 50 Contact-Handled and 12 Remote-Handled Packages may be stored in the Parking Area Storage Unit.

The safety criteria for Contact-Handled and Remote-Handled Packages require that they be opened and vented at a frequency of at least once every 60 days. During normal operations, Contact-Handled and Remote-Handled Packages will not require venting while located in the Parking Area Unit. Any off-normal event which results in the need to store a waste container in the Parking Area Unit for a period of time approaching fifty-nine (59) days shall be mitigated by returning the shipment to the generator prior to the expiration of the 60 day NRC venting period or by moving the Contact-Handled or Remote-Handled Package inside the WHB Unit where the waste will be removed and placed in one of the permitted storage areas or in the underground hazardous waste disposal unit.

D-1f Off-Normal Events

Off-normal events could interrupt normal operations in the waste management process line. Shipments of waste from the generator sites will be stopped in any event which results in an interruption to normal waste handling operations that exceeds three days.

D-1g Containment

The WHB Unit has concrete floors, which are sealed with a coating designed to resist all but the strongest oxidizing agents. Such oxidizing agents do not meet the TSDF-WAC and will not be

accepted in TRU mixed waste at the WIPP facility. Therefore, TRU mixed wastes pose no compatibility problems with respect to the WHB Unit floor.

During normal operations, the floor of the normal storage areas within the CH Bay and RH Complex shall be visually inspected on a weekly basis to verify that it is in good condition and free of obvious cracks and gaps. When a RH TRU mixed waste container is present in the RH Complex, inspections will be conducted visually and/or using closed-circuit television cameras in order to manage worker dose and minimize radiation exposures. Manual inspections of the areas are performed at least annually during routine maintenance periods when waste is not present.

Floor areas of the WHB used during off-normal events will be inspected prior to use and weekly while in use. Containers located in the permitted storage areas shall be elevated from the surface of the floor. Facility pallets provide at least 6 in (15 centimeters [cm]) of elevation from the surface of the floor. TRU mixed waste containers that have been removed from Contact-Handled or Remote-Handled Packages shall be stored at a designated storage area inside the WHB so as to preclude exposure to the elements.

Secondary containment at permitted storage areas inside the WHB Unit shall be provided by the floor. The Parking Area Unit and TRUDOCK storage area of the WHB Unit do not require engineered secondary containment, since waste is not stored there unless it is protected by the Contact-Handled or Remote-Handled Packaging. Floor drains, the fire suppression water collection sump, and portable dikes, if needed, will provide containment for liquids that may be generated by fire fighting. Sump capacities and locations are shown in Drawing 41-F-087-014. Residual fire fighting liquids will be placed in containers and managed as described above. Secondary containment at storage locations inside the RH Bay, Cask Unloading Room, Transfer Cell, and Facility Cask Loading Room is provided by the cask or canisters that contain drums of RH TRU mixed waste. In the Hot Cell, secondary containment is provided by the Hot Cell subfloor. In addition, the RH Complex contains a 220-gallon (833-L) sump in the Hot Cell, a 11,400-gallon (43,152-L) sump in the RH Bay, and a 220-gallon (833-L) sump in the Transfer Cell to collect any liquids.

D-2 Response Personnel

Persons qualified to act as the RCRA Emergency Coordinator, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.55), are listed in Table D-2.

A RCRA Emergency Coordinator will be on-site at the WIPP facility 24 hours a day, seven days a week, with the responsibility for coordinating emergency response measures. RCRA Emergency Coordinators are listed in Table D-2, where four individuals have been designated primary RCRA Emergency Coordinators. This is because the on-duty Facility Shift Manager (**FSM**) is designated as the RCRA Emergency Coordinator. The four individuals shown serve as FSM on a rotating shift basis.

Persons qualified to act as the RCRA Emergency Coordinator are thoroughly familiar with this Contingency Plan, the TRU mixed waste and hazardous waste operations and activities at the WIPP facility, the locations of TRU mixed waste and hazardous waste activities, the locations on the site where hazardous materials are stored and used, and the locations of waste staging and accumulation areas. They are familiar with the characteristics of hazardous substances, TRU mixed waste and hazardous waste handled at the WIPP facility, the location of TRU mixed

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waste and hazardous waste records within the WIPP facility, and the facility layout. In addition, persons qualified to act as the RCRA Emergency Coordinator have the authority to commit the necessary resources to implement this Contingency Plan. Figure D-4 outlines the RCRA Emergency Coordinator's position relative to other organizations that provide support.

In addition to the RCRA Emergency Coordinator, the following individuals or groups have specified responsibilities during any WIPP facility emergency:

- Assistant Chief Office Warden (**ACOW**)—Persons assigned to take accountability for sections of the site, and then reporting the accountability to the Chief Office Warden.

- Central Monitoring Room Operator (**CMRO**)—The on-shift operator responsible for Central Monitoring Room (**CMR**) operations, including coordination of facility communications. The facility log is maintained by the CMRO.

- Chief Office Warden (**COW**)—A predesignated individual with responsibilities for complete surface accountability at staging areas in the event of an evacuation. The Chief Office Warden receives reports from the ACOWs.

- Emergency Response Team (**ERT**)—Supplemental group trained to respond to surface emergencies, to provide emergency first aid, and to respond to releases of hazardous waste or hazardous material. ERT members are part of the WIPP Supplemental Emergency Response Program.

- Emergency Services Technician (**EST**)/Fire Protection Technician (**FPT**)—Regular employee whose job is that of full-time emergency responder. During non-emergency conditions, the EST/FPT inspects facility fire suppression systems and emergency equipment. The EST/FPT completes specific sections of the "WIPP Hazardous Material Incident Report." Additional technical personnel complete identified sections of the report.

- Fire Brigade—The fire brigade is a team of five personnel who respond to site emergencies. The team consists of an Incident Commander and four fire fighters. The fire fighters are trained in accordance with NFPA Standards for Industrial Fire Brigades (Fire Brigades that perform both advanced exterior and interior structural fire fighting).

- First Line Initial Response Team (**FLIRT**)—Supplemental primary responders in the event of a general underground emergency for medical and hazardous material response. The FLIRT also provides backup support for the ERT in the event of a general surface-facility emergency. FLIRT members are part of the WIPP Supplemental Emergency Response Program.

- Mine Rescue Team (**MRT**)—Supplemental group responsible for underground reentry and rescue after an emergency evacuation. The MRT responds in accordance with 30 CFR Part 49 requirements. MRT members are part of the WIPP Supplemental Emergency Response Program.

- Office Warden—An individual assigned responsibility for assuring that personnel are evacuated from his/her assigned area or building during evacuations. Office Wardens

maintain a list of all personnel in their specific area. This list is compared with the physical presence of personnel who assemble at the staging areas. The Office Wardens report area accountability to the ACOWs.

- EOC Staff-The EOC consists of a minimum staff of three MOC management positions (the Crisis Manager, a Safety Representative and an Operations Representative) to activate the EOC. The full EOC Staff includes the Crisis Manager, the Deputy Crisis Manager, a Safety Representative, an Operations Representative and the EOC Coordinator. Additional technical and logistics personnel will provide support as necessary. The EOC is activated by the FSM. Since EOC staff are performing duties similar to their normal job functions and providing support related to their area of expertise, no specific RCRA training is required.

D-3 Implementation

The provisions of this Contingency Plan will be implemented immediately whenever there is an emergency event (e.g., a fire, an explosion, or a natural occurrence that involves or threatens hazardous or TRU mixed wastes or a release of hazardous substances, hazardous materials, or hazardous wastes) that could threaten human health or the environment, or whenever the potential for such an event exists as determined by the RCRA Emergency Coordinator, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.51(b)). The following information is utilized for categorization of events to determine implementation of the Contingency Plan:

1. Medical Emergencies (does not implement the Contingency Plan)
2. Non-emergency (does not implement the Contingency Plan)
    a. Fire already out, did not involve any hazardous materials.
    b. Spill or release involved materials excluded according to the SARA Title III, Statute 42 U.S.C. 11021 (e). Such as:
        1) Any substance present in the same form and concentration as product packaged for distribution and use by the general public. (Example: Cleaning solutions)
        2) Any substance to the extent it is used in a laboratory under the direct supervision of a technically qualified individual.
        3) Petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance by Comprehensive Environmental Response, Compensation and Liability Act (**CERCLA**).

3. Incident Level I: According to the NFPA 471, Responding to Hazardous Materials Incidents (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level I incident and does not implement the Contingency Plan.

   a. The product does not require a U.S. Department of Transportation (**DOT**) placard, is a NFPA listed 0 or 1 for all categories, or is Other Regulated Materials A, B, C, or D.

   b. The fire is under control and the reactivity rating of the material is less than a rating 2, indicating a low potential for subsequent explosion as the hazardous material can be considered normally stable.

   c. There was no release or the release can be confined with readily available resources.

   d. There is no life-threatening situation.

   e. There is no potential environmental impact.

4. Incident Level II: According to NFPA 471, Responding to Hazardous Materials Incidents, (See Table D-3). If the product(s) involved in the fire, explosion, spill or leakage meets the following criteria, it will be classified as a Level II incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

   a. The product requires a DOT placard, is an NFPA 2 for any categories, or is Environmental Protection Agency (**EPA**) regulated waste (Site-specific: Table D-1 and TRU mixed waste) AND

   b. The incident involves multiple packages.

   c. There is potential for the fire to spread since the hazardous material's flammability level (rating 2) is below 200 degrees Fahrenheit, or the reactivity (rating 2) indicates that violent chemical changes are possible and thus may be explosive.

   d. The release may not be controllable without special resources.

   e. The incident requires evacuation of a limited area for life safety.

   f. The potential for environmental impact is limited to soil and air within incident boundaries.

   g. The container is damaged but able to contain the contents to allow handling or transfer of product.

5. Incident Level III: According to NFPA 471, Responding to Hazardous Materials Incidents (See Table D--3). If the product(s) involved in the fire, explosion, spill or leakage meet the following criteria, it will be classified as a Level III incident and the Contingency Plan will be implemented by the RCRA Emergency Coordinator.

    a. The product is a poison A (gas), an explosive A/B, organic peroxide, flammable solid, material that is dangerous when wet, chlorine, fluorine, anhydrous ammonia, NFPA 3 and 4 for any categories including special hazards, EPA extremely hazardous substances, and cryogenics.

    b. The site-specific container size for this incident level will be a tank truck.

    c. There is potential for the fire to spread since the hazardous material's flammability level (rating 3 or 4) is below 100 degrees Fahrenheit, or the reactivity (rating 3 or 4) indicates that the material may explode.

    d. The release may not be controlled even with special resources.

    e. The incident requires mass evacuation of a large area for life safety.

    f. Even though the NFPA guidelines for this incident level indicate that the potential for environmental impact is severe, due to the site engineering controls, the impact is contained within the HWMUs.

    g. The container is damaged to such an extent that catastrophic rupture is possible.

The above categories include fire situations, weather conditions, natural phenomena, and explosions which will have to be evaluated to make an incident level determination. A Level II (potential threat to human health in localized area, potential for moderate on-site environmental impact) or Level III (potential threat to human health in a larger area, potential for severe environmental impact) incident by definition is considered to be a potential threat to human health or the environment and, therefore, is considered to be an emergency requiring activation of the Contingency Plan.

D-4 Emergency Response Method

Methods that describe how and when the WIPP Contingency Plan will be implemented cover the following 11 implementation areas:

1. Notification (Section D-4a)
2. Identification of hazardous materials (Section D-4b)
3. Assessment of the nature and extent of the emergency (Section D-4c)
4. Control, containment, and correction of the emergency (Section D-4d)
5. Prevention of recurrence or spread of fires, explosions, or releases (Section D-4e)
6. Management and containment of released material and waste (Section D-4f)
7. Incompatible waste (Section D-4g)
8. Post-emergency facility and equipment maintenance and reporting (Section D-4h)
9. Container spills and leakage (Section D-4i)
10. Tank spills and leakage (Section D-4j)
11. Surface impoundment spills and leakage (Section D-4k)

D-4a Notification

Notification requirements in the event of an emergency at a RCRA hazardous waste management facility are defined by 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(a) and (d)). Necessary notifications in case of an emergency at the WIPP facility are described in this section (Figure D-4a). Personnel at the WIPP facility are trained to respond to emergency notifications.

D-4a(1) Initial Emergency Response and Alerting the RCRA Emergency Coordinator

The first person to become aware of an incident shall immediately report the situation to the CMRO, and provide the following information, as appropriate:

- Name and telephone number of the caller
- Location of the incident and the caller
- Time and type of incident
- Severity of the incident
- Magnitude of the incident
- Cause of the incident
- Assistance needed to deal with or control the incident
- Areas or personnel affected by the incident

In addition to receiving incident reports, the CMRO continuously monitors (24 hours a day) the status of mechanical, electrical, and/or radiological conditions at selected points on the site, both above and below ground. Alarms to indicate abnormal conditions are located throughout the WIPP facility. The alarm(s) (e.g., fire, radiation) may be the first notification of an emergency situation received by the CMRO. The CMRO monitors alarms, takes telephone calls and radio messages, and initiates outgoing calls to emergency staff and outside agencies.

Once the CMRO is notified of a fire, explosion, or a release anywhere in the facility (either by eyewitness or an alarm), the RCRA Emergency Coordinator is immediately notified. Once notified, the RCRA Emergency Coordinator assumes responsibility for the management of activities related to the assessment, abatement, and/or cleanup of the incident.

A RCRA Emergency Coordinator is on-site at all times and, therefore, can be reached at any time via a two-way radio or over the public address (**PA**) and plectrons on-site. If the RCRA Emergency Coordinator is unavailable or unable to perform these duties, a qualified alternate RCRA Emergency Coordinator is available.

The EST/FPT is also notified in case of fire, explosion, or release. The RCRA Emergency Coordinator, as incident commander, determines if supplemental emergency responders are necessary. Notification of the ERT (surface) is made by using the ERT pagers and/or the public announcement system. Notification of the FLIRT is by using the Mine Page Phone System. If the MRT is needed the RCRA Emergency Coordinator will instruct the CMRO to make a PA announcement for the MRT to assemble in the Mine Rescue Room, located in a predetermined location.

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Off-shift personnel may be notified using the on-call list, which is updated weekly by the Permittees. The FSM/CMRO, each individual on the on-call list, and WIPP Security receive copies of the on-call list. The CMRO may direct Security to make the notifications.

The response to an unplanned event will be performed in accordance with procedures based on the applicable Federal, State, or local regulations and/or guidelines for that response. These include the U.S. Mine Safety and Health Administration (**MSHA**); NMAC; CERCLA; Chapter 74, Article 4B, New Mexico Statutes Annotated 1978, New Mexico Emergency Management Act; and agreements between the Permittees and local authorities (Section D-6) for emergencies throughout the WIPP facility.

After notification by the CMRO, the EST/FPT shall immediately investigate to determine pertinent information relevant to the actual or potential threat posed to human health or the environment. The information will include the location of release, type, and quantity of spilled or released material (or potential for release due to fire, explosion, weather conditions, or other naturally occurring phenomena), source, areal extent, and date and time of release. The EST/FPT shall provide information for classification of the incident, according to the emergency response guidelines, to the RCRA Emergency Coordinator. The RCRA Emergency Coordinator then classifies the incident after evaluation of all pertinent information. This classification will consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).

When the RCRA Emergency Coordinator determines that an Incident Level II or III has occurred, the Contingency Plan is implemented. The RCRA Emergency Coordinator then may choose to activate the EOC for additional support (Figure D-4). If the RCRA Emergency Coordinator determines that due to extenuating circumstances the potential to upgrade to an incident Level II or III exists, the RCRA Emergency Coordinator also may activate the EOC. The EOC will assist the RCRA Emergency Coordinator in mitigation of the incident with use of communications equipment and technical expertise from any WIPP organization (see Section D-4c).

The EOC staff will assess opportunities for coordination and the use of mutual-aid agreements with local outside agencies making additional emergency personnel and equipment available (Section D-6), as well as the use of specialized response teams available through various State and Federal agencies. As a DOE-owned facility, the WIPP facility may use the resources available from the Federal Response Plan, signed by 27 Federal departments and agencies in April 1987, and developed under the authorities of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7701 et seq.) and amended by the Stafford Disaster Relief Act of 1988. Most resources are available within 24 hours. The WIPP facility maintains its own emergency response capabilities on-site. In addition to the supplemental emergency responders, radiological control technicians, environmental sampling technicians, wildlife biologists, and various other technical experts are available for use on an as-needed basis.

D-4a(2) Communication of Emergency Conditions to Facility Employees

Procedures for notifying facility personnel of emergencies depend upon the type of emergency. Methods of notification are:

- Local Fire Alarms

  The local fire alarms sound a bell tone and may be activated automatically or manually in the event of a fire.

- Surface Evacuation Signal

  The evacuation signal is a yelp[2] tone and is manually activated by the CMRO when needed. The CMRO shall follow the evacuation signal with verbal instructions and ensure the Site Notification System (i.e., the plectron) has been activated.

- Underground Evacuation Warning System

  The evacuation signal is a yelp tone and flashing strobe light. In the event of an evacuation signal, underground personnel will proceed to the nearest egress hoist station (Section D-7b) to be apprised of the nature of the emergency and the evacuation route to take. Underground personnel are trained to report to the underground assembly areas and await further instruction if all power fails or if ventilation stops. If evacuation of underground personnel is required, this will be done using the backup electric generators and in accordance with the applicable requirements of MSHA.

- Contingency Evacuation Notification

  If the primary warning system consisting of alarms and signals fails to operate when activated (as in a total power outage and failure of the back-up power systems), WIPP Security will be notified by the CMRO to initiate the contingency evacuation plan. In this event Security officers will alert personnel to evacuate the area and will check trailers, if possible, to ensure that personnel have been alerted/evacuated.

WIPP facility personnel are trained and given instruction during General Employee Training to recognize the various alarm signals and the significance of each alarm. WIPP facility employees and site visitors are required to comply with directions from emergency personnel and alarm system notifications and to follow instructions concerning emergency equipment, shutdown procedures, and emergency evacuation routes and exits.

D-4a(3) Notification of Local, State, and Federal Authorities

If it is determined that the facility has had a fire, an explosion, a spill, or a release of hazardous waste or hazardous waste constituents (included in 20.4.1.200 NMAC (incorporating 40 CFR § 261)) in the miscellaneous unit or TRU mixed waste handling areas, or an emergency resulting in a release of a hazardous substance (included in 40 CFR §302.4 and §302.6 or the New

[2] The yelp tone increases from 500 to 1,000 hertz and drops to 500 hertz.

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Mexico Emergency Management Act, §74-4B-3 and §74-4B-5) that could threaten human health or the environment outside the facility, the RCRA Emergency Coordinator, after consultation with the DOE as the owner of the facility, will assure that local authorities are notified by telephone and/or radio, including:

- Carlsbad Police Department (telephone number: [575] 885-2111) (or 911)
- Carlsbad Fire Department (telephone number: [575] 885-2111) (or 911)
- Eddy County Sheriff (telephone number: [575] 887-7551)
- Hobbs Fire Department (telephone number: [575] 397-9265)

After local authorities are notified, the RCRA Emergency Coordinator will ensure notification of the following:

- New Mexico Environment Department (**NMED**)
  Department of Public Safety
  24-Hour Emergency Reporting Telephone Number: (505) 827-9329
  FAX number: (505) 827-9368

- Department of Public Safety WIPP Coordinator
  Telephone Number: (505) 827-9221
  FAX number: (505) 829-3434

- Hazardous Materials Emergency Response, Chemical Safety Office, Department of Public Safety, State Emergency Response Commission
  Telephone number: (505) 476-9681
  FAX number: (505) 476-9695

- National Response Center
  Telephone number: 1-800-424-8802
  FAX number: (202) 479-7181

- Local Emergency Planning Committee
  Telephone number: (575) 885-3581
  Fax number: (575) 628-3973

The first notification of public safety and regulatory agencies will include the following:

- The name and address of the facility and the name and phone number of the reporter
- The type of incident (fire, explosion, or release)
- The date and time of the incident
- The type and quantity of material(s) involved, to the extent known
- The exact location of the incident
- The source of the incident

- The extent of injuries, if any
- Possible hazards to human health and the environment (air, soil, water, wildlife, etc.) outside the facility
- The name, address, and telephone number of the party in charge of or responsible for the facility or activity associated with the incident
- The name and the phone number of the RCRA Emergency Coordinator
- The identity of any surface and/or groundwater involved or threatened and the extent of actual and potential water pollution
- The steps being taken or proposed to contain and clean up the material involved in the incident

The RCRA Emergency Coordinator will also be available to advise the appropriate local, State, or Federal officials on whether or not local areas should be evacuated.

D-4a(4) Notification of the General Public

Immediate notification of the general public through the public safety and emergency agencies listed above will be made by, or under the direction of, the RCRA Emergency Coordinator following an evaluation to determine if local adjacent areas need to be evacuated. This evaluation will be made in consultation with the DOE who, as the owner of the facility, has management responsibility for the land withdrawal area. DOE policy is to provide accurate and timely information to the public by the most expeditious means possible concerning emergency situations at the WIPP site that may affect off-site personnel, public health and safety, and/or the environment. A DOE (**DOE**) Management representative is always on-call. This person is available by pager or telephone 24 hours a day.

A Hazards Assessment was conducted, which indicated no need for protective actions or emergency action levels, as defined by the Permittees, for the facility. Therefore, no procedures are in place for evacuation of the public. Procedures are in place for notification of the public by radio, television, and newspapers for news items which might include notification of on-site emergency situations. These procedures include a Public Affairs Coordinator in the EOC who writes and transmits press releases to the DOE office, where formal press conferences are conducted.

D-4b Identification of Hazardous Materials

The identification of hazardous wastes, hazardous waste constituents, or hazardous materials involved in a fire, an explosion, or a release to the environment is a necessary part of the assessment of an incident, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). RCRA hazardous waste and hazardous substances and materials listed in 40 CFR §302.4 and §302.6 or New Mexico Emergency Management Act, §74-4B-3 and §74-4B-5 and, involved in any release at the WIPP facility will be identified. The identification of likely hazardous materials at any location is enhanced because hazardous materials and hazardous waste are only stored or managed in specified locations throughout the WIPP facility. An attempt will be made to identify products involved by occupancy/location, container shape,

markings/color, placards/labels, United Nations/North America/Product Identification Number, on-site technical experts, or field sampling. Further, the ES&H department maintains an updated inventory of hazardous materials/substances that are brought on site, and a master MSDS listing in the Safety and Emergency Services Facility, Building 452.

Sources of information available to identify the hazardous wastes, substances, or materials involved in a fire, an explosion, or a release at the WIPP facility include operator/supervisor knowledge of their work areas, materials used, and work activities underway; the WIPP Waste Information System (**WWIS**), which identifies the location within the facility of emplaced TRU mixed waste, including emplaced derived waste; and waste manifests and other waste characterization information in the operating record. The WWIS also includes information on wastes that are in the waste handling process. Also available are MSDSs for hazardous material in the various user areas throughout the facility, waste acceptance records, and materials inventories for buildings and operating groups at the WIPP facility. Information or data from the derived waste accumulation areas, the hazardous waste staging area, satellite staging areas, and nonregulated waste accumulation areas are included.

TRU mixed waste received by the WIPP facility during the Disposal Phase will be characterized for hazardous constituents prior to receipt, and acceptable knowledge will be used to characterize derived waste prior to emplacement.

Information required for identifying TRU mixed hazardous constituents in case of an incident is readily available through the WWIS and the waste acceptance records. Waste accepted at WIPP is already known to be compatible with all materials used to respond to an emergency. All non-TRU mixed waste materials received on site, other than those listed in Table D-1, are in such small quantities that no reaction could develop which would trigger an Incident Level II or III response.

The RCRA Emergency Coordinator will have access to the WWIS through Operations, or through the Facility Shift Manager's Office.

The RCRA Emergency Coordinator has access to the inventory lists and MSDSs in the Safety and Emergency Services Facility at all times.

D-4c Assessment of the Nature and Extent of the Emergency

Once the required notifications have been made, the RCRA Emergency Coordinator will ensure that the identity, exact source, amount, and areal extent of any released materials are determined, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.56(b)). The RCRA Emergency Coordinator will determine whether the occurrence constitutes an emergency based on knowledge of the area and access to the waste identification/characterization information described in Section D-4b. An emergency will require response by only trained emergency response personnel. The RCRA Emergency Coordinator will be responsible for responding to immediate and potential hazards, using the services of trained personnel to determine: 1) the identity of hazardous wastes, hazardous waste constituents, and other hazardous materials involved in a release, as described in Section D-4b; 2) whether or not a release involved a reportable quantity of a hazardous substance; 3) the areal extent of a release; 4) the exact source of a release; and 5) the potential hazards to human health or to the environment.

After the materials involved in an emergency are identified, the specific information on the associated hazards, appropriate personal protective equipment (**PPE**), decontamination, etc., will be obtained from MSDSs and from appropriate chemical reference materials at the same location. These information sources may be accessed by the RCRA Emergency Coordinator or through several WIPP facility organizations.

The emergency assessment requires determination of hazards involving evaluation of several criteria, including:

- Exposure: magnitude of actual or potential exposure to employees, the general public, and the environment; duration of human and environmental exposure; pathways of exposure
- Toxicity: types of adverse health or environmental effects associated with exposures; the relationship between the magnitude of exposure and adverse effects
- Reactivity: hazardous materials or hazardous wastes, which are not TRU mixed wastes, involved in an incident will be assessed for reactivity through accessing the MSDSs for the affected material and the recommended method(s) for managing such waste
- Uncertainties: considerations for undeterminable or future exposures; uncertain or unknown health effects, including future health effects

D-4d Control, Containment, and Correction of the Emergency

The WIPP facility is required to control an emergency and to minimize the potential for the occurrence, recurrence, or spread of releases due to the emergency situation, as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.56 (e)). The WIPP Emergency Response procedures utilize the incident mitigation guidelines in NFPA 471, Responding to Hazardous Materials Incidents, with initial response priority being on control, and those actions necessary to ensure confinement and containment (the first line of defense) in the early, critical stages of a spill or leak. The RCRA Emergency Coordinator is responsible for stopping processes and operations when necessary, and removing or isolating containers. TRU mixed waste will remain within the WHB Unit, the Parking Area Unit, and the underground HWDU.

D-4d(1) All Emergencies

The WIPP Emergency Response procedures include, but are not limited to, the following actions appropriate for control:

1. Isolate the area from unauthorized person by fences, barricades, warning signs, or other security and site control precautions. Isolation and evacuation distances vary, depending upon the chemical/product, fire, and weather situations.
2. Identify the chemical/product according to Section D-4b.
3. Drainage controls.
4. Stabilization of physical controls (such as dikes or impoundment[s]).

5. Capping of contaminated soils to reduce migration.

6. Using chemicals and other materials to retard the spread of the release or to mitigate its effects.

7. Excavation, consolidation, removal, or disposal of contaminated soils.

8. Removal of drums, barrels, or tanks where it will reduce exposure risk during situations such as fires.

If the facility stops operations in response to a fire, explosion, or release, the RCRA Emergency Coordinator shall ensure continued monitoring for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever appropriate. If operations continue, personnel normally assigned to these tasks will continue.

Both natural and synthetic methods will be employed to limit the releases of hazardous materials so that effective recovery and treatment can be accomplished with minimum additional risk to human health or the environment. A combination of the above methods to achieve protection of human health and the environment, with emphasis on two basic methods for mitigation of hazardous materials incidents - Physical and Chemical (Tables D-4, D-5) mitigation, will be used.

1. Physical methods of control involve any of several processes to reduce the area of the spill/leak, or other release mechanism (such as fire suppression).

   A. Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume of the sorbate/sorbent system through the process of swelling. Some of the materials utilized in response to Level I incidents or Level II incidents involving liquids will be absorbent sheets of polyolefin-type fibers, spill control bucket materials (specifically for solvents, neutralization, or for acids/caustics), and absorbent socks for general liquids or oils.

   B. Covering refers to a temporary form of mitigation for radioactive incidents that will be utilized in response to Level II or Level III incidents involving CH TRU mixed waste. These could include absorbent sheets, plastic, or actual ambulance blankets.

   C. Dikes or Diversions refer to the use of physical barriers to prevent or reduce the quantity of liquid flowing into the environment. Dikes may be soil or other barriers temporarily utilized to hold back the spill or leak. Diversion refers to the methods used to physically change the direction of the flow of the liquid. Absorbent socks or earth may be utilized as dikes or diversions for all levels of incidents.

   D. Overpacking is accomplished by the use of an oversized container. Overpack containers will be compatible with the hazards of the materials involved.

   E. Plug and Patch refers to the use of compatible plugs and patches to reduce or temporarily stop the flow of materials from small holes, rips, tears, or gashes in containers. A Series "A" hazardous response kit containing nonsparking

equipment to control and plug leaks may be utilized for response to all levels of incidents.

F. Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually or by pump, from a leaking or damaged container. Scoops, shovels, jugs, and pails as well as drum transfer pumps for chemical and petroleum transfer are utilized as needed in response to all levels of incidents.

G. Vapor Suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents such as an aqueous foam blanket.

2. Chemical Methods of Mitigation

A. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. This would include using the neutralizing adsorbents.

B. Solidification is the process whereby a hazardous liquid is added to material such as an absorbent so that a solid material results.

The established procedures are based upon the incident level and a graded approach for nonradioactive or CH TRU waste emergencies and initiated to:

1. Minimize contamination or contact (through PPE, etc.)
2. Limit migration of contaminants
3. Properly dispose of contaminated materials

For RH TRU mixed waste that is not managed in shielded containers, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using appropriate measures which may include the items above.

D-4d(2) Fire

The incident level emergency response identified in Section D-3 includes fire/explosion potential. WIPP fire response includes incipient, exterior structure fires, and internal structure fires. The RCRA Emergency Coordinator can implement the Memoranda of Understanding (**MOU**) for additional support.

The first option in mine fire response will be to apply mechanical methods to stop fires (e.g., cut electrical power). The last option in mine fire response will be to reconfigure ventilation using

control doors associated with the underground ventilation system. The following actions are implemented in the event of a fire:

1. All emergency response personnel at an incident will wear appropriate PPE.

2. Only fire extinguishing materials that are compatible with the materials involved in the fire will be used to extinguish fires. Compatibility with materials involved in a fire are determined by pre-fire plans, Emergency Response Guide Book (DOT, 1993), DOT labeling, and site-specific knowledge of the emergency response personnel. Water and dry chemical materials have been determined to be compatible with all components of the TRU mixed waste. Pre-fire plans for the WHB are included in Figures D-10 and D-11.

   Fires in areas of the WHB Unit should not propagate, due to limited amount of combustibles, and the concrete and steel construction of the structures. Administrative controls, such as landlord inspections and EST/FPT inspections, help to insure good housekeeping is maintained. Combustible material and TRU mixed waste will be isolated, if possible. Firewater drain trenches collect the water and channel it into a sump. In areas not adjacent to the trenches, portable absorbent dikes (pigs) will be used to retain as much as possible, until it can be transferred to containers or sampled and analyzed for hazardous constituents.

3. If the fire spreads or increases in intensity, personnel will be directed to evacuate.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards.

5. In order to ensure that storm drains and/or sewers do not receive potentially hazardous runoff, dikes will be built around storm drains to control discharge as needed. Collected waste will be sampled and analyzed for hazardous constituents, before being discharged to evaporation ponds. There are two ponds south of the security fence, opposite the WHB Unit, that will collect drainage from the parking area. The rest of the site, inside the security fence, drains to the large pond to the west. Samples will be taken from these ponds, after the emergency has been abated, to determine any cleanup requirements. NMED will approve any procedures associated with the sampling and analysis of the ponds.

6. The RCRA Emergency Coordinator maintains overall control of the emergency and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains overall responsibility.

7. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

8. Materials involved in a fire can be identified in the following ways:

   - According to Section D-4b.

   - If the contents of the waste container cannot be determined based on its location and the label is destroyed by fire, the material will be treated as an

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unknown, evaluated for radiological contamination, and analyzed according to methods in the EPA's "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (**SW-846**), Third Edition, after the fire has been extinguished.

- Airborne radioactivity samples may be obtained during a fire involving radioactive materials, using portable and fixed air samplers. Response personnel will be adequately protected from airborne radioactivity by their PPE required for fire response.

9. Only materials compatible with the waste may be used for fire response.

10. When cleanup has proceeded to the point of finding no radionuclide activity, then the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

    - For waste containers, once radiologically clean and free of any visible evidence of hazardous waste spills on the container, it will be placed in the underground without further action.

    - For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues (for further information see Section D-4d, Emergency Termination Procedures).

11. Fire suppression materials used in response to incidents will be retained on-scene, where an evaluation will be performed to determine appropriate recovery and disposal methods.

D-4d(3) Explosion

The following actions will be implemented in the event that an explosion that involves or threatens hazardous or TRU mixed waste or hazardous materials has occurred:

1. The area will be evacuated immediately.

2. The CMRO will immediately notify the appropriate emergency response personnel and the RCRA Emergency Coordinator about the explosion.

3. Injured personnel will be treated and transported as necessary.

4. The RCRA Emergency Coordinator will remain in contact with responding personnel to advise them of the known hazards involved and the degree and location of the explosion and associated fires.

5. The RCRA Emergency Coordinator will be in command and may accept and evaluate the advice of WIPP facility personnel and emergency response organization members, but retains the overall responsibility. Selections of methods and tactics of response are the responsibility of the Incident Commander.

6. The RCRA Emergency Coordinator will be in overall control of WIPP facility emergency response efforts until the emergency is terminated.

7. When cleanup has proceeded to the point of finding no radionuclide activity, then samples may be taken for chemical analysis if there is visible evidence to suspect additional hazardous waste residues. Chemical residues on floor surfaces resulting from a hazardous waste explosion will be evaluated, sampled, analyzed (if required), isolated, and returned to appropriate containers, and surfaces will be cleaned using appropriate cleaners.

8. The RCRA Emergency Coordinator may shut down operational units (e.g., process equipment and ventilation equipment) that have been affected directly or indirectly by the explosion. Once the areas have been determined safe for reentry, processes may be reactivated.

D-4d(4) Spills

Protection of response personnel at a hazardous material incident is paramount. The primary methods to protect personnel are time, distance, and shielding. If a Level II or III incident exists, the RCRA Emergency Coordinator will implement the following actions:

1. The immediate area will be evacuated.

2. The RCRA Emergency Coordinator will review facility records to determine the identity and chemical nature of released material.

3. Entry team procedures will be utilized, with special attention to the following:

   - Buddy system
   - Appropriate PPE
   - Backup rescue team
   - Supplemental communication signals (hand signals and hand-light signals)
   - Monitoring equipment
   - Exposure time limitations

4. If possible, the source of the release will be secured.

5. A dike to contain runoff may be built.

6. Emergency responders will ensure that storm drains and/or sewers do not receive potentially hazardous runoff or spilled material. They may build dikes around storm drains to control discharge.

7. Released wastes may be collected and contained by stabilizing or neutralizing the spilled material, as appropriate, pouring an absorbent over the spilled material, and sweeping or shoveling the absorbed material into drums or other appropriate containers. The absorbents have been determined to be compatible with all components of the TRU mixed waste.

8. No TRU mixed waste that may be incompatible with the released material will be managed in the affected area until cleanup procedures are complete.

9. The RCRA Emergency Coordinator will direct spill control, decontamination, and termination procedures described below.

D-4d(5) Decontamination of Personnel

Decontamination of personnel with radioactive contamination is the responsibility of the Radiological Control (**RC**) section. If a person is contaminated with radioactivity during a site evacuation to the staging areas, the contaminated area will be covered before the person can be moved (under escort by RC personnel) to the staging area. The RC personnel will ensure the contaminated person remains segregated from other site personnel while under RC supervision.

In the event of an emergency that requires immediate evacuation of the area, the contamination can be covered by any method warranted, given the circumstance (e.g., clean clothing wrapped around the area). If the size of the radioactive contamination on the body is small and localized, it can be covered with clothing (e.g., glove, shoe cover, coveralls). If the size of the radioactive contamination on the body is large, it may be covered by dressing the individual in a full set of Anti-Contamination clothing (coveralls, hood, gloves, shoe covers, etc.).

If time and location permit and the contamination is on the face, it will be decontaminated immediately using a cloth moistened with tepid water (and a mild detergent, if necessary). If the size of the radioactive contamination on the individual's body is small and localized, it will be decontaminated using the same method as for the face, but after the individual has been transferred to an area appropriate for conducting decontamination.

If the individual is transferred to the staging area prior to decontamination, he/she will be decontaminated at the staging area using site procedures for personnel decontamination and using decontamination supplies and equipment as appropriate for the extent and magnitude of the contamination.

D-4d(6) Control of Spills or Leaking or Punctured Containers of CH and RH TRU Mixed Waste

In the event of spills or leaking or punctured containers of CH and RH TRU mixed waste, the WIPP responds to three distinct phases: 1) the event, 2) the re-entry, and 3) the recovery.

During the event, the following immediate actions are completed: 1) stop work, 2) warn others (notify CMR), 3) isolate the area, 4) minimize exposure, and 5) close off unfiltered ventilation. These actions can take place simultaneously, as long as they are completed before proceeding to the re-entry phase.

CH TRU Mixed Waste

Prior to the re-entry following an event involving containers that are managed as CH TRU mixed waste, a Radiological Work Permit (**RWP**) is written for personnel to enter with protective clothing to assess the conditions, take surveys and samples, and mitigate problems that could compound the hazards in the area (cover up spilled material with plastic material sheeting and or any approved fixatives such as paint, place equipment in a safe configuration, etc.). During the re-entry phase, smears and air sample filters are taken and counted. This information is

used by cognizant managers, RC personnel, and As Low As Reasonably Achievable (**ALARA**) Committee representatives to determine an appropriate course of action to recover the area. A plan to decontaminate and recover affected areas and equipment will be approved with a separate RWP written to establish the radiological controls required for the recovery.

During the recovery phase, the plan will be executed to utilize the necessary resources to conduct decontamination and/or overpacking operations as needed. The completion of this phase will occur prior to returning the affected area and/or equipment to normal activities. The recovery phase will include activities to minimize the spread of contamination to other areas. These activities will involve placing the waste material in another container; vacuuming the waste material; overpacking or plugging/patching the spilled, leaking, or punctured waste container; and/or decontaminating the affected area(s). If an affected surface cannot be decontaminated to releasable levels, it may be covered with a fixative coating and established as a Fixed Contamination Area to prevent spread of contamination, or it may be removed using heavy machinery and tools, packaged in approved waste containers, and emplaced in the underground. Every reasonable effort to minimize the amount of derived waste, while providing for the health and safety of personnel, will be made.

Should a breach of a CH TRU mixed waste container occur at the WIPP that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into an available overpack container (e.g., 85-gal drum, SWB, TDOP), except that TDOPs and SLB2s will be decontaminated, repaired/patched in accordance with 49 CFR §173 and §178 (e.g., 49 CFR §173.28), or returned to the generator. The decontamination of equipment and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations CH TRU mixed waste will be handled only in the areas of the WHB Unit. Therefore, it is within these same areas that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced.

Equipment used during a spill cleanup or CH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and others as needed for a given incident.

At the underground emplacement room, salt contaminated by a spill of CH TRU mixed waste would be either covered or cleaned up, depending on location, extent, and spilled material, due to potential radioactive contamination spread via the salt dust. The contaminated salt would be covered to isolate it from the workers, and the stacking of waste containers would resume or would be removed and packaged as site-derived waste using applicable site procedures for decontaminating surfaces.

The decontamination methods will initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for uncontrolled use. The free release criteria for items, equipment, and areas is < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to verify the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log.

RH TRU Mixed Waste

For RH TRU mixed waste, the detection of contamination on or damage to a RH TRU mixed waste canister or a facility canister may occur outside the Hot Cell during cask to cask transfer of the canister or during loading of the Shielded Insert in the Transfer Cell. When such contamination or damage is found, the Permittees have the option to decontaminate or return the canister to the generator/storage site or another site for remediation. In the case of a damaged facility canister, the Shielded Insert may be used as an overpack to facilitate further management. Contamination may also be detected within the Hot Cell during the unloading of the CNS 10-160B shipping cask. In this case, the Permittees may decontaminate the 55-gallon drums or return them to the generator/storage site or another site for remediation. Spills or releases that occur within the RH Complex or the underground as the result of RH TRU mixed waste handling will be mitigated by using the following measures, as appropriate:

During the re-entry phase, an evaluation of the incident, including the nature of the release, amount, location, and other appropriate factors, will be performed. A RWP will be written and approved prior to personnel entering the Hot Cell with the appropriate PPE to further assess the situation, perform surveys and take samples, and, if possible, mitigate problems that could compound the hazards in the area. Based on the results of the evaluation, a determination will be made by the RCRA Emergency Coordinator, with input from the cognizant managers, radiological control personnel, and ALARA Committee representatives whether to implement the Contingency Plan and to determine the appropriate course of action to recover from the event. An action response plan to decontaminate and recover affected areas and equipment, together with an RWP establishing the radiological controls required for the recovery will be developed and approved.

Should a breach of a RH TRU mixed waste container occur in the Hot Cell that results in removable contamination exceeding the small area "spot" decontamination levels, the affected container(s) (e.g., breached and contaminated) will be placed into a canister and processed for disposal. The decontamination of equipment, cleanup of spilled material and the overpacking of contaminated/damaged waste containers will be performed in the vicinity of the incident. For example, under normal operations RH TRU mixed waste in 55-gallon drums will be handled only in the Hot Cell. Therefore, it is within this area that decontamination and/or overpacking operations would occur. By eliminating the transport of contaminated equipment to other areas for decontamination or overpacking, the risk of spreading contamination is reduced. Contaminated materials for the cleanup and overpacking of a breached RH TRU mixed waste container may be managed as CH TRU mixed waste, depending on the surface dose rate.

Equipment used during a spill cleanup or RH TRU mixed waste overpacking operation could include: cloths, brushes, scoops, absorbents, squeegees, tape, bags, pails, slings, hand tools, and other equipment as needed for a given incident.

The decontamination methods may initially involve wiping down structures, equipment, and other containers in the area with absorbent cloths moistened with tepid water. Surveys of these structures will take place and the need to continue decontamination activities will be established. If further decontamination is required, nonhazardous decontaminating agents, such as Liquinox©, Simple Green©, Windex©, citric acid, Bartlett Strip Coat©, and high pressure CO_2 will be used to prevent generating CH TRU mixed waste.

RWPs and other administrative controls provide protective measures to help ensure that new hazardous constituents will not be added during decontamination activities.

Certain structures and/or equipment within the Hot Cell may be disassembled to facilitate decontamination or may be placed directly into a derived waste container. Items used in the spill cleanup and decontamination operations (e.g., swipes, tools, PPE, etc.) may also be placed into a derived waste container.

When decontamination of the Hot Cell is deemed by the recovery team to be complete, RC personnel will conduct one final, intensive radcon survey of the area and components in the area to release it for continued use. The free release criteria for items and equipment that will be released for uncontrolled use are < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity. Personnel will then perform hazardous material sampling after decontamination efforts are complete to confirm the removal of hazardous waste substances. After cleanup is complete, facility personnel will complete an inspection and include the details of the spill and cleanup in the log. The recovery phase must be completed before the affected area and/or equipment are returned to service.

D-4d(7) Natural Emergencies

After a natural emergency (earthquake, flood, lightning strike, etc.) that involves hazardous waste or hazardous materials, the FSM will ensure the following actions are taken:

1. Inspect containers which have not been disposed and containment for signs of leakage or damage. Inspect areas where containers are stored looking for leaking containers and for deterioration of containers and the containment system.

2. Inspect affected equipment or areas associated with hazardous waste management activities for proper operating mode in accordance with site procedures and manually check to ensure automatic and alarmed features on the units are working.

3. Inspect affected equipment or areas within the HWMUs in accordance with site procedures for damage.

4. Inspect electrical boards and overhead electrical lines for damage.

5. Check container areas for signs of leakage or damage to drums and containers.

6. Check affected buildings and fencing directly related to hazardous waste management activities for damage.

7. Conduct a general survey of the site looking for signs of land movement, etc.

8. Take any necessary corrective measures, however temporary, to rectify potential or real problems.

9. Record inspection results.

D-4d(8) Roof Fall

Roof fall is not expected to affect RH TRU mixed waste because it is emplaced in the rib of the disposal room and not subject to impact from a roof fall. The following incident description and mitigation apply to CH TRU mixed waste.

The WIPP underground is routinely evaluated for stability and safety of the underground openings. These evaluations can be as simple as the MSHA required visual checks by personnel working in the area or as extensive as the expert review of the roof support system for Room 1 Panel 1 conducted in 1991. An in-depth evaluation of all of the accessible underground is performed on an annual basis as part of the formal ground control operating plans. Weekly visual and sounding inspections are performed by the Permittees. More frequent inspections and evaluations are performed in areas where roof or ribs are in need of evaluations, based on visual observations, analysis of rock deformation data, excavation effects program data acquired from observation holes, and support system performance.

This process applies not only to the waste disposal rooms but to the entire WIPP underground. Prior to waste emplacement, stability of each room will be evaluated. This evaluation will concentrate on the age and current performance of the installed support systems (if any) and the rate of roof beam expansion based on data from installed instrumentation. The roof support system's performance and surety, to provide the support necessary for the required time will be addressed. Criteria used will include design parameters such as the amount of load, the deformation of the installed system, and the number and type of component failures observed, if any. Geotechnical criteria will include parameters such as the type and quantity of fracturing, roof beam expansion rates, and future ground performance based on a predictive model.

Should the evaluation results indicate that remedial actions are necessary prior to placement of waste, experiences at the WIPP indicate that rebolting or installing supplemental support can extend the safe life of a room for several years.

After waste emplacement commences, geomechanical monitoring will continue with monitors that are tied into a computer network program. The readings obtained will provide information needed for the roof beam stability assessment. Visual observations of the ground and the support systems will also continue in all accessible areas. Based on the experiences from the Site and Preliminary Design Validation test rooms, it has been proven that any developing instability will be detected through monitoring. Multiple measures to deal with the observed conditions can be implemented months before an event to mitigate any risk associated with a roof fall in the storage room or any affected area within the mine. At a minimum, the affected area will be isolated and withdrawn from ventilation flow. Isolation operations will utilize current available methods, materials, and equipment.

Ground control conditions which could result in a fall can be divided into two scenarios: The first consists of spalling (falling) of individual small and localized rock falling on waste containers.

By definition, they can be considered insignificant as no damage to the drums can occur. The second consists of an entire section of roof falling on multiple stacks of waste containers. Each of these scenarios is discussed below.

Spalling-of-Ground Scenario

The maximum distance between the room roof and a container of waste is 10 ft. Waste containers are designed to withstand impact loads of at least 1,000 pounds (lbs) dropped from a height of 6 ft. flat or 450 lbs dropped on a circumferential edge from a height of 4 ft. Both of which correspond to an allowable impact stress of 25,450 pounds per square inch (psi). Rocks from spalling are small and would not be of sufficient weight when striking a drum from a 10 ft vertical height to cause an impact stress of more than 25,450 psi. Taking into account the falling distance, average weight, and the typical shape of the salt rock, the conclusion is that puncturing a drum by spalling is non-credible.

Fall-of-Ground Scenario

Fall-of-ground occurs when a large section of roof beam falls onto the waste containers. As previously discussed, the possibility of this occurring in an active room is remote, due to continuous monitoring and engineered roof support systems.

The following actions have been developed and will be taken by the RCRA Emergency Coordinator should a rock fall occur in an active waste emplacement area of the repository:

Spalling-of-Ground Actions

1. Determine whether the roof conditions allow for safe entry and if the waste container or containers in question are accessible.

   The process used to determine if a roof condition of a room will allow for safe entry is the same as the ground control inspection process used for inspection of the ground conditions and roof bolt integrity. The inspection will begin at a safe and sound roof starting point and consist of visual inspections of roof bolts, roof, and rib areas for missing or damaged bolts; deformed roof bolt plates; or roof and rib cracks, fractures, or separations. If during the visual inspection suspicious roof bolts, roof, or ribs are found, then operators will proceed with sounding the area in question with a scaling bar for loose roof bolts, bad roof, or ribs (loose roof bolts will not ring when sounded). Bad roof or ribs will have a drummy, hollow, or un-solid sound when struck with the scaling bar. When this operation is performed, a safe avenue for retreat is always maintained. Also maintained is a position such that an unexpected event will not place personnel in a position where the scaling bar or material being scaled could fall on personnel. If the inspection reveals ground that cannot be safely scaled manually or with the available mining equipment, the affected area, up to and including the entire room, will be barricaded and removed from ventilation flow.

   The criteria used to determine whether a waste container is accessible is based on the location of the container, the amount of waste in the room, and the expense of

reaching the waste container safely versus the expense of abandonment of the room. For example, if the room is 95% filled and spalling-of-ground punctured a waste container at or near the exit of the room, the decision to isolate the room and move waste emplacement activities to the next room would be prudent.

2. Restrict access in ventilation flow path downstream of the incident.

3. Restrict ventilation to the affected room to ensure that there is no spread of contamination that may have been released. Survey for contamination and establish the boundaries.

4. Inspect accessible and affected containers and containment for signs of leakage or damage.

5. Cover the spill area with material such as plastic or fabric sheets or paint, in a way that would safely isolate the area.

6. Determine if the covered spill area safely allows for continued waste disposal operations or whether further cleanup is required. If further cleanup is required, provide with cleanup methods described below. Note: Cleaning may not be required since this is the permitted disposal area.

7. Inspect any affected equipment (vehicles, handling equipment, and communication and alarm equipment) for proper function.

8. Repackage spilled waste and repackage, plug, or patch breached waste containers into 55 or 85-gallon drums, SWBs, or TDOPs, depending on volume. Temporarily locate overpack waste containers in an adjacent room. Remove only those intact waste containers necessary to clear the area for decontamination.

9. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets or PVA to isolate it from the workers or removed and packaged as site derived waste in accordance with site procedures for decontaminating surfaces.

10. Manage the radioactive debris as derived waste.

11. Characterize containers of waste based on the waste containers that were damaged.

12. Replace the removed and derived waste containers into the waste stack as appropriate and update the WWIS.

13. Document activities and record results.

<u>Fall-of-Ground Actions</u>

1. Restrict access in ventilation flow path downstream of the incident.

2. Restrict the room from ventilation flow by closing bulkhead regulators.

3. Survey for radiological contamination and establish the boundary for a Radiological Buffer Area.

4. Install barricade devices to remove access.

5. At the underground emplacement room, salt contaminated by a spill of TRU mixed waste will be covered with materials such as salt, plastic or fabric sheets, or PVA to isolate it from the worker or removed and packaged as site derived waste using damp rags, hand tools, and HEPA filtered vacuums.

   The criteria used to determine whether to close the entire panel or just the affected room of waste containers would include the location of the roof fall and the stability of the unaffected roof area in the panel. Techniques to determine the stability would be the same as previously described in this section.

D-4d(9) Structural Integrity Emergencies

In the event of a WIPP facility emergency involving underground structural integrity, the situation will be handled as a natural emergency. Monitoring and inspection procedures ensure the safety and integrity of the WIPP facility underground.

D-4d(10) Emergency Termination Procedures

For the transition from emergency phase to cleanup phase, the following items will be complete:

- Emergency scene will be stable
- Release of hazardous substance will be stopped
- Reaction of hazardous substance will be controlled
- The released hazardous substance will be contained within a localized and manageable area
- The area of contamination will be adequately secure from unauthorized entry

At every incident involving hazardous materials, there is a possibility that response personnel and their equipment will become contaminated. Emergency response personnel have procedures to minimize contamination or contact, and to properly dispose of contaminated materials.

For nonemergencies and Incident Level I emergencies, the following methods of decontamination are available for personnel, environment, and/or equipment according to emergency response procedures:

- Absorption
- Adsorption
- Chemical degradation
- Dilution
- Disposal

- Isolation
- Neutralization
- Solidification

Any necessary verification of air, soil, or water samples will be directed by the RCRA Emergency Coordinator. Immediately after an emergency, the RCRA Emergency Coordinator will provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility in accordance with standard operating procedures.

For Level II and III incidents after the emergency itself is controlled and contained, the RCRA Emergency Coordinator will be responsible for the development and implementation of an incident-specific decontamination plan.

PPE will be decontaminated or disposed according to procedure before it is returned to its storage location.

As part of the facility's defense-in-depth approach, equipment will be assumed to be contaminated after each hazardous material response and a thorough check for radioactive contamination will be conducted. If contamination is found, a technically sound decontamination process will be followed. Many types of equipment are difficult to decontaminate and may have to be discarded as hazardous or derived waste. Whenever possible, pieces of equipment will be disposable or made of nonporous material.

If radioactive contamination is detected on equipment or on structures, it will be assumed that hazardous constituents may also be present. Radiological surveys to determine whether a potential release of hazardous constituents has occurred (Permit Attachment I3) will be used along with other techniques as a detection method to determine when decontamination is required. Radiological cleanup standards will be used to determine the effectiveness of decontamination efforts. To provide verification of the effectiveness of the removal of hazardous waste constituents, once a contaminated surface is demonstrated to be radiologically clean, the "swipe" can be sent for analysis for hazardous constituents. The use of these confirmation analyses is as follows:

For waste containers, the analyses become documentation of the condition of the container at the time of emplacement. These containers will be placed in the underground without further action, once the radiological contamination is removed, unless there is visible evidence of hazardous waste spills or hazardous waste on the container and this contamination is considered likely to be released prior to emplacement in the underground. In no case shall these containers contain a total liquid content equal to, or which exceeds, one volume percent of the container.

For area contamination, once the area is cleaned up and is shown to be radiologically clean, it will be sampled for the presence of hazardous waste residues. If the area is large, a sampling plan will be developed. The sampling plan will be approved by the NMED before it is implemented. If the area is small, swipes will be used. If the results of the analysis show that residual contamination remains, a decision will be made whether further cleaning will be beneficial or whether final clean up will be deferred until closure. Appropriate notations will be entered into the operating record to assure proper consideration of formerly contaminated areas at the time of closure. Furthermore,

measures such as covering, barricading, and/or placarding will be used as needed to mark areas that remain contaminated.

For all Contingency Plan emergency responses, the RCRA Emergency Coordinator will ensure, in keeping with standard operating procedures, that, in the affected area(s) of the facility:

- No waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed
- All emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use, or replaced before operations are resumed

D-4e Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the RCRA Emergency Coordinator will ensure that reasonable measures are taken so that fires, explosions, and releases do not occur, recur, or spread to TRU mixed waste or other hazardous materials at the facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.56(e) and (f)). These measures include:

- Stopping processes and operations.
- Collecting and containing released wastes and materials.
- Removing or isolating containers of waste or hazardous substances posing a threat.
- Ensuring that wastes managed during an emergency are handled, stored, or treated with due consideration for compatibility with other wastes and materials on site and with containers utilized (Section D-4h).
- Restricting personnel not needed for response activities from the scene of the incident.
- Evacuating the area.
- Curtailing nonessential activities in the area.
- Conducting preliminary inspections of adjacent facilities and equipment to assess damage.
- Overpacking and/or removing damaged containers/drums from affected areas. Damaged equipment and facilities will be repaired as appropriate.
- Constructing, monitoring, and reinforcing temporary dikes as needed.
- Maintaining fire equipment on standby at the incident site in cases where ignitable liquids have been or may be released and ensuring that all ignition sources are kept out of the area. Ignitable liquids will be segregated, contained, confined, diluted, or otherwise controlled to preclude inadvertent explosion or detonation.

No operation that has been shut down in response to the incident will be restarted until authorized by the RCRA Emergency Coordinator. Sections D-4g, Incompatible Waste, and D-4h, Post-Emergency Facility and Equipment Maintenance and Reporting, address specific issues related to decreasing the possibility of a recurrence or spread of a release, a fire, or an explosion.

After resolution of the incident, a Root Cause Analysis will be conducted to review all Level II and Level III incidents for determination of cause, and the corrective action plan to prevent recurrence.

D-4f Management and Containment of Released Material and Waste

Once initial release or spill containment has been completed, the RCRA Emergency Coordinator will ensure that recovered hazardous materials and waste are properly stored and/or disposed, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.56(g)). For spills of liquid, the perimeter of the spill will be diked with an absorbent material that is compatible with the material(s) released. Free-standing liquid will be transferred to a marked compatible container. The remaining liquid will be absorbed with an absorbent material and swept or scooped into a marked compatible container. Spill residue will be removed. Spills of dry material will be swept or shoveled into a labeled compatible recovery container. Material recovered from the spill will be transferred to clean containers or tanks or to containers or tanks that have held a compatible material. All containers will meet DOT specifications for shipping the wastes, and materials will be recovered.

Nonradioactive hazardous waste resulting from the cleanup of a fire, an explosion, or a release involving a nonradioactive hazardous waste or hazardous substance at the WIPP facility will be contained and managed as a hazardous waste until such time as the waste is disposed of, or determined to be nonhazardous, as defined in 20.4.1.200 NMAC (incorporating 40 CFR §261) Subparts C and D. In most cases, hazardous materials inventories for the various buildings and areas at the facility will allow a determination of the hazardous materials present in any cleanup of a release or of the residues from an emergency condition (The quantities of such spills are so small, it is not likely to trigger an Incident Level II or III). When necessary samples of the waste will be collected and analyzed to determine the presence of any hazardous characteristics and/or hazardous waste constituents; this information is needed to evaluate disposal options. EPA-approved sampling and analytical methods will be utilized. Hazardous wastes will be transferred to the Hazardous Waste Staging Area. The staging area is used to store hazardous waste awaiting transfer to an off-site treatment or disposal facility in accordance with applicable regulations (e.g., 20.4.1 NMAC and DOT regulations). The Hazardous Waste Staging Area for nonradioactive hazardous waste is Buildings 474A and 474B, as shown in Figure D-1. Nonradioactive hazardous wastes will be shipped off-site for disposal at a RCRA permitted disposal facility.

Under normal operations, administrative controls will be implemented to ensure that hazardous materials and incompatible materials will not be introduced to the radioactive materials area during TRU mixed waste handling operations. Examples of administrative controls include restricting the waste received in the TRU mixed waste management area(s) to TRU mixed waste properly manifested from the generator sites and ensuring that materials used in these area(s) are restricted to only those that have previously been determined to be compatible with the TRU mixed waste. The RCRA Emergency Coordinator will have access to building design information and information on specific equipment used within an area upon which to base a

determination of the compatibility of materials with the area. If necessary, the RCRA Emergency Coordinator will use EPA-600/2-80-076, "A Method for Determining the Compatibility of Hazardous Waste," (EPA, 1980) for making compatibility determinations. Waste resulting from the cleanup of a fire, explosion, or release in the miscellaneous unit, the CH TRU mixed waste handling areas, or the RH Complex will be considered derived from the received TRU mixed waste and may be treated and managed as CH TRU mixed waste depending on the surface dose rate.

In the event of a prolonged cessation of TRU mixed waste handling operations, TRU mixed waste can be placed in areas of the WHB Unit that are available for such contingencies. These areas and the TRU mixed waste containers in them would be located so that adequate aisle space would be maintained for unobstructed movement of personnel and equipment in an emergency. Permit Attachments A1 and A2 describe the HWMUs in detail, including the facility description, support structures and equipment, security, waste handling areas, ventilation, and fire protection.

The contaminated area will be decontaminated. If a release is to a permeable surface, such as soil, asphalt, concrete, or other surface, the surface material will be removed and placed in containers meeting applicable DOT requirements. Contaminated soil, asphalt, concrete, or other surface material, as well as materials used in the cleanup (e.g., rags and absorbent material) will be contained and disposed of in the same manner as dictated for the contaminant. Clean soil, new asphalt, or new concrete will be emplaced at the spill location.

If a spill occurs on an impermeable surface, the surface will be decontaminated with water and/or a detergent. In the event that the spilled material is water reactive, a compatible nonhazardous cleaning solution will be used. Contaminated wash water or cleaning solution will be transferred to an appropriate container, marked, and managed as described above for nonradioactive or radioactive liquid wastes.

In the event of a hazardous material or hazardous waste release, the RCRA Emergency Coordinator will ensure that no wastes will be received or disposed of in the affected areas until cleanup operations have been completed. This is to ensure that incompatible waste will not be present in the vicinity of the release.

Because of the restrictions which the WIPP facility places on generators, and because of control of WIPP operations, TRU mixed wastes and derived wastes will not contain any incompatible wastes. However, the areas established for the temporary holding of nonradioactive waste routinely generated at the WIPP facility is divided into bays to accommodate the management of wastes that may be incompatible. If waste is generated as the result of a spill or release of hazardous materials or nonradioactive hazardous waste, the waste generated as a result of abatement and cleanup will be evaluated to determine its compatibility with other wastes being managed in the temporary holding areas. The evaluation will be by identifying the material or waste that was spilled or released and determining its characteristics (e.g., ignitable, reactive, corrosive, or toxic). The waste generated by the abatement and cleanup activities will be stored in that part of the temporary holding area that has been established to manage wastes with which it is compatible.

For small nonemergency liquid spills (e.g., a detergent solution leaking out of the pump handle during decontamination, a spill of hydraulic fluid while servicing a vehicle), spill control procedures will be used to contain and absorb free-standing liquid. The contaminated absorbent

will be swept or shoveled into a compatible container and managed as described above. No notifications will be required, but site procedures require documentation of the incident.

D-4g Incompatible Waste

Implementation of the TSDF-WAC for the WIPP ensures that incompatible TRU mixed waste will not be shipped to the WIPP facility. Nonradioactive waste at the WIPP facility will be carefully segregated during handling and holding and will be transported within and off the facility. The RCRA Emergency Coordinator will not allow hazardous or TRU mixed waste operations to resume in a building or area in which incompatible materials have been released prior to completion of necessary post-emergency cleanup operations to remove potentially incompatible materials. In making the determination of compatibility, the RCRA Emergency Coordinator will have available the resources and information described in Section D-4b, Identification of Hazardous Materials. In addition, ES&H department personnel will be available for consultation. Finally, the RCRA Emergency Coordinator may use EPA-600/2-80-076, (EPA, 1980).

D-4h Post-Emergency Facility and Equipment Maintenance and Reporting

The RCRA Emergency Coordinator will ensure that emergency equipment that is located or used in the affected area(s) of the facility and listed in the Contingency Plan is cleaned and ready for its intended use before operations are resumed, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.56(h)(2)). Any equipment that cannot be decontaminated will be discarded as waste (e.g., hazardous, mixed, solid), as appropriate. The WIPP facility is committed to replacing any needed equipment or supplies that cannot be reused following an emergency. After the equipment has been cleaned, repaired, or replaced, a post-emergency facility and equipment inspection will be performed, and the results will be documented.

Cleaning and decontaminating equipment will be accomplished by physically removing gross or solid residue; rinsing with water or another suitable liquid, if required; and/or washing with detergent and water. Decontamination and cleaning will be conducted in a confined area, such as a wash pad or building equipped with a floor drain and sump isolated from the environment. Care will be taken to prevent wind dispersion of particles and spray. Liquid or particulate resulting from cleaning and decontamination of equipment will be placed in clean, compatible containers. Waste produced in an emergency cleanup in the TRU mixed waste handling areas is derived waste and will be emplaced in the underground derived waste emplacement area. Waste resulting from decontamination operations elsewhere in the WIPP facility will be analyzed for hazardous waste constituents and/or hazardous waste characteristics to ensure proper management.

When the WIPP facility has completed post-emergency cleanup of waste and hazardous residues from areas where waste management operations are ready to resume and the RCRA Emergency Coordinator has ensured that emergency equipment used in managing the emergency has been cleaned or replaced and is fit for service, the notifications will be made by the Permittees to the following: the EPA Region VI Administrator; the Secretary of the NMED; and any relevant local authorities. This post-emergency notification complies with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), and is the responsibility of the RCRA Emergency Coordinator.

D-4i Container Spills and Leakage

The waste received at the WIPP facility will meet stringent TSDF-WAC (e.g., no more than one percent liquid), which will minimize the possibility of waste container degradation and liquid spills. Should a spill or release occur from a container, following an initial assessment of the event, the WIPP facility will immediately take the following actions, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.52(a) and §264.171):

- Assemble the required response equipment, such as protective clothing and gear, heavy equipment, empty drums, overpack drums, and hand tools
- Transfer the released material to a container that is in good condition or overpack the leaking container into another container that is in good condition
- Once the release has been contained, determine the areal extent of migration of the release and proceed with appropriate cleanup action, such as chemical neutralization, vacuuming, or excavation

D-4j Tank Spills and Leakage

The TRU mixed waste handling areas at the WIPP facility do not include tank storage or treatment of hazardous waste, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR §264) Subpart J. At the WIPP facility, tanks are used to store water and petroleum fuels only. The petroleum tanks store diesel and unleaded gasoline.

D-4k Surface Impoundment Spills and Leakage

The WIPP facility does not manage hazardous or TRU mixed waste using a surface impoundment, as defined in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), and as regulated under 20.4.1.500 NMAC (incorporating 40 CFR, §264) Subpart K. Surface impoundment regulations are not applicable to the WIPP facility.

D-5 Emergency Equipment

A variety of equipment is available at the facility for emergency response, containment, and cleanup operations in both the HWMUs and the facility in general. This includes equipment for spill control, fire control, personnel protection, monitoring, first aid and medical attention, communications, and alarms. This equipment is immediately available to emergency response personnel. A listing of major emergency equipment available at the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.52(e)), is shown in Table D-6. Table D-7 identifies the locations where fire suppression systems are provided. Locations of the underground emergency equipment are shown in Figure D-5. The firewater-distribution system map is shown in Figure D-6. The underground fuel area fire-protection system is shown in Figure D-7.

D-6 Coordination Agreements

The Permittees have established MOUs with off-site emergency response agencies for firefighting, medical assistance, hazardous materials response, and law enforcement. In the

event that on-site response resources are unable to provide all the needed response actions during either a medical, fire, hazardous materials, or security emergency, the RCRA Emergency Coordinator will notify appropriate off-site response agencies and request assistance. Once on site, off-site emergency response agency personnel will be under the direction of the RCRA Emergency Coordinator.

The MOUs with off-site cooperating agencies are available from the Permittees. A listing and description of the MOUs with state and local agencies and mining operations in the vicinity of the WIPP facility, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.37 and §264.52(c)), are:

- An agreement among the Permittees, Intrepid Potash NM LLC, and Mosaic Potash Carlsbad Inc., provides for the mutual aid and assistance, in the form of MRTs, in the event of a mine disaster or other circumstance at either of the two facilities. This provision ensures that the WIPP MOC will have two MRTs available at all times when miners are underground.

- A memorandum of agreement between the City of Carlsbad, New Mexico, and the WIPP MOC for ambulance service assistance provides that, upon notification by the WIPP MOC, the Carlsbad Fire Department/Ambulance Service will be dispatched from Carlsbad toward the WIPP site by a designated route and will accept the transfer of patient(s) being transported by the WIPP facility ambulance at the point both ambulances meet. If the patient(s) is not transferrable, the Carlsbad Fire Department/Ambulance Service will provide equipment and personnel to the WIPP facility ambulance, as necessary.

- A MOU between the DOE and the Carlsbad Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Carlsbad Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the Lea Regional Medical Center provides for the treatment of radiologically contaminated personnel who have incurred injuries beyond the treatment capabilities at the WIPP facility. The DOE will provide transport of the patient(s) to the Lea Regional Medical Center for decontamination and medical treatment.

- A MOU between the DOE and the U.S. Department of Interior (**DOI**), represented by the Bureau of Land Management (**BLM**), Roswell District, provides for a fire-management program that will ensure a timely, well-coordinated, and cost-effective response to suppress wild fire within the withdrawal area using the WIPP incident commander for fire-management activities. The DOI will provide firefighting support if requested. In addition, the MOU provides for responsibilities concerning cultural resources, grazing, wildlife, mining, gas and oil production, realty/lands/rights-of-way, and reclamation.

- A mutual-aid firefighting agreement between the Eddy County Commission and the DOE provides for the assistance of the Otis and Joel Fire Departments (a volunteer fire district created under the Eddy County Commission and the New Mexico State Fire

Marshall's Office), including equipment and personnel, at any location within the WIPP Fire Protection Area upon request by an authorized representative of the WIPP Project. These responsibilities are reciprocal.

- A mutual-aid agreement between the City of Hobbs and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Hobbs during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A mutual-aid agreement between the City of Carlsbad and the DOE provides for mutual ambulance, medical, fire, rescue, and hazardous material response services; provides for joint annual exercises; provides for use of WIPP facility radio frequencies by the City of Carlsbad during emergencies; and provides for mutual security and law enforcement services, within the appropriate jurisdiction limits of each party.

- A MOU between the DOE and the New Mexico Department of Public Safety (**DPS**) concerning Mutual Assistance and Emergency Management applies to any actual or potential emergency or incident that: 1) involves a significant threat to employees of the Permittees or general public; 2) involves property under the control or jurisdiction of either the DOE or the State; 3) involves a threat to the environment which is reportable to an off-site agency; 4) requires the combined resources of the DOE and the state; 5) requires a resource that the DOE has which the State does not have, or a resource the State has which DOE does not have; or 6) involves any other incident for which a joint determination has been made by the DOE and the State that the provisions of this MOU will apply. The MOU provides that the DPS shall permit qualified and security cleared DOE Emergency Management members into the State EOC for the purpose of: a) coordinating communications functions; b) evaluating and maintaining communications capabilities; c) participating in exercises; d) link the State's High Frequency radio communications network with the DOE; and e) assisting the State during radioactive materials accidents that require joint operations or the use of the DOE Radiological Assistance Program team. The DOE shall permit qualified and security cleared members the State Emergency Management community into the DOE's EOCs for the purposes of coordinating communications and activities. Additional duties for each participant are specified for assistance in incidents or emergencies.

D-7 Evacuation Plan

If it becomes necessary to evacuate the WIPP facility, the assigned on-site and off-site staging areas have been established. The off-site staging areas are outside the security fence. The WIPP facility has implementation procedures for both surface and underground evacuations. Drills are performed on these procedures at the WIPP facility at least once annually. The following sections describe the evacuation plan for the WIPP facility, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.52(f)).

D-7a Surface Evacuation On-site and Off-site Staging Areas

Figure D-8 shows the surface staging areas. Personnel report to their Office Wardens at designated staging areas where accountability is conducted. If site evacuation is necessary, the

RCRA Emergency Coordinator will decide which staging areas are to be used and will advise Office Wardens of the selections. The RCRA Emergency Coordinator will communicate the locations to Office Wardens via office warden pager, radio, plectron, WIPP Security, or telephone, as appropriate. Office Wardens will direct personnel to the selected staging area outside the security fence. Personnel who are working in a contaminated area when site evacuation is announced, will assemble at specific staging areas to minimize contact with other personnel during the evacuation (Figure D-8).

Office Wardens conduct accountability of personnel assigned to their specific areas. For complete surface accountability, the Office Wardens report to their ACOW, who reports to the COW. When the COW has reports from all ACOWs, surface accountability is reported to the CMRO, who then notifies the RCRA Emergency Coordinator of the accountability.

The COW and all ACOWs communicate between themselves and the CMRO using devices (e.g., telephones, radios, pagers, the public address system, email, Internet). The Office Wardens, Assistant Office Wardens, ACOWs, and COW are notified by a public address announcement (or other devices) in accordance with emergency response procedures for evacuation or sheltering in place. At the staging areas Office Wardens report directly to their ACOW.

There are three off-site staging areas identified on Figure D-8. The RCRA Emergency Coordinator determines which staging area will be used. Security officers remain at the primary staging area gate 24 hours a day, and the vehicle trap is opened for personnel during emergency evacuations. The north gate has a single person gate and large gate which can be opened, similar to the main gates for the primary staging area. The east gate is a turnstile gate. Upon notification by the RCRA Emergency Coordinator, Security will respond, open gates, and facilitate egress for evacuation.

The on-site staging areas are identified in Figure D-8. These are used for building or area evacuations as determined by the RCRA Emergency Coordinator.

D-7b Underground Assembly Areas and Egress Hoist Stations

In the event of an underground or surface event, the RCRA Emergency Coordinator can call for underground personnel to report to assembly areas (Figure D-9). Underground personnel are also trained to immediately report to assembly areas under specific circumstances (i.e. loss of underground power or ventilation). If accountability is required, the underground will be evacuated. The Underground Controller is responsible for underground accountability by comparing the brass numbers with the brass tags signed out in the lamproom. Each assembly area contains a Mine Page Phone, miner's aid station, and evacuation maps.

In accordance with 30 CFR §57.11, the mine maintains two escapeways. These escapeways are designated as Egress Hoist Stations. When an underground evacuation is called for, all underground personnel report to the Egress Hoist Stations.

Decontamination of underground personnel will be conducted the same way as described for surface decontamination. Contaminated personnel are trained to remain segregated from other personnel until RC personnel can respond to the incident at the underground location.

D-7c Plan for Surface Evacuation

Surface evacuation notification is initiated by the RCRA Emergency Coordinator directing the CMRO to sound the surface evacuation alarm. The Office Wardens assist personnel in evacuation from their areas. Evacuation routes and instructions are posted throughout the site.

If the FSM/CMRO notifies the ERT members by a communication device (e.g., pager) to respond to an identified area, these members will not depart the site during an evacuation, but will report to the FSM for instructions and accountability. The EST/FPT notifies the COW of response members present. These personnel will not evacuate until released by the RCRA Emergency Coordinator.

D-7d Plan for Underground Evacuation

Notification for underground evacuation will be made using the underground evacuation alarm and strobe light signals.

Personnel will evacuate to the nearest egress hoist station. Primary underground evacuation routes (identified by green reflectors on the rib) will be used, if possible. Secondary underground evacuation routes (identified by red reflectors on the rib) will be used if necessary (Figure D-5). Brass tags will be collected from personnel at the hoist collar on the surface, and taken to the Underground Controller, who functions as an Office Warden. When all brass tags are accounted for, underground accountability is reported to the RCRA Emergency Coordinator.

Upon reaching the surface, personnel will report to their on-site staging area to receive further instructions.

Members of the FLIRT and the MRT who may be underground, will evacuate the underground when an underground evacuation is called for. A reentry by the MRT will be performed according to 30 CFR 49 and MSHA regulations for reentry into a mine. The two MRTs are trained in compliance with 30 CFR 49 in mine mapping, mine gases, ventilation, exploration, mine fires, rescue, and recovery.

D-7e Further Site Evacuation

In the event of an evacuation involving the need to transport employees, the following transportation will be available:

- Buses/vans—WIPP facility buses/vans will be available for evacuation of personnel. The buses/vans are stationed in the employee parking lot.

- Privately Owned Vehicles—Because many employees drive to work in their own vehicles, these vehicles may be utilized in an emergency. Personnel may be directed as to routes to be taken when leaving the facility.

These vehicles may be used to transport personnel who have been released from the site by the RCRA Emergency Coordinator.

D-8 Required Reports

The RCRA Emergency Coordinator, on behalf of the Permittees, will note in the operating record the time, date, and details of any incident that requires implementing this Contingency Plan. This notation will be in the facility log maintained by the CMRO. In compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(j)), within 15 days after the incident, the Permittees will ensure that a written report on the incident will be submitted to the EPA Region VI Administrator and to the Secretary of the NMED. The report will include:

- The name, address, and telephone number of the Owner/Operator
- The name, address, and telephone number of the facility
- The date, time, and type of incident (e.g., fire, explosion or release)
- The name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where this is applicable
- The estimated quantity and disposition of recovered material that resulted from the incident

In addition to the above report, the Permittees will ensure that the ES&H Manager, or designee, submits reports to the appropriate agencies as listed in Tables D-8 and D-9.

In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.56(i)), the Permittees will notify the Secretary of the NMED and EPA Region VI Administrator that the WIPP facility is in compliance with requirements for the cleanup of areas affected by the emergency and that emergency equipment used in the emergency response has been cleaned, repaired, or replaced and is fit for its intended use prior to the resumption of waste management operations in affected areas. The means the WIPP facility will use to meet these requirements are described in Sections D-4e, D-4f, D-4g, and D-4h.

The WIPP requires the EST/FPT to initiate the "WIPP Hazardous Materials Incident Report" if the Contingency Plan is implemented. A form is attached as Figure D-12. The form is initiated by the EST/FPT. The RCRA Emergency Coordinator, CMRO, and Environmental Compliance representatives complete their respective sections.

D-9 Location of the Contingency Plan and Plan Revision

The owner/operator of the WIPP facility will ensure that copies of this Contingency Plan are available to all emergency personnel and organizations described in Section D-2. When the Contingency Plan is revised, updated copies are manually distributed (electronically or via site mail) or hand delivered to applicable WIPP Facility emergency personnel and alternate Emergency Operations Center and Joint Information Center. In addition, the owner/operator will make copies available to the following outside agencies:

- Intrepid Potash NM LLC and Mosaic Potash Carlsbad Inc.
- Carlsbad Fire Department, Carlsbad
- Carlsbad Medical Center, Carlsbad
- Lea Regional Medical Center, Hobbs
- Otis Fire Department, Otis
- Hobbs Fire Department, Hobbs
- Joel Fire Department, Carlsbad
- BLM, Carlsbad
- New Mexico State Police

The owner/operator of the WIPP facility will ensure that this plan is reviewed annually and amended whenever:

- Applicable regulations are revised
- The RCRA Part B permit for the WIPP facility is revised in any way that would affect the Contingency Plan
- This plan fails in an emergency
- The WIPP facility design, construction, operation, maintenance, or other circumstances change in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents or change the response necessary in an emergency
- The list of RCRA Emergency Coordinators change
- The list of WIPP facility emergency equipment changes.

References

U.S. Environmental Protection Agency, "A Method for Determining the Compatibility of Hazardous Waste," EPA-600/2-80-076, 1980.

U.S. Department of Transportation, Emergency Response Guidebook, U.S. Government Printing Office, 1993.

Westinghouse Electric Corporation, 1994, "Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling," WP 02-EM1, Westinghouse Electric Corporation, Carlsbad, New Mexico.

U. S. Department of Energy, "WIPP Safety Analysis Report," DOE/WIPP-95-2065, Rev. 2

U. S. Department of Energy, "WP 12-5, WIPP Radiation Safety Manual".

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TABLES

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Table D-1
Hazardous Substances in Large Enough Quantities to Constitute a Level II Incident

Chemical Description	Building Location	Hazard Category
Ethylene Glycol Solution - 35%	Buildings 411; 412; 451; 452; 486; 463; 474C; FAC 414	Immediate (acute) Delayed (chronic)
Gasoline, Unleaded GASC0001	FAC 480	Fire Immediate (acute) Delayed (chronic)
No. 1 Diesel Fuel Oil GASC0210	U/G Fuel Station; Oil Depot U/G; FACs 480, 255.1 & 255.2; Transport Tank; Building 456	Fire Immediate (acute) Delayed (chronic)
Multiple containers of TRU Waste as described in Permit Section 3.3.1	WHB Waste Shaft U/G	Delayed (chronic)
Hazardous materials in quantities that exceed 5 times the Reportable Quantity (Per DOE O 151.1) values as defined in 40 CFR 302	It should be noted that WIPP is not expected to possess such quantities.	Fire Immediate (acute) Delayed (chronic)

Table D-2
Resource Conservation and Recovery Act Emergency Coordinators

Name	Address*	Office Phone	Personal Phone*
R. C. (Russ) Stroble (primary)[1]		234-8276 or 234-8554	
J. E. (Joseph) Bealler[2]		234-8276 or 234-8916	
M. G. (Mike) Proctor[2]		234-8276 or 234-8143	
G. L. (Gary) Kessler[2]		234-8326	
A. E. (Alvy) Williams[1] (primary)		234-8276 or 234-8216	
P. J. (Paul) Paneral[1] (primary)		234-8498	
J. R. (Joel) Howard[2]		234-8325	
M. L. (Mark) Long[1] (primary)		234-8170	
A.C (Andy) Cooper[2]		234-8197	

* NOTE: Personal information (home addresses and personal phone numbers) has been removed from informational copies of this Permit.

1 The on-duty Facility Shift Manager is the primary RCRA Emergency Coordinator pursuant to 20.4.1.500 NMAC (incorporating 40 CFR §264.52), and is designated to serve as the RCRA Emergency Coordinator.

2 The on-duty Facility Operations Engineer is the alternate RCRA Emergency Coordinator and is available as needed.

Table D-3
Planning Guide for Determining Incident Levels and Response

Incident Condition	Incident Level		
	I	II *	III *
Product identifications	Placard not required, NFPA 0 or 1 all categories, all Other Regulated Materials A, B, C, and D.	DOT placarded, NFPA 2 for any categories, PCBs without fire, EPA regulated waste. SITE SPECIFIC: Table D-1 and TRU mixed waste AND	Poison A (gas), explosive A/B, organic peroxide, flammable, solid, materials dangerous when wet, chlorine, fluorine, anhydrous ammonia, radioactive materials, NFPA 3 and 4 for any categories including special hazards, PCBs and fire including special hazards, PCBs and fire DOT inhalation hazard, EPA extremely hazardous substances, and cryogenics.
Container size	Container size does not impact this incident level.	Involves multiple packages.	Tank truck.
Fire/explosion potential	Under control.	May spread/may be explosive.	May spread/may be explosive.
Leak severity	No release or small release contained or confined with readily available resources.	Release may not be controllable without special resources.	Release may not be controllable even with special resources.
Life safety	No life-threatening situation from materials involved.	Localized area, limited evacuation area.	Localized area, limited evacuation area.
Environmental impact (Potential)	None.	Limited to incident boundaries	Contained within the Hazardous waste Management Units.
Container integrity	Not damaged.	Damaged but able to contain the contents to allow handling or transfer of product.	Damaged to such an extent that catastrophic rupture is possible.

* Contingency Plan is implemented

Table D-4
Physical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Absorption	Yes	No	Yes	No
Covering	Yes	Yes	Yes	Yes
Dikes, diversions	Yes	Yes	Yes	Yes
Overpack	Yes	Yes	Yes	Yes
Plug/patch	Yes	Yes	Yes	Yes
Transfer	Yes	Yes	Yes	Yes
Vapor suppression	Yes	Yes	No	No

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Table D-5
Chemical Methods of Mitigation

Method	Chemical		Radiological	
	Liquid	Solid	Liquid	Solid
Neutralization	Yes	Yes(1)	No	No
Solidification	Yes	No	Yes(2)	No

(1) When solid neutralizing agents are used, they will be used simultaneously with water.

(2) This method could be utilized for mitigation of firewater involving TRU-waste.

Table D-6
Emergency Equipment Maintained at the Waste Isolation Pilot Plant

Equipment	Description and Capabilities	Location
	Communications	
Building Fire Alarms	Manual pull stations and automatic devices (sprinkler system flow, and smoke and thermal detectors) trigger fire alarm; locally visible and audible; visual display and alarm in Central Monitoring Room (CMR)	Guard and Security Building, Pumphouse, Warehouse/Shops, Exhaust Filter Building, Support Building, CMR/ Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, SH Hoisthouse, Maintenance Shops, Guard Shack*, Auxiliary Warehouse, Core Storage Building, Engineering Building, Training Facility, Safety Building, Maintenance Shop, Hazardous Waste Storage (non-TRU) Area (Facility 474) *local alarms; not connected to the CMR
Underground Fire Alarms	Automatic/Manual; have priority over other paging channel signals but not override intercom channels; alarms sound in the general area of the control panel and are connected to the underground evacuation alarms; they also interface with the CMR.	Fire detection and control panel locations: Waste Shaft Underground Station, SH Shaft Underground Station, Between E-140 and E-300 in S-2180 Drift, E-O/N-1200, Fuel Station
Site-wide Evacuation Alarm	Transmitted over paging channel of the public address system, overriding its normal use; manually initiated according to procedures requiring evacuation; audible alarm produced by tone generator at 10 decibels above ambient noise level (or at least 75 decibels); flashing strobe lights; radios and/or pagers are used to notify facility personnel outside alarm range. Monthly test are performed on the PA, site notification alarms, and plectrons.	Site-wide
Vehicle Siren	Manual; oscillating; emergency services/surface response vehicles, is mechanical and electronic.	WIPP surface emergency vehicles
Public Address System	Includes intercom phones; handset stations and loudspeaker assemblies, each with own amplifiers; multichannel, one for public address and pages, and others for independent party lines.	Surface and underground
Intraplant Phones	Private automatic branch exchange; direct dial; provide communication link between surface and underground operations	Throughout surface and underground

Equipment	Description and Capabilities	Location
Mine Page Phones	Battery-operated paging system	CMR, Mine Rescue Room, EOC, lamproom, underground at S550/W30, S100/W30, S1950/E140, SH Shaft Collar and Underground Station, Waste Shaft Collar and Underground Station, FSM desk, EST Station
Emergency Pagers	Manual; , intermittent alarm signals	Issued to appropriate emergency personnel
Plectrons	Tone-alert radio receivers placed in areas not accessible by the public address system	Site-wide
Portable Radios	Two-way, portable; transmits and monitors information to/from other transmitters	Issued to individuals
Plant Base Radios	Two-way, stationary, VHF-FM; linked to Eddy County Sheriff Department, NM State Police, and Otis Fire Department), and WIPP Channels 1-18 (Communication with the Lea County Sheriff's Department, the Hobbs Fire Department, Carlsbad Medical Center and Lea Regional Hospital is available via the Eddy County dispatcher) (Site Security, Site Operations and Site Emergency, maintenance, repeater to Carlsbad). Wireless communications such as cellular phones may be used to contact the Eddy County emergency responders.	Various site locations
Mobile Phones	Provide communications link between WIPP Security and key personnel	Issued to individuals plus emergency vehicles,
	Spill Response	
SPILL-X-S Guns and Recharge Powder	Containment; (1)SPILL-X model SC-30-C(Gun) (1)SPILL-X model XC-30-S(Gun) (1)SPILL-X model SC-30-A(Gun); (1) A-Acid, 5 gallon bucket (Recharge Powder) (1)S-Solvent, 5 gallon bucket (Recharge Powder) (1)C-Caustic, 5 gallon bucket (Recharge Powder)	HAZMAT trailer
Absorbent Sheets	Containment or cleanup; (1) 3' x 100' Sheet	HAZMAT trailer
Absorbents	Grab and Go container; spill control bucket; (1) for solvents and neutralizing absorbents; 5 gallon bucket (1) for acids/caustics; 5 gallon bucket	HAZMAT trailer
Absorbent Material	Containment or cleanup; (1) 100 ft. rolled or equivalent socks "Pig" for general liquid (1) 100 ft. rolled or equivalent socks "Pig" for oil	HAZMAT trailer

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Equipment	Description and Capabilities	Location
Air Bag System	Extrication, Stabilization, Cribbing (1) bag system with tank kit and the following bag sizes: (1)12-ton, (1) 21.8-ton, (1)17-ton	Surface rescue truck
Air Chisel	Extrication (1) Capable of cutting 3/16" steel	Surface rescue truck
Drum Transfer Pumps and Drum Opener	Containment or cleanup; (1) unit for chemical transfer (1) hand operated pump for petroleum transfer (1) drum opener	HAZMAT trailer
Floor Squeegee	Containment or cleanup; (1) straight rubber blade, nonwood handle	HAZMAT trailer
Foam Concentrate	AFFF 6% (4) 5-gallon pail	Fire truck # 1
Gas Cylinder Leak Control Kit	(1)Series A Hazardous Material Response Kit; contains nonsparking equipment to control and plug leaks	HAZMAT trailer
Portable Generator	(1)Backup power; 5,000 watt; 120 or 240 volt	Surface rescue truck

Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
Medical Resources		
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
Fire Detection and Fire Suppression Equipment		
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

Equipment	Description and Capabilities	Location
Water Tanks, Hydrants	Fire suppression water supply; one 180,000-gallon capacity tank, plus a second tank with 100,000 gallon reserve	Tanks are at southwestern edge of WIPP facility; pipelines and hydrants are throughout the surface
Fire Water Pumps	Fire suppression water supply; pumps are rated at 125 pounds per square inch, 1,500 gallons per minute centrifugal pump, one with electric motor drive, the other with diesel engine; pressure maintenance pump	Pumphouse
Personal Protection Equipment		
Headlamps	Mounted on hard hat; battery operated	Each person underground
Underground Self-Rescuer Units	Short-term rebreathers; approximately 300	Each person underground
Self-Contained Self-Rescuer	At least 60 minutes of oxygen available. Approximately 400 units cached throughout the underground	Cached throughout the underground
Self-Contained Breathing Apparatus (SCBA)	Oxygen supply; 4-hour units; approximately 14 Mine Rescue Team Draeger units	Mine Rescue Training Room
Chemical and Chemical-Supported Gloves	Body protection; (12 pair) inner-cloth, (12 pair) outer-pvc, (5 pair) outer-viton	HAZMAT trailer
Suit, Acid	Body protection; (4) acid	HAZMAT trailer
Suit, Fully Encapsulated	Body protection; used with SCBAs; full outerboot; (4) Level A; (4) Level B	HAZMAT trailer
Emergency Medical Equipment		
Antishock Trousers	Shock treatment; (2) inflatable, one on each ambulance	Ambulance # 1 and # 2
Heart Monitor and Defibrillator	Heart Monitor/defibrillator	Ambulance # 1 and # 2
Oxygen	Patient care; Size D: (2) Ambulance #1 (1) Underground Ambulance (1) Health Services Size E: (1) Rescue Truck (2) Underground Ambulance Size M: (1) Ambulance #1	Ambulance # 1 and # 2, surface rescue truck

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Equipment	Description and Capabilities	Location
Resuscitators (Bag)	Disposable bag resuscitation Ambulance #1: (2) adult size (1) child size Underground Ambulance: (2) adult size	Ambulance # 1, Ambulance # 2
Splints	Immobilize limbs; (1) Adult traction splint, lower extremity, with limb-supporting slings, padded ankle hitch and traction device per ambulance. (2) Rigid splinting devices or equivalents, suitable for immobilization of upper extremities per ambulance. (2) Rigid splinting devices or equivalents, suitable for the immobilization of lower extremities. (1) Set of Airsplints: 6 assorted splints; hand/wrist, half arm, full arm, foot/ankle, half leg, and full leg per miner's aid stations.	Ambulance # 1 and # 2, Miner's Aid Stations
Stretchers	Patient transport; (2) Spine Boards, one short and one long, with nylon straps per ambulance. (also used to perform cardiopulmonary resuscitation) (2) Emergency Stretchers or scoops, or combination per ambulance (1) All-purpose multi-level ambulance stretch (gurney), with 3 safety straps and locking mechanism per ambulance. (1) Stretcher in each miner's aid station.	Various combinations in Ambulance # 1 and # 2, Miner's Aid Station
Suctions	For medical emergencies: Portable (1) Suction unit, capable of delivering at least 300 mm. HG on each ambulance.	Ambulances #1 and #2
Trauma Kits	(1) adult blood pressure cuff and stethoscope (4) soft-roller bandages (3) triangular bandages (1) pkg. band-aids (2) trauma dressings (25) 4X4 sponges (1) roll adhesive tape (1) bite stick (1) penlight (1) sterile burn sheet (1) oropharyngeal airway (1) glucose substance (2) sterile gauze dressings	(1) kit in each: Ambulances #1 and #2, surface rescue truck

Equipment	Description and Capabilities	Location
Miner's Aid Station	For First Aid Stations in the Underground (1) Stretcher--as referenced above per station (1) Set of airsplints--as referenced above per station (1) Blanket per station (1) Box of latex gloves (50) per station (5) Pathogen Wipes per station (1) First Aid Kit (24) per station; includes, (3) Band-Aid Combo Paks (2) Swabs, PVP (1) Antibiotic Ointment (1) Sting-Kill Swab (2) Dressing, compresses (2) Roller Bandages (2) Tape (2) Triangle Bandage (1) Eyedressing Pak (1) Burn Dressing (1) Ammonia Inhalants (1) User Log Sheet	Miner's Aid Stations - Various Underground Locations
First Aid Supplies	According to General Order #35 (12) bandages, soft roller, self-adhering type--4" or 6" x 5 yards. (6) triangular bandages, 40" (1) box band-aids (1) 1 pair bandage shears (6) Trauma dressings, 30" x 10" (6) Trauma dressings, 5" x 7" (50) 4" x 4" sponges, individually wrapped and sterile (2) rolls adhesive tape (1) penlight (2) sterile burn sheets (2) oropharyngeal airways -- adult (2) oropharyngeal airways -- child (Ambulance #1 only) (2) oropharyngeal airways -- infant (Ambulance #1 only) (1) Glucose substance (3) Occlusive dressings (1) Roll aluminum foil (6) Rigid cervical collars--2 each small, medium and large sizes (4) Cold packs (4) Heat packs (2) Bite sticks	Ambulance #1
First Aid Supplies	(2) Transfer sheets (2) Blankets	Ambulances #1 and #2

Equipment	Description and Capabilities	Location
First Aid Supplies	(2) #16g angiosets (2) #18g angiosets (2) #20g angiosets (1) 1000cc LR IV fluid (1) 500cc NS IV fluid	Ambulances #1 and #2, surface rescue truck
General Plant Emergency Equipment		
Emergency Lighting	For employee rescue and evacuation, and fire/spill containment; linked to main power supply, and selectively linked to back up diesel power supply and/or battery-backed power supply	Surface and underground
Backup Power Sources	Two diesel generators, and battery-powered uninterruptible power supply (UPS); use limited to essential loads; manual or remote starting 1,100-kilowatt diesel generators with on-site fuel for 62% load for 3 days for selected loads; 30-minute battery capacity for essential loads	Generators are east of Safety and Emergency Services Building; UPS is located at the essential loads
Hoists	Hoists in Waste Shaft, Air Intake Shaft, and SH Shaft	Waste Shaft, Air Intake Shaft, SH Shaft
Radiation Monitoring Equipment	(5) Portable alpha and beta survey meters, portable air samplers, and portable continuous air monitors	Building 412
Emergency Shower	For emergency flushing of chemical contact or injury	Surface
Eye Wash Fountains	For emergency flushing of affected eyes	Various locations on surface and in the underground
Decon Shower Equipment	Self-contained decon shower trailer, portable decon shower unit	Surface
Overpack containers	14-85 Gallon drums 4-SWBs 1-TDOP	Building 481 Building 481 Building 481
HEPA Vacuums	2 HEPA Vacuums to be utilized for removal of contamination.	Building 481
Aquaset or Cement	100 lbs. of aquaset or cement material for solidification of liquid waste generated as a result of fire fighting water or decontamination solutions.	Building 481
Paint or Fixative	1 - 5 gallon bucket of approved fixative to be used during recovery.	Building 481
TDOP Upender	Upender facilitates overpacking standard waste boxes	Building 481
Non hazardous Decontaminating Agents	4-1 Gallon bottles for decontamination of surfaces, equipment, and personnel	Building 481

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Table D-7
Types of Fire Suppression Systems by Location

Location	AS	AD	MPS	PFE
Waste Handling Building	*		*	*
Support Building	*		*	*
Exhaust Filter Building	*		*	*
Water Pumphouse	*		*	*
Underground Support Areas (also has rescue truck) (as illustrated in Figure D-5)		*	*	*
Station A Effluent Monitoring Shed			*	*
Station B Effluent Monitoring Shed			*	*

(1) Symbols for WIPP fire-protection systems:

AS = Automatic Wet Pipe Sprinkler System
AD = Automatic Dry Chemical Extinguishing System
MPS = Manual Pull Stations
PFE = Portable Fire Extinguishers

(2) The Waste Handling Building and the Support Building contain the following:

- Automatic wet pipe sprinklers
- Fire detection in the heating, ventilation, and air conditioning instrumentation (Support Building, only)
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Safety and Emergency Services Building contains the following:

- Automatic wet pipe sprinklers
- Manual pull stations
- Portable fire extinguishers
- Automatic detectors

The Core Storage Building contains the following:

- Automatic wet pipe sprinklers
- Portable fire extinguishers

(3) The Exhaust Filter Building, Underground Facilities, Warehouse/Shops Building, Water Pumphouse, and Salt Handling Hoist house also have portable fire extinguishers, manual pull stations, and automatic detectors.

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Table D-8
Hazardous Release Reporting, Federal

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA) (40 CFR Part 302)	"Reportable quantities" of CERCLA/SARA "hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Chemical identification; 2) what hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g., evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA). EPA may request a written report.
Emergency Planning and Community Right-to-Know Act (SARA Title III) (40 CFR Parts 302 and 355)	SARA Title III "extremely hazardous substances."	National Response Center: (800) 424-8802, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581.	1) Chemical identification; 2) what extremely hazardous substance; 3) quantity released; 4) time, location and duration of release; 5) media of release; 6) health risks and medical advice; 7) proper precautions (e.g. evacuation); and 8) name and phone number of reporter and facility.	As soon as practicable, update of oral notice and response action taken. Send report to: New Mexico State Emergency Response Commission, Department of Public Safety, Title III Bureau, P.O. Box 1628, Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220. National Response Center will contact the U.S. Environmental Protection Agency (EPA) for an address if a written report is requested by EPA.
Resource Conservation and Recovery Act (RCRA), 40 CFR §§264.56(a) and 265.56(a)	Any imminent or actual emergency situation.	State or local agencies with designated response roles, if their help is needed: Carlsbad Police Department: 885-2111; Carlsbad Fire Department: 885-2111; Eddy County Sheriff: 887-7551.	What assistance is required.	Not Applicable (NA)

Statute	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
RCRA, 40 CFR §§264.56(d), 264.56(i), 265.56(d), and 265.56(i)	RCRA "hazardous waste" release, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802 and State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response).	(1) Name and telephone number of reporter; (2) name and telephone number of facility; (3) time and type of incident; (4) name and quantity of materials involved; (5) extent of injuries, if any; and (6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: (1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and (2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
RCRA, 40 CFR §§264.56(i), 264.56(j), 265.56(i), and 265.56(j)	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	NA	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g. fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

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Table D-9
Hazardous Release Reporting, State of New Mexico

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
20.4.1.500 and 600 NMAC	RCRA "hazardous waste" releases, fire, or explosion, which could threaten human health or environment outside the facility.	National Response Center: (800) 424-8802; State Emergency Response Commission and (505) 476-9620 (New Mexico State Police, Hazardous Materials Emergency Response)	1) Name and telephone number of reporter; 2) name and telephone number of facility; 3) time and type of incident; 4) name and quantity of material involved; 5) extent of injuries, if any; and 6) possible health or environmental hazards outside the facility.	Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored, or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.
20.4.1.500 and .600 NMAC	Any incident which triggers implementation of Contingency Plan.	New Mexico Environment Department, Emergency Response Office, 24-hour telephone: (505) 827-9329 (emergencies); for non-emergencies contact (866) 428-6535 (24 hour voice mail) or Monday to Friday, 8 am to 5 pm: (505) 476-6000.	1) Name and telephone number of reporter; 2) name and address of facility; 3) name and quantity of materials involved, to extent known; 4) extent of injuries, if any; and 5) possible hazards to human health or the environment, outside the facility.	Within 15 days: 1) name, address and telephone number of owner/operator; 2) name, address and telephone number of facility; 3) date, time and type of incident (e.g., fire, explosion); 4) name and quantity of materials involved; 5) extent of injuries, if any; 6) possible hazards to human health or the environment; and 7) estimated quantity of material that resulted from the incident. Prior to resumption of operations, notify that: 1) no waste that may be incompatible with released material is treated, stored or disposed of until cleanup is complete, and 2) all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use. Send to Secretary, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Emergency Management Act, Section 74-4B-5	Any accident (spill) involving hazardous materials (including hazardous substances, radioactive substances, or a combination thereof) which may endanger human health or the environment.	New Mexico Environment Department: (505) 827-9329, State Emergency Response Commission: (505) 476-9681 (New Mexico State Police, Hazardous Materials Emergency Response), and Local Emergency Planning Committee: (575) 885-3581	1) Name, address and telephone number of owner or operator; 2) name, address and telephone number of facility; 3) date, time and type of incident; 4) name and quantity of material(s) involved; 5) extent of any injuries; 6) assessment of actual or potential threat to environment or human health; and 7) estimated quantity and disposition of recovered material.	Written submission within one week of time permittees become aware of discharge. Same as oral and description of noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence. Send reports to New Mexico Environment Department, Chief, Ground Water Quality Bureau, P.O. Box 26110, Santa Fe, New Mexico, 87502, New Mexico State Emergency Response Commission Department of Public Safety, Title III Bureau, P.O. Box 1628 Santa Fe, New Mexico, 87504-1628, and Local Emergency Planning Committee, 324 S. Canyon Street, Suite B, Carlsbad, New Mexico 88220.
New Mexico Water Quality Control Commission, Part 1, Section 203	Any discharge from any facility of oil or any other water contaminant in such quantities as may, with reasonable probability, injure or be detrimental to human health, animal or plant life, or property.	Chief, Ground Water Quality Bureau, New Mexico Environment Department, or his counterpart in any constituent agency delegated responsibility for enforcement of the rules as to any facility subject to such delegation (505) 827-2918.	Within 24 hours: 1) the name, address, and telephone number of the person or persons in charge of the facility; 2) the name, address, and telephone number of the owner/operator of the facility; 3) the date, time, location, and duration of the discharge; 4) the source and cause of the discharge; 5) a description of the discharge, including its chemical composition; and 6) the estimated volume of discharge, and immediate damage from the discharge.	Submit within seven days: verification of the prior oral notification, also provide any appropriate additions or corrections to the information contained in the prior oral notification. Within 15 days: submit a written report describing any corrective actions taken and/or to be taken relative to the discharge. Send reports to Chief, Ground Water Quality Bureau, New Mexico Environment Department, P.O. Box 26110, Santa Fe, New Mexico, 87502.

Regulations	Chemical Releases Covered	To Whom Report Will Be Made	What Will Be Reported	
			Immediately (Oral)	Subsequently (Written)
New Mexico Underground Storage Tank Regulations-2	Any known or suspected release from an Underground Storage Tank (UST) system, any spill or any other emergency situation.	New Mexico Environment Department Petroleum Storage Tank Bureau (505) 984-1741.	Within 24 hours: 1) the name, address, and telephone number of the agent in charge of the site at which the UST system is located, as well as the owner/operator of the system; 2) the name and address of the site and the location of the UST system on that site; 3) the date, time, location, and duration of the spill, release, or suspected release; 4) the source and cause of the spill, release, or suspected release; 5) a description of the spill, release, or suspected release, including its chemical composition; 6) the estimated volume of the spill, release, or suspected release; and 7) action taken to mitigate immediate damage from the spill, release, or suspected release.	Mail or deliver within seven days of the incident, a written notice describing the spill, release, or suspected release and any investigation or follow-up action taken or to be taken. Send reports to Petroleum Storage Tank Bureau, New Mexico Environment Department, 2044 Galisteo Street, Santa Fe, New Mexico, 87504.

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FIGURES

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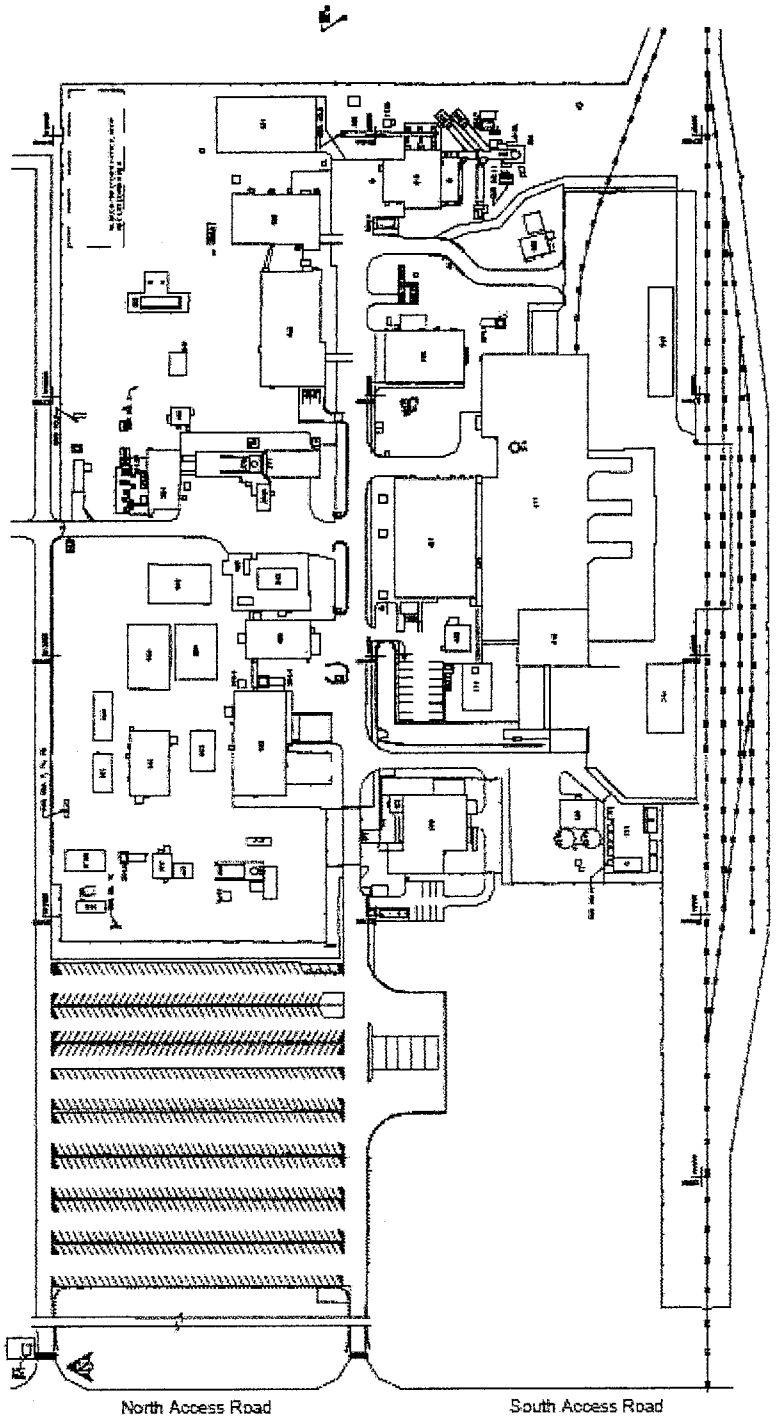

Figure D-1
WIPP Surface Structures

BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION	BLDG./ FAC.#	DESCRIPTION
#241	EQUIPMENT SHED	#384	SALT HANDLING SHAFT HOISTHOUSE	#475	GATEHOUSE
#242	GUARDSHACK	#384A	MINING OPERATIONS	#480	VEHICLE FUEL STATION
#243	SALT HAULING TRUCKS SHELTER	#411	WASTE HANDLING BUILDING	#481	WAREHOUSE ANNEX
#245	TRUPACT TRAILER SHELTER	#412	TRUPACT MAINTENANCE BUILDING	#482	EXHAUST SHAFT HOIST EQUIP. WAREHOUSE
#246	MgO STORAGE SHELTER	#413	EXHAUST SHAFT FILTER BUILDING	#485	SULLAIR COMPRESSOR BUILDING
#253	13.8 KV SWITCHGEAR 25p-SWG15/1	#413A	MONITORING STATION A	#486	ENGINEERING BUILDING
#254.1	AREA SUBSTATION NO. 1 25P-SW15.1	#413B	MONITORING STATION B	#489	TRAINING BUILDING
#254.2	AREA SUBSTATION NO. 2 25P-SW15.2	#414	WATER CHILLER FACILITY & BLDG	#H-16	SANDIA TEST WELL
#254.3	AREA SUBSTATION NO. 3 25P-SW15.3	#451	SUPPORT BUILDING	#917	AIS MONITORING
#254.4	AREA SUBSTATION NO. 4 25P-SW15.4	#452	SAFETY & EMERGENCY SERVICES FACILITY	#918	VOC TRAILER
#254.5	AREA SUBSTATION NO. 5 25P-SW15.5	#453	WAREHOUSE/SHOPS BUILDING	#918A	VOC AIR MONITORING STATION
#254.6	AREA SUBSTATION NO. 6 25P-SW15.6	#455	AUXILIARY WAREHOUSE BUILDING	#918B	VOC LAB TRAILER
#254.7	AREA SUBSTATION NO. 7 25P-SW15.7	#456	WATER PUMPHOUSE	#950	WORK CONTROL TRAILER
#254.8	AREA SUBSTATION NO. 8 25P-SW15.8	#457N	WATER TANK 25-D-001B	#951	PROCUREMENT/PURCHASING
#254.9	480V SWITCHGEAR (25P-SWGO4/9)	#457S	WATER TANK 25-D-001A	#952	TRAILER
#255.1	BACK-UP DIESEL GENERATOR #1 25-PE 503	#458	GUARD AND SECURITY BUILDING	#953	MODULAR OFFICE COMPLEX
#255.2	BACK-UP DIESEL GENERATOR #2 25-PE 504	#459	CORE STORAGE BUILDING	#971	HUMAN RESOURCES TRAILER
#256.4	SWITCHBOARD #4 (25P-SBD04/4)	#463	COMPRESSOR BUILDING	#956	PUBLICATIONS & PROCEDURES TRAILER
#311	WASTE SHAFT	#465	AUXILIARY AIR INTAKE	SWR NO. 6	SWITCHRACK NO. 6
#351	EXHAUST SHAFT	#466	TELEPHONE HUT	SWR NO. 7	SWITCHRACK NO. 7, 7A, 7B
#361	AIR INTAKE SHAFT	#473	ARMORY BUILDING	SWR NO. 7C	SWITCHRACK NO. 7C
#362	AIR INTAKE SHAFT/HOIST HOUSE	#474	HAZARDOUS WASTE STORAGE FACILITY	SWR NO. 10	SWITCHRACK NO. 10
#363	AIR INTAKE SHAFT/WINCH HOUSE	#474A	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 11	SWITCHRACK NO. 11
#364	EFFLUENT MONITORING INSTRUMENT SHED A	#474B	HAZARDOUS WASTE STORAGE BUILDING	SWR NO. 12	SWITCHRACK NO. 12
#365	EFFLUENT MONITORING INSTRUMENT SHED B	#474C	OIL & GREASE STORAGE BUILDING	SWR NO. 15	SWITCHRACK NO. 15
#366	AIR INTAKE SHAFT HEADFRAME	#474D	GAS BOTTLE STORAGE BUILDING		
#371	SALT HANDLING SHAFT	#474E	HAZARD MATERIAL STORAGE BUILDING		
#372	SALT HANDLING SHAFT HEADFRAME	#474F	WASTE OIL RETAINER		

Figure D-1a
Legend to Figure D-1

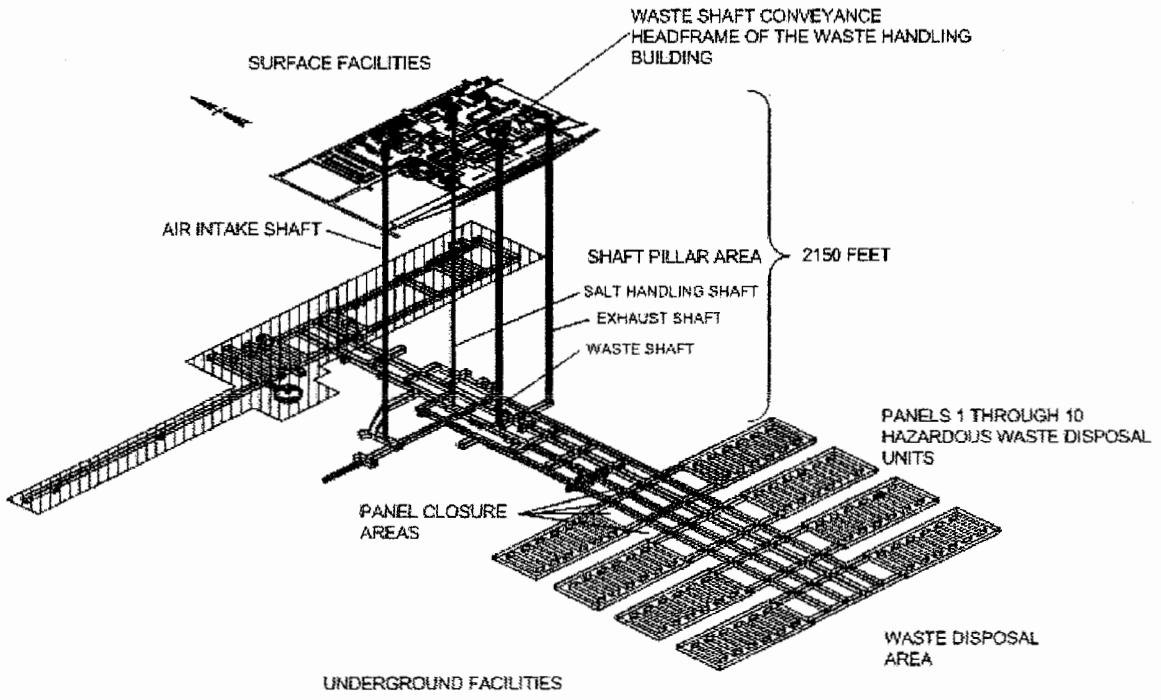

Figure D-2
Spatial View of the WIPP Facility

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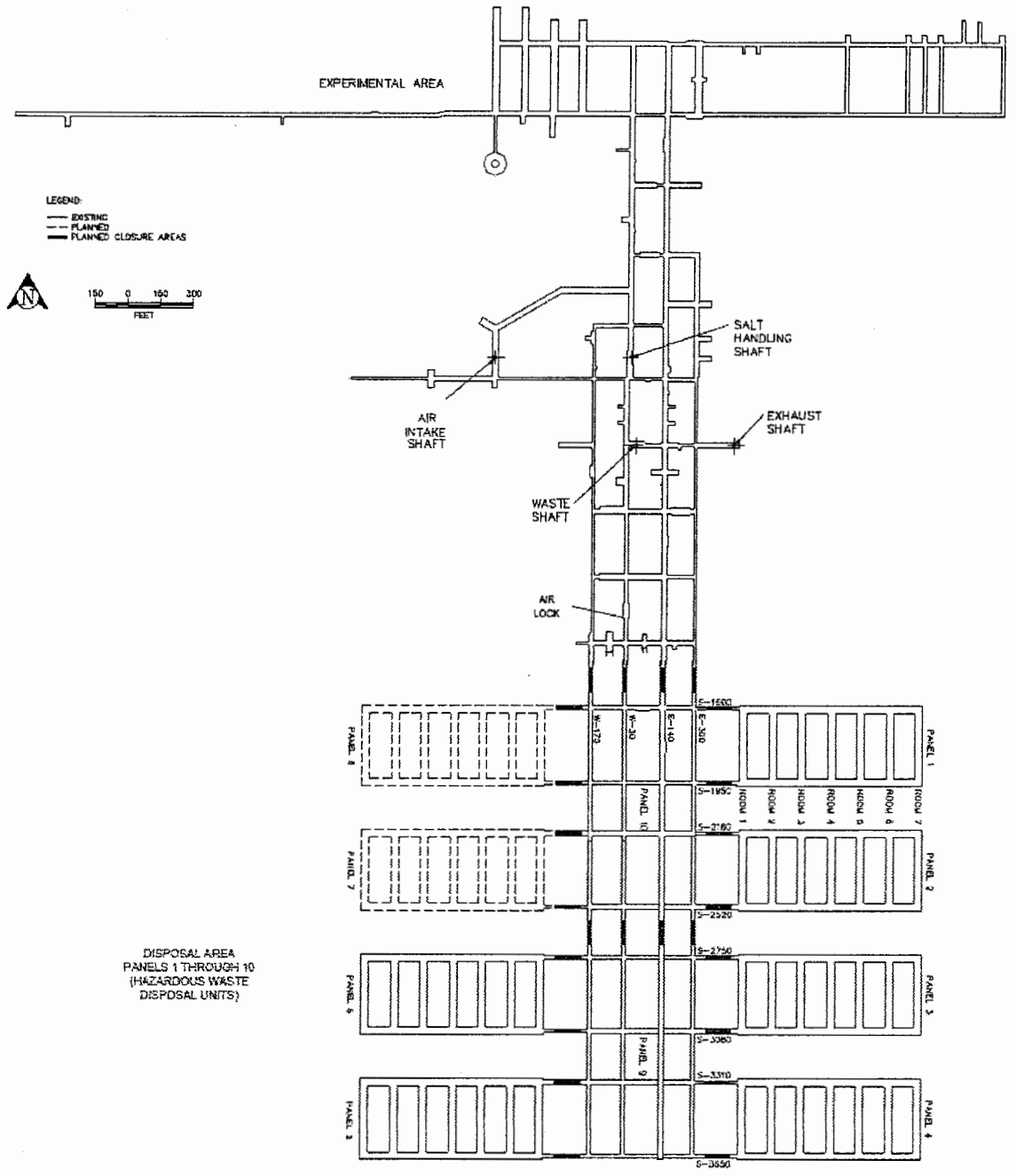

Figure D-3
WIPP Underground Facilities

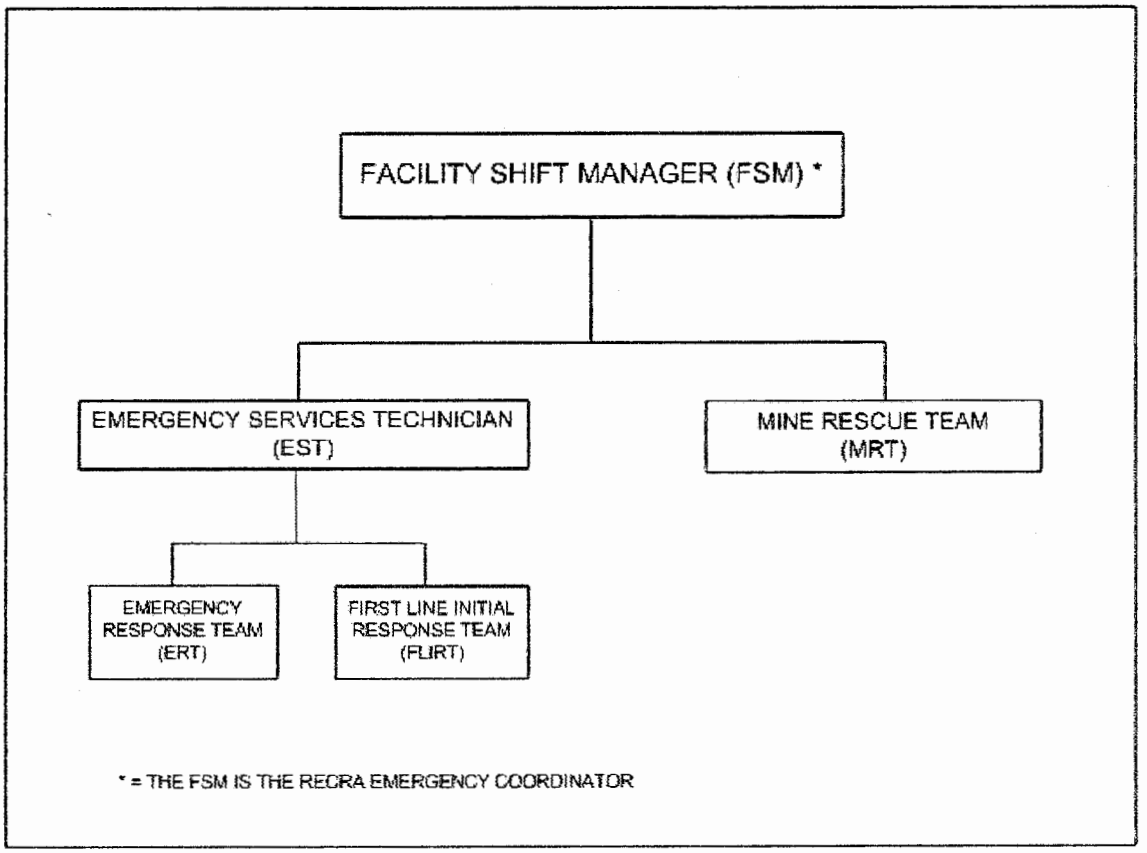

Figure D-4
Direction and Control Under Emergency Conditions in Which the Plan Has Been Implemented

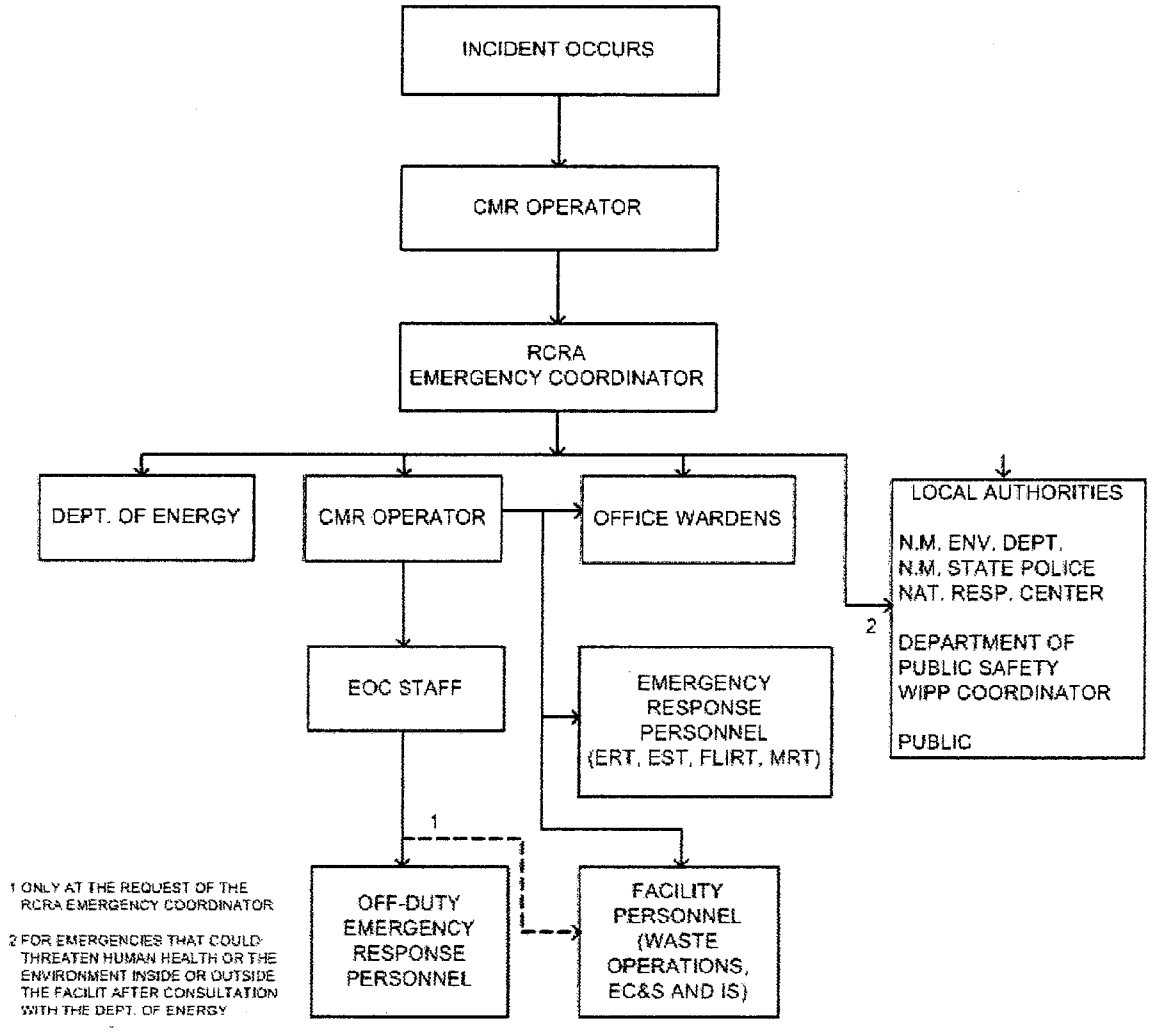

Figure D-4a
WIPP Facility Emergency Notifications

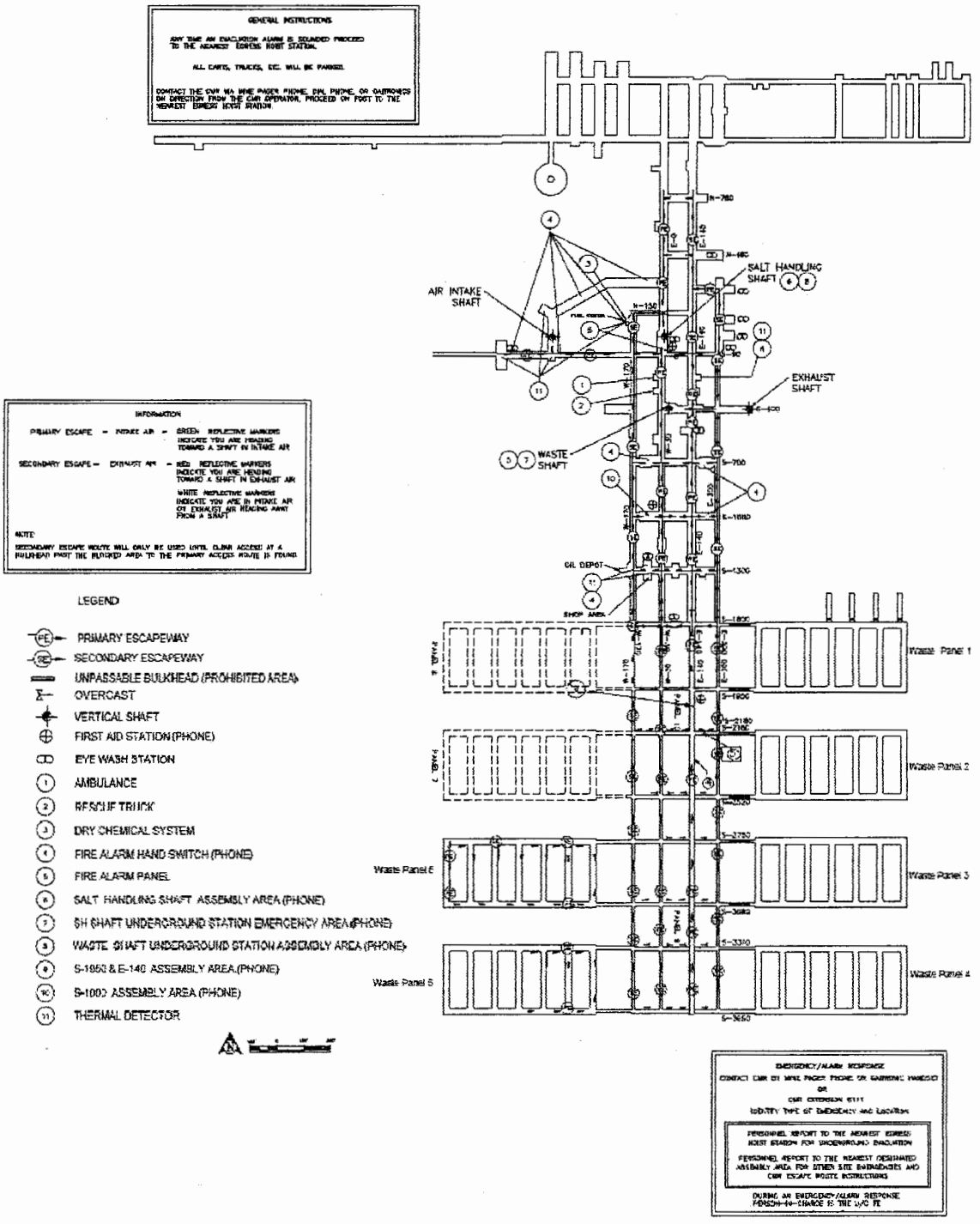

Figure D-5
Underground Emergency Equipment Locations and Underground Evacuation Routes

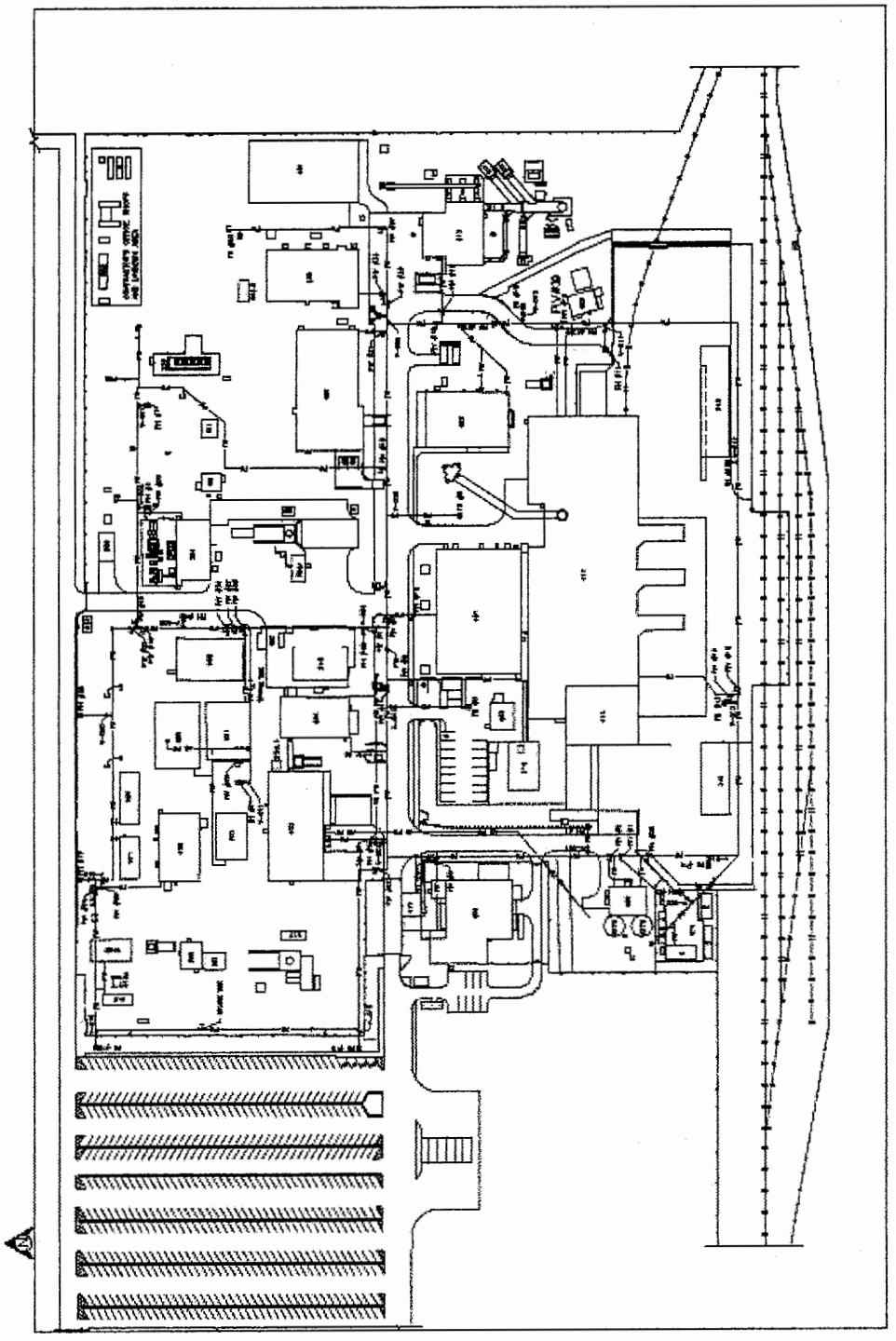

Figure D-6
Fire-Water Distribution System

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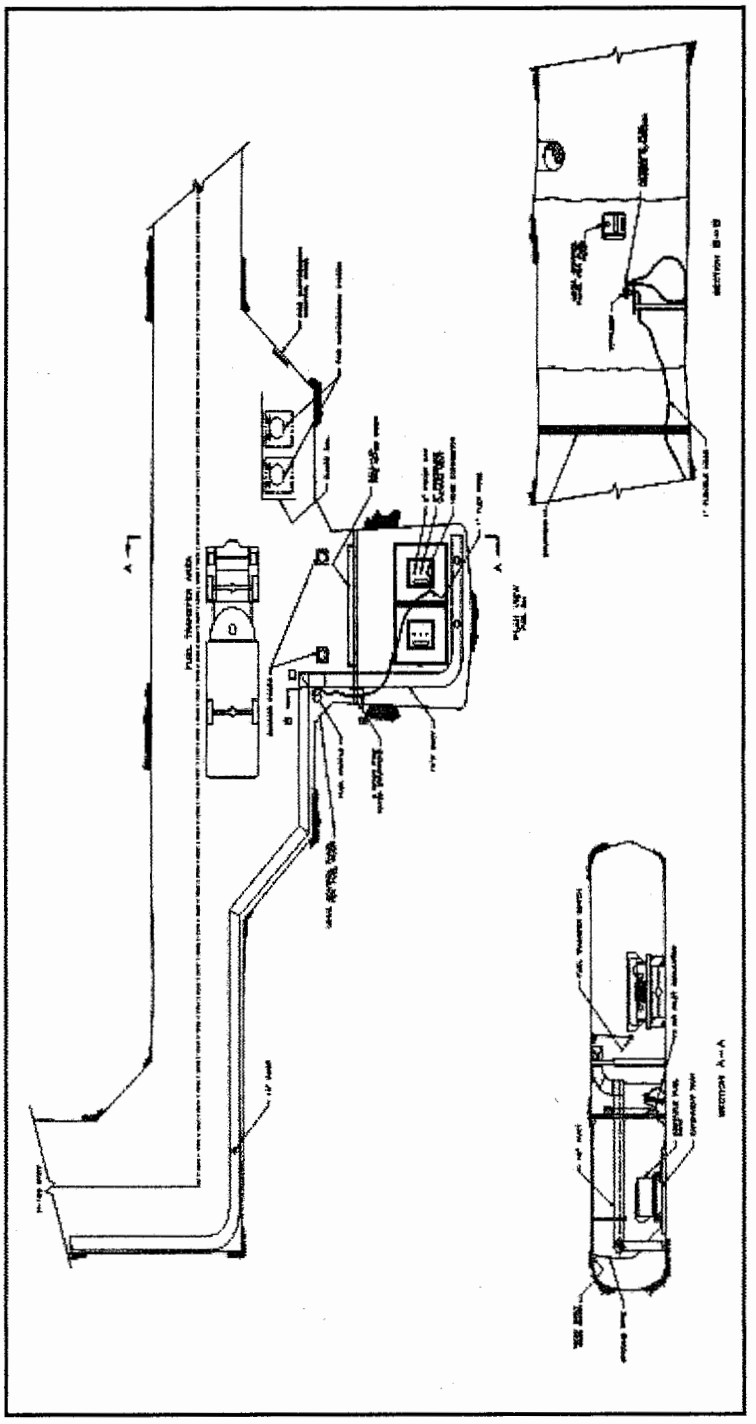

Figure D-7
Underground Diesel Fuel-Station Area Fire-Protection System

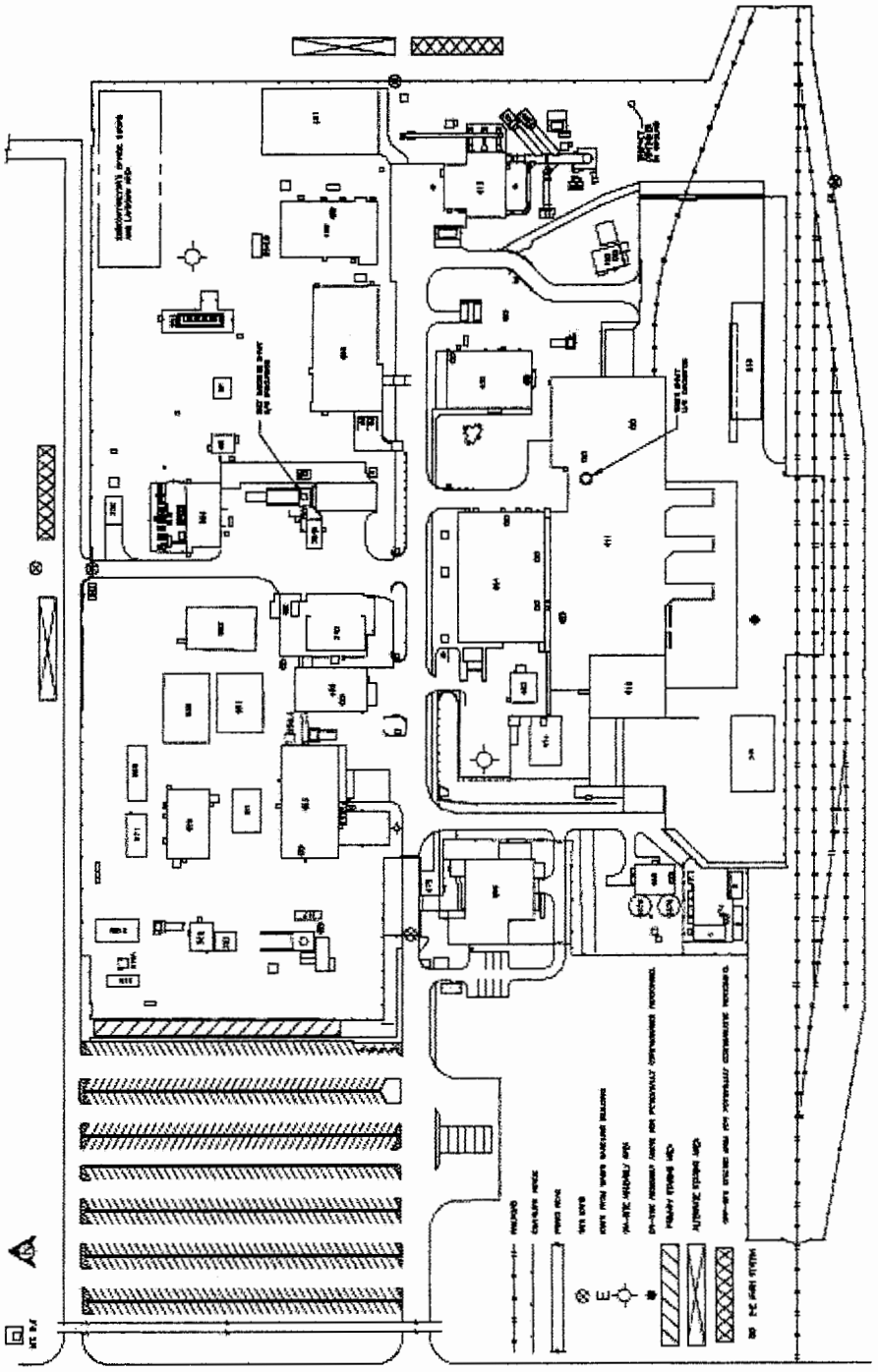

Figure D-8
WIPP On-Site Assembly Areas and WIPP Staging Areas

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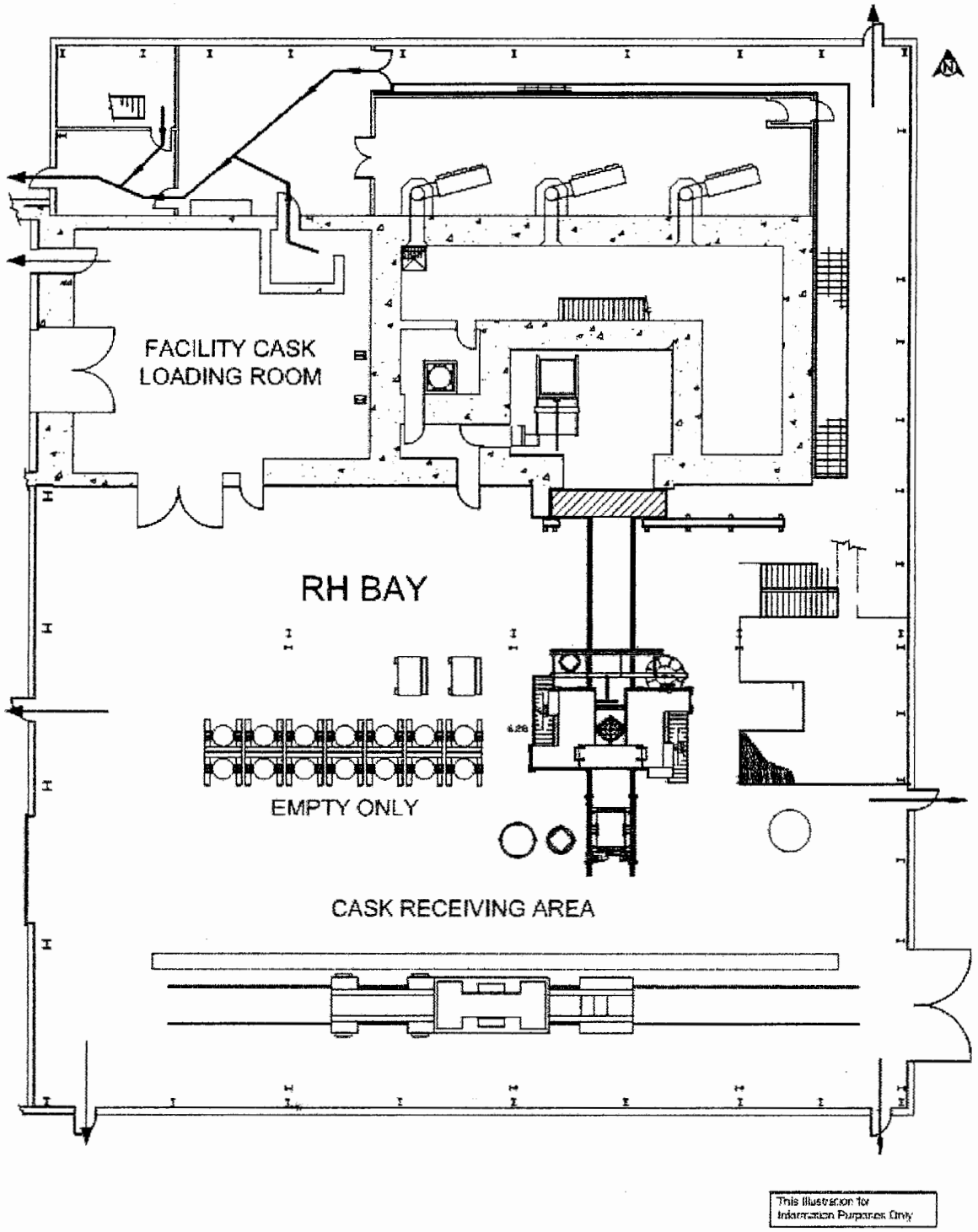

Figure D-8a
RH Bay Evacuation Routes

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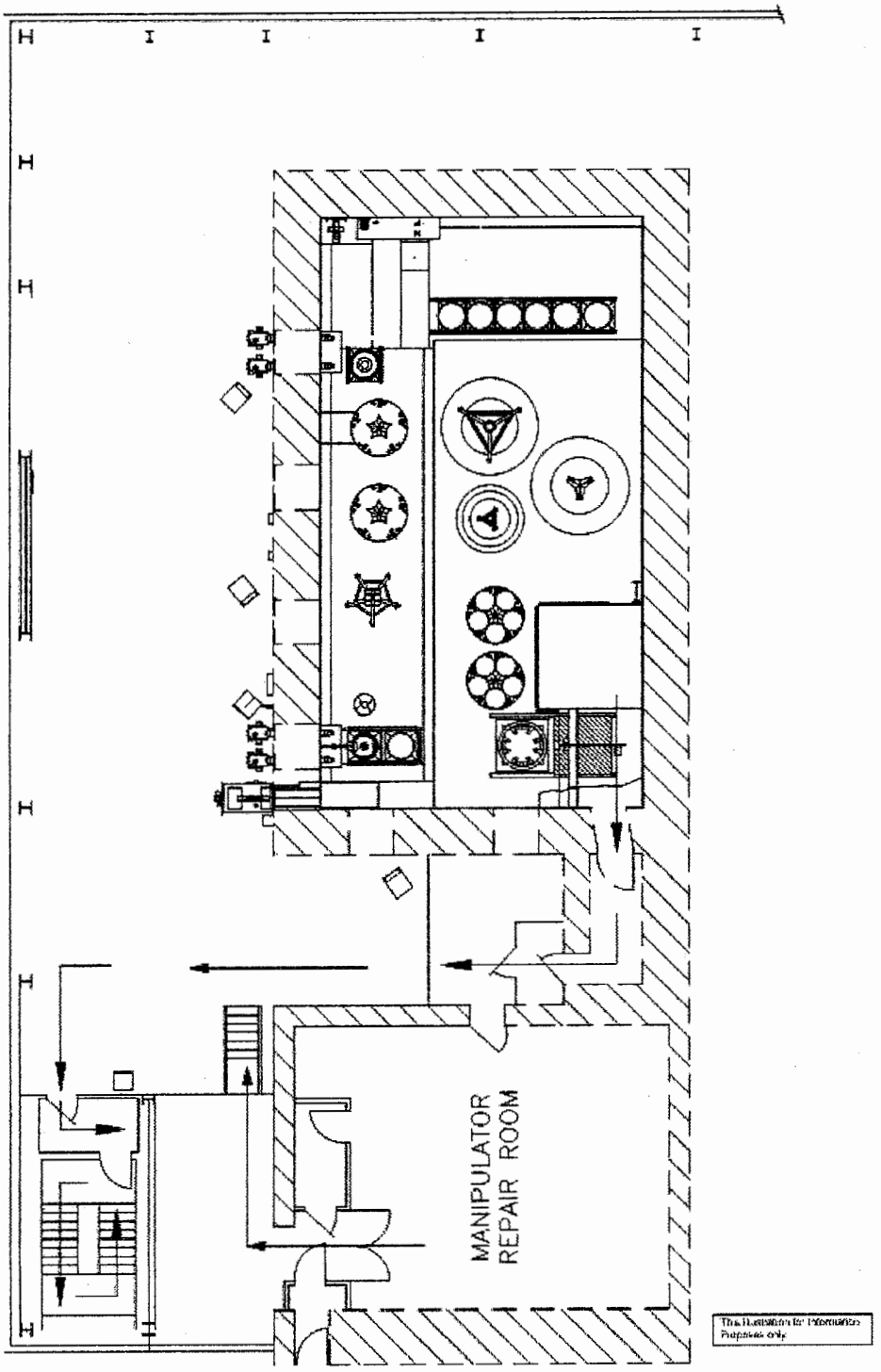

Figure D-8b
RH Bay Hot Cell Evacuation Route

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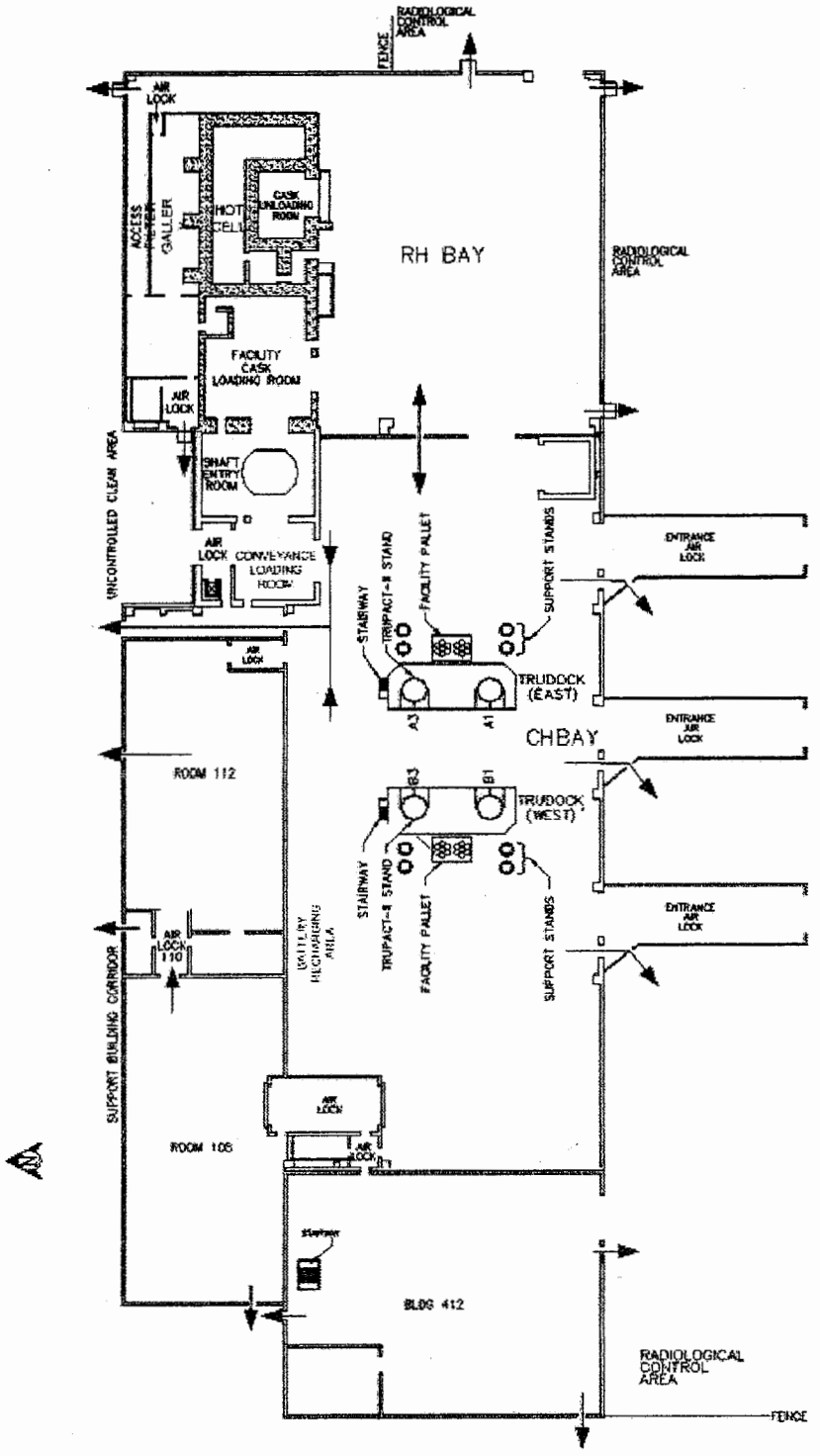

Figure D-8c
Evacuation Routes in the Waste Handling Building

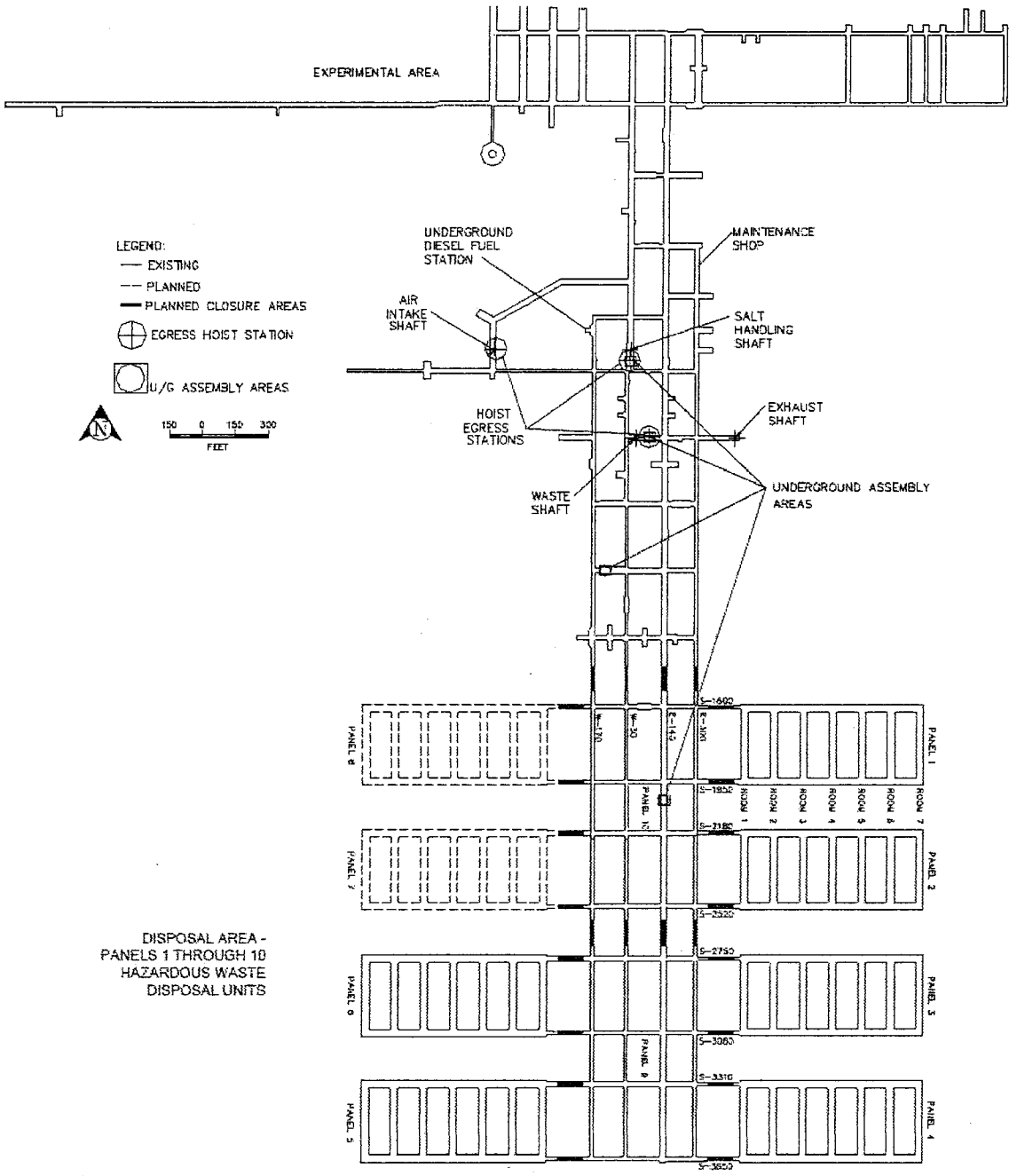

Figure D-9
Designated Underground Assembly Areas

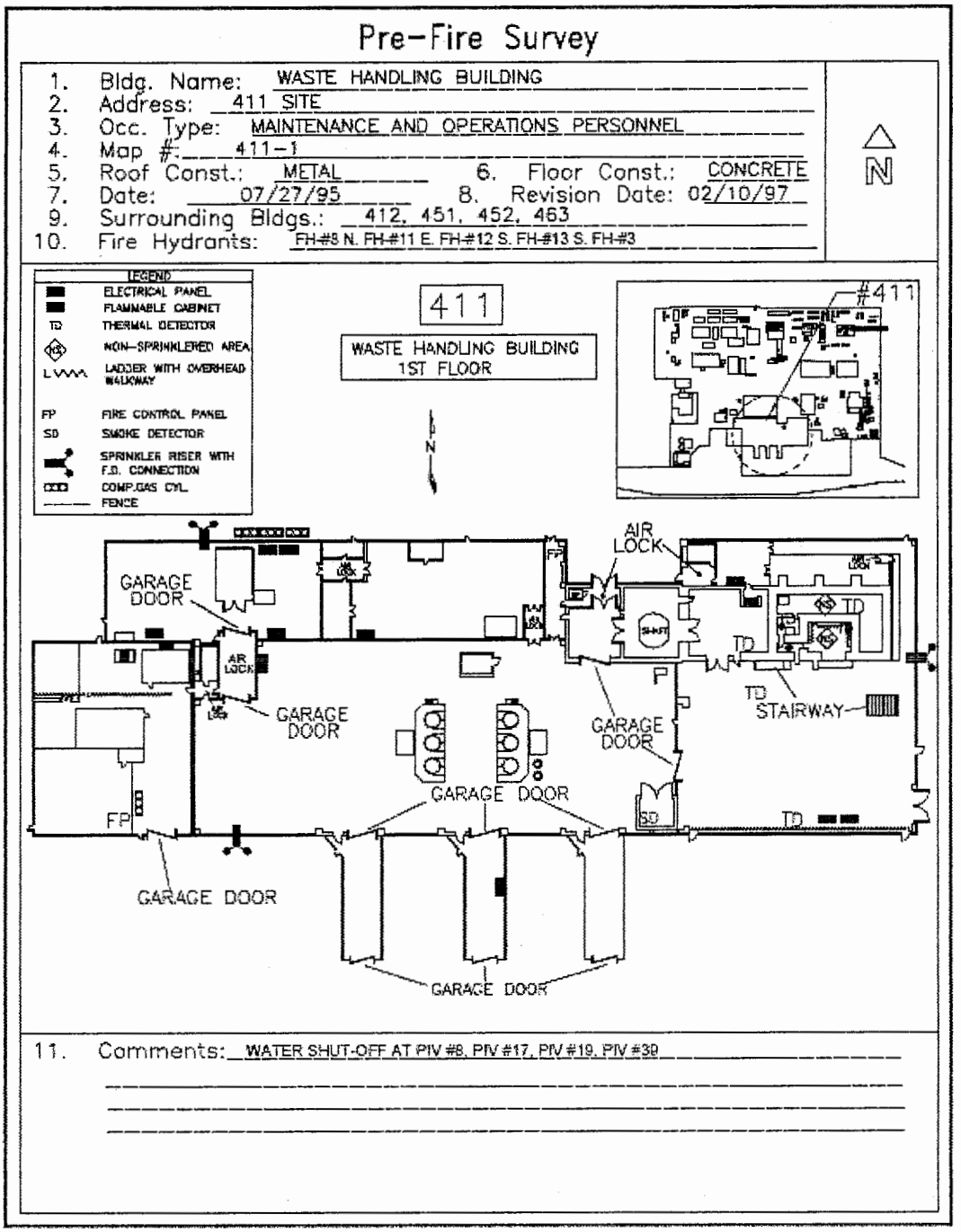

Figure D-10
Waste Handling Building Pre-Fire Survey (First Floor)

Pre-Fire Survey Cont.

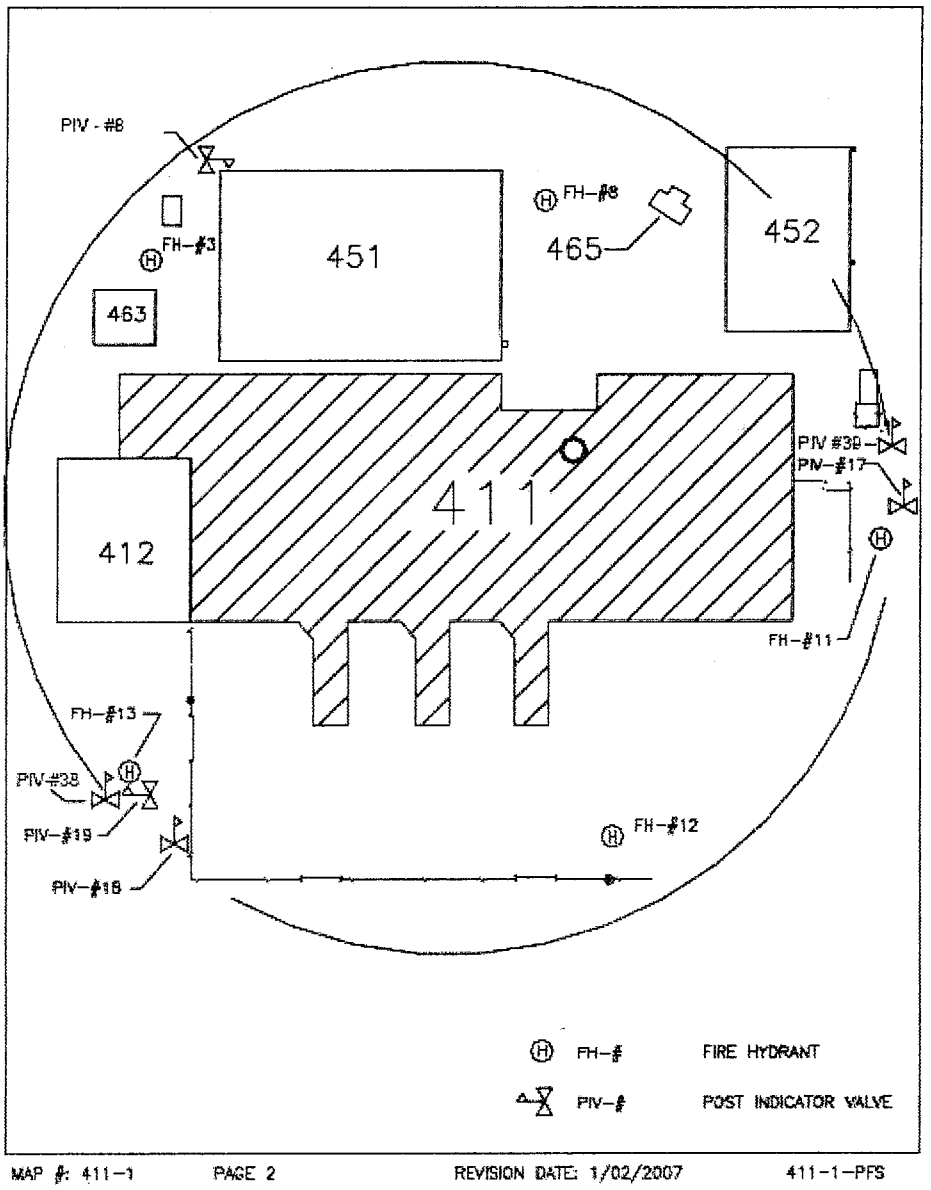

Figure D-10a
Waste Handling Building Pre-Fire Survey
(First Floor - Fire Hydrant/Post Indicator Location)

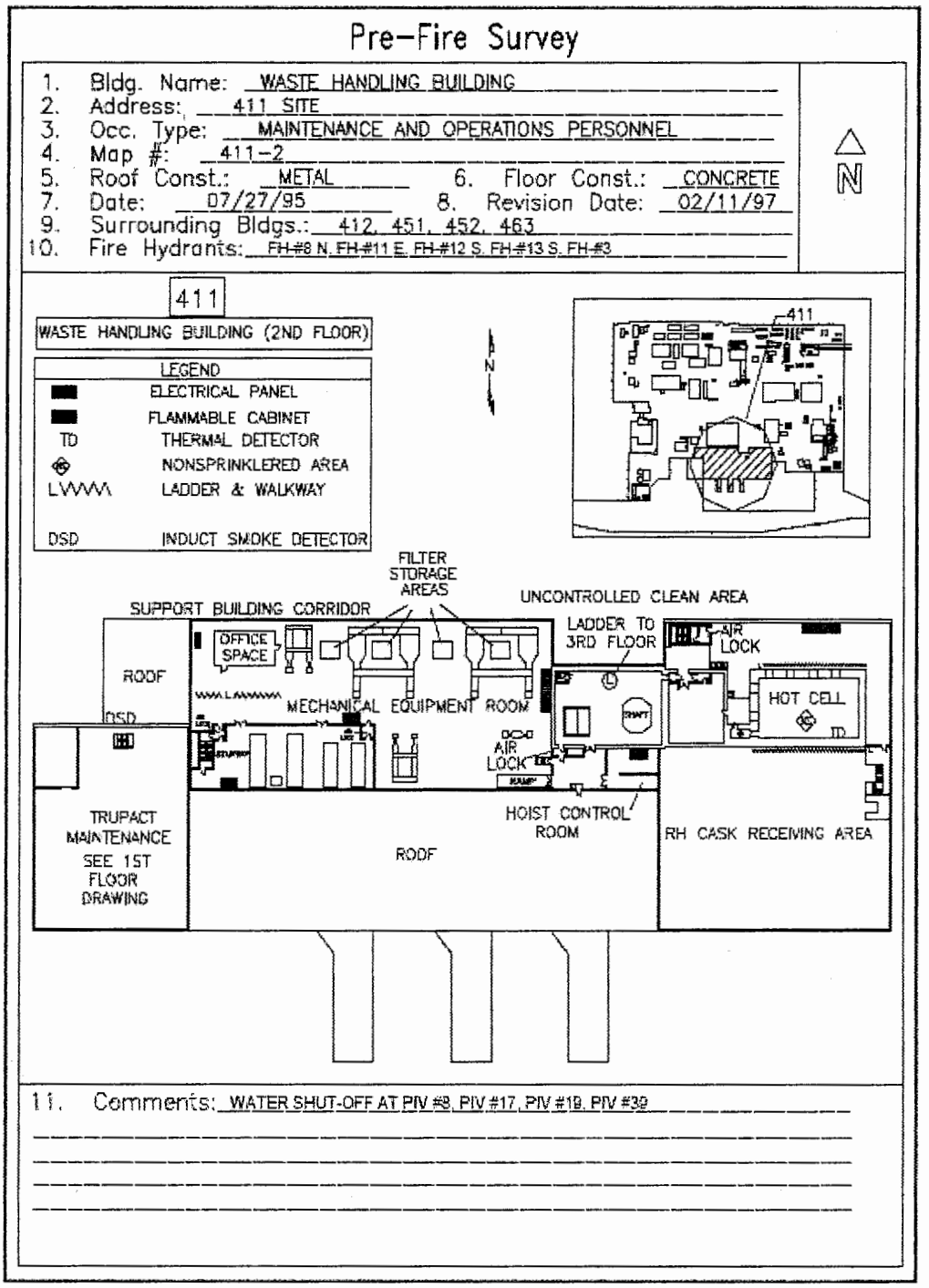

Figure D-11
Waste Handling Building Pre-Fire Survey (Second Floor)

Pre-Fire Survey Cont.

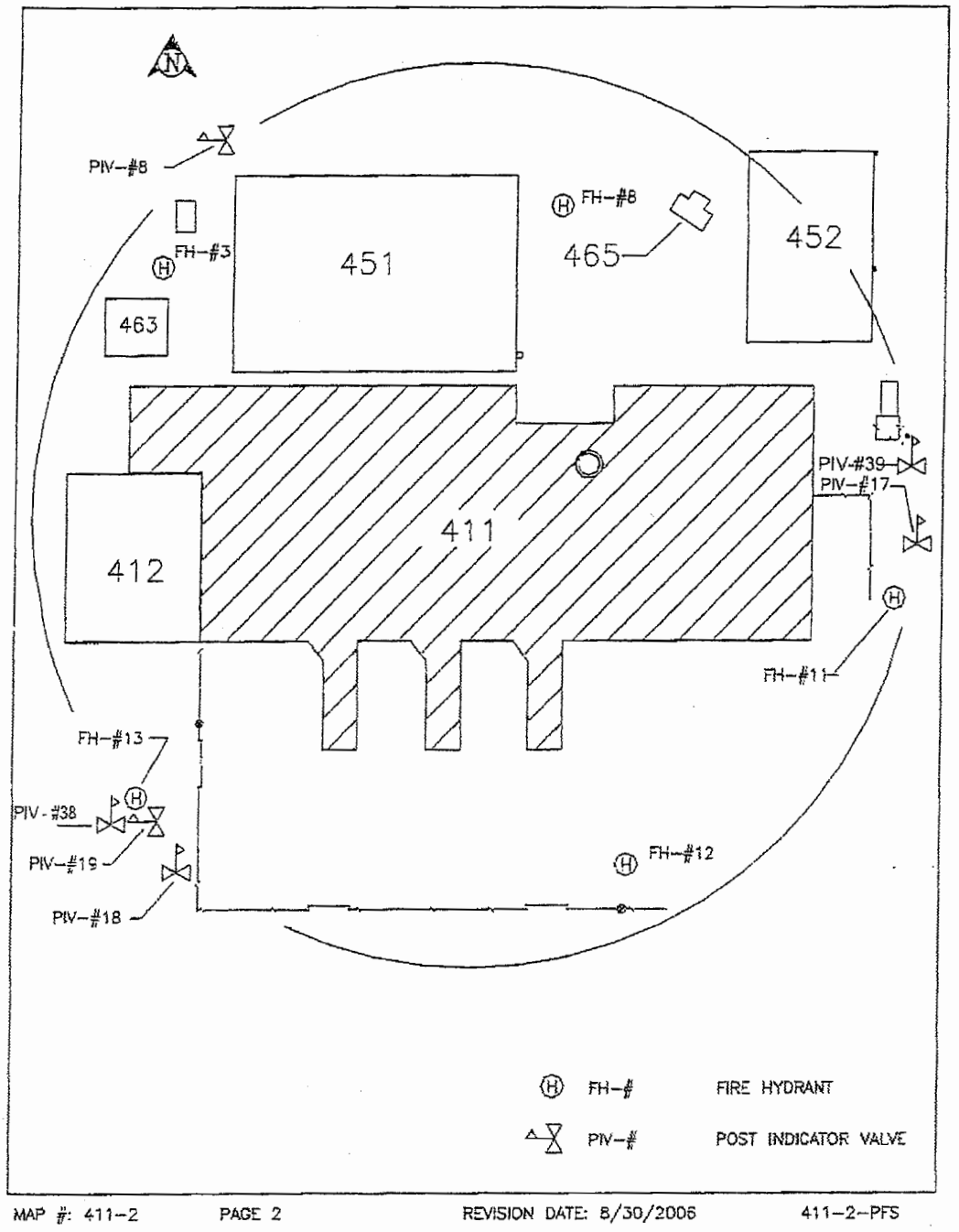

Figure D-11a
Waste Handling Building Pre-Fire Survey
(Second Floor - Fire Hydrant/Post Indicator Location)

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

I. INITIAL INFORMATION DATE:_____ TIME:_____
EST:_____ REPORTED LOCATION:_____
REPORTED BY:_____ DEPT.:_____
INITIALLY REPORTED TO:_____ DEPT.:_____
RESPONSIBLE MANAGER:_____ DEPT.:_____

II. WEATHER CONDITIONS WIND DIRECTION_____ WIND SPEED:_____mph TEMP.:_____F
CONDITIONS (i.e.., icy, snowing, raining, cloudy, sunny):_____

III. TYPE OF INCIDENT (SPILL, LEAK, ETC.):_____ Fire involved: [ ]YES [ ]NO
(If fire is involved attach a copy of the fire report)

MATERIALS INVOLVED	UN/NA NO.	QUANTITY	HAZARD CLASS	NFPA CLASS

IV. PERSONNEL INVOLVED IN CLEAN-UP ACTIVITIES

PERSONNEL/DEPT	DECON METHOD/MEDICAL TREATMENT

V. PERSONNEL CONTAMINATED NOT INVOLVED IN THE CLEANUP ACTIVITIES

PERSONNEL/DEPT.	MATERIAL CONTACTED	DECON/MEDICAL TREATMENT

Figure D-12
WIPP Hazardous Materials Incident Report, Page 1 of 3

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

VI. EQUIPMENT USED FOR CLEAN-UP AND CONTROL MEASURES

EQUIPMENT/MATERIAL/PPE	QUANTITY	DISPOSITION (decon or replacement)

VII. DESCRIPTION OF INCIDENT AND RESPONSE (including containment and control)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

VIII. ENVIRONMENTAL COMPLIANCE

Date:_____ Time:_____of evaluation.

Waste Category_____

Disposition_____

ORGANIZATION	DATE	TIME

EC Representative:_____
Print name Signature Date

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 2 of 3

WIPP HAZARDOUS MATERIAL INCIDENT REPORT

Date:_____ Location:_____

IX. INITIAL NOTIFICATION BY CMRO

DEPARTMENT	PERSON CONTACTED	TIME	NOTIFIED BY
Facility Ops (FSM)			
Emerg. Mgmt (EST)			
EC			
Industrial Safety			
Facility Ops. (FM/FMD)			

CMRO:_____
Print name Signature Date

FSM:_____
Print name Signature Date

X. CONTINGENCY PLAN IMPLEMENTATION

Contingency Plan implemented [ ]YES [ ]NO

FSM:_____
Print name Signature Date

XI. REVIEWS

Report submitted by:_____
Print name Signature Date

Emergency Management Manger:_____
Print name Signature Date

EC Manager:_____
Print name Signature Date

COMMENTS:_____

Figure D-12 (Continued)
WIPP Hazardous Materials Incident Report, Page 3 of 3

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DRAWINGS

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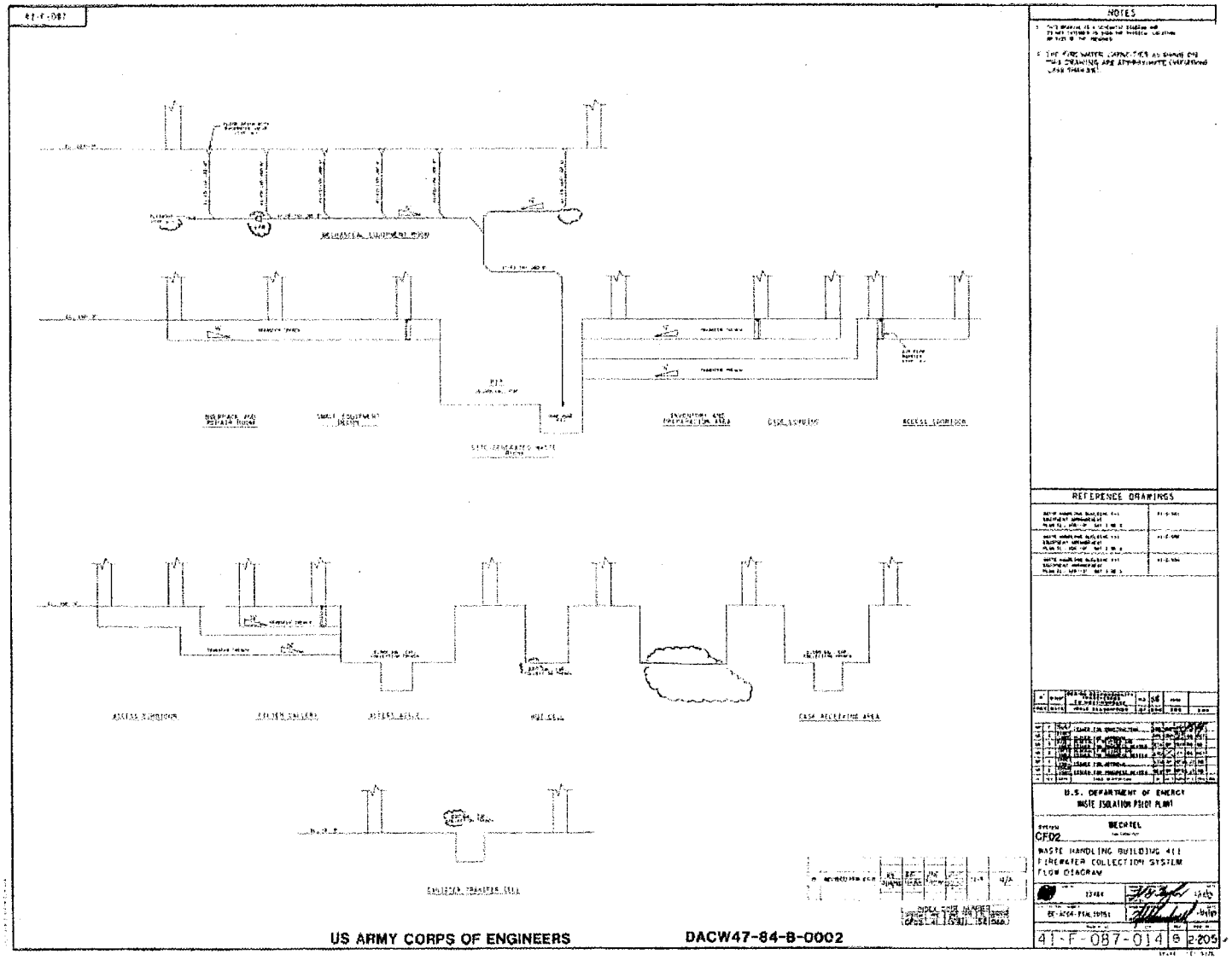
NOTES
REFERENCE DRAWINGS
U.S. DEPARTMENT OF ENERGY
WASTE ISOLATION PILOT PLANT
WASTE HANDLING BUILDING 411
FIREWATER COLLECTION SYSTEM
FLOW DIAGRAM
41-F-087-014
US ARMY CORPS OF ENGINEERS
DACW47-84-B-0002

ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

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  - E-1a(3) Monitoring Systems 4
- E-1b Specific Process Inspection Requirements 4
  - E-1b(1) Container Inspection 4
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References 6

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Figure E-2	Typical Logbook Entry

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ATTACHMENT E

INSPECTION SCHEDULE, PROCESS AND FORMS

Introduction

This Permit Attachment describes the facility inspections (including container inspections) that are conducted to detect malfunctions, deterioration, operator errors, and discharges that may cause or lead to releases of hazardous waste or hazardous waste constituents to the environment or that could be a threat to human health.

E-1 Inspection Schedule

Equipment instrumental in preventing, detecting, or responding to environmental or human health hazards, such as monitoring equipment, safety and emergency equipment, security devices, and operating or structural equipment are inspected. The equipment will be inspected for malfunctions, deterioration, potential for operator errors, and discharges which could lead to a release of hazardous waste constituents to the environment or pose a threat to human health.

The WIPP facility has developed and will maintain a series of written procedures that include all the detailed inspection procedures and forms necessary to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)), during the Disposal Phase. Tables E-1 and E-1a list each item or system requiring inspection under these regulations, the inspection frequency, the organization responsible for the inspection, the applicable inspection procedure, and what to look for during the inspection. 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(b), 264.174, and 264.602) list requirements that are applicable to the WIPP facility.

Operational procedures detailing the inspections required under 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(a) and (b)), are maintained in electronic format on the WIPP computer network, in the Operating Record and, as appropriate, in controlled document locations at the WIPP facility. Frequency of inspections is discussed in detail in Section E-1a(2). Inspections are conducted often enough to identify problems in time to correct them before they pose a threat to human health or the environment and are based on regulatory requirements. The operational procedures assign responsibility for conducting the inspection, the frequency of each inspection, the types of problems to be watched for, what to do if items fail inspection, directions on record keeping, and inspector signature, date, and time. The operational procedures are maintained at the WIPP facility. Tables E-1 and E-1a summarize inspections, frequencies, responsible organizations, personnel making the inspection (by job title), and the types of anticipated problems as well as the references for the operational procedures. Inspection records are maintained at the WIPP site for three years. Beginning with the effective date of this Permit, records that are over the three year retention period are either maintained at the WIPP site or transferred to the WIPP Records Archive located in Carlsbad, NM until closure. The records maintained at the WIPP Records Archive are stored in facilities that are temperature and humidity controlled especially for the long term storage of records and readily retrievable and available for inspection.

Waste handling equipment and area inspections are typically controlled through established procedures and the results are recorded in logbooks or on data sheets. Operators are trained to consult the logbook to identify the status of any piece of waste handling equipment prior to its

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use. Once a piece of equipment is identified to be operable, a preoperational inspection is initiated in accordance with the appropriate inspection procedure in Tables E-1, E-1a, or in operational procedures. Inspection results as described below are entered in the applicable logbook.

Inspections include identifying malfunctions or deteriorating equipment and structures. Inspection results and data, including deficiencies, discrepancies, or needed repairs are recorded. A negative inspection result does not necessarily lead to a repair. A deficiency, such as low fluid level, may be corrected by the inspector immediately. A discrepancy, such as an increasing trend of a data point, may necessitate additional inspection prior to the next scheduled frequency. The actions taken (corrected, additional inspection, or Action Request (**AR**) for repair submitted) are recorded on the inspection form, the WIPP automated Maintenance Management tracking program (**CHAMPS**) work order sheet, or the equipment logbook, whichever is applicable.

Items that are operational with restrictions are tagged with those restrictions. Items that are not operational are tagged and locked to prevent their use. Tagged and locked items are listed on the Tagout/Lockout Index. Once a scheduled repair or replacement is accomplished in accordance with the work authorization procedures, the tag or lock is removed from the item in accordance with the equipment tagout/lockout procedures. Normally, the individual inspecting the equipment/system is not qualified to make repairs and consequently, prepares an AR if repairs are needed. The AR is tracked by the CHAMPS system through the work control process. When parts are received and work instructions are completed, the work order can be scheduled on the Plan of the Day (**POD**). The POD is held daily to ensure facility configuration can support scheduled work items and to allocate and coordinate the resources necessary to complete the items.

Work orders are released for work by the responsible organization. When repairs are complete the responsible organization tests the equipment to ensure the repairs corrected the problem, then closes out the work order, to return the equipment to an operational status for normal operations to resume. Implementation of these procedures constitutes compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

Requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)), are met by the inspections for each item or system included in Tables E-1 and E-1a. Beginning with the effective date of this Permit, the results of the inspections are maintained in the operating record for three years and are then transferred to the WIPP Records Archive where they are maintained until closure. The inspection logs or summary records include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions. Major pieces of waste handling equipment are inspected using proceduralized inspections. Current copies of inspection forms are maintained in the Operating Record. Non-administrative changes (i.e., changes that affect the frequency or content of inspections) to inspection forms must be submitted to the NMED in accordance with the appropriate portions of 20 NMAC 4.1.900 (incorporating 40 CFR §270.42). The status of these pieces of equipment is maintained in an equipment logbook that is separate from the checklist. The logbook contains information regarding the condition of the equipment. Equipment operators are required, by the inspection checklist, to consult the logbook as the first activity in the inspection procedure. This logbook is maintained in the operating record. CH transuranic (**TRU**) mixed waste equipment that is controlled by a logbook includes the waste handling forklifts, all waste handling cranes, the adjustable center of gravity lift fixture, the CH

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TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and emplacement equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

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E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site waste that will be managed and stored as CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**), in standard large box 2s (**SLB2s**) or shielded containers as (3)-packs. The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

As described in Permit Attachment A1, Section A1-1d(3), off-site waste that will be managed and stored as RH TRU mixed waste will arrive in containers inside Nuclear Regulatory Commission (**NRC**)-certified casks designed to provide shielding and facilitate safe handling. Canisters, will be loaded singly into an RH-TRU 72-B cask. Drums will be loaded into a CNS 10-160B cask. The cask will be visually inspected upon arrival. Because RH TRU mixed waste is stored in the Parking Area Unit in sealed casks, there are no additional requirements for engineered secondary containment systems. Following removal of the canisters and drums, the interior of the cask will be inspected and surveyed for evidence of contamination that may have occurred during transport.

Off-site waste that will be managed and stored as RH TRU mixed waste is managed and stored in the RH Complex of the WHB. The RH Complex includes the following: RH Bay, the Cask Unloading Room, the Hot Cell, the Transfer Cell, and the Facility Cask Loading Room. As RH TRU mixed waste is held in canisters within a canister rack the physical inspection of the drum or canister is not possible. Inspections of RH TRU mixed waste in these areas occurs remotely via closed-circuit cameras a minimum of once weekly when stored waste is present. Because RH TRU mixed waste is in sealed casks, there are no additional requirements for engineered secondary containment systems. However, the floors in the RH Complex (including the RH Bay, Facility Cask Loading Room and Cask Unloading Room) are coated concrete and during normal operations (i.e., when waste is present), the floor of the RH Complex is inspected visually or by using close-circuit cameras on a weekly basis to verify that it is in good condition and free of visible cracks and gaps.

Inspections of RH TRU mixed waste containers stored in the Hot Cell and Transfer Cell are conducted using remotely operated cameras. RH TRU mixed waste in the Hot Cell is stored in either drums or canisters. The containers in the Hot Cell are inspected to ensure that they are in acceptable condition. RH TRU mixed waste in the Transfer Cell is stored in the RH-TRU 72-B cask or shielded insert; therefore, inspections in this area focus on the integrity of the cask or shielded insert. RH TRU mixed waste in the Facility Cask Loading Room is stored in the facility cask; therefore, inspections in this area focus on the integrity of the facility cask.

Inspections will be conducted in the Parking Area Unit at a frequency not less than once weekly when waste is present. These inspections are applicable to loaded Contact- Handled and Remote-Handled Packages. The perimeter fence located at the lateral limit of the Parking Area Unit, coupled with personnel access restrictions into the WHB Unit, will provide the needed security. The perimeter fence and the southern border of the WHB shall mark the lateral limit of the Parking Area Unit. Radiologically controlled areas can be established temporarily with barricades. More permanent structures can be installed. The western boundary can be established with temporary barricades since this area is within the perimeter fence. Access to radiologically controlled areas will only be permitted to personnel who have completed General Employee Radiological Training (**GERT**), a program defined by the Permittees, or escorted by personnel who have completed GERT. This program ensures that personnel have adequate knowledge to understand radiological posting they may encounter at the WIPP site. The fence of the Radiologically Controlled Area, south from the WHB airlocks, was moved to provide more maneuvering space for the trucks delivering waste. Since TRU mixed waste to be stored in the Parking Area Unit will be in sealed Contact-Handled or Remote-Handled Packages, there will be no additional requirements for engineered secondary containment systems. Inspections of the Contact-Handled and Remote-Handled Packages stored in the Parking Area Unit shall be conducted at a frequency no less than once weekly and will focus on the inventory and integrity

of the shipping containers and the spacing between trailers carrying the Contact-Handled or Remote-Handled Packages. This spacing will be maintained at a minimum of four feet.

Container inspections will be included as part of the surface TRU mixed waste handling areas (i.e. Parking Area Unit and WHB Unit) inspections described in Tables E-1 and E-1a. These inspections will also include the Derived Waste Storage Areas of the WHB Unit. The Derived Waste Storage Areas will consist of containers of 55 or 85-gallon drums or SWBs for CH TRU mixed waste and 55-gallon drums for RH TRU mixed waste. A Satellite accumulation area (**SAA**) may be required in an area adjacent to the TRUDOCKs for CH TRU mixed waste. A SAA may also be required in the RH Bay and Hot Cell for RH TRU mixed waste. These SAAs will be set up on an as needed basis at or near the point of generation and the derived waste will be discarded into the active derived waste container. All SAAs will be inspected in accordance with 20.4.1.300 NMAC (incorporating 40 CFR §262.34).

E-1b(2) Miscellaneous Unit Inspection

20.4.1.500 NMAC (incorporating 40 CFR §264.602), requires that inspections required in 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33), as well as any additional requirements needed to protect human health and the environment, be met. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15 and §264.33) are discussed in Section E-1 of this Permit Attachment, along with how the WIPP facility complies with those requirements for standard types of inspections. Inspection frequencies for geomechanical monitoring equipment are provided in Table E-1. The monitoring schedule for geomechanical instrumentation is given in Table E-2.

References

DOE, 1999. "WIPP Safety Analysis Report," DOE/WIPP-95-2065. Rev. 4, U.S. Department of Energy. Washington, D.C.

DOE, 2000. "WIPP Remote-Handled Waste Preliminary Safety Analysis" (RH PSAR), U.S. Department of Energy. Washington, D.C.

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FIGURES

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TYPICAL EQUIPMENT
WEEKLY CHECK LIST

_√_ OK _X_ Adjustment Made _O_ Repairs Required

AR Written [ ] Yes [ ] No AR # _____

(check or complete appropriate information)

ITEM INSPECTED	Condition	Comments/Corrective Action
Mechanical Checks: (examples)		
Oil level		
Radiator fluid level		
Automatic transmission fluid level		
Operate all valves/check gauges		
Emergency brake		
Fuel level (> ¾ full)		
Oil pressure (at warm idle)		
Tire Pressure		
Sirens, horn, & back-up alarm		
Deterioration Checks: (examples)		
Fan belts		
Battery (terminals, cables)		
Run generator 5 min.		
Hose, nozzles & valves		
Leaks/Spills Checks: (examples)		
Leaks around pump		
Foam tank level		
Required Equipment: (examples)		
Inspect SCBAs (> 4050 psi)		
Hand tools & equipment		
Trauma Kit		

Inspected by: _____
Print Name Signature Time/Date

Inspected by: _____
Print Name Signature Time/Date

Reviewed by: _____
Print Name Signature Time/Date

Comments: _____

_____

_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-1
Typical Inspection Checklist

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HOUR METER READING _____ EQUIPMENT NO. _____

DEFICIENCIES NOTED: _____

_____

_____

_____

_____

PRE OPS COMPLETED PER __{Procedure Number}__ SAT _____ **PROBLEMS NOTED** _____

CORRECTIVE ACTIONS TAKEN: _____

_____

_____

_____

_____

_____

_____

OPERATOR SIGNATURE	**DATE**	**TIME**	**SUPERVISOR SIGNATURE/DATE**
_____	_____	_____	_____

NOTE: All items that are mandatory for every inspection form are shown in bold.

Figure E-2
Typical Logbook Entry

1

TABLES

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1
2

Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	12-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[j]	Emergency Services	Monthly See List 11	12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[l] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030 and 12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Waste Handling Cranes	Waste Handling	Preoperational See List 8	WP 05-WH1407 Inspecting for Mechanical Operability[m], Deterioration[b], and Leaks/Spills
Waste Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1003 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m], Leaks/Spills, in accordance with MSHA requirements
Water Tank Level	Facility Operations	Daily See List 3	SDD-WD00 Inspecting for Deterioration[b], and water levels. Results of this inspection are logged in accordance with WP 04-AD3008.
Push-Pull Attachment	Waste Handling	Preoperational See List 8	WP 05-WH1401 Inspecting for Damage and Deterioration[b]
Trailer Jockey	Waste Handling	Preoperational See List 8	WP 05-WH1405 Inspecting for Mechanical Operability[m] and Deterioration[b]
Explosion-Isolation Walls	Underground Operations	Quarterly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bulkhead in Filled Panels	Underground Operations	Monthly See List 1	Integrity and Deterioration[b] of Accessible Areas
Bolting Robot	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m]
Yard Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1205 Mechanical Operability[m], Deterioration[b], Path clear of obstacles and Guards in proper place
Payload Transfer Station	Waste Handling	Preoperational See List 8	WP 05-WH1208 Mechanical Operability[m], Deterioration[b], and Guards in proper place
Monorail Hoist	Waste Handling	Preoperational See List 8	WP 05-WH1202 Mechanical Operability[m], Deterioration[b], and leaks/spills

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System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Bolting Station	Waste Handling	Preoperational See List 8	WP 05-WH1203 Mechanical Operability[m], Deterioration[b], and Guards in proper place

1

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Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
   Senior Mining Technician *
   Continuous Mining Specialist *
   Senior Mining Specialist *
   Mine OPS Supervisor *
b. Waste Hoist Operator
   Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
   Shaft Technician *
d. Operations Engineer
   Supervisor U/G Services*
   Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
   Senior Safety Technician *
   Safety Specialist *
   Safety Engineer *
   Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator*

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

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Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table D-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

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Table E-1a
RH TRU Mixed Waste Inspection Schedule/Procedures

System/ Equipment Name	Responsible Organization [j]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [j]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Transfer Car(s)	Waste Operations	Pre-evolution [c,d,e] See List 1	WP05-WH1701 PM041187 (Semi-Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
RH Bay Overhead Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041232 (Quarterly) PM041117 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1713 PM041201 (Annual) PM041203 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical PM.
RH Bay Cask Lifting Yoke	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1741 PM041169 (Annual)	Yes	NA	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Facility Cask Transfer Car	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1704 PM041186 (Quarterly) PM041195 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Cask Rotating Device	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1713 PM041175 (Annual) PM041176 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication Electrical Inspection
Facility Grapple	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1721 PM041172 (Quarterly) PM041177 (Annual)	Yes	NA	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear. Non-Destructive Examination
6.25-Ton Grapple Hoist	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1721 PM041173 (Annual)	Yes	Yes	Pre-evolution Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication
Transfer Cell Shuttle Car	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1705 PM041184 (Semi-Annual) PM041222 (Annual)	Yes	Yes	Pre-evolution Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection.

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System/ Equipment Name	Responsible Organization [J]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration [b]	Leaks/ spills	Other
Cask Unloading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell	Waste Operations	Preoperational [c,d,e,f,g,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Hot Cell Overhead Powered Manipulator	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1743 PM041215 (Annual) PM041216 (Annual) IC411037 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration
Hot Cell Bridge Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1742 PM041217 (Annual) PM041209 (Annual) IC411038 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.
Transfer Cell	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Facility Cask Loading Room	Waste Operations	Preoperational [c,d,e,f,h,i] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Closed Circuit Television Camera	Waste Operations	Preoperational [c,i] See List 1	WP05-WH1757	NA	NA	Operability
Radiation Monitoring Equipment	Radiation Control	Preoperational [c,d,e] See List 2	WP12-HP1245 IC240010 WP12-HP1307 IC240007 WP12-HP1314 (Annual)	Yes	NA	Operability Checks, Functional Checks, Instrument calibrations, Flow Calibration, Efficiency Checks.
Cask Unloading Room Crane	Waste Operations	Preoperational [c,d,e,i] See List 1	WP05-WH1719 PM041190 (Quarterly) PM041191 (Annual) PM041192 (Annual) IC411035 (Annual)	Yes	Yes	Pre-operational Checks and Operating Instructions. Mechanical Inspection for Wear and Lubrication. Electrical Inspection. Load Cell Calibration.

System/ Equipment Name	Responsible Organization [J]	Inspection [a] Frequency and Job Title of Personnel Normally Making Inspection [J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration[b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,f] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,j] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,n,l] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [i] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

1

Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer

Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

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Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts, and concrete walls.

[b] Deterioration includes: visible cracks, erosion, salt build-~~up~~, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Pre-evolution" signifies that inspections are required prior to equipment use in the waste handling process. (An evolution is considered to be from the receipt of a cask into the RH Bay through canister emplacement in the underground.) For an area, preoperational inspection includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that functional components and emergency equipment are present and operational. When the equipment is not in use, no inspections are required.

[d] When equipment needs to be inspected while handling waste (i.e., during waste unloading or transfer operations), general cleanliness and functional components will be inspected to detect any problem that may harm human health or the environment. The inspection will verify that emergency equipment is present.

[e] Inspection of RH TRU mixed waste equipment and areas in the RH Complex applies only after RH TRU mixed waste receipt begins.

[f] The inspection/maintenance activities associated with these pieces of equipment are performed when the RH Complex is empty of RH TRU mixed waste. If contamination is present, a radiation work permit may be needed.

[g] For the Hot Cell and Transfer Cell, if RH TRU mixed waste is present, camera inspections will be performed in lieu of physical inspection.

[h] The integrity of the floor coating will be inspected weekly if RH TRU mixed waste is present.

[i] "Preoperational" signifies that inspections are required prior to the first use in a calendar day.

[J] Responsible organizations refers to the organization that owns the equipment. Preventive Maintenance (PM) procedures are conducted by either mine maintenance or surface operations maintenance personnel and Instrument Calibration (IC) procedures are conducted by instrument and calibration maintenance personnel.

[k] Inspection will be performed after 250 evolutions (actual and training emplacements), if such usage occurs prior to the semi-annual inspection.

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Table E-2
Monitoring Schedule

System/Equipment Name	Responsible Organization	Monitoring Frequency	Purpose
Geomechanical [b]	Geotechnical Engineering	Monthly	To evaluate the geotechnical performance of the underground facility and to detect ground conditions that could affect operational safety
Central Monitoring System	Facility Operations	System Dependent	Monitor and provide status for the following facility parameters: Electrical Power Status [d] Fire Alarm System [e] Ventilation System Status [f] Meteorological Data System [g] Facility Systems (compressors [g], pumps [h], water tank levels [i], waste hoists [j])

[b] Equipment is listed as Underground-Geomechanical Instrumentation System (GIS) in Table E-1.

[d] Equipment listed as Backup Power Supply Diesel Generator in Table E-1.

[e] Equipment listed as Fire Detection and Alarm System in Table E-1.

[f] Equipment listed as Ventilation Exhaust in Table E-1.

[g] Not RCRA equipment.

[h] Equipment listed as Fire Pumps in Table E-1.

[i] Equipment listed as Water Tank Level in Table E-1.

[j] Equipment listed as Waste Hoist in Table E-1.

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ATTACHMENT F

PERSONNEL TRAINING

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ATTACHMENT F

PERSONNEL TRAINING

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ATTACHMENT F

PERSONNEL TRAINING

Introduction

This attachment describes the personnel training program for the Waste Isolation Pilot Plant (**WIPP**) in accordance with the requirements of the Resource Conservation and Recovery Act (**RCRA**) and the New Mexico Hazardous Waste Act as described in 20.4.1.500 NMAC (incorporating 40 CFR §264.16), and 20.4.1.900 NMAC (incorporating 40 CFR §270.14).

The primary objective of the WIPP facility training program is to prepare personnel to operate the WIPP facility in a safe and environmentally sound manner. To achieve this objective, the program provides employees with training relevant to their positions. Every WIPP facility employee, including those not directly involved in transuranic (**TRU**) mixed waste handling activities, receives an introduction to the RCRA and emergency preparedness within 30 days of employment. In this way everyone at the WIPP facility is given, at a minimum, a basic understanding of the regulatory requirements and emergency procedures. Employees in hazardous waste management positions receive additional classroom and on-the-job training designed specifically to teach them how to perform their duties safely and in conformance with regulatory requirements. Hazardous waste management personnel receive the required training before being allowed to work unsupervised, and emergency response personnel receive appropriate training before being called upon to respond to actual emergencies.

The training requirements apply to all appropriate employees of the U.S. Department of Energy (**DOE**) and contractors who regularly work at the facility that may come in contact with and/or manage hazardous waste. The WIPP Project training program is comprehensive and applies to all areas of personnel performance and development. This attachment describes the introductory and continuing training provided to personnel at the WIPP facility, with emphasis on those facility personnel and their supervisors whose jobs are such that their actions or failure to act could result in a spill or release, or the immediate threat of a spill or release of hazardous waste. These personnel are directly involved with hazardous waste management at the WIPP facility. Their training allows them to operate the facility safely and in compliance with hazardous waste regulations.

F-1 Outline of the Training Program

Employee training for the purpose of hazardous waste management at the WIPP facility is the overall responsibility of the MOC General Manager, with responsibility for implementation delegated to the manager of the Human Resources Department. The Human Resources Department Manager has established a technical training group (referred to as Technical Training) within the department to implement the requirements for training. The Technical Training Group is managed by the Technical Training Manager who has the responsibility for directing the training program. Members of the training staff are assigned to Technical Training within the Human Resources Department. The organizational structure of the Human Resources Department and its relationship to the line organizations is shown in an abbreviated organizational chart in Figure F-1. This chart also shows departments with key responsibilities for waste management and emergency response.

The WIPP facility uses a modified version of the Systematic Approach to Training (**SAT**) to analyze, design, develop, implement, and evaluate training.

This approach employs five distinct phases to develop programs. These phases are:

- Analysis
- Design
- Development
- Implementation
- Evaluation

In "analysis," technical training and line management identify job performance requirements. These requirements are derived by studying job duty areas, related tasks, and required skills and knowledge. These derived skills and knowledge, in turn, form the blueprint for the "design" phase. In "design" these requirements are translated into learning objectives, performance standards, and test items. In "development" the products of design are incorporated into new training programs or, if appropriate, incorporated into revisions of existing programs. Products of development are lesson plans, qualification cards, student materials, and examinations. Implementation of these programs then occurs. This may be through classroom instruction, on-the-job-training, self-paced study, or any combination of the three. "Evaluation" is the final phase of the SAT process. Evaluation uses feedback derived from several sources to improve or enhance the training. The WIPP utilizes extensive guidance provided within the DOE Handbook, "Training Program Handbook: A Systematic Approach to Training (DOE-HDBK-1078-94)," to direct all program analysis, design, development, implementation, or evaluation. Further details of these processes may be derived by reviewing this manual.

The Human Resources Department ensures that required RCRA-related training is conducted by qualified instructors. On-the-job training is conducted by Level I instructors. Level I instructors are subject matter experts; members of line organizations who have qualified on the related equipment and have attended the on-the-job training course. Classroom instruction is provided by Level II and Level III instructors. Level II instructors are members of Technical Training and line organizations who are qualified to conduct limited classroom training in their technical area of expertise. Level III instructors are members of Technical Training who are qualified to conduct classroom training, skills evaluation, and needs assessment. Level II and III instructors are required to attend a train-the-trainer course and periodic refresher training.

Cognizant line managers provide significant input on training requirements for the WIPP facility to qualified instructors who develop the following, as required:

- Classroom Instruction

  Objectives
  Lesson Plans
  Student Materials
  Examinations

- On-the-Job Training

  Qualification Cards

Technical training materials are approved by the Technical Training Manager and the cognizant line manager.

Following technical training, trainees must successfully complete written examinations or oral examinations conducted by boards made up of cognizant personnel (referred to as "oral boards") to demonstrate competency. The records of oral examinations are called "oral board sheets". These examinations are based on objectives and/or competency statements. Oral boards are based on knowledge learned in the on-the-job training process. Trainees also provide feedback on the content and quality of instruction, at this time, in the form of course critiques and verbal input.

Technical training documentation is maintained by the Technical Training Group located at the WIPP facility. These technical training records include:

- Course Attendance
- Completed Qualification Cards
- Off-Site Training Documentation
- Oral Board Sheets

A database is maintained which records training qualifications, and course attendance. The database is used to identify course refresher and requalification dates. Training records on current personnel are kept in the Technical Training files. Technical training records on former employees are kept by the Technical Training Group for at least three years from the date of employment termination from the WIPP facility. Training documentation for emergency response training received by personnel called out in the WIPP Contingency Plan (Permit Attachment D) is maintained by the Technical Training Group. The documents which define the process by which these training activities are managed are maintained by the Technical Training Group and are part of the Operating Record.

To ensure the safe and efficient operation of the WIPP facility, certain positions require formal qualification. Department managers identify these positions based upon safety, complexity, and involvement with hazardous waste handling operations. A document known as a "qualification card" is prepared to identify required training for each designated position. In the case of equipment and system/procedure qualification, a "qualification card" is prepared that specifies the required knowledge and practical skills needed in such areas as equipment maintenance and safety. Individual participation in the qualification card system is varied and is dependent on an incumbent's specific job duties. A complete listing of active qualifications, as they apply to any individual position, may be determined by review of the WIPP Training Database. The list of active WIPP Qualification cards is maintained at the WIPP facility.

When the qualification card is completed, that particular qualification is recorded. Successful completion of formal classroom training is documented on the individual's qualification card. When requirements are met, both for classroom instruction and on-the-job training, and oral board, if applicable, the qualification card is signed by the manager certifying that the employee is fully competent to perform all aspects of the associated qualification. Qualification cards are included in the training records maintained by the Technical Training Group. Qualification cards are living documents subject to change as the scope and content of training changes to meet new and revised regulatory requirements and modifications in job scope.

The hazardous waste management training program described in Section F-1b consists of a series of courses designed to ensure that hazardous waste management employees at the WIPP facility receive initial and continuing training relevant to their positions. These courses include instruction on the RCRA and Occupational Safety and Health Administration regulations, emergency procedures, and procedures for handling both site-generated hazardous waste and TRU mixed waste. Visitors, temporary personnel, and contractors are trained commensurate with the nature of their visit or duties. For visitors, this includes basic site safety and emergency notification procedures. Visitors who require unescorted access are also required to take an examination covering the material in the training they are given. Visitor records are maintained by security. Temporary or subcontract personnel, if hired to fill a hazardous waste management position, are required to complete the same training as permanent personnel. Record of this training is maintained by Technical Training.

F-1a Job Title/Job Description

Employees at the WIPP facility who are involved in hazardous waste management activities receive the same core training. A list of hazardous waste management job titles and position descriptions are provided in Permit Attachment F1. An up-to-date list of personnel assigned to these positions is maintained by the Permittees in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.16). These core hazardous waste management training courses are described briefly in Section F-1(b)(1) and outlines of the core classes, as well as other job specific training classes, are included in Permit Attachment F2. Any changes to the training plan that decrease the type or amount of training that is given to employees will be handled as a Class 2 modification, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42). Other changes to the training plan will be handled as Class 1 modifications. In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d)(2)), the job descriptions include hazardous and TRU mixed waste management job duties, required skills, qualifications, and experience, as well as educational requirements. These job descriptions are approved by the cognizant staff managers. Included in the appendices are management and supervisory positions that are considered to be critical from the standpoint of hazardous waste management or emergency response. These include the following positions:

- Shift Manager, Facility Operations
- Manager, Hoisting Operations
- Manager, Radiation Control
- Manager, Waste Handling
- Team Leader, Inspection Services
- Manager, Environmental Compliance
- Manager, Technical Training

F-1b Training Content, Frequency, and Techniques

The WIPP training program includes a comprehensive combination of classroom training courses and on-the-job training. Each training course is carefully developed and periodically reevaluated to ensure relevancy to the course objectives and to ensure its support of the goal of safe and environmentally sound operations at the WIPP facility. On-the-job training is accomplished and documented through the use of qualification cards. Before an employee is considered qualified to operate certain equipment, the person must pass a prescribed set of performance standards.

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F-1b(1) Training Content

WIPP facility employees who will be on site longer than 30 days, including personnel in management and supervisory positions and personnel not directly involved with hazardous waste management, receive facility-specific training in the following areas:

- General Employee Training (GET) Overview (procedures and policies)
- WIPP Facility Description
- Radiation Safety
- Emergency Preparedness (including RCRA Contingency Plan implementation)
- Security
- Fire Protection
- Quality Assurance
- Occurrence Reporting
- Industrial Safety
- RCRA
- Hazard Communication

This training is provided in GET-19X/GET-20X/GET-21X [1], conducted by the WIPP qualified instructors, and must be completed within 30 days of employment.

Annual refresher training on the topics taught in GET-19X/GET-20X/GET-21X is given in the General Employee Training Annual Refresher (GET-19XA/GET-20XA/GET-21XA). This self-paced module provides employees with a review and update of the topics covered in GET-19X/GET-20X/GET-21X.

WIPP employees involved in managing site-generated, nonradioactive waste, or TRU mixed waste will receive the Hazardous Waste Worker course (HWW-101). This comprehensive course will provide job specific training required to safely receive, transfer, or handle waste at the WIPP facility. Review and update of HWW-101 topics is provided annually in the Hazardous Waste Worker refresher course (HWW-102).

Course outlines for GET-19X/GET-20X/GET-21X, GET-19XA/GET-20XA/GET-21XA, HWW-101, and HWW-102 are provided in Permit Attachment F2.

F-1b(2) Training Frequency

Hazardous waste management courses are offered at a frequency that ensures new hires or transfers can receive relevant training within six months of assuming their new position. Employees do not work unsupervised in hazardous waste management positions until they have completed the required initial training. The Human Resources Department notifies the cognizant manager and training staff when any employee is transferred into or out of a position associated with hazardous waste management.

[1] The "X" in the course number is assigned the last number of the current year (e.g., GET-195 is General Employee Training for 1995, GET-200 is for the year 2000). Course content is updated annually to provide the latest information available to students.

F-1b(3) Training Techniques

A variety of instructional techniques are used at the WIPP facility depending on the subject matter and the techniques that best suit the learning objectives. Many courses include a combination of lectures, demonstrations, visual aids (such as video tapes, slides, and viewgraphs), and exercises. Most equipment operation courses include hands-on practical instruction.

Written examinations are used as a technique to test and document the knowledge level of individuals participating in classroom training courses. The length and content of each exam varies according to its objective. Calculation, multiple-choice, and fill-in-the-blank, or other approved formats, may be used. If individuals fail a written examination, they must be reexamined in identified areas of weakness. Personnel filling positions requiring qualification cards to perform job functions will be requalified at least biennially in those specific areas.

On-the-job training at the WIPP facility follows a prescribed set of standards specific to the job to be performed. Typically, to become qualified to operate a piece of equipment or system, employees must be able to demonstrate the location and purpose of specified controls and gauges, describe proper startup and shutdown procedures, describe specific safety features and limitations of the equipment, and, in some cases, perform maintenance functions. They must also demonstrate the ability to operate the equipment or system. On-the-job training may also be function specific, such as performing a specific administrative function that is regulated.

In addition to on-the-job training, some positions require the trainee to attend an oral board. The oral board is given upon completion of on-the-job training and prior to operating any equipment unsupervised. In the oral board, the trainee is quizzed on knowledge learned in on-the-job training. The purpose of the oral board is to determine if the trainee fully understands and can apply the knowledge learned in the training process.

F-1c Training Manager

The Technical Training Manager directs the training program and is responsible for establishing technical training requirements in cooperation with the line managers. Specifically, this includes analysis, design, development, implementation, and evaluation of technical training. The Technical Training Manager is trained in hazardous waste management procedures and receives train-the-trainer and instructor training. The Technical Training Manager is also required to be knowledgeable of the applicable regulations, orders, guidelines, and the specific training process employed at the WIPP facility.

The name and qualifications of the current Technical Training Manager are documented at the WIPP facility.

F-1d Relevance of Training to Job Position

The WIPP facility training program provides employees and their supervisors with training relevant to their positions. A functional chart showing positions that receive training related to hazardous waste management or emergency response is included as Figure F-1. This figure also shows the next level manager for these positions. The SAT process mentioned in Section F-1 is a systematic method for determining the proper training for each hazardous waste management position. It compels managers and training staff to look critically at each position

and determine the necessary training program for each employee to fully develop their necessary expertise.

Several training courses are determined to be so basic to the WIPP Project mission that they are considered relevant for all WIPP facility employees. The basic philosophy at the WIPP facility is that, as a RCRA-regulated facility, employees must understand the basic regulatory requirements under which the WIPP facility must operate. Therefore, all WIPP facility employees receive an introduction to the RCRA during their introductory training.

Beyond these core courses, training is designed and implemented relevant to the specific job functions being performed. For example, employees who operate key pieces of equipment necessary to manage contact-handled (**CH**) or remote-handled (**RH**) TRU mixed waste (such as forklifts, hoists, bridge cranes, cask transfer cars, etc.) must be trained to operate and inspect equipment and to recognize maintenance problems before a specific job function is performed. These employees must receive on-the-job training and demonstrate the ability to operate the equipment, as appropriate, before being qualified. This process is controlled and documented by the qualification process described in Section F-1. A complete listing of active qualification cards, along with descriptions of training courses, are on file at the WIPP facility. Summaries of qualification cards and other job specific training courses are included in Permit Attachment F2. Waste handling personnel performing CH or RH TRU mixed waste handling tasks will be qualified to the applicable specific equipment or system qualification card on file at the WIPP facility.

Managers who have direct responsibility for supervising hazardous waste management personnel receive hazardous waste management training relevant to their positions. This training will include GET-19X/GET-20X/GET-21X and its refresher GET-19XA/GET-20XA/GET-21XA, which is required for all employees, and the Hazardous Waste Worker Supervisor course HWS-101 and its refresher HWS-101A. In addition, a manager may also take HWW-101 and its refresher HWW-102 if these courses are determined to be useful for his/her position. These course descriptions are included in Permit Attachment F2. Managers who do not have direct hazardous waste management supervisory responsibilities receive training sufficient to ensure their awareness of hazardous waste management requirements and procedures; however, they do not perform hazardous waste management duties and their positions are not included in the appendices. As is the case with all WIPP facility employees, all managers receive RCRA overview training in GET-19X/GET-20X/GET-21X.

Security personnel are an important element of the safe and secure operations at the WIPP facility; however, they do not perform hazardous waste management functions during normal operations at the WIPP facility. Security personnel who serve as members of a Fire Support Team (see Section F-1e) receive emergency response training required of that team.

F-1e Training for Emergency Response

The WIPP facility training program ensures that personnel are able to respond appropriately and effectively to emergency situations. WIPP facility employees receive GET-19X/GET-20X/GET-21X, which includes instruction on hazard awareness, emergency preparedness, spill control, and the WIPP RCRA Contingency Plan (Permit Attachment D). This training ensures that every employee understands how to recognize real or potential emergencies and how to report such incidents to the proper WIPP facility officials. It also ensures that employees will not endanger themselves or others by taking actions beyond their ability. Emergency response personnel

receive more extensive training in emergency response procedures as described in the next paragraph.

The WIPP facility emergency response organization is capable of providing emergency response services both above ground and underground. The Emergency Response Team (**ERT**), under the supervision of the Emergency Services Technician, has primary responsibility for above ground emergency response activities, and the First Line Initial Response Team (**FLIRT**) and the Mine Rescue Team (**MRT**) are responsible for underground emergency response activities. The responsibilities of these units are described in the WIPP RCRA Contingency Plan, Permit Attachment D. Members of these teams are volunteers from the WIPP organization. These teams receive thorough emergency response training before they are called upon to perform in real emergencies. This training includes firefighting elements, such as fire behavior, ladders, fire hose, fire streams, and ventilation. The FLIRT includes current qualification for unescorted underground access, National Fire Protection Association (**NFPA**) 600 Industrial Fire Brigades requirements, and additional qualifications pertaining to the team. MRT training includes current qualification for unescorted underground access, at least one year of underground work, Mine Safety and Health Administration requirements for medical and mine rescue, and additional qualifications pertaining to the team. ERT training includes NFPA 600 Industrial Fire Brigade requirements, and additional training pertaining to the team. In addition, all teams receive lifesaving elements, such as rescue, cardiopulmonary resuscitation and first aid, and other specific elements, such as self-contained breathing apparatus. A list of required training for these positions is included in each job position description in Permit Attachment F1.

Because these response teams are used for unusual occurrences and not routine hazardous waste handling, a RCRA position title is not included. A duty description is included which summarizes basic anticipated duties of these positions. Training records for these individuals are maintained in each individual's training file in Technical Training located at the WIPP site. These training requirements must be met prior to an individual serving in an emergency response function

Hazardous waste handling and emergency response personnel receive training that ensures their familiarity with emergency procedures, emergency equipment, and emergency systems including:

- Procedures for using and inspecting facility emergency and monitoring equipment
- Repairing and replacing facility emergency and monitoring equipment (RADCON only)
- Communications and alarm systems
- Response to fires or explosions
- Shutdown of operations.

Course outlines for emergency response training courses are provided in Permit Attachment F2.

The RCRA Emergency Coordinator receives training relevant to the RCRA Contingency Plan and must be familiar with the contents of the RCRA Contingency Plan prior to serving as RCRA Emergency Coordinator. Documentation of this training is maintained in the RCRA Emergency Coordinator's training file. All individuals qualified to serve as RCRA Emergency Coordinators are required to complete Contingency Plan training (SAF-645). The RCRA Emergency Coordinator is provided with updated copies of the Contingency Plan in accordance with permit

Attachment D, Section D-9 whenever changes are made. Office wardens receive Office Warden Training (SAF-632) and are required to take an annual refresher. In addition, the training requirements of the Central Monitoring Room (**CMR**) operator are included in Permit Attachment F1. The CMR operator is listed in Permit Attachment D as an emergency response related position.

As there are no automatic waste feed systems at the WIPP facility, training on parameters for waste feed cut-off systems is not required. Similarly, as there is no potential for groundwater contamination incidents at the WIPP facility, training for responding to such incidents is not required.

F-2 Implementation of Training Program

The WIPP facility training program has been implemented to ensure that hazardous waste management and emergency response personnel employed at the WIPP facility receive the training indicated within the respective authorization cards. These authorization cards record training that the individual team members have completed. Personnel are trained on the RCRA Contingency Plan through their basic training. Newly hired employees receive the indicated training within six months of their date of hire or their transfer to a new position. Personnel do not work in unsupervised positions until they successfully complete the indicated training requirements. Hazardous waste management personnel attend annual refresher courses that review the initial training received and document knowledge transfer.

Records relating to the WIPP facility training program for hazardous waste management and emergency response personnel are maintained by the WIPP Technical Training Group located at the WIPP facility. These records include a roster of employees in hazardous waste management positions; a list of courses required for each position; course descriptions; documentation when each employee has received and completed appropriate training; and all of the backup information regarding qualification and examination. Training records of current personnel are kept by the Technical Training Group until closure of the WIPP facility. Records of former employees are kept by the Technical Training Group for at least three years from the date the employee last worked at the facility.

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FIGURES

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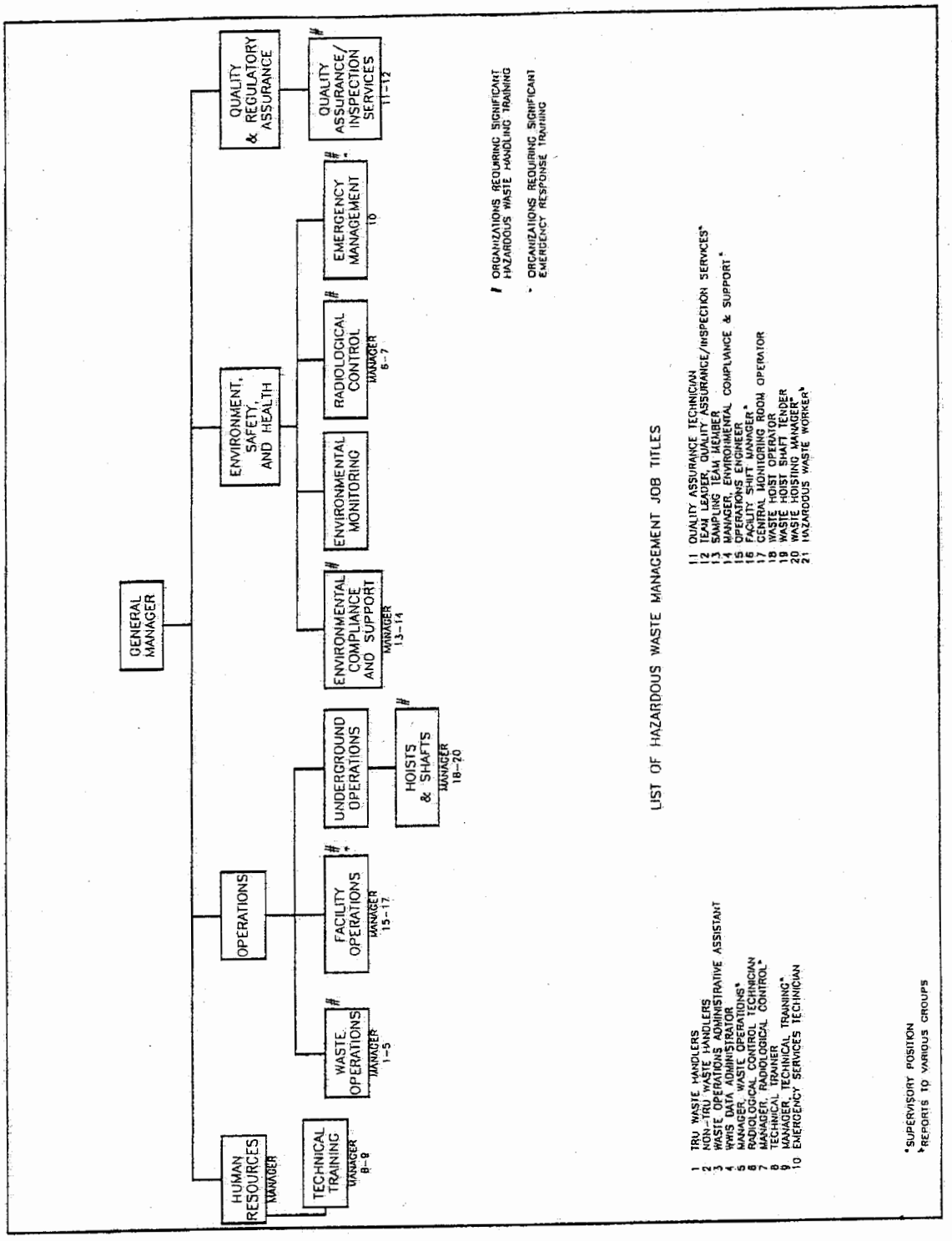

Figure F-1
Organizational Location of Training, Waste Handling, and Emergency Response Functions

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ATTACHMENT F1

RCRA HAZARDOUS WASTE MANAGEMENT JOB TITLES AND DESCRIPTIONS

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ATTACHMENT F1

RCRA HAZARDOUS WASTE MANAGEMENT JOB TITLES AND DESCRIPTIONS

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- Quality Assurance Technician 17
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ATTACHMENT F1

RCRA HAZARDOUS WASTE MANAGEMENT JOB TITLES AND DESCRIPTIONS

RCRA Hazardous Management Job Titles
Hazardous Waste Worker TRU Mixed Waste Handlers Underground Hazardous Waste Worker Site-Generated Waste Handlers Transportation Engineer WWIS Data Administrator Manager, Waste Handling Manager, Shipping Coordination
Radiological Control Technician Manager, Radiation Control
Technical Trainer Manager, Technical Training
Emergency Services Technician
Quality Assurance Technician Team Leader, Inspection Services Facility Inspection, Repair, and Service Team (FIRST) Leader Facility Inspection, Repair, and Service Team (FIRST)
Sampling Team Member Sampling Team Assistant Manager, Environmental Compliance
Facility Shift Engineer Facility Shift Manager Central Monitoring Room Operator
Waste Hoist Operator Waste Hoist Shaft Tender Waste Hoisting Manager
Chief Office Warden Assistant Chief Office Warden
Mine Rescue Team Member First Line Initial Response Team member Emergency Response Team Fire Brigade Fire Protection Technician
Radiographer (Radiography Independent Technical Reviewer) Visual Examination Operator/Expert (VE Independent Technical Reviewer) DOE Management Representative

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03703

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Hazardous Waste Worker

Duties:

- Performs hazardous waste operations in accordance with WIPP procedures

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X) (Annual)
- Hazardous Waste Worker (HWW-101/102) (Annual)

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: TRU Mixed Waste Handlers

Duties:

- Operates waste handling equipment and support systems to unload, handle and emplace TRU mixed waste and backfill into the repository
- Performs functional and operational checks of waste handling equipment and support systems as well as conduct waste container storage area inspections
- Performs spot decontamination of shipping casks, waste containers, and waste handling equipment.
- Perform waste container overpacking operations

Requisite Skills, Experience and Education:

Academic or vocational high school graduate with courses in algebra and physics or chemistry, or equivalent, plus two years of college-level technical study with courses in nuclear waste management and health physics, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Waste Handling Operations Qualification Card Signature
  - CH TRU Mixed Waste Handler - (WH-01A Backfill Technician, Floor, Yard, and Emplacement Technician, and WH-01B Waste Handling Technician or WH-02 Waste Handling Engineers) and Waste Handling Operations Guidebook (WH-GUIDE-1)
  - RH TRU Mixed Waste Handler - (RH-01A, RH-01B, RH-01C) RH Waste Handling Technician Qualification Card or (RH-02) RH Waste Handling Engineer Qualification Card and Waste Handling Operations Guidebooks
- Radworker II (RAD-201)
- Hazardous Waste Worker (HWW-101/102)
- Respiratory Protection (SAF-630/631)
- Hazardous Waste Responder (HWR-101, 101A)
- Hazardous Waste Transportation (HMT-102)
- Forklift Safety (EQP 402) (Once)
- Conduct of Shift Operations (OPS 115) (Once)
- Technical Safety Requirements (OPS 122) (Once)
- Incident Rigger (OPS 402) (Biennial)
- 40-Hour Inexperienced Miner (SAF 501/502) (Annual)
- Subject Matter Expert/On the Job Trainer (TRG 293/298) (Biennial)
- Waste Handling Systems (STC-003/STC-015) (Once)

NOTE: Waste Handling Technicians will not participate in TRU waste handling activities and integrated system functions unsupervised until full qualification is acquired.

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Underground Hazardous Waste Worker

Duties:

- Move waste from generation point to waste shaft conveyance
- Containerize waste generated at the wash bay and exhaust shaft catchment basin

Requisite Skills, Experience and Education:

High school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X) (Annual)
- Hazardous Waste Worker (HWW-101/102) (Annual)

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Site-Generated Waste Handlers

Duties:

- Inspects and inventories site-generated hazardous waste staging areas
- Assists the transfer of site-generated hazardous waste to on-site staging areas
- Directs storage of site-generated hazardous waste in the hazardous waste staging areas
- Conducts inspections of Satellite Accumulation Areas

Requisite Skills, Experience and Education:

High school diploma.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21X)
- Hazardous Waste Worker (HWW-101/102)
- Transportation of Hazardous Material (HMT-102)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Transportation Engineer

Duties:

- Supervise/oversee the preparation of hazardous waste shipments
- Review hazardous waste manifests and accompanying land disposal restriction notification forms for compliance
- Resolve manifest discrepancies
- Prepare hazardous waste manifests and supporting documentation for outgoing shipments of TRU mixed waste
- Provide generator sites with a signed copy of the hazardous waste manifest

Requisite Skills, Experience and Education:

Bachelor's degree in engineering, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Transportation of Hazardous Material (HMT-102)
- Hazardous Waste Worker (HWW-101/102)
- Radioactive Transportation Qualification Card (TE-01)
- Federal Motor Carrier Safety Regulations Qualification Card (TE-02)
- Hazardous Materials Qualification Card (TE-03)
- Hazardous Waste Shipments by Public Highway Qualification Card (TE-05)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: WWIS Data Administrator

Duties:

- Supervise the day to day operation of the WWIS
- Review and approve waste characterization, certification, and shipping data
- Manage the WWIS, including data change control, archival of the database, and reporting functions
- Review Waste Stream Profile Forms (WSPF) and compare with WWIS data on specific containers. Make approval/rejection recommendations to the WSPF review team

Requisite Skills, Experience and Education:

Bachelor of Science degree with technical courses in nuclear waste management, chemistry and health physics, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- Subject Matter Expert/On-The-Job Training (TRG-293/298)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Manager, Waste Handling

Duties:

- Oversee all TRU waste and non-TRU waste handling activities conducted by Waste Operations personnel

Requisite Skills, Experience and Education:

B.S. degree, or equivalent, in nuclear-related field.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Worker Supervisor (HWS-101/101A)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Manager, Transportation Operations

Duties:

- Oversee all TRU waste and non-TRU handling activities conducted by Transportation Operations

Requisite Skills, Experience and Education:

B.S. degree, or equivalent, in nuclear-related field.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker Supervisor (HWS-101/101A)

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Radiological Control Technician

Duties:

- Conducts routine surveys of all incoming shipping containers for radiation, contamination, and damage
- Conducts routine radiological surveys (monitoring for surface and airborne contamination and radiation exposure) of various areas at the WIPP site
- Serves as emergency response personnel for any event involving radiation and radioactive materials
- Oversees any radiological work at the facility. This duty involves writing radiological work permits (RWPs), issuing radiological protective clothing and supplemental dosimetry, conducting radiological monitoring of the job (including personnel, equipment, and areas involved), as well as providing any other radiological safety oversight function
- Monitors TRU waste handling and related operations, as well as any other radiological work, to determine compliance with radiological control documents and procedures
- Performs operational and functional checks of radiological detection and monitoring equipment
- In the unlikely event of personnel radiological contamination, the RadCon Tech is qualified to perform personnel decontamination and provide radiological oversight to medical personnel if an injury is contaminated
- Posts radiological areas with applicable signs and barriers
- Controls radioactive sources (including leak testing) used in the performance/functional checks and calibrations of radiological instrumentation
- Operates some non-radiological measurement equipment associated with radiological monitoring (gravimetric scale, chart recorders, data loggers, etc.)

Requisite Skills, Experience and Education:

Academic or vocational high school graduate, or equivalent, with courses in chemistry, physics, geometry, or trigonometry, or equivalent; associate degree in radiation safety or health physics preferred.

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS (CONTINUED)

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Health Physics Technician Qualification (RCT-01/02)
- Radiological Worker II (RAD-201)
- Respiratory Protection (SAF-630/631)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Responder (HWR-101/101A)
- Conduct of Shift Operations (OPS-115)
- First Aid/CPR (MED-101 or 101A)
- Electrical Safety (ELC 103) (Annual)
- Hazardous Material Transportation (HMT 102/103) (Biennial)
- 40-Hour Inexperienced Miner (SAF 501/502) (Annual
- compressed Gas Cylinder Safety (SAF 619) (Once)
- Fundamental Academic Lessons
- Site-Specific Academic Lessons

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Manager, Radiation Control

Duties:

- Supervises/oversees hazardous waste management duties performed by personnel in the Radiation Control section

Requisite Skills, Experience and Education:

B.S. degree in engineering, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Worker Supervisor (HWS-101/101A)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Technical Trainer

Duties:

- Conduct Hazardous Waste Management training

Requisite Skills, Experience and Education:

High school graduate with knowledge in areas of skills taught.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Level II Trainer (TRG-300)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Manager, Technical Training

Duties:

- Directs hazardous waste management training

Requisite Skills, Experience and Education:

B.S. degree and 5 years nuclear experience, or seven years nuclear training experience, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Level II Trainer (TRG-300)
- Subject Matter Expert/On-the-Job Training (TRG-293/298)
- Hazardous Waste Supervisor ((HWS-101)

RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Emergency Services Technician

Duties:

- Responds to hazardous waste spills in emergency situations
- Provides emergency fire-response services
- Conducts routine inspections and maintains all response equipment on site
- Directs emergency teams to control hazardous situations

Requisite Skills, Experience and Education:

Vocational or commercial high school graduate, or equivalent, plus additional training in emergency fire and medical response, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- EST Qualification Card (EST-01)
- Subject Matter Expert/On-The-Job Training (TRG-293/298)
- Hazardous Waste Worker (HWW-101/102)
- Respiratory Protection (SAF-630/ 631)
- Firefighter I (SAF-621)
- Hazardous Waste Responder (HWR-101/101A)
- Incident Command Structure (ERT 113) (Once)
- Radiological Worker II (RAD 201) (Annual)
- 40-Hour Inexperienced Miner (SAF 501/502) (Annual)
- Heated Environment/Confined Space (SAF 515/515A) (Annual)
- Compressed Gas Cylinder Safety (SAF 619) (Once)

NOTE: The trainee may perform duties prior to qualification only for those evolutions and/or operations for which training has been completed.

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Quality Assurance Technician

Duties:

- Observes waste handling operations and verifies adherence with hazardous waste handling procedures

Requisite Skills, Experience and Education:

Vocational, technical or high school graduate, or equivalent, plus two years of technical training with courses in inspection techniques, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Quality Assurance Inspector Qualification Card

RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Team Leader, Inspection Services

Duties:

- Ensures that items or services that do not conform with specified quality requirements are controlled to prevent use until disposition and corrective action, where applicable, are implemented
- Provides technical supervision for Quality Assessment Technicians inspecting and verifying waste handling operations

Requisite Skills, Experience and Education:

Associate of science degree in a technical field, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Worker Supervisor (HWS-101/101A)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Facility Inspection, Repair, and Service Team (FIRST) Leader

Duties:

- Oversee the packaging and shipment of hazardous and non-hazardous waste

Requisite Skills, Experience and Education:

High school graduate, or equivalent, supervisory experience and one year maintenance-related experience.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Worker Supervisor (HWS-101/101A)
- Hazardous Materials and Waste Transportation (HMT-102, 103)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Facility Inspection, Repair, and Service Team (FIRST)

Duties:

- Support hazardous and non-hazardous waste packaging and shipments

Requisite Skills, Experience and Education:

High school graduate, or equivalent, and one year maintenance-related experience. Maintain CDL Driver's License

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102) (Annual)
- Hazardous Materials and Waste Transportation (HMT-102, 103) (Biennial)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Sampling Team Member

Duties:

- Collects samples of waste for characterization and environmental media for determination of possible releases

Requisite Skills, Experience and Education:

Academic or vocational high school graduate, or equivalent, with courses in algebra and chemistry or biology, plus Associate degree in engineering or science with courses in computer science, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Responder (HWR-101/101A)
- Sampling Team Qualification (ST-001)
- Respiratory Protection (SAF 630/631) (Annual)

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Sampling Team Assistant

Duties:

- Assists sampling team members in the collection of waste samples for characterization and environmental media for determination of possible releases. Sampling Team Assistant will not respond to hazardous material spills.

Requisite Skills, Experience and Education:

Academic or vocational high school graduate, or equivalent, with courses in algebra and chemistry or biology, plus Associate degree in engineering or science with courses in computer science, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Sampling Team Assistant Qualification (STA-001)
- Respiratory Protection (SAF 630/631) (Annual)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Manager, Environmental Compliance

Duties:

- Supervises/oversees hazardous duties performed by Sampling Team members

Requisite Skills, Experience and Education:

B.S. degree in an environmental science, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Supervisor (HWS-101/101A)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Facility Shift Engineer

Duties:

- Notifies emergency response personnel and on-call facility manager during emergency occurrences
- Serves as backup RCRA Emergency Coordinator

Requisite Skills, Experience and Education:

Associate degree in engineering or scientific discipline, or equivalent, and five years related practical experience, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Facility Operations Shift Supervisor Qualification Card (FO-FOSE-3 or FO-FOSE-3R)
- Roving Watch Qualification (FO-RW-1)
- Central Monitoring Room Operator Qualification (FO-CMRO-2)
- Conduct of Shift Operations (OPS-115)
- Hazardous Materials Emergency Response (HMT-104)
- Root Cause Analysis (TRG-296)
- WIPP Occurrence Reporting for Facility Managers (OPS-110)
- WIPP Contingency Plan Procedure (SAF-645)
- Hazardous Waste Worker (HWW-101)

NOTE: Full Qualification must be completed prior to the candidate operating any equipment or performing any operating evolutions without the direct supervision of a qualified operator.

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Facility Shift Manager

Duties:

- Serves as RCRA Emergency Coordinator
- Notifies emergency response personnel and on-call facility manager during emergency occurrences

Requisite Skills, Experience and Education:

Academic or vocational high school (mechanical/electrical) graduate and eight years of nuclear plant operating experience, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Facility Operations Shift Engineer Qualification Card (FO-FOSE-3 or FO-FOSE-3R)
- Roving Watch Qualification (FO-RW-1)
- Central Monitoring Room Operator Qualification (FO-CMRO-2)
- Conduct of Shift Operations (OPS-115)
- Hazardous Materials Emergency Response (HMT-104)
- Root Cause Analysis (TRG-296)
- WIPP Occurrence Reporting for Facility Managers (OPS-110)
- WIPP Contingency Plan Procedure (SAF-645)
- Hazardous Waste Worker (HWW-101)

NOTE: Full Qualification must be completed prior to the candidate operating any equipment or performing any operating evolutions without the direct supervision of a qualified operator.

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Central Monitoring Room Operator

Duties:

- Notifies emergency response personnel
- Documents emergency actions

Requisite Skills, Experience and Education:

Vocational or academic high school graduate, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Roving Watch Qualification (FO-RW-1)
- Central Monitoring Room Operator (FO-CMRO-2 or FO-CMRO-2R)
- Hazardous Materials Emergency Response (HMT-104)
- Conduct of Shift Operations (OPS-115)

NOTE: Full Qualification must be completed prior to the candidate operating any equipment or performing any operating evolutions without the direct supervision of a qualified operator.

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Waste Hoist Operator

Duties:

- Operates waste shaft hoist in accordance with established procedures
- Maintains daily hoist operations log
- Performs routine inspections of the Waste Shaft hoisting equipment

Requisite Skills, Experience and Education:

Vocational or academic high school graduate, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Waste Hoist Qualification (M-30)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Waste Hoist Shaft Tender

Duties:

- Oversees and directs loading and unloading of the Waste Shaft Conveyance above and below ground

Requisite Skills, Experience and Education:

Vocational or academic high school graduate, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Waste Hoist Shaft Tender (M-31)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Waste Hoisting Manager

Duties:

- Coordinate and direct the daily operations and maintenance of the operating hoist and shaft
- Supervise/oversee hazardous waste management duties performed by hoisting personnel

Requisite Skills, Experience and Education:

B.S. degree, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Worker Supervisor (HWS-101/101A)

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Chief Office Warden

Duties:

- Cooperate, participate, and comply with the provisions of WIPP Emergency Plan
- Primary function is to coordinate personnel accountability in the event of an evacuation
- Responsible for surface accountability at staging areas in the event of an evacuation

Requisite Skills, Experience and Education:

High School Diploma or equivalent, approval from employee's manager, compliance with the requirements of the WIPP Emergency Plan, and current knowledge of emergency evacuations, staging and assembly areas, and the site notification system.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Office Warden Training (SAF-632)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Assistant Chief Office Warden

Duties:

- Cooperate, participate, and comply with the provisions of WIPP Emergency Plan
- Primary function is to coordinate personnel accountability in the event of an evacuation
- Responsible for surface accountability at staging areas in the event of an evacuation

Requisite Skills, Experience and Education:

High School Diploma or equivalent, approval from employee's manager, compliance with the requirements of the WIPP Emergency Plan, and current knowledge of emergency evacuations, staging and assembly areas, and the site notification system.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Office Warden Training (SAF-632)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Mine Rescue Team Member

Duties:

- Cooperate, participate, and comply with provisions of the WIPP Emergency Management Program (WP 12-9)
- Trained in accordance with 30 CFR to respond to mine emergencies beyond that of the FLIRT
- Responsible for underground reentry and rescue after an underground evacuation

Requisite Skills, Experience and Education:

High School Diploma or equivalent, written approval from employee's manager (Authorization Card MRT-01), compliance with health and physical requirements, 1) Initial examination and clearance by the Occupational Medical Director, 2) Examined and cleared annually by the Occupational Medical Director, 3) Additional tests: pulmonary function test, cardiac stress test every five years, drug screen, 4) Encouraged to maintain good medical and physical condition, Compliance with requirements of the SERP, current knowledge regarding rescue and recovery of personnel involved in mine emergencies according to 30 CFR. At least one year verifiable underground work.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- First Aid and CPR (MED-101)
- Respiratory Protection (SAF-630/SAF-631 D)
- Radiological Worker II (RAD-201)
- Mine Rescue Team Initial training (EOC-101)
- Inexperienced Miner Training (SAF-501/502)
- Compressed Gas Cylinder Safety (SAF 619) (Once)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: First Line Initial Response Team member

Duties:

- Cooperate, participate, and comply with provisions of the Supplemental Emergency Response Program Plan (SERP)
- Primary function is to provide medical and hazardous material response to the WIPP underground

Requisite Skills, Experience, and Education:

High School Diploma or equivalent, written approval from employee's manager (Authorization Card FLIRT-01), compliance with health and physical requirements, 1) Initial examination and clearance by the Occupational Medical Director, 2) Examined and cleared annually by the Occupational Medical Director, 3) Additional tests: pulmonary function test, cardiac stress test every five years, drug screen, 4) Encouraged to maintain good medical and physical condition, compliance with requirements of the SERP, current knowledge regarding medical response and hazardous materials response.

Training (Type/Amount):

The following training must be completed and current prior to participation during an emergency response:

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA)
- Inexperienced miner (SAF 501/502)
- Confined Space Training (SAF-515)
- Hazardous Waste Worker (HWW-101)
- Respiratory Protection (SAF-630 and SAF-631 D)
- First Aid and CPR (MED-101)
- Radiological Worker II (RAD-201)
- Confined Space Rescue (ERT 102/102A) (Annual)
- Annual Live Fires Practical (ERT 107) (Annual)
- Introduction to Firefighting (ERT 117) (Once)
- Eight hours of training quarterly
- Hazardous Waste Responder (HWR 101/101A)(Annual)

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Emergency Response Team

Duties:

- Responding to hazardous waste incidents or releases due to fires, HAZMAT, and medical emergencies
- Operating as part of the WIPP Supplemental Emergency Response Program

Requisite Skills, Experience, and Education:

High School Diploma or equivalent, written approval from employee's manager (Authorization Card ERT-01), compliance with health and physical requirements:
1) Initial examination and clearance by the Occupational Medical Director
2) Examined and cleared annually by the Occupational Medical Director
3) Additional tests: pulmonary function test, cardiac stress test every five years, drug screening.

Training (Type/Amount):

- Emergency Response Team (ERT-102/102A) (Annual)
- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA) (Annual)
- Hazardous Waste Worker (HWW-101/102) (Annual)
- Hazardous Waste Responder (HWR-101/101A) (Annual)
- Respiratory Protection (SAF-630/ SAF-631C/ SAF-631 D) (Annual)
- First Aid and CPR (MED-101/101A) (Annual)
- Radiological Worker (RAD-201/202) (Annual)
- Confined Space/Heated Environment (SAF-515/515A)
- Emergency Response Team Member Authorization Card (ERT-01)

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RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: Fire Brigade

Duties:

- Fight fires

Requisite Skills, Experience, and Education:

High School Diploma or equivalent, fire fighting training, compliance with health and physical requirements:
1) Initial examination and clearance by the Occupational Medical Director.
2) Examined and cleared annually by the Occupational Medical Director.
3) Encouraged to maintain good medical and physical condition.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA) (Annual)
- Hazardous Waste Worker (HWW-101/102) (Annual)
- Hazardous Waste Responder (HWR-101/101A) (Annual)
- Radiological Worker (RAD-201/202) (Annual)
- Respiratory Protection (SAF-630/ SAF-631D) (Annual)

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Fire Protection Technician

Duties:

- Responds to hazardous waste spills in emergency situations
- Provides emergency fire-response service
- Conducts routine inspections and maintains all response equipment on site
- Serves as incident commander
- Directs emergency teams to control hazardous situations

Requisite Skills, Experience, and Education:

Vocational or commercial high school graduate, or equivalent, plus additional training in emergency fire and medical response, or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-19XA/GET-20XA/GET-21XA) (Annual)
- Hazardous Waste Worker (HWW-101/102)
- Hazardous Waste Responder (HWR-101/101A)
- Radiological Worker (RAD-201/202)
- Respiratory Protection (SAF-630/ SAF-631D)
- Fire Protection Technician Qualification Card (FTP-01)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Radiographer Level 1 (Radiography Independent Technical Reviewer)

Duties:

- Reviews radiography record performed by another radiographer

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-20XA/GET-21XA)
- Conduct of Shift Operations (OPS 115) (Once)
- Radiography Training (Level 1)

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1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Radiographer Level 2 (Radiography Independent Technical Reviewer)

Duties:

- Performs confirmation of waste using radiography
- Reviews radiography record performed by another radiographer

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-20XA/GET-21XA)
- Radworker II (RAD-201)
- Hazardous Waste Worker (HWW-101/102)
- Respiratory Protection (SAF-630/631)
- Conduct of Shift Operations (OPS 115) (Once)
- Technical Safety Requirements (OPS 122) (Once)
- Subject Matter Expert/On the Job Trainer (TRG 293/298) (Biennial)
- Waste Handling Systems (STC-003) (Once)
- Radiography Training (Level 2)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Visual Examination Operator/Expert Level 1 (VE Independent Technical Reviewer)

Duties:

- Reviews visual examination or visual examination record review performed by another Visual Examination Expert.

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-20XA/GET-21XA)
- Conduct of Shift Operations (OPS 115) (Once)
- Visual Examination (Level 1)

1 **RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS**

Position Title: Visual Examination Operator/Expert Level 2 (VE Independent Technical Reviewer)

Duties:

- Performs confirmation of waste using visual examination or review of visual examination records
- Reviews visual examination or visual examination record review performed by another Visual Examination Expert.

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-20XA/GET-21XA)
- Radworker II (RAD-201)
- Hazardous Waste Worker (HWW-101/102)
- Respiratory Protection (SAF-630/631)
- Conduct of Shift Operations (OPS 115) (Once)
- Technical Safety Requirements (OPS 122) (Once)
- Subject Matter Expert/On the Job Trainer (TRG 293/298) (Biennial)
- Waste Handling Systems (STC-003) (Once)
- Visual Examination (Level 2)

1

RCRA HAZARDOUS WASTE MANAGEMENT JOB DESCRIPTIONS

Position Title: DOE Management Representative

Duties:

- Reviews confirmation data packages in accordance with SOPs
- Approves confirmation data packages to authorize shipments
- Takes action to suspend shipments and initiate corrective actions per Permit Attachment C7, Section C7-2

Requisite Skills, Experience and Education:

Academic or vocational high school diploma or equivalent, and shall be employed by DOE.

Training (Type/Amount):

- General Employee Training (GET-19X/GET-20X/GET-21X)
- General Employee Training Refresher (GET-20XA/GET-21XA)
- Required Reading
  - QAPD
  - Permit Attachments C through C7
  - Relevant DOE confirmation procedures

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ATTACHMENT F2

TRAINING COURSE AND QUALIFICATION CARD OUTLINES

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ATTACHMENT F2

TRAINING COURSE AND QUALIFICATION CARD OUTLINES

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1 **Course Outlines**

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1

COURSE: GET-19X/GET-20X/GET-21X - General Employee Training

DURATION: ≈ 16 Hours

PREREQUISITES: None

SCOPE:

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student will be able to perform their job in a safe manner and will have an overview of the site organization and description.

Mastery of the terminal objectives will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: GET-19XA/GET-20XA/GET-21XA annually

COURSE DESCRIPTION (by module)

1. Site Overview & WIPP Description
   ≈1 hour
   a. Mission of DOE and CBFO
   b. Relationship of WIPP organizations
   c. Surface structures
   d. WIPP shafts
   e. Underground area

2. Emergency Preparedness (includes Occurrence Reporting)
   ≈1 hour
   a. Definition of occurrence
   b. DOE Order 5000.3B
   c. WP 12-ES3918
   d. Occurrence reporting process
   e. Employee involvement with Emergency Preparedness
   f. Types of emergencies
   g. Emergency response by WIPP groups
   h. Off-site response groups
   i. WIPP emergency procedures
   j. Emergency equipment
   k. Employee actions during emergencies

3. General Safety ≈1 hour	a. Personal Protective Equipment b. Requirements for PPE c. Warning Tags d. WIPP safety hazards e. Medical assistance f. Actions to take for injuries g. Reporting injuries/accidents h. Employee concerns
4. Computer Security ≈1 hour	a. Department to contact b. WIPP policies and procedures for: 1. Personally owned software 2. Computer games 3. Passwords/password protection c. Computer virus prevention
5. Fire Protection ≈1 hour	a. WIPP Fire Protection Program b. Fire sources at WIPP c. Fire Tetrahedron d. Classes of fires e. Fire extinguisher f. Office Warden Program g. Employee responsibilities during a fire
6. RCRA & Storm Water Management ≈2 hours	a. RCRA history b. RCRA goals c. WIPP goals and relation to RCRA d. Definition of RCRA wastes e. Site generated waste program f. Training requirements for treatment storage and disposal facilities g. Contingency Plan h. Waste Minimization Program i. RCRA regulatory agencies j. RCRA enforcement options k. Application of Storm Water Management policy in relation to the general employee

8. Work Policies and Procedures
≈1 hour
   a. DOE Orders and MOC Procedures
   b. Teamwork
   c. Conduct of Operations Policy
      1. Elements of Conduct of Ops
   d. Quality Assurance Program
   e. Responsibility for following procedures
   f. Resuming work after stoppage
   g. Stopping work for unsafe acts
   h. Purpose and uses of "Hold Tag"
   i. Quality records and requirements
   j. Correcting errors on QA Records
   k. Configuration Management and affected departments

9. Electrical Safety
≈1 hour
   a. Variables of electrical circuits
   b. Severity of electrical shock
   c. Areas where electrical accidents occur
   d. WIPP policy on using damaged electrical equipment
   e. WIPP policy for modifying electrical protective devices
   f. Requirements for use of Ground Fault Interrupters.
   g. Purpose of GFIs
   h. WIPP policy for resetting breakers
   i. WIPP policy for using extension cords, plug-in devices, and other equipment exposed to energized electrical circuits

10. Hazard Communications
≈1 hour
   a. Description of Haz Comm Std.
   b. Health and Safety hazards
   c. Protection from workplace hazards
      1. PPE
      2. Preparedness/Prevention
      3. Employee responsibilities
   d. Emergency procedures
   e. WIPP Hazard Communication Prog.
      1. Training
      2. Container labels
      3. Chemical transfers
      4. Material Safety Data Sheets
   f. Other information sources

11. Personal Protective Equipment
≈1 hour
   a. Requirements for head protection
   b. Requirements for hearing conservation
   c. Requirements for face/eye protection
   d. Requirements for foot protection

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12. Bloodborne Pathogens
≈1 hour
    a. Def. of Bloodborne Pathogens
    b. Def. of Hepatitis B and Human Immunodeficiency Virus
    c. Bloodborne Pathogen transmission
    d. Prevention of bloodborne pathogen infection
    e. WIPP Exposure Control Plan

13. Ergonomics
≈2 hours
    a. Cumulative Trauma Disorder
    b. Risk factors for CTD
    c. Prevention of CTD
    d. Recognition of CTD
    e. Steps to take when CTD develops

14. Security
≈1 hour
    a. Security Mission
    b. Def. of Security Officer
    c. Security Officer Tasks
    d. Access and Property Control at WIPP
    e. Badge accountability
    f. Property Pass system
    g. Physical security
    h. Telephone threat list
    i. Employee responsibilities during demonstration
    j. Fitness for duty
    k. Computer security
    l. Parking requirements

15. General Employee Radiological Training (GERT)
≈1 hour

This program will be implemented prior to declaration of site readiness for all site employees. The standardized core materials for GERT include the following topics:

Sources of Radiation
Non-ionizing and Ionizing Radiation
Risk in Perspective
ALARA Concept
Radiological Controls
Monitoring/Dosimetry
Emergency Procedures
Employee Responsibilities

All times are approximate and do not reflect time spent on additional topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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1

COURSE: GET-19XA/GET-20XA/GET-21XA - General Employee Training Refresher

DURATION: Self-paced Course

PREREQUISITES: None

SCOPE:

TYPE: Self-paced Module

OBJECTIVES: Objectives are stated at the beginning of each module, including security, radiological basics, general safety, hazard communications, bloodborne pathogens, hearing protection, and OSHA/RCRA.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the module examination.

REFRESHER: Annually

COURSE DESCRIPTION (by module)

1. Introduction
   a. Self Paced Course
   b. Information about WIPP organizations
   c. Appendix Information
      1. Storm Water Management
      2. WIPP Land Withdrawal Act
      3. DOE Mission
   d. Exam Guidelines
2. General Security
   a. Prohibited Articles
   b. Primary responding agencies
   c. Wearing your badge
   d. Escort Responsibility
   e. Number of visitors an employee may escort
   f. When to turn off your computer
   g. Personal Property Passes
3. Computer Security
   a. Point of contact
   b. WIPP policies and procedures for:
      1. Personally owned software
      2. Computer games
      3. Passwords/password protection
   c. Computer virus prevention
4. Fitness for Duty
   a. Reasons for the Fitness for Duty Program
   b. General Employee Responsibilities

5. RCRA	a. Types of waste disposed b. Waste Identification
6. Storm Water Management	a. Application of Storm Water Management policy in relation to the general employee
7. Bloodborne Pathogens	a. Transmission Identification of Bloodborne Pathogens b. Prevention of Hepatitis B and Human Immunodeficiency Virus c. Actions to take if exposed
8. Hazard Communications	a. Purpose of MSDS b. Responsibilities when transferring hazardous materials c. WIPP Hazard Communication Prog. 1. Training 2. Container labels 3. Chemical transfers 4. Material Safety Data Sheets
9. Ergonomics	a. Identification of CTD b. Ways to prevent CTD c. Required actions
10. Personal Protective Equipment	a. Requirements for head protection b. Requirements for hearing conservation c. Requirements for face/eye protection d. Requirements for foot protection
11. General Safety	a. Requirements for obeying signs and tags b. Requirements for reporting an occurrence c. Actions for emergency situations d. Resolving employee concerns e. Proper uses of extension cords f. WIPP Circuit Breaker Policy g. Steps to take when responding to fire h. Responsibilities when fighting a fire i. When to use the sign-out board
12. Conduct of Operations	a. Goals of In-House Management Program b. Required actions before posting information c. Correcting a written record d. Point of Contact for Records Management

1

COURSE: HWW-101 - Hazardous Waste Worker

DURATION: ≈24 hours

PREREQUISITES: None

SCOPE:

REFRESHER: HWW-102 Annually

COURSE DESCRIPTION (by module)

1. Course and Regulatory Overview
   ≈1 hour
   a. OSHA regulations and their applicability to RCRA facilities and operations
   b. RCRA standards for generator facilities and for TSDFs
   c. DOT/EPA regulations and applicability to hazardous waste transportation

2. Hazard Communications
   ≈1 hour
   a. Purpose of the Hazard Communication standard (29 CFR 1910.1200)
   b. Locations of Material Safety Data Sheets (MSDS)
   c. Labeling of containers
   d. Other resources for information on hazardous materials/waste including NFPA 704 hazard warning symbol, DOT United Nations Identification System, DOT Emergency Response Guidebook, NIOSH Pocket Guide to Chemical Hazards. Student exercises are included in this section on the use of these references.

3. Principles of Toxicology
   ≈3 hours
   a. Dose-response relationship with regard to exposures to hazardous materials
   b. Immediate and delayed effects (acute and chronic effects)
   c. Different ways substances enter the human body
   d. Effects of substances on the human body including target organ effects, systemic effects, carcinogens, and genetic effects

	e. Exposure limits including Threshold Limit Value (TLV), Permissible Exposure Limit (PEL), Lethal Dose 50% (LD_{50}), Lethal Concentration 50%(LC_{50}) f. Effects of temperature extremes on the human body including signs and symptom heat stress and cold stress g. Effects of ionizing radiation
4. Hazards ≈3 hours	a. Safety and health hazards when conducting hazardous waste operations including fire, explosion, oxygen deficiency, ionizing radiation, biological, electrical, heat and cold stress b. Hazard classification including chemical, physical, mechanical, biological, and radiological c. Airborne hazards including gases, vapors, and particulates d. Properties of materials including corrosivity, pH, flammability, explosivity, (upper and lower explosive limits), specific gravity, vapor density, boiling point, solubility, and reactivity e. Protection from hazards f. Confined space hazards g. Causes and prevention of accidents
5. Personal Protective Equipment ≈3 hours	a. Description and examples of Personal Protective Equipment (PPE) b. Factors in the selection of PPE c. Non-radiological and radiological hazards d. Selection process for PPE e. Ways substances enter PPE including permeation, degradation, penetration f. Equipment included in each of the four levels of PPE adopted by the EPA (Levels A, B, C, and D), capabilities and limitations of each level g. PPE inspection h. Job scope planning i. Human factors that limit the use of PPE j. Demonstration on donning and removal of Level D PPE. Students perform a Level D dress out sequence and are evaluated by a Job Performance Measure.

6. Satellite Accumulation Areas ≈2 hours	a. Purpose of hazardous waste satellite accumulation areas (proper accumulation of hazardous waste to protect human health and the environment) b. Key elements of satellite accumulation areas including maintenance of containers, labeling, maximum quantities allowed, and transfers to storage area c. Inspection criteria including aisle space, stacking of containers, closing of containers, labeling requirements, containment structures, housekeeping, warning signs, alarms, fire extinguisher, spill control materials, and ignition sources
7. Decontamination ≈2 hours	a. Purpose of decontamination (prevent the spreading of contamination, prevention of exposure to workers, protection of the environment) b. Causes and prevention of worker contamination c. Decontamination planning including methods for decontaminating d. Layout of decontamination stations e. Emergency decontamination procedures

All times are approximate and do not reflect time spent on additional topics that arise due to class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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1

COURSE: HWW-102 - Hazardous Waste Worker Refresher

DURATION: 8 hours

PREREQUISITES: HWW-101

SCOPE: This course reviews precautions for safe handling and use of a hazardous material and the management of any hazardous waste generated during these activities. This is accomplished by reviewing the concepts presented in HWW-101 and the application to a particular hazardous material by the use of a Material Safety Data Sheet (MSDS). Also included in this course is an overview of mixed waste.

TYPE: Classroom and Practical

COURSE DESCRIPTION (by lesson)

1. Material or Waste Information
   ≈2 hours
   a. Definition of TRU mixed waste
   b. Emergency actions in the event of a spill or leaking or punctured container of TRU mixed waste
   c. This module describes the information found in the supplier information section of a Material Safety Data Sheet (MSDS)
   d. This information is used in the event the user of the material needs more information than what is included in the particular MSDS
   e. Information
      1. This module describes the product's individual ingredients, relative concentration, and the exposure limit for each ingredient
   f. Physical/Chemical Data
      1. This module describes the chemical and physical properties of the material including; boiling point, specific gravity, melting point, vapor pressure, vapor density, evaporation rate, solubility, pH, and volatility

2. Hazard Data
≈2 hours

a. This module describes the fire and explosion hazards of the particular material including; flash point, lower explosive limit, upper explosive limit, auto-ignition temperature, NFPA 704M Hazard Classification Rating, fire extinguishing media, special fire fighting procedures, unusual fire and explosion hazards, toxic gases produced, and explosion data
b. Reactive Data Module
    1. This module describes the material's reactivity characteristics including stability, incompatibility, decomposition, and polymerization
c. Health Hazards Data Module
    1. This module describes the different ways the user may be exposed to the material and the adverse effects the material may have on the body including; lethal dose 50% (LD_{50}), lethal concentration 50 % (LC_{50}), target organ effects, carcinogenicity, acute and chronic effects, and emergency first aid procedures

3. Safety ≈2 hours	a. This module describes the precautions for the safe handling of the material including steps to take in the event the material is spilled, waste disposal method (EPA hazardous waste numbers), regulatory requirements (SARA Title III hazard categories/lists and CERCLA Hazardous Substance classification), labeling of containers, protective equipment, and site specific requirements b. Control Measures Module 1. This module describes safety control measures to take when using the material including respiratory protection, ventilation requirements, work/hygiene practices and site specific requirements c. Personal Protective Equipment Module 1. This module describes the purpose of personal protective equipment (PPE), the categories of protection, EPA Levels of Protection (A,B,C,D), PPE material and chemical resistance. In this module the donning and doffing of Level D PPE is demonstrated. The students are given an opportunity to practice and then are evaluated by completion of a Job Performance Measure.
4. Demonstration ≈1 hour	a. The effects the hazardous material has on various types of PPE material (degradation, permeation, and penetration effects), other common materials and neutralization effects are demonstrated

All times are approximate and do not reflect additional time spent on topics that arise due to class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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1

COURSE: HWR-101 - Hazardous Waste Responder

DURATION: 20 hours

PREREQUISITES: GET-19X/GET-20X/GET-21X
Medical Physical
SAF 630/631- Respiratory Protection
HWW 101 - Hazardous Waste Worker

SCOPE: The instructor will present updated information needed for personnel who respond to hazardous material and/or hazardous waste emergencies at the WIPP site.

TYPE: Classroom and Field Exam

OBJECTIVES: Upon completion of this course, the student will be able to respond to hazardous materials emergencies at the WIPP site.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the post course examination, satisfactory performance on the job performance measure for donning and doffing Personal Protective Equipment, and participate as a team in the final practical.

REFRESHER: HWR-101A Annually

COURSE DESCRIPTION

1. Regulatory Requirements
   ≈1 hour
   a. 29 CFR 1910.120

2. Evaluation of Incident
   ≈3 hours
   A. (Types of Information)
      a. Physical data
         1. color
         2. odor
         3. sound
      b. Cognitive
      c. Technical

   B. Dispatch and Initial Response Phase
      a. Primary focus information
      b. CMR information
      c. During a response

   C. Product Information
      a. Product identification
      b. Primary and secondary hazards

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D. Incident Elements
   a. Spill
   b. Leak
   c. Fire

E. Incident Priorities

3. Response Operations
   ≈1 hour
   A. Size-up, Strategy, and Tactics
      a. Size-up
         1. Monitoring atmospheric conditions near the release
            a. Weather conditions
            b. Organic vapors, gases, particulates
            c. Oxygen deficiency
            d. Specific materials
            e. Combustible gases
            f. Inorganic vapors, gases, particulates
            g. Radiation
         2. Visual observations
         3. Unusual odors
         4. Off-site samples
         5. Entry team procedures
            a. Monitoring on-site ambient air
            b. Types of containers and impoundments
            c. Physical condition of material
            d. Leaks or discharges
            e. Labels and markings
         6. Additional considerations
            a. Type, condition, and behavior of container
            b. Resources and control measures
         7. Summary of size-up
      b. Strategy and tactics
         1. Definitions
         2. Strategy
         3. Tactics
         4. Rescue
         5. Prevent container failure
         6. Containment
         7. Confinement
         8. Remove ignition sources
         9. Extinguish fires
         10. Tactical withdrawal

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B. Incident Command System and Mitigation Plan at the WIPP
≈1 hour
   a. Key elements required
   b. Key personnel and functions
      1. Incident commander
      2. Science officer
      3. Safety officer
      4. Records keeper
      5. Medical officer
      6. Resource officer
      7. Operations officer
   c. Implementing response operations
      1. Organize
      2. Evaluate the situation
      3. Develop a plan of action

4. Safety
≈5 hours
   A. Responder Protection
      a. Pre-entry evaluation
      b. Deny entry
      c. Hydration
      d. Pre-entry briefing
      e. Post-exit evaluation
      f. Support location
      g. Environmental temperature monitoring

   B. Personal Protective Equipment
      a. Selection of appropriate PPE
         1. Levels
            a. Level A
            b. Level B
            c. Level C
            d. Level D
         2. Optional equipment
         3. Manufacturer recommendations/testing
            a. Gloves

   C. Donning and Doffing Level A PPE

   D. Job Performance Measures
      a. Students will Don and Doff Level A PPE with a partner

   E. Decontamination

   F. Emergency Medical Services

5. Table-top Drill
≈2 hours

6. Course Review

7. Written Examination

8. Practical
   ≈5 hours

a. Objective
b. Demonstration
c. Equipment needed
d. Have students develop Incident Commander and System
e. Evaluation

All times are approximate and do not reflect time spent on additional topics that arise due to class participation, student breaks, and/or practical exercises. (i.e., Job Performance Measures)

COURSE: HWR-101A - Hazardous Waste Responder, Refresher

DURATION: ≈8 hours

PREREQUISITES: HWR-101

OBJECTIVES: Upon Completion of this course, the student will be able to respond to hazardous materials emergencies at the WIPP site.

Mastery of the terminal objective will be demonstrated by satisfactory performance on the job performance measure for donning and doffing Personal Protective Equipment (PPE), and successfully participate as a team in the final practical

REFRESHER: Annually

COURSE DESCRIPTION

1. Review of HWR-101
   ≈2 hours

2. Changes in Regulations, procedures, and polices
   ≈2 hours

3. Lessons Learned
   ≈2 hours

4. Conclusion and Exam
   ≈2 hours

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size and/or practical exercises (i.e., Job Performance Measures)

1

COURSE: HWS-101 - Hazardous Waste Worker Supervisor

DURATION: ≈8 hours

SCOPE: This course will provide the students with the knowledge necessary to identify factors affecting individual and corporate liability under applicable hazardous waste laws and regulations. Students will be able to state the stages of criminal and civil litigation, identify the types of behavior that leads to criminal prosecution, and identify appropriate actions to ensure compliance with applicable hazardous waste operations.

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student shall be able to perform supervisory functions in compliance with policies, procedures, and regulations, with regard to hazardous waste management.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: HWS 101A annually

COURSE DESCRIPTION (by lesson)

1. Liability and Responsibility
   ≈3 hours
   a. General requirements
   b. Definitions and key liability concepts
   c. Mental element in criminal litigation
   d. Typical litigation chronology
   e. Civil and criminal penalties under OSHA
   f. Criminal penalties under environmental laws
   g. Federal sentencing guidelines
   h. Mitigation credit under Federal Sentencing Guidelines
   i. Who will be defendants
      1. Direct involvement
      2. Direct supervisory involvement
      3. Indirect involvement and Responsible Corporate Officer doctrine
   j. Representation
   k. Indemnification
   l. Scope of employment
   m. Types of criminal cases being pursued
   n. Recommended actions

- o. Illustrative cases
  1. Knowledge
  2. Sovereignty
  3. Multiple prosecutions
  4. Pervasiveness of liability
  5. Potential for catastrophic corporate consequences
- p. Conclusions

2. Health and Safety Program ≈3 hours
   - a. Purpose
   - b. Authority
   - c. Supervisor responsibilities
     1. Hazard control
     2. Hazardous waste management
     3. Hazardous materials management
        - a. Training
        - b. Storage and handling
        - c. Labeling containers
        - d. General precautions and practices
   - d. Personal protective equipment

   A. Industrial Hygiene
      - a. Exposure limits
      - b. Conversion and comparison of PPM

   B. Spill Containment (Emergency Response)
      - a. Spill response plan

   C. Site Control
      - a. Zoning

   D. Decontamination

   E. Reporting Requirements

3. Conclusion ≈1 hour

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises (i.e. Job Performance Measures)

1

COURSE: HWS-101A - Hazardous Waste Worker Supervisor-Refresher

DURATION: ≈8 Hours

PREREQUISITES: HWS-101

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student will be able to perform supervisory functions in compliance with policies, procedures, and regulations with regard to hazardous waste management

Mastery of the terminal objective will be demonstrated by scoring 80% or higher on the course examination.

REFRESHER: Annually

COURSE DESCRIPTION (by lesson)

1. Review of HWS-101
   ≈2 hours
   a. Liability and Responsibility
   b. Health and Safety Program
2. Changes in regulations, procedures, policies
   ≈2 hours
3. Lessons Learned
   ≈2 hours
4. Conclusion and Exam
   ≈1 hour

2 **All times are approximate and do not reflect additional time spent on topics that arise**
3 **from class participation, student breaks, class size, and/or practical exercises (i.e. Job**
4 **Performance Measures)**

1

COURSE: SAF-630/631 - Respiratory Protection

DURATION: ≈8 hours

PREREQUISITES: Medical physical

TYPE: Classroom and Practical

SCOPE: This program contains the requirements of respiratory protection as outlined in 29 CFR 1910.134, 10 CFR 20, ANSI, Z88.2-1980 and applicable WIPP procedures.

OBJECTIVES: Upon completion of this course the trainee will demonstrate a knowledge of the WIPP respiratory protection program; respiratory health hazards; and types of respiratory protection devices, their proper use and limitations.

Mastery of the terminal objective will be demonstrated by scoring 80% or higher on a closed book lesson examination.

COURSE DESCRIPTION (by lesson)

1. Introduction
   ≈2 hours
   A. Basic Requirements
      a. Regulations
      b. DOE Orders
      c. Industry Standards
      d. WIPP Procedures
         1. Physical exam
         2. Pulmonary test
         3. Training
         4. Fit Testing
         5. Identification of potential respirator activities
         6. Selection of Respirators
         7. Respirator usage, storage and sanitation

B. Nature, Extent, and Effects of Respiratory Hazards and the Need for Protection
   a. Human Respiratory System
   b. Respiratory Hazards
   c. Contaminants (Identification)
      1. Physical Properties
      2. Chemical Properties
      3. Concentration
      4. Warning Properties
      5. MSDS
      6. Toxicology
         a. Gases/Vapors
         b. Particulates

C. Engineering and Administrative Controls
   a. Hazard Control
      1. Engineering Controls
      2. Administrative Controls
   b. ALARA

2. Use of Respirators at WIPP
   ≈2 hours
   A. Selection of Respirators
      a. Medical Verification
         1. Physical Exam
         2. Spirometer Testing
      b. Training
      c. Qualitative/Quantitative Fit Testing
      d. Selection Factors
         1. User Acceptance
         2. Psychological/Physiological Complications

   B. Air Purifying Respirators
      a. Operation
      b. Limitations/Capabilities
         1. Particulate Air Filters
         2. Chemical Cartridge Respirators

   C. Atmosphere Supplying Respirators
      a. Operation
      b. Limitations/Capabilities

   D. Respirator Cleaning/Storage
      a. Cleaning Frequency
      b. Maintenance
      c. Storage

   E. Respiratory Emergencies
      a. Actions for Air Purifying Respirators
      b. Self Contained Breathing Apparatus (SCBA) Emergency Actions
         1. Buddy System
         2. Regulator Failure
         3. Insufficient Air Flow
         4. Hyperventilation

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3. Practical Session
   ≈2 hours

a. Half-Facepiece, Air Purifying Regulators
   1. Types
   2. Mode of Operation
   3. Protection Factors
   4. Inspection
   5. Donning
   6. Qualitative Test
   7. Cartridge Type
   8. Removal

b. Full Facepiece, Air Purifying Regulator
   1. Types
   2. Mode of Operation
   3. Protection Factor
   4. Inspection
   5. Donning
   6. Qualitative Test
   7. Removal

c. Full Facepiece, SCBA
   1. Types
   2. Mode of Operation
   3. Protection Factor
   4. Inspection
   5. Donning
   6. Qualitative Test
   7. Removal

All time are approximate and do not reflect time spent on additional topics that arise due to class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: SAF-515 - Confined Space

DURATION: ≈12 hours

PREREQUISITES: GET-19X/GET-20X/GET-21X initial training
Medical physical
SAF-630/631 Respiratory Protection
Current OPS-08 Qual Card

SCOPE: The instructor will present hazards, personal protective equipment requirements, emergency action, and compliance with regulatory and WIPP procedures involving confined space. Students will learn emergency retrieval techniques for removal of personnel from confined spaces.

Students will enter a simulated confined space using Personal Protective Equipment (PPE)

TYPE: Classroom and practical

OBJECTIVES: Upon completion of this course, the student will be able to state the requirements for entry into confined spaces, identify hazards which may exist, provide proper monitoring of the environmental conditions of spaces, and provide proper emergency response actions involving employees in distress.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: SAF-515A Annually

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COURSE: SAF-515A - Confined Space

DURATION: 4 Hours

PREREQUISITES: SAF-515 - Confined Space Initial Training
SAF-630/631 - Respiratory Protection
Current OPS-08 Qual Card

SCOPE: The instructor will present hazards, personal protective equipment requirements, emergency action, and compliance with regulatory and WIPP procedures involving confined space. The course will also review several confined space fatalities lessons learned.

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student will be able to describe the WIPP's Confined Space Program

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination

REFRESHER: Annually

1

COURSE: RAD-101 - Radiological Worker I

DURATION: ≈16 hours

PREREQUISITES: Radiation Manager Approval

SCOPE: The instructor will present radiological theory and practical information necessary to allow unescorted entry into a controlled area, radioactive materials area, radiological buffer area, and radiation area as required by the WIPP Radiation Safety Manual.

TYPE: Classroom and Practical

OBJECTIVES: Upon completion of this course, the student will have the knowledge to work safely in areas controlled for radiological purposes.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination and satisfactory performance on the practical examination.

Completion of the course meets the training requirements necessary for Radiological Worker -I (RWT-I).

REFRESHER: Retraining every two years with an alternate year refresher.

COURSE DESCRIPTION (by lesson)

1. Radiological Fundamentals
   ≈2 hours

a. Introduction
   1. DOE Safety Policy
   2. Course Overview
   3. Radiological Worker (core academics)
      a. Radiological Worker II (RW II) training
      b. Course outline
      c. Successful completion

b. Atomic Structure
   1. Basic Units of Matter
      a. Protons
      b. Neutrons
      c. Electrons
   2. Stable and Unstable atoms
   3. Charge of the atom

c. Definitions
   1. Ionization
   2. Ionizing radiation
   3. Non-ionizing radiation
   4. Radioactivity
   5. Radioactive material
   6. Radioactive Contamination
   7. Radioactive decay
   8. Radioactive half-life

d. Four Basic Types of Ionizing Radiation
   1. Alpha particles
      a. Physical characteristics
      b. Range
      c. Shielding
      d. Biological hazard
      e. Sources
   2. Beta particles
      a. Physical characteristics
      b. Range
      c. Shielding
      d. Biological hazard
      e. Sources
   3. Gamma rays/x rays
      a. Physical characteristics
      b. Range
      c. Shielding
      d. Biological hazard
      e. Sources
   4. Neutron particles
      a. Physical characteristics
      b. Range
      c. Shielding
      d. Biological hazard
      e. Sources

e. Units of Measure
   1. Radiation
      a. Roentgen
      b. RAD (Radiation Absorbed Dose)
      c. Rem (Roentgen Equivalent Man)
      d. Radiation dose and dose rate
   2. Contamination/Radioactivity

f. 10 CFR Part 835, "Occupational Radiation Protection"

2. Biological Effects
   ≈1 hour

a. Introduction
b. Sources of Radiation
   1. Natural sources
      a. Cosmic radiation
      b. Sources in earth's crust (terrestrial)
      c. Internal
      d. Radon
   2. Man-made sources
      a. Medical radiation sources
         1. X-rays
         2. Diagnosis and therapy
      b. Atmospheric testing of nuclear weapons
      c. consumer products
      d. Industrial uses
c. Effects of Radiation on Cells
   1. Biological effects
   2. Cell sensitivity
   3. Possible effects of radiation on cells
      a. No damage
      b. Cells repair damage and operate normally
      c. Cells are damaged and operate abnormally
      d. Cells die as a result of damage
d. Acute and Chronic Radiation Dose
   1. Acute radiation doses
   2. Chronic radiation doses
   3. Genetic effects
   4. Factors affecting biological damage due to exposure to radiation
      a. Total dose
      b. Dose rate
      c. Types of radiation
      d. Area of the body which receives a dose
      e. Cell sensitivity
      f. Individual sensitivity
e. Prenatal Radiation Exposure
   1. Sensitivity to the unborn
   2. Potential effects associated with prenatal exposures
f. Risks in Perspective
   1. Risk from exposures to ionizing radiation
   2. Comparison or risks
g. Summary

3. Radiation Limits
≈1 hour

a. Basis and Purposes for Radiation Dose Limits and Administrative Control levels for radiological workers
   1. Bases for DOE dose limits
   2. WIPP administrative control levels
b. Dose Limits and Administrative
   1. Whole body Control Levels
      a. Definition
      b. Limit and control levels
   2. Extremities
      a. Definition
      b. Limit and control levels
   3. Skin and other organs
      a. Definition
      b. Limit and control levels
   4. Lens of the eye
      a. Definition
      b. Limit and control levels
   5. Declared pregnant worker: Embryo/fetus
      a. DOE policy
      b. DOE limit
      c. Site policy
      d. WIPP administrative control level
   6. Visitors and public
c. Worker Responsibilities Regarding Dose Limits
d. Summary

4. ALARA Program
≈1 hour

a. ALARA Program
   1. ALARA Concept
   2. DOE Management Policy for the ALARA program
   3. Site policy
b. Responsibilities for the ALARA
   1. Management Program
   2. Radiological control organization
   3. Radiological workers
c. External and internal radiation
   1. Basic protective measures used to Dose Reduction reduce external doses
      a. Time
      b. Distance
      c. Shielding
   2. Additional methods to reduce dose
   3. Lessons learned

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d. Internal Radiation Dose Reduction
   1. Pathways
      a. Inhalation
      b. Ingestion
      c. Absorption through the skin
      d. Absorption through wounds
   2. Methods to reduce internal radiation dose
e. Radioactive Waste Minimization
   1. Methods to minimize radioactive waste
   2. Separate radioactive waste from nonradioactive waste
   3. Separate compactable material from noncompactable material
   4. Minimize the amount of waste generated
   5. Use good housekeeping techniques
f. Summary

5. Personnel Monitoring Programs
   ≈1 hour

a. External Dosimetry
   1. Thermoluminescent dosimeters
   2. Direct reading dosimeters
   3. Alarming dosimeters
   4. Worker responsibility for external dosimetry
b. External Monitoring
c. Worker Dose Records
d. Summary

6. Radiological Postings and Controls
   ≈2 hours

a. Radiological Work Permits
   1. Use
   2. Types
      a. General radiological work permit
      b. Job specific radiological work permit
   3. Information to be included on the permit
   4. Worker responsibilities
b. Radiological postings
   1. Uses
   2. Requirements
   3. Responsibilities of the worker associated with postings, signs, and labels
   4. Consequences of disregarding radiological postings, signs, and labels
   5. Requirements for entry, exit, and area working in radiologically posted areas

c. Radiological areas
   1. Radiological buffer areas
      a. Posting requirements
      b. Minimum requirements for unescorted entry
      c. Requirements for working in RBAs
      d. Requirements for exit
   2. Radiation areas
      a. Posting requirements
      b. Minimum requirements for unescorted entry
      c. Requirements for working in area
      d. Requirements for exit
   3. Contamination areas
      a. Posting requirements
      b. Require special training
   4. High contamination areas
      a. Posting requirements
      b. Require special training
   5. Airborne radioactivity areas
      a. Posting requirements
      b. Require special training
   6. Radioactive materials areas
      a. Posting requirements
      b. Minimum requirements for unescorted entry
      c. Requirements for working in area
      d. Requirements for exit
   7. Fixed contamination area
      a. Posting requirements
      b. Contact radiological control for entry requirements
   8. Soil contamination area
      a. Posting requirements
      b. contact radiological control for entry requirements
   9. Underground radioactive materials area
      a. Posting requirements
      b. General requirements
   10. Hot spots
      a. Posting requirements
d. Summary

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6. Radiological Emergencies
   ≈1 hour
   a. Emergency alarms and responses
      1. Area radiation monitors (ARMs)
      2. Continuous Airborne Monitors (CAMs)
   b. Disregard for radiological alarms
   c. Radiological emergency situations
   d. Considerations in Rescue and Recovery Operations
   e. Summary

7. High/very High Radiation Area Training
   ≈1 hour
   a. Definitions
      1. High radiation area
      2. Very high radiation area
   b. Signs and postings
   c. General entry, work, exit
      1. Entry requirements
      2. Working requirements
      3. Exit requirements
   d. Access controls
      1. Administrative controls
      2. Physical controls
      3. Consequences for violating radiological signs or postings or bypassing physical access controls
   e. Response to area radiation alarms and unusual conditions
   f. Considerations in Rescue and Recovery Operations
   g. Summary

8. Written Examination and Review
   ≈1 hour

9. JPM Review and JPM Evaluations
   ≈4 hours

All times are approximate and do not reflect time spent on additional topics that arise from class participation, student breaks, class size and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: RAD-201 - Radiological Worker II

DURATION: ≈8 hours

PREREQUISITES: Radiation Manager Approval

SCOPE: The instructor will present an intensive course intended for the radiological workers whose job assignments involve unescorted entry to high and very high radiation areas, contamination areas, high contamination areas, and airborne activity areas.

TYPE: Classroom and Practical

OBJECTIVES: Demonstrate the ability to work safely in radiologically controlled areas, use ALARA techniques in accordance with WIPP radiation protection procedures

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination and satisfactory performance on the practical examination

REFRESHER: Retraining every two years with an alternate year refresher

COURSE DESCRIPTION (by lesson)

1. Radioactive Contamination
   ≈3 hours
   a. Plutonium
   b. Comparison of ionizing radiation
      1. Ionizing radiation and radioactive contamination
      2. Radioactive contamination
      3. Radiation is energy, contamination is material
   c. Types of contamination
   d. Sources of radioactive contamination
      1. Sources
      2. Indicators of possible area contamination
      3. Employee response to a spill
   e. Contamination control methods
      1. Preventable methods
      2. Engineering control methods
      3. Personal protective measures
         a. Protective clothing

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f. Contamination monitoring equipment
   1. Purpose
   2. Types and uses
   3. Frisking
g. Decontamination
   1. Personnel decontamination
   2. Material decontamination
      a. General considerations
      b. Methods available
      c. Techniques
h. Contamination control requirements
   1. Posting requirements
   2. Requirements for entering
   3. Donning double PC's
   4. Exit requirements
   5. Method for removing items from contamination areas
i. Unusual events involving radioactive materials
   1. Unusual events
   2. Use of the incident command system
   3. Actions of emergency responders
   4. Response techniques
j. Identification of radiation hazards
   1. Placards
   2. Labels
   3. Shipping papers
k. Field operation protocol for radiation accidents

2. Practical Examination and review
   ≈1 hour

3. JPM Review and JPM Evaluations
   ≈4 hours

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

3. On-The-Job (OJT) Training
   ≈1 hour
   a. Definition
   b. Formal training vs. informal training
   c. Process for OJT
      1. Introduction phase
      2. Explanation phase
      3. Knowledge evaluation phase
      4. Demonstration phase
      5. Practice phase
      6. Practical evaluation phase
      7. Rules
   d. Trainee failures or slow learners
   e. Good OJT practices
   f. Common OJT instructor errors

4. Qualification Cards
   ≈1 hour
   a. Purpose
   b. Elements
   c. Writing competency statements
   d. Selecting competency statements for requalification
   e. Reviewing qualification cards

5. Qualification Guide
   ≈.5

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: TRG-293/298 - Subject Matter Expert and On-the-Job Training

DURATION: ≈4 hours

PREREQUISITES: Manager Approval

TYPE: Classroom

SCOPE: The instructor will provide the training skills and knowledge necessary to perform the role of subject matter expert (SME)/on-the-job trainer (OJT).

OBJECTIVES: Upon completion of this course the student will be able to perform the instructional duties of a Level I Instructor (SME/OJT trainer) In compliance with WIPP training policies.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: Every Two Years

COURSE DESCRIPTION (by lesson)

1. Requirements for Qualification
   ≈.5 hour
   a. Qualification card
   b. Designation letter to training
   c. Training course
   d. SME Qualification Board
   e. Arranging the SME Board
   f. Conduct of the Board
   g. Maintaining qualification
   h. Lapses in qualification

2. Role of the Level I Instructor
   ≈1 hour
   a. Conduct formal OJT
   b. Develop/revise qualification cards
   c. Maintaining files related to area of expertise
   d. Limitations of Level I Instructors

1

COURSE: TRG-300 - Classroom Instructor - Level II

DURATION: ≈40 hours

PREREQUISITES: Manager's approval

SCOPE: The Instructor will present the student with the information and skills necessary to develop and preform classroom instruction based on DOE guideline "Good Practice For Training And Qualification of Instructors" DOE-HDBK-1001-96.

TYPE: Classroom and Practical

OBJECTIVES: Upon completion of this course the student will be able to develop, conduct, and document formal classroom training in compliance with current WIPP training policies.

Mastery of the terminal objective will be demonstrated by satisfactory performance on all practical sessions and maintaining 80 percent or higher for an overall course Average. No score less than 70 percent may be scored on any daily examination.

REFRESHER: TRG-292 Every six months

COURSE DESCRIPTION (by lesson)

1. Introduction
   ≈1 hour
   a. Course title
   b. Course terminal objective
      1. Part I
      2. Part II
   c. Course topics
      1. Qualities of a competent instructor
      2. Adult learning principles
      3. PBT
      4. Training settings
      5. Learning objectives
      6. Test development
      7. Development of lesson plans
      8. Use of instructional aids
      9. Presentation and facilitation skills
      10. Effective questioning techniques
      11. Behavioral problems
      12. Demonstration method
      13. Evaluations

14. Administration
15. Final practical examination
    a. Subject choices
    b. Time limit
    c. Requirements in the lecture
    d. Evaluation method
    e. Video taped

d. Summary

2. Competencies of a Competent Instructor
   ≈1 hour

a. Motivator
b. Role of the Instructor
c. Role of the Level II Instructor
    1. Develop instructional materials
    2. Conduct formal classroom instruction in their technical area
    3. Administer examinations
    4. Document formal training
d. Reasons for Qualified Instructors
e. Categories of Instructor Qualities
f. Qualities of competent instructor
g. Common pitfalls to an instructor's success
h. Summary

3. Adult Learning Principles
   ≈2 hours

a. Motivator
b. Learning defined
    1. Learning based on experience
    2. Learning as an experience retained by the learner and produces a measurable change in behavior
    3. How change can occur
    4. Categories of learning
c. Learning style
d. Instructor learning principles
    1. Learning principles and information processing
    2. Learning principle equals motivation
    3. Learning principle equals digestible chunks
    4. Learning principle equals experience
    5. Learning principle equals attention
    6. Learning principle equals reinforcement
    7. Learning principle equals retention
    8. Learning principle equals retrieval
    9. Learning principle equals transfer
    10. Summarize concepts

e. Adults as Learners
    1. Four adult learning principles
    2. Concept of the learner
    3. Role of experience
    4. Readiness to learn
    5. Orientation to learning
    6. Internal summary
f. Barriers to learning in adults
    1. Physical barriers
    2. Emotional barriers
    3. Intellectual barriers
    4. Learning style barriers
g. Summary

4. Overview of PBT/TAP
   ≈1 hour

a. Motivator
b. Performance Based Training
    1. Definition
c. Five Phases of PBT System
    1. Analysis
    2. Design
    3. Development
    4. Implementation
    5. Evaluation
d. Reasons for using the PBT process
e. Definitions of five phases
    1. Analysis
        a. Purpose
        b. Process/products
            1. Job analysis
            2. Task analysis
    2. Design
        a. Purpose
        b. Process/products
    3. Development
        a. Purpose
        b. Process/products
    4. Implementation
        a. Purpose
        b. Process/products
    5. Evaluation
        a. Purpose
        b. Process/products
f. DOE Order
    1. DOE Order 5480.18
h. Summary

5. Methods of Instruction
   ≈1 hour

   a. Motivator
   b. Training sessions
      1. Definition
      2. Training sessions common to DOE
      3. Classroom setting
      4. On-the-Job
      5. Laboratory setting
      6. Self-paced instruction setting
      7. Simulator setting
   c. Setting selection criteria
      1. Setting criteria
   d. Training methods
      1. Lecture
      2. Discussion
      3. Role-play
      4. Self-study
      5. Walk-through
      6. Case study
   e. Summary

6. Development of Learning Objectives
   ≈1 hour

   a. Motivator
   b. Definition of learning objective
      1. Definition
      2. Why write objectives
      3. When to write objectives
      4. Basic assumptions
   c. Component parts of learning objectives
      1. Action statement
      2. Conditions
      3. Standard
      4. Implied conditions and standards
   d. Definition of Terminal Objective
      1. Definition
      2. First sentence
      3. Second sentence
   e. Source of Information for Terminal Objectives
   f. Definition of Enabling Objective
      1. Definition
   g. Information source for enabling objectives
   h. Exercise
      1. Terminal objective
      2. Enabling objective
   i. Summary

7. Methods of Testing
   ≈2 hours

a. Motivator
b. Purpose of testing
   1. Purpose of testing
   2. Selection and placement
   3. Feedback to trainers and trainees
   4. Motivation
   5. Improvement to training programs
c. When are tests developed?
   1. Analysis phase
   2. Design phase
      a. Training settings
      b. Learning objectives
      c. Entry-level skills
      d. Design
      e. Written tests
      f. Oral tests
   3. Development phase
   4. Implementation phase
   5. Evaluation phase
d. Guidelines for question development
   1. Approved test question formats at the WIPP
      a. True/false
      b. Multiple choice
      c. Matching
      d. Completion/short answer
      e. Draw/label
   2. General guidelines
   3. True/false format
   4. Multiple choice
   5. Matching
   6. Completion/short answer
   7. Draw/label
e. Approved examination format
   1. Two items per objective
   2. Meet the intent of the objective
   3. Use acceptable format
f. Examination format
   1. Version vs. multiple exam
   2. Required formats
   3. Approval
g. Control of examinations
   1. Examination preparation
   2. Administering the examination
   3. Grading examination
h. Examination failure
i. Summary

8. Developing Lesson Plans
   ≈2 hours

a. Motivator
b. Function of a Lesson Plan
   1. Defined as TAP
   2. Accomplish objective
   3. Promote consistency
   4. Serve as guide
c. Elements of Lesson Plan format
   1. Cover page
   2. Instructor pages
d. Definition of "Introduction"
   1. Goal of introduction
   2. Preliminaries
      a. Instructor name and background
      b. Lesson title
      c. Trainee comfort
      d. Solicit participation for questions and comments
   3. Learning objectives
   4. Overview
e. Development of the Body
   1. Outline content
   2. Topics sequence
   3. Detail of content
f. Definition of Summary
g. Summary

9. Development of Instructional Aids
   ≈2 hours

a. Motivator
b. Definition of instructional aid
c. Purpose of instructional aids
d. General guidelines for instructional aids
   1. Design and development guidelines
   2. Utilization guidelines
e. Guidelines for the use of visual aids
f. Writing boards (white and chalk)
   1. Introduction
   2. Development tips
   3. Utilization tips
g. Flip charts
   1. Introduction
   2. Development tips
   3. Utilization tips
h. Overhead transparencies
   1. Introduction
   2. Development tips
   3. Utilization tips
i. Handout materials and study guides/workbooks
   1. Introduction
   2. Purpose
   3. Development tips
   4. Utilization tips
j. Videos/films
   1. Introduction
   2. Development tips
   3. Introduce video
   4. Utilization tips
k. Training aids
   1. Transition
   2. Types of training aids
   3. Purpose
l. Consideration for selecting training aids
m. Summary

10. Use of Presentation and Facilitation Skills
≈2 hours

a. Motivator
b. Understanding speaking fears
c. Presentation skills
    1. Personal space
    2. Body movements/ gestures/eye contact/voice
    3. Exercise
d. Communications model
e. Facilitation skills
    1. Transition
    2. Attending skills
    3. Observing skills
        a. Exercise
    4. Listening skills
f. Summary

11. Effective Questioning Techniques
≈2 hours

a. Motivator
    1. Why trainers do not ask questions
        a. Control
        b. Time
        c. Discomfort for self and trainees
        d. Other
b. Advantages of questioning
c. Characteristics of effective questions
d. Difference between comprehension and interaction questions
e. Types of questions
    1. Overhead question
    2. Rhetorical question
    3. Direct question
    4. Relay questions
    5. Reverse question
    6. Pointed question
    7. Offensive question
f. Asking questions
g. Responding to answers
h. Summary

12. Handling Behavioral Problems
≈1 hour

a. Motivator
b. Characteristics of behavioral problems
    1. Argumentative
    2. Belligerent
    3. Bored
    4. Chronic questioner
    5. Clown
    6. Late to class
    7. Monopolizer
    8. Preoccupied
    9. Shy
    10. Slow learner
    11. Superior learner
    12. Exercise
c. Guidelines for determining
    1. Determining need a personal conference
d. Guidelines for personal conference
    1. Planning the conference
        a. State the problem
        b. Describe your reaction to the problem
        c. Ask for the trainee view of the situation
        d. Ask the trainee for recommendations
        e. Present your alternatives
        f. Select the best solution from alternatives and develop an action plan
        g. Set specific follow up review dates
    2. Physical arrangement for the conference
    3. Conducting the conference
    4. Strategies for active listening
e. Methods for correcting behavioral problems
f. Summary

13. Use of Demonstration Methods
≈1 hour

a. Motivator
b. Purpose of the demonstration method
c. Effective areas of demonstration method
    1. Concepts
    2. Manipulative skills
    3. Attitudes
    4. Practice
d. Training aids
e. Advantages and disadvantages
    1. Advantages
    2. Disadvantages
f. Preparing for the lesson
g. Steps in the demonstration method
    1. Introduction
    2. Presentation
    3. Practice
    4. Summary
h. Actual presentation
i. Exercise
j. Summary

14. Purpose of Evaluations
≈1 hour

a. Motivator
b. Definition of evaluation
c. Purposes of evaluation
d. Sections of evaluation process
e. Evaluations performed
    1. Trainee questionnaire
    2. Post training survey (trainee)
    3. Post training survey (supervisor)
    4. Annual instructor observation form
f. Results of the evaluation
g. Summary

15. Training Administration
    ≈1 hour
    a. Motivator
    b. Course package
        1. Lesson plan
        2. Exam, quizzes, and JPM's
        3. Trainee handouts
        4. Overheads
        5. Approval
            a. Training records
            b. Cognizant manager
            c. Training manager
            d. Material given back to instructor
    c. Course preparation
        1. Lesson plan
        2. Exams and quizzes
        3. Trainee handouts
        4. Overheads
        5. Paperwork
    d. Training attendance sheet
    e. Post class activities
    f. Summary

16. Final Practical
    ≈6 hours

17. Examinations
    ≈2 hours

18. Work Time
    ≈8 hours

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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COURSE: MED-101 - First Aid and CPR

DURATION: 12 hours

PREREQUISITES: None

SCOPE: The instructor will provide CPR training including one-rescuer CPR, the Heimlich maneuver, and first aid techniques.

TYPE: Classroom and CPR Practical

OBJECTIVES: Upon completion of this course, the student will be able to administer basic first aid and one-rescuer CPR in accordance with the national safety council. Identify heart disease factors, signs, and symptoms of a heart attack and perform one-rescuer CPR and the Heimlich maneuver.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination and satisfactory performance on the practical examination.

REFRESHER: MED 101A Annually

COURSE DESCRIPTION (by lesson)

1. Definitions and Legal Aspects
   ≈1 hour
   a. Duty to act
   b. Consent for treatment
   c. Abandonment
   d. Good Samaritan law
   e. Confidentiality

2. Assessment
   ≈1 hour
   a. Purpose
   b. Systematic approach considerations
   c. Parts
   d. Scene assessment
   e. Primary survey
   f. Secondary survey

3. Cardiopulmonary Resuscitation (CPR)
   ≈1 hour
   a. Anatomy of cardiovascular system
   b. Physiology of the heart
   c. Anatomy of the respiratory system
      1. Upper airway
      2. Lower airway
      3. Alveoli
      4. Pulmonary arteries, veins, capillaries
   d. Physiology of the respiratory system
   e. Heart disease

Treatment of Various Conditions
≈4 hours

4. Shock
   a. Hypovolemic shock
   b. Fainting
   c. Anaphylactic shock

5. Bleeding
   a. Types
   b. Control
   c. Treatment
   d. AIDS and HBV

6. Head Injury
   a. General information
   b. Scalp lacerations
   c. Skull fractures
   d. Spinal injuries
      1. Treatment

7. Burns
   a. Classifications
   b. Causes
   c. Treatment

9. Heat Related Injuries/Illnesses
   a. Types
      1. Heat cramps
         a. Treatment
      2. Heat exhaustion
         a. Signs and symptoms
         b. Treatment
      3. Heat stroke
         a. Signs and symptoms
         b. Treatment

10. Bone and Joint Injuries
    a. General information
    b. Signs and symptoms
    c. Treatment

11. Summary

12. Written examination

13. Practical
    ≈3 hours

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: MED-101A - First Aid and CPR Refresher

DURATION: ≈8 Hours

PREREQUISITES: MED-101

SCOPE: The instructor will provide refresher training Basic CPR (one-rescuer) and basic first aid techniques

TYPE: Classroom and practical

OBJECTIVES: Upon completion of this course, the student will able to administer basic first aid and one-rescuer CPR

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination and satisfactory performance on the practical examination

REFRESHER: Annually

1

COURSE: HMT-102 - Hazardous Materials and Waste Transportation

DURATION: ≈16 Hours

PREREQUISITES: Manager approval and/or assignment to transportation duties in accordance with 49 CFR

SCOPE: Instruction meeting 49 CFR 172 Subpart H provided in a modular format. This course covers: awareness, the hazards material table, packaging, marking, labeling, placarding, material separation and segregation, special or unique transportation moves, safety, and site specific transportation issues.

TYPE: Classroom lecture including exercises to enhance trainee learning and retention

OBJECTIVES: Upon completion of the course, the trainee will be able to define, locate, apply and maintain compliance with the DOT regulations involving the transportation and/or offering for transportation of a hazardous material or waste.

Mastery of this objective will be demonstrated by scoring a minimum of 80 percent on the course examinations using "approved course" reference material.

REFRESHER: Biennially

COURSE DESCRIPTION (by lesson)

1. Awareness/familiarization
   ≈1 hour

a. Introduction
   1. Instructor
   2. Lesson
   3. Course content
   4. Lesson objectives

b. Lesson materials
   1. Department of Transportation (DOT) Regulations
      a. Brief history
      b. Purpose
      c. Scope
      d. Terminology
      e. Application of regulations

2. Training programs
   a. Module assignments
      1. Basic modules
      2. Additional modules

c. Training program objectives
d. Training requirements
e. General transportation responsibility
f. General transportation liability
g. Potential exposures
   1. Number of shipments
   2. Events leading to exposures
   3. Causes for events
h. Compliance mandate
   1. Regulator responsibility
   2. Penalties
   3. Trends
i. DOE guidance
   1. DOE Orders
   2. Interaction of DOE Orders and Federal Regulations
j. Enforcement
k. Application of DOT Regulations at DOE facility
l. Introduction to Title 49 CFR
   1. Overview transportation regulations
   2. Navigating within the code book
m. Shippers acronym
n. Standardized DOT communications
o. Summary
p. Review
q. Questions and answer

2. The Hazardous Materials Table
   ≈3 hours

a. Introduction
b. Lesson body
   1. Lesson objectives
c. Shipper's Star
d. Definition
   1. Hazardous material
   2. Hazardous waste
   3. Hazardous substance
e. Hazard classes
   1. 9 classes
   2. Special cases
   3. Class system
   4. Identification
   5. Shipper's responsibility
   6. Material identification

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f. The Hazardous Materials Table
   1. 10 columns
   2. Navigating the hazardous materials table
g. Summary
h. Review
i. Questions and answers

3. Packaging
   ≈1.5 hours

a. Introduction
   1. Lesson
b. Lesson body
   1. Lesson objectives
c. Terminology
   1. Packaging vs. package
      a. Packaging
      b. Package
d. Identifying packaging by code
   1. Recognition types
   2. Code interpretation for UN packaging
      a. Packaging type
      b. Packaging group
e. Limited quantity packing exemptions
   1. Describe "Limited Quantity"
   2. General criteria
f. Package Acceptance Criteria
   1. Acceptable packaging
   2. Unacceptable packaging
g. Summary
h. Review
i. Questions and answers

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4. Marking
   ≈1.5 hours

   a. Introduction
   b. Lesson body
      1. Lesson objectives
      2. Purpose
      3. Material identification
         a. The PSN
         b. UN/UA number
         c. Shipments containing multiple materials
      4. Physical markings
         a. Location
         b. Marking format
         c. PIH
         d. Arrows
         e. Reportable quantities
         f. Consignor/consignee information
      5. Exemptions
   c. Summary
   d. Review
   e. Questions and answers

5. Labeling
   ≈1.5 hours

   a. Introduction
   b. Lesson body
      1. Lesson objective
      2. Purpose
      3. Label selection
         a. HMT table
      4. General placement of labeling
      5. Primary vs. secondary labeling
         a. Primary label
         b. Secondary
      6. Specific labeling requirements
         a. Gas cylinders
         b. Alterative labeling
      7. Mixed shipment in one package
         a. Special requirements
      8. Combination package in one
         a. Special requirements of outer package
   c. Summary
   d. Review
   e. Questions and answers

6. Shipping Papers
≈1.5 hours

a. Introduction
   1. Lesson
b. Lesson body
   1. Lesson objectives
c. Types of shipping documents
   1. Standard bill of lading
   2. Waste manifest
d. Basic components of a proper shipping paper
e. Specific shipping paper
   1. Shipper information
   2. Quantity of packages
   3. Hazardous materials
   4. Quantity of material
   5. Emergency response information
   6. Certification statement signature
f. Shipping paper format
g. Additional information
   1. Hazardous and non-hazardous shipping paper
h. Emergency information
i. Summary
j. Review
k. Questions and answers

7. Placarding
≈1.5 hours

a. Introduction
b. Lesson material
c. Lesson objectives
d. Purpose
   1. Hazardous material identification
   2. Materials with certain exemptions
e. Application
   1. Placards should not be used
   2. Selection criteria
      a. Table application
      b. Aggregate gross weight
   3. Authorized placards
      a. Displaying requirements
      b. Placard identification
f. Shipper's requirements
g. Other placards
   1. Explosives
   2. Residue
   3. Spontaneously combustible
   4. Organic peroxide
   5. Harmful
   6. Class 9

h. Displaying of subsidiary placards
   1. Criteria
j. Displaying placards
   1. Single trailer or bobtail type truck
   2. Multiple trailers
k. Summary
l. Review
m. Questions and answers

8. Separation and Segregation
   ≈1 hour

a. Introduction
b. Lesson material
   1. Lesson objectives
   2. Purpose
c. The table
   1. Layout
   2. Symbols
d. Summary
e. Review
f. Questions and answers

9. Special and Unique Moves
   ≈1 hour

a. Introduction
b. Lesson material
   1. Lesson objectives
   2. Terminology
      a. Empty
      b. Residue
c. Treatment of "empty" shipments
d. Overpack and salvage drums
   1. Overpack drums
      a. Intended use
      b. Use requirements
   2. Salvage drums
      a. Intended use
      b. Package requirements
e. Shipment of samples
   1. Material identification
   2. Unknown material
f. Summary
g. Review
h. Questions and answers

10. Safety
≈1 hour

a. Introduction
b. Lesson material
    1. Lesson objectives
    2. Emergency response information
        a. Transportation
        b. Resources
c. Emergency Response Guide
    1. Purpose
    2. Emergency Response Guidebook layout and overview
d. Using the emergency
    1. Locate chemical identity in Response Guidebook
    2. Review concerns and response recommendations
e. Potential risk and actions
    1. Risk
    2. Actions
f. Response principles
    1. "Never"
    2. Consider
g. Documentation
    1. DOT Form F5800.1
    2. When to document
h. Summary
i. Review
j. Questions and answers

11. Site Specific Transportation
≈1 hour

a. Introduction
b. Lesson material
    1. Lesson objectives
    2. Department/sect/individual
        a. Employee involvement for shipment from the WIPP
        b. Material control
        c Procurement
        d. Health physics
        e. Hazardous waste operations (HWO)
c. The shipping process
d. Additional information requirements by HWO
e. Hazardous waste shipments
f. Summary
g. Review
h. Questions and answers

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All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: HMT-104 - DOT Emergency Response Information

DURATION: ≈3 hours

PREREQUISITES: None

SCOPE: This course is designed to instruct the trainee in the basic concepts of applying DOT Transportation regulations involving shipments from the WIPP site. This course will inform the trainee of information that may be required when responding to an emergency involving transportation of hazardous materials and hazardous waste from the WIPP site.

TYPE: Classroom

OBJECTIVES: Upon completion of this lesson, the trainee will be able to respond to phone request from emergency personnel when hazardous materials or hazardous waste are in transit from the WIPP site that may have been involved in a transportation accident.

Mastery of the terminal objective will be demonstrated by scoring a minimum of 80 percent on the course examination.

REFRESHER: None

COURSE DESCRIPTION (by lesson)

1. Regulations
   ≈.5 hour
   a. Emergency response information
   b. Applicability
   c. Availability

2. Logistics of an Emergency Response
   ≈2.5 hours
   a. Central Monitoring Room Operator response to a request for emergency
      1. Request received at CMR
      2. Requestor need further information
   b. Organization of Emergency Response Guidebook
      1. By placard
      2. By shipping papers
      3. By package hazardous waste label
      4. Highlighted entries
      5. No available reference Information
   c. Log entries
   d. Summary

2 **All times are approximate and do not reflect additional time spent on topics that arise**
3 **from class participation, student breaks, class size, and/or practical exercises. (i.e., Job**
4 **Performance Measures)**

1

COURSE: SAF-501 - Inexperienced Miner Training

DURATION: 40 Hours

PREREQUISITES: None (Steel-toe shoes/boots required for underground tour)

SCOPE: The instructor will present the required information to allow unescorted underground access

OBJECTIVES: Fulfill all requirements of 30 CFR part 48 for underground access.

Mastery of the terminal objective will be demonstrated by satisfactory performance on all practical sessions and by scoring 80 percent or higher on the daily exams with no score less than 70 percent with post course examination.

REFRESHER: SAF-502 Annually

COURSE DESCRIPTION (by lesson)

1. Introduction
   ≈.5 hour
   a. Paperwork
   b. Course attendance
      1. Required attendance
      2. Special instructions
   c. Overview of the WIPP Underground Operations
      1. Similarity to other mining operations
         a. Potash mining
      2. Differences to other mining operations
         a. Potash mining
         b. Coal mining
   d. Summary

2. Act of 1977
   ≈1 hour
   a. Creation of the Federal Mine Safety and Health Act of 1977
      1. Congressional Act
   b. Purpose
   c. Coverage under the Act of 1977
      1. Mandatory safety and health standards
      2. Inspection rights
      3. Accident investigations
      4. Record keeping
      5. Guidelines for correcting dangerous conditions
      6. Mandatory posing of violations and warnings
      7. Required training
   d. Summary

3. Miner's Representative
   ≈1 hour
   a. Definition
   b. The miner's representative under the Act of 1977
   c. The miner's representative system at WIPP
   d. Protection of the employee
   e. Need for employee participation in the inspection of the site
   f. Summary

4. Reporting of Hazards/Lines of Authority
   ≈1 hour
   a. Hazards
   b. Reporting of hazards
      1. Responsibilities
         a. Miner operator
         b. Supervisor
         c. Employee
   c. Method of reporting
      1. Potential minor hazard
      2. Hazards involving possible imminent dangers
   d. Disciplinary actions and the employee
   e. Need for employee involvement
   f. Summary

5. Self-Rescuer/Respiratory Devices
   ≈1.5 hour
   a. Purpose
   b. Service life
   c. Inspection/Color code
   d. Mine operator quarterly inspection
   e. The self-rescuer
      1. Features
      2. The assembly
   f. Operation
   g. Demonstration
   h. Practical application
   i. Respiratory protection
      1. The WIPP program
      2. Requirements
   j. Summary

6. Entering and Leaving the Mine
   ≈1 hour
   a. Access requirements
      1. Miner training
   b. Qualification period
   c. Lamproom location
      1. Proper safety equipment
      2. Sign-in procedure
      3. Brass tag
   d. Summary

7. Transportation
   ≈1 hour

   a. General
      1. Surface
      2. Underground
   b. Hazards
   c. Hazard preventive equipment
      1. Lighting
      2. Alarms
   d. Personnel warning systems
   e. Interaction with pedestrians
      1. Normal travel patterns
      2. Variations
   f. Samples of hazards
      1. Conveyance
      2. Electric carts
      3. Haulage trucks
      4. Fork lift trucks
   g. Summary

8. Communications
   ≈1.5 hours

   a. WIPP communications systems overview
      1. Personnel
      2. Artificial
   b. System breakdown
      1. Personnel communication
         a. Lamp signals
         b. Hand signals
         c. Appropriate uses
      2. Artificial communications
         a. Commercial telephone
         b. Mine phone
         c. Gia-tronics
         d. Alarms systems
         e. Alarm warning lights
   c. Summary

9. Mine Map
≈1 hour

a. Definitions
b. Map legends
c. Directions and locations
    1. Underground reference point
    2. Boundary limits
d. Primary drifts
    1. North/South
    2. East/West
e. Drifts by area name
    1. North
        a. East/West
        b. North/South
    2. Other North area drifts
    3. South construction area
    4. South disposal area
f. Assembly areas
g. Summary

10. Ventilation
≈1.5 hours

a. Ventilation
    1. General requirements
b. Intake volume
c. Intake points
    1. Air Intake Shaft
    2. Salt Handling Shaft
    3. Waste Shaft
d. Exhaust volume
e. Primary air-flow routes
    1. North mine area air flow (intake)
    2. North mine area air flow (exhaust)
    3. South mine area air flow (intake)
    4. South mine area air flow (exhaust)
f. Air quality
g. Air flow balancing
    1. The plan
    2. Adjustments
    3. Unapproved adjustments
h. Escapeways
i. Summary

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11. Evacuation and Escape Routes ≈2 hours	a. WIPP underground evacuation procedures 1. Authorization for evacuation 2. Notifications 3. Initial actions b. Escapes 1. Purpose 2. Primary 3. Secondary c. Non-routine egress 1. Combination usage 2. Blocked access d. Define a barricade e. Function of barricades f. Permanent barricades g. Temporary barricades h. Methods of erecting a temporary barricade i. Barricades in relationship with WIPP design j. Summary
12. Ground Control ≈2.5 hours	a. Evaluation of ground control b. Federal regulations c. State mining regulations d. WIPP procedures e. Introduction to ground control and ventilation f. Introduction to barring down and scaling g. Demonstration of bar down and scaling techniques h. Geological formation at WIPP i. Review of class room instruction j. Field activities 1. Identification of bad back or rib 2. Bar down operations 3. Scaling down operations 4. Safety issues k. Summary/exam

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13. Hazard Recognition
≈6 hour

a. General hazard recognition
   1. Mining as a whole
   2. Comparing WIPP with general mining industry
b. Mobile equipment
   1. Size
   2. Construction
   3. Other hazards
c. Ground control
   1. Over confidence in work place
   2. Barriers
   3. Improper installation of control devices
d. Electrical hazards
   1. Cables
   2. Substations and switch racks
   3. Unauthorized personal equipment
e. Loss of ventilation
   1. Air quality
   2. Radiation
f. Housekeeping
   1. General
   2. Risk to personnel
g. Laser operations
h. Seismic activity
i. Summary

14. Health
≈1 hour

a. Air quality
    1. Dust
    2. Other vapors
    3. Personal protective equipment
b. Noise
    1. Acceptable working levels
        a. 8 hour shift
        b. Short term
    2. Protection against damage
        a. In-ear protection
        b. Over-the-ear protection
c. Chemicals
    1. Use
    2. Personal protective equipment
    3. Training
    4. Health effects
    5. Pre-event planning
d. Potable water
e. Toilet facilities
    1. Chemical toilets
f. Waste receptacles
    1. General
g. Food consumption
    1. Restriction
h. Radiation exposure
    1. ALARA
    2. External
    3. Internal
    4. Through wounds
i. Summary

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: SAF-502 - Mine Safety-Experienced Miner Refresher

DURATION: ≈8 Hours

PREREQUISITES: SAF-501

SCOPE: The instructor will update personnel of any change or modification in the underground

TYPE: Classroom

OBJECTIVES: Fulfill requirements of 30 CFR part 48, for annual experienced miner refresher training

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination

REFRESHER: Annually

COURSE DESCRIPTION (by lesson)

1. Introduction
   ≈.5 hour
   a. Hand out 5000-23 MSHA Forms
   b. Workplace overview
      1. Ground control
      2. Electrical
      3. Air quality
      4. Equipment
         a. Accidents
         b. Fires
         c. Noise
   c. Summary

2. Authority and Responsibility of Supervisors, Miner's Representatives
   ≈.5 hour
   a. Miner's representative
   b. Miner's rights and responsibilities
   c. Normal reporting of safety issues
   d. Safety issues with eminent danger
      1. Verbal notification
      2. Protection from reporting safety issues
      3. Work refusal
   e. Summary

3. Ventilation ≈1 hour	a. Intake volume b. Intake points 1. Air Intake Shaft 2. Salt Handling Shaft 3. Waste Shaft c. Exhaust volume 1. Exhaust Shaft 2. EFB capabilities d. Primary air-flow routes 1. North mine area air flow (intake) 2. North mine area air flow (exhaust) 3. South construction air flow (intake) 4. South construction air flow (exhaust) 5. South disposal area air flow (intake) 6. Waste Shaft station area e. Air quality 1. Required testing 2. Ventilation failure 3. Adjustments 4. Unapproved adjustments f. Summary
4. Ground Control ≈1 hour	a. Ground control 1. General employee responsibility 2. Typical ground failures 3. Ground control practices b. Summary
5. Entering and Leaving the Mine Transportation and Controls ≈.5 hour	a. Underground access procedure 1. General employee responsibility 2. Violation of restricted areas b. Personal protective equipment c. Transportation 1. The conveyance 2. Mobile equipment 3. Airlocks and doors d. Summary
6. Communication, Warning Alarms and signals ≈.5 hour	a. Communication systems 1. GTE telephone 2. Mine telephone 3. Public address system b. Alarm systems 1. Fire c. Emergency staging areas 1. Assembly areas 2. Station areas

	d. Alarm notification actions 1. Escapeways 2. Retreat to station for evacuation 3. Retreat to assembly areas e. Summary
7. Mine Map, Escapeway, Emergency Evacuation and Barricades ≈1 hour	a. Escapeways b. Assembly areas 1. Purpose 2. Locations 3. Personnel duties during emergencies c. Barricade equipment d. Summary
8. Accident Prevention ≈.5 hour	a. Event happenings b. Changing events c. Pre-event recognition d. Lessons learned e. Summary
9. Self-Rescuer ≈.5 hour	a. Definition b. Purpose c. Inspections d. Methods of conversion - catalytic conversion e. Protection from deadly gas f. Conversion to what compound? g. Effect time limit h. Compounds and operation i. Practical applications j. Summary
10. First Aid ≈1 hour	a. Basic principles

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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1

COURSE: RIG-001 - Incidental Rigger

DURATION: ≈16 Hours

PREREQUISITES: None

SCOPE: The instructor will present types of rigging, how to size up the load to be lifted, and the mechanical lifting devices.

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student will be able to perform incidental rigger duties in compliance with the DOE Standard Hoisting and Rigging Manual DOE-STD-1090-96.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: None

COURSE DESCRIPTION (by lesson)

1. Identifying Rigging Components
   ≈4 hours
   a. Qualifications
   b. Definitions
   c. Wire rope components
      1. Core
      2. Strand
      3. Wire
   d. Core
      1. Strand
      2. Wire
      3. Lay of the rope
      4. Length of the rope lay
      5. Inspection
   e. Web slings
   f. Polyester slings
   g. Wire rope slings
      1. Inspection
      2. Hooks
      3. Spreader beam
      4. Eyebolts
      5. Shackles - anchor and chain
      6. Wire rope clips - U bolt and twin base
      7. Turnbuckles

2. Inspection and Storage - Weight Calculation
   ≈4 hours
   a. Rigging inspection
      1. Improper sling use
      2. Inspection techniques
      3. Rigging storage
      4. Load weight determination
      5. Calculations
      6. Center of gravity
      7. Slings and hitches
      8. Load angle
      9. Choker hitch rated capacity adjustment
      10. Load cell

3. Identity Lifts/Long Term Check-Out Hand Signals
   ≈4 hours
   a. Load indicating devices
      1. Ordinary lift
   b. Critical lifts
      1. Determination
      2. Requirements
   c. Pre-engineered production lift
   d. Rigging check-out
   e. Long-term checkout
   f. Standard signals and signaler identification

4. Identify rigging Attachments, Accessories and Uses
   ≈4 hours
   a. Beam Clamps
      1. Types
      2. Inspection
      3. Hand operated hoists
         a. Chain hoist
         b. Lever operated hoist
            1. Link chain
            2. Roller chain
            3. Wire rope
   b. Jacks
   c. Using jacks
   d. Cribbing
   e. Cribbing assembly

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: OPS-115 - Conduct of Shift Operations

DURATION: ≈8 hours

PREREQUISITES: None

SCOPE: The instructor will describe how shift operation will be conducted at the site.

OBJECTIVES: Upon completion of this course, the student will be able to perform their job in accordance with Operations Department "Conduct of Operations" WP 04-CO.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: NONE

COURSE DESCRIPTION (by lesson)

1. DOE Guidance for Conduct of Operations and Basic Requirements ≈1 hour
   a. DOE Policy
   b. DOE Orders
   c. Conduct of operations sections
      1. Operations organization and administration
      2. Shift routines and operating practices
      3. Control area activities for the WIPP
      4. Communications
      5. Control of on-shift training
      6. Investigation of abnormal events
      7. Notifications
      8. Control of equipment and system status
      9. Tagouts and lockouts
      10. Independent verification
      11. Logkeeping
      12. Operations turnover
      13. Operations aspects of facility unique processes
      14. Required reading
      15. Timely orders to operators
      16. Operations procedures
      17. Operator aid posting
      18. Equipment and piping labeling

d. Operations organization and administration
   1. Operations Policies
   2. Resources
   3. Monitoring of operating performance
   4. Accountability
   5. Planning for safety
e. Procedures
   1. Use of procedures
   2. Working copies

2. Sections of Conduct of Operations
   ≈5 hours

A. Communications
   a. Emergency communications
   b. Public address system usage
   c. Contacting operators
   d. Radios
   e. Abbreviations and acronyms
   f. Oral instructions and informational communications

B. Control Area Activities
   a. Control area access
   b. Professional behavior
   c. Monitoring the main control panels
   d. Control operator ancillary duties
   e. Operation of control area equipment

C. Control of Equipment and System Status
   a. Status change authorization and reporting
   b. Equipment and systems alignment
   c. Equipment locking and tagging
   d. Equipment deficiency identification and documentation
   e. Work authorization and documentation
   f. Equipment post-maintenance testing and return to service
   g. Alarm status
   h. Temporary modification control
   i. Distribution and control of equipment and system documents

D. Independent Verification
   a. Components requiring independent verification
   b. Occasions requiring independent verification
   c. Verification techniques

E. Operator Aid Postings

F. Equipment and Piping Labeling
   a. Requirements
   b. Identifying labeling deficiencies

G. Shift Requirements	a. Routines and operating practices 1. Status practices 2. Safety practices 3. Operator inspection tours 4. Round/tour inspection sheets 5. Personnel protection 6. Response to indications 7. Resetting protective devices 8. Load changes 9. Authority to operate equipment 10. Shift operating bases
H. Control of On-Shift Training	a. Adherence to training programs b. On-shift instructor qualification c. Supervision and control of trainees d. Operator qualification program approval e. Training documentation f. Suspension of training g. Maximum number of trainees
I. Logkeeping	a. Establishment of operating logs b. Timeliness of recordings c. Information to be recorded d. Legibility e. Corrections f. Log review g. Care and keeping of logbooks
J. Operations Turnover	a. Turnover checklists b. Document review c. Control panel walk-down d. Discussion and exchange of responsibility e. Shift crew briefing f. Reliefs occurring during the shift
K. Operations Aspects of Facility Unique Processes	a. Operator responsibilities b. Operator knowledge c. Operator response to process problems d. Communications between operations and process personnel
L. Required Reading	a. File Index b. Reading assignments c. Required dates for completion of reading d. Documentation e. Review

M. Timely Orders to Operators

a. Content and format
b. Issuing, segregating, and reviewing orders
c. Removal of orders

3. Summary

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

1

COURSE: TRG-296 - Root Cause Analysis

DURATION: ≈8 hours

PREREQUISITES: None

SCOPE: The instructor will provide personnel with the knowledge and skills necessary to identify the root cause of unplanned plant events, in accordance with DOE standards. Students will analyze incidents to identify corrective action necessary to prevent the incidents from recurring. This training is recommended for all operators, technicians, supervisors, and managers.

TYPE: Classroom And Practical

OBJECTIVES: Upon completion of this course, the student will be able to perform root cause analysis in accordance with DOE Order 232.1.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination and satisfactory performance on the practical examination.

REFRESHER: None

COURSE DESCRIPTION (by lesson)

1. Introduction to Root Cause Analysis
   ≈2 hours
   a. Case study
   b. Root cause
   c. Other causes
   d. Event
   e. Event/cause relationship
   f. Root cause analysis
   g. Reason for root cause analysis
      1. Overview
      2. Specifics
      3. Concern - employees
      4. Concern - facility
      5. Concern - company permanent image
      6. Concern - public and environment
      7. Concern - economic
      8. Concern - legal

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2. Root Cause Analysis Process
   ≈4 hours
   a. Phases and sub-phases
      1. Collect data
      2. Correct
      3. Inform
      4. Follow-up
   b. Phase one - collect data
      1. What to collect
      2. How to collect
      3. Data review
   c. Phase two - assess
      1. Purpose
      2. Methods
      3. Use, advantages, and disadvantages
      4. Event and casual factor charting
      5. Consists of two phases
      6. Cause and effect
      7. Cause and effect charting
   d. Phase three - correct
   e. Phase four - communications
      1. Internal
      2. External
   f. Phase five - follow-up

3. Root Cause Analysis at the WIPP
   ≈1 hour
   a. Investigations
   b. Reportable and non-reportable events
   c. Root cause analysis team report
   d. Reportable events
   e. Non-reportable events
   f. Follow-up

4. Summary
   ≈1 hour

5. Homework

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises. (i.e., Job Performance Measures)

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1

COURSE: SAF-645 - RCRA Emergency Coordinator (WIPP Contingency Plan Procedure)

DURATION: N/A

PREREQUISITES: None

SCOPE: This self-paced lesson describes the responsibilities and actions to be taken by the RCRA Emergency coordinator and other emergency response personnel whenever the WIPP Contingency Plan is implemented.

TYPE: Self-paced

OBJECTIVES: Upon completion of this course, the student will be able to perform the duties of RCRA Emergency Coordinator in accordance with established requirements.

Mastery of the terminal objective will be demonstrated by scoring 80 percent or higher on the course examination.

REFRESHER: None

1. State the purpose of the RCRA Contingency Plan.
2. Describe the general responsibilities of the RCRA Emergency Coordinator.
3. Identify the emergency response groups and their responsibilities.
4. State when the Contingency Plan is to be implemented.
5. Describe the criteria for Incident Levels I, II, and III.
6. Describe the types of events that do not implement the Contingency Plan.
7. Describe the activities regarding initial response and notification of emergency response personnel.
8. Describe the actions to be taken when a surface evacuation is declared.
9. Describe the action to be taken when an underground evacuation is declared.
10. State the information that is included in notifications to public safety and regulatory safety agencies.
11. Describe the various means of identifying hazardous materials.

12. Describe the information that is initially provided to the Emergency Coordinator by the EST.

13. Describe the additional information that is collected to conduct a more thorough assessment.

14. Define the 4 criteria that are evacuated in the assessment stage of an incident.

15. State when the RCRA Emergency Coordinator would request assistance from off-site agencies.

16. Describe the actions involved in the control, containment, and correction of an incident.

17. Describe physical and chemical methods of mitigation.

18. Describe the actions that are implemented in the event of a fire.

19. Describe the actions to be taken in the event of an explosion.

20. Describe the actions to be taken in the event of a spill.

21. Describe the actions to be taken in the event of container spills or leakage.

22. State who is responsible for the radiological decontamination of personnel.

23. Describe the response actions to spills, or leaking, or punctured CH and RH TRU mixed waste containers.

24. Describe the actions to be taken in the event of a natural emergency (earthquake, lightning strike, etc.) involving hazardous waste or materials.

25. Describe the response efforts in the event of spalling of ground in the underground.

26. Describe the response efforts in the event of a roof fall in the underground.

27. Describe the events to be completed during the emergency termination phase.

28. Describe the reporting requirements in the event the Contingency Plan is implemented.

: 03827

1

COURSE: SAF-632 - Office Warden

DURATION: ≈ 2 Hours

PREREQUISITES: None

SCOPE:

TYPE: Classroom

OBJECTIVES: Upon completion of this course, the student will be able to state the responsibilities and duties of the Office Warden, in accordance with established guidelines, policies, and regulations.

REFRESHER: SAF-632 annually

1. Objectives
   ≈ 10 minutes
   a. Define role of Office Warden
   b. List responsibilities
   c. Describe emergency notification system
   d. Describe purpose of assembly/staging areas

2. Presentation
   ≈ 90 minutes
   a. Role of Office Warden
   b. Office Warden responsibilities
      1. Day-to-day
      2. Emergency situations
      3. Bomb threats
      4. Inclement weather
      5. Personnel accountability w/no assembly
   c. Emergency Notification System
      1. Different evacuation notifications
      2. Reporting emergencies
   d. Assembly/staging areas
      1. Purpose
      2. Locations

3. Review and Exam
   ≈ 20 minutes

2 **All times are approximate and do not reflect additional time spent on topics that arise**
3 **from class participation, student breaks, class size, and/or practical exercises (i.e. Job**
4 **Performance Measures)**

1

COURSE: SAF-621 - Firefighter I

DURATION: ≈40 hours

PREREQUISITES: None

SCOPE: This class prepares the student to respond to fires. This class is taught by the New Mexico Fire Academy

OBJECTIVES:

REFRESHER: Training is conducted 8 hours quarterly

COURSE DESCRIPTION (by lesson)

1. Inspection ≈.5 hour classroom	a. Common causes of fires and their prevention b. Fire protection procedures c. Define importance of public relations d. Define dwelling inspection procedures
2. Sprinklers ≈.5 hour classroom	a. Identify a fire department sprinkler connection and water motor alarm b. Connect hose lines to a fire department connection of a sprinkler or standpipe system c. Define how automatic sprinkler heads open and release water d. Temporarily stop flow of water from a sprinkler head
3. Overhaul ≈2 hours classroom	a. Demonstrate searching for hidden fires b. Demonstrate exposure of hidden fires by opening ceilings, walls, floors, and pulling apart burned material c. Demonstrate how to separate and remove charred materials from unburned material d. Define duties of fire fighters left at the scene for fire and security surveillance e. Identify the purpose of overhaul

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4. Salvage ≈1.5 hours classroom ≈.5 hours practical	a. Identify the purpose of salvage and its value b. Demonstrate folds and rolls of salvage covers c. Demonstrate salvage cover throws d. Demonstrate the techniques of inspection, cleaning, and maintaining salvage equipment
5. Fire Streams ≈1.5 hours classroom ≈2.5 hours practical	a. Define a fire stream b. Manipulate a nozzle so as to attack Class A and Class B fires c. Define water hammer and at least one method for its prevention d. Demonstrate how to open and close a nozzle
6. Fire Hoses, Nozzles, and Appliances ≈2.5 hours classroom ≈3.5 hours practical	a. Identify the sizes, types, amounts, and uses of hose carried on a pumper b. Demonstrate the use of nozzles, hose adapters, and hose appliances carried on a pumper c. Advance dry hose lines of two different sizes from a pumper: 1. Into a structure 2. Up a ladder into an upper floor window 3. Up an inside stairway to an upper floor 4. Up an outside stairway to an upper floor 5. Down an inside stairway to a lower floor 6. Down an outside stairway to a lower floor 7. To an upper floor by hoisting d. Advance charged hose lines of two different sizes from a pumper 1. Into a structure 2. Up a ladder into an upper floor window 3. Up an inside stairway to an upper floor 4. Up an outside stairway to an upper floor 5. Down an inside stairway to a lower floor 6. Down an outside stairway to a lower floor 7. To an upper floor by hoisting

	e. Demonstrate the techniques for cleaning fire hose, couplings, and nozzles and inspecting for damage f. Connect a fire hose to a hydrant and fully open and close the hydrant g. Demonstrate the loading of fire hose on a fire apparatus and identify the purpose of at least three types of hose loads and finishes h. Demonstrate three types of hose rolls i. Demonstrate two types of hose carries j. Demonstrate coupling and uncoupling of the fire hose k. Work from a ladder with a charged attack line which shall be 1.5" or larger l. Demonstrate carrying hose into a building to be connected to a standpipe m. Demonstrate the methods for extending a hose line n. Demonstrate replacing a burst section of hose line
7. Forcible Entry ≈3 hours classroom ≈1 hour practical	a. Identify and demonstrate each type of manual forcible entry tool b. Identify the method and procedure of properly cleaning, maintaining, and inspecting each type of forcible entry tool and equipment

: 03831

8. Ladders ≈1.5 hours classroom ≈2.5 hours practical	a. Identify each type of ladder and its intended use b. Demonstrate the following ladder carries: 1. One person carry 2. Two person carry 3. Three person carry 4. Four person carry 5. Five person carry 6. Six person carry c. Raise each type and size of ground ladder d. Climb the full length of every type e. Climb the full length of each type of ground and aerial ladder carrying fire fighting tools or equipment while ascending and descending f. Climb down the full length of a ground and aerial ladder carrying an injured person g. Demonstrate the techniques of working from ground and aerial ladders with tools and appliances h. Demonstrate the techniques of cleaning ladders
9. Rescue ≈5 hour classroom ≈1.25 hours practical	a. Demonstrate the removal of injured persons from immediate hazards practical by use of carries, drags, and stretchers b. Demonstrate searching for victims in burning, smokefilled buildings, or other hostile environments c. Define the use of a life belt d. Define safety procedures as they apply to rescue

10.	Self-Contained Breathing Apparatus ≈2 hours classroom ≈2 hours practical	a. Identify at least four hazardous respiratory environments encountered in fire fighting b. Demonstrate the use of all types of self-contained breathing apparatus in a dense smoke environment c. Identify the physical requirements of the wearer, the limitations of the self-contained breathing apparatus, and the safety features of all types of self-contained breathing apparatus d. Demonstrate donning self-contained breathing apparatus while wearing protective clothing e. Demonstrate that the self-contained breathing apparatus is in a safe condition for safe use f. Identify the procedure for cleaning and sanitizing the self-contained breathing apparatus for future use
11.	Ropes ≈2 hours class room and practical	a. Identify and describe the purpose for specific knots b. Identify the construction characteristics and appropriate uses of natural and synthetic fiber rope c. Demonstrate tying a bowline knot, a clove hitch, rescue knot, figure of eight knot, a becket or sheep bend, and an overhand safety knot d. Demonstrate the bight, loop, round turn, and half hitch as used in tying knots and hitches e. Using an overhand knot, hoist any selected forcible entry tool, ground ladder, or appliance to a height of 20 feet f. Demonstrate the techniques of inspecting, cleaning, maintaining, and storing rope

: 03833

12. Ventilation
≈5 hours classroom

a. Define the principals of ventilation, and identify the advantages and effects of ventilation
b. Identify the dangers present and precautions to be taken when performing ventilation
c. Demonstrate opening various types of windows from inside and outside, with and without tools
d. Demonstrate breaking window and door glass and its removal
e. Using an ax, demonstrate the ventilation of a room and a floor
f. Define the theory of a back draft explosion

13. Safety
≈1 hour classroom

a. Identify dangerous building conditions created by fire
b. Demonstrate techniques for action when trapped or disoriented in a fire situation
c. Define procedures to be used in electrical emergencies
d. Define fire service lighting equipment
e. Identify safety procedures when using fire services lighting equipment
f. Demonstrate the use of portable power plants, lights, cords, and connectors
g. Define safety procedures as they apply to emergency operations, specifically:
    1. Protective equipment
    2. Team concept
    3. Portable tools and equipment
    4. Riding and apparatus
    5. Hazardous materials incidents

14. Fire Behavior ≈3 hours	a. Define fire b. Define the fire triangle and fire tetrahedron c. Identify two chemical, mechanical, and electrical energy sources d. Define the following stages of fire: 1. Incipient 2. Flame spread 3. Hot smoldering 4. Flash over 5. Steady state 6. Clear burning e. Define the three methods of heat transfer f. Define the three physical stages of matter in which fuels are commonly found g. Define the hazard of finely divided fuels as they relate to the combustion process h. Define flash point, fire point, and ignition temperature i. Define concentrations in air as it affects combustion j. Identify three products of combustion found in structural fires which create a life hazard

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size, and/or practical exercises (i.e., Job Performance Measures)

1

COURSE: EOC-101 - Initial Mine Rescue

DURATION: 20 Hours

PREREQUISITES: Physical, underground experience

SCOPE:

TYPE: Classroom, field, hands-on

OBJECTIVES: Upon completion of this training, the student will be able to wear and maintain a Drager self-contained breathing apparatus, and perform all the functions required as a member of a mine rescue team.

REFRESHER: 48 hours of refresher training is required annually

COURSE DESCRIPTION (by lesson)

1. MSHA 2004 (Drager BG 174-A)
   ≈8 hours
   a. Description
   b. Major parts
   c. Wearing and testing
   d. Limitations
   e. Maintenance

2. MSHA 2202 (Mine Gases)
   ≈2 hours
   a. Meaning of terms
      1. Specific gravity
      2. Explosive range
      3. Toxicity
      4. Asphyxiate
      5. Solubility
   b. Physical properties and characteristics
      1. Normal air
      2. Oxygen
      3. Nitrogen
      4. Carbon dioxide
      5. Carbon monoxide
      6. Oxides of nitrogen
      7. Hydrogen
      8. Hydrogen sulfide
      9. Sulfur dioxide
      10. Methane
   c. Composition, physical properties, and characteristics
      1. Smoke
      2. Rock strata gases
      3. Damps

3. MSHA 2203 (Mine Ventilation) ≈2 hours	a. Purpose and methods b. Ventilation controls c. Proper chain-of-command when altering ventilation d. Air measurement devices e. Construction of ventilation controls
4. MSHA 2204 (Mine Exploration) ≈2 hours	a. Examination of mine openings b. Barefaced exploration c. The fresh air base d. Apparatus teams e. Briefing f. Going underground g. Exploration procedures h. Traveling procedures i. Ground testing j. Debriefing
5. MSHA 2205 (Firefighting) ≈2 hours	a. Classification of fires b. Firefighting equipment c. Firefighting techniques 1. Indirect 2. Direct d. Explosions
6. MSHA 2206 (Rescue of Survivors) ≈2 hours	a. Rescuing survivors 1. Rescue techniques 2. First aid b. Recovery of bodies
7. MSHA 2207 (Mine Recovery) ≈2 hours	a. Assessing conditions b. Reestablishing ventilation c. Clearing and rehabilitating

All times are approximate and do not reflect additional time spent on topics that arise from class participation, student breaks, class size and/or practical exercises (i.e., Job Performance Measures)

1

COURSE: Radiological Control Technician Fundamental Academic Lessons

DURATION: ~52 hours
Students may elect to test out of these courses with Radiological Control Manager approval

PREREQUISITES: Lesson specific

SCOPE: Lesson specific

REFRESHER: Requalification every two years

COURSE DESCRIPTION (by module)

1. Basic Mathematics and Algebra (CL1.01) ≈4 hours

    a. Prerequisites - None
    b. Scope - This lesson is a review of arithmetic and algebraic methods used to perform various radiological control calculations required by the RCT to perform his/her daily duties. These calculations include scientific notation, unit analysis and conversion, radioactive decay calculations, dose rate/distance calculations, shielding calculations, and stay-time calculations.
    c. Outline - Introduction
        - Basic math operations with fractions
        - Basic math operations with decimals
        - Convert fractions to decimals and vice-versa
        - Convert percent to decimal and vice-versa
        - Basic math operations with signed numbers
        - Basic math operations with exponents
        - Find rational square roots
        - Convert scientific notation to standard form and vice-versa
        - Basic math with scientific notation
        - Solving equations using the "Order of Mathematical Operations"
        - Performing algebraic functions
        - Solving equations with common and natural logarithms
        - Exam

2. Unit Analysis and Conversion (CL1.02) ≈4 hours

    a. Prerequisites - None
    b. Scope - This lesson is a review of the unit analysis and conversion process necessary for the RCT to perform air and water sample activity calculations, contamination calculations, and many other applications.
    c. Outline - Introduction
        - Unit systems of measurement and base units for mass, length and time
        - SI prefix values and abbreviations
        - Using conversion factors/tables
        - Using formulas

- Exam

3. Physical Sciences (CL1.03) ≈4 hours

   a. Prerequisites - None
   b. Scope - This lesson is a review of basic physics since the RCT may work in environments where materials can undergo changes in state, resulting in changes in the radiological work environment.
   c. Outline - Introduction -
      - Work/force/energy in relation to physics
      - Identify and describe four forms of energy
      - State the Law of Conservation of Energy
      - Solid/liquid/gas in regards to shape and volume
      - Basic atom structure
      - Defining physical science terms
      - Identifying symbols
      - Periodic Table element arrangement
      - Identifying Periodic Table layout
      - Defining terms relative to atomic structure
      - Exam

4. Nuclear Physics (CL1.04) ≈4 hours

   a. Prerequisites - None
   b. Scope - This lesson is designed to provide an understanding of the forces present within an atom.
   c. Outline - Introduction
      - Definitions: Nucleon, Nuclide, Isotope
      - Mass-Energy Equivalence Concept
      - Definitions: Mass Defect, Binding Energy
      - Definitions: Fission, Criticality, Fusion
      - Exam

5. Sources of Radiation (CL1.05) ≈4 hours

   a. Prerequisites - None
   b. Scope - This lesson provides an understanding that radiation sources are not limited to nuclear facilities. The study of radiation sources provides data for:
      - The basis for occupational exposure
      - Showing the effects from high source exposures
      - Assessing the impact on radiation background from nuclear facilities
      - Determining the use of building materials
   c. Outline - Introduction
      - Identifying natural background radiation sources
      - Identifying artificially produced radiation sources and dose magnitudes from each source
      - Exam

6. Radioactivity and Radioactive Decay (CL1.06) ≈4 hours

a. Prerequisites - None
b. Scope - This lesson provides an understanding of the radioactive decay processes from different types of radionuclides.
c. Outline - Introduction
   - Neutron to proton ratio
   - Definitions: radioactivity, radioactive decay
   - Characteristics of alpha, beta, and gamma
   - Identifying radioactive decay modes
   - Decay of radioactive nuclides
   - Differences: natural and artificial radioactivity
   - Unstable fission products
   - Three naturally-occurring radioactive families and their end products
   - Identify nuclide attributes with Nuclide Chart
   - Tracing nuclide decay and stable end-product
   - Definitions: curie, Becquerel
   - Definitions: specific activity, half-life
   - Calculate activity using the decay formula
   - Defining exposure, absorbed dose, dose equivalent, and quality factor
   - Defining roentgen, rad/gray, and rem/sievert
   - Exam

7. Interaction of Radiation with Matter (CL1.07) ≈4 hours

a. Prerequisites - None
b. Scope - This lesson provides an understanding of how different types of radiation interacts with different types of matter.
c. Outline - Introduction
   - Define ionization, excitation, bremsstrahlung
   - Defining specific ionization, linear energy transfer (LET), stopping power, range, and W-value
   - Alpha particle energy transfer
   - Energy transfer for beta particulate radiation
   - Gamma photon interaction with matter
   - Kinetic energies of various types of neutrons
   - Slow neutron capture
   - Scattering interactions for fast neutrons
   - Characteristics of materials shielding alpha, beta, gamma and neutron radiations
   - Exam

8. Biological Effects of Radiation (CL-1.08) ≈ 4 hours

a. Prerequisites - None
b. Scope -This lesson provides a basic understanding of the methods in which radiation may cause biological damage so that the RCT may protect themselves and the workers from unnecessary exposure to ionizing radiation.
c. Outline - Introduction
   - Function of various cell structures
   - Effects of radiation on cell structures
   - Law of Bergonie and Tribondeau

- Factors affecting radiosensitivity of cells
- Most and least radiosensitive cells
- Reactions on cells from ionizing radiation
- Definitions: stochastic, non-stochastic effect
- LD 50/30 value for humans
- Somatic effects of chronic radiation exposure
- Three types of acute radiation syndromes and associated exposure levels and symptoms
- Radiation exposure risks to embryo and fetus
- Somatic and heritable effects
- Exam

9. Radiological Protection Standards (CL1.09) ≈ 4 hours

a. Prerequisites - None
b. Scope -This lesson provides an understanding of the history of the development of the limits to show why the current limits of exposure are imposed. This lesson also provides an awareness of the current CFRs and DOE Orders that may affect the RCTs at the work place.
c. Outline - Introduction
   - Role of advisory agencies in developing radcon recommendations
   - Role of regulatory agencies in developing standards and regulations
   - DOE RCM purpose and scope
   - DOE RCM use of "shall" and "should"
   - Exam

10. ALARA (CL1.10) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson provides an understanding of the ALARA philosophy and shows the methods for the RCT to establish and maintain the commitment to ALARA that all personnel at the facility must have for a safe radiological work place.
c. Outline - Introduction
   - Base assumptions for ALARA philosophy
   - Collective personnel and individual exposure
   - Effective radiological ALARA program
   - Purposes of pre- and post-job reviews
   - RCT responsibilities for implementation
   - Exam

11. External Exposure Control (CL1.11) ≈ 4 hours

a. Prerequisites - None
b. Scope -This lesson provides an understanding of external exposure reduction and control measures available to the RCT to provide the best coverage and support at the radiological work site.
c. Outline - Introduction
   - Four basic methods for minimization
   - Calculating gamma exposure rates
   - Source reduction techniques
   - Time-saving techniques
   - Calculating remaining allowable dose equivalent or stay time
   - "Distance to radiation sources" techniques
   - Calculating exposure rate or distance for a point source of radiation
   - Calculating exposure rate or distance for a line source of radiation
   - Effects of distance on exposure rates from a plane source
   - Mass and linear attenuation coefficients
   - Defining "density thickness"
   - Density-thickness values for skin, lens of the eye, and the whole body
   - Using equations to calculate shielding thickness and exposure rates for gamma/x-ray radiation
   - Exam

12. Internal Exposure Control (CL1.12) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson is designed to familiarize the technician with those actions necessary as a result of the entry of radioactive materials into the body and the basis for those actions.
c. Outline - Introduction
   - Four ways radioactive material enters the body
   - Methods to prevent/minimize entry of radioactive material
   - Defining and distinguishing ALI and DAC
   - Determining basis for ALI
   - Defining "reference man"
   - Using DACs to minimize internal exposure
   - Behavior of radioactive materials in the body
   - Natural reductions of radionuclides in body
   - Relationship between physical, biological and effective half lives
   - Calculating effective half life
   - Medical elimination methods
   - Exam

13. Radiation Detector Theory (CL1.13) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson provides a good theoretical understanding of radiological instrumentation to help RCTs understand the data obtained by that instrumentation.
c. Outline - Introduction
   - Fundamental laws of electrical charges
   - Defining current, voltage, resistance, and their respective units
   - Functions of detector and readout circuitry components in radiation measurement system
   - Parameters affecting ion pair numbers in a gas-filled detector
   - Regions of gas amplification curves
   - Characteristics of a detector used in gas amplification curve regions
   - Defining resolving time, dead time, and recovery time
   - Discriminating between various types of radiation and various radiation energies
   - Operation of scintillation detector and associated components
   - Operation of neutron detector
   - Principles of GeLi and HPGe detectors
   - Exam

1

COURSE: Radiological Control Technician Site-Specific Academic Lessons

DURATION: ≈88 hours

PREREQUISITES: Lesson specific

SCOPE: Lesson specific

1. Counting Errors and Statistics (CL2.03) ≈ 4 hours

    a. Prerequisites - CL1.01 through CL1.13
    b. Scope - This lesson provides a basic knowledge of the random process of detecting and measuring radioactivity and the associated counting errors involved with that process. The RCTs will use this knowledge when obtaining the radioactivity measurements to make decisions that may affect the health and safety of workers at the facility and its surrounding environments
    c. Outline - Introduction
        - Analyzing errors and their effect on sample measurements
        - Sample analysis statistics applications
        - Defining mean, median, and mode
        - Determining mean, median, and mode
        - Defining variance and standard deviation
        - Calculating the standard deviation
        - Purpose of Chi-squared test
        - Criteria for acceptable Chi-squared values at the WIPP
        - Purpose of creating quality control charts
        - WIPP QC chart maintenance and review requirements
        - Purpose of warning and control limits
        - Purpose of efficiencies and correction factors
        - Calculating efficiencies and correction factors
        - Meaning of counting data reported as "x±y"
        - Reporting results to desired confidence level
        - Purpose of determining background
        - WIPP methods and requirements for determining background
        - Purpose of performing sample planchet maintenance
        - WIPP method and requirements of performing planchet maintenance for counting systems
        - Methods to improve statistical validity of sample measurements
        - Defining and explaining "detection limits"
        - Calculate detection limit values at WIPP
        - Purpose, method, and criteria for acceptable values of determining crosstalk at the WIPP
        - Purpose and method of performing voltage plateau
        - Exam

2. Dosimetry (CL2.04) ≈ 4 hours

    a. Prerequisites - None
    b. Scope - This lesson introduces the types of dosimeters used to measure external radiation to people at the facility. The material presented in this lesson is valuable to RCTs since dosimeters are the only direct method to measure and document personnel radiation exposure and ensure regulatory compliance with applicable limits.
    c. Outline - Introduction
        - DOE occupational worker external exposure limits
        - DOE established limits for embryo/fetus
        - WIPP administrative exposure control guidelines for radiation/non-radiation workers, incidents and emergencies, and unborn children
        - Requirements for pregnant worker
        - Theory of operation of a TLD
        - Theory of operation of a TLD reader
        - Advantages and disadvantages of a TLD
        - WIPP beta-gamma TLDs
        - WIPP neutron TLDs
        - WIPP TLD use requirements
        - WIPP personnel neutron dosimeter types and principle of operation
        - WIPP self-reading dosimetry (SRD) principle of operation
        - WIPP alarming dosimeter use guidelines and principle of operation
        - WIPP bioassay monitoring methods
        - Exam

3. Contamination Control (CL2.05) ≈ 4 hours

    a. Prerequisites - None
    b. Scope - This lesson shows that contamination control is probably one of the most difficult and challenging tasks the RCTs will encounter. This lesson covers the methods to prevent personnel contaminations and releases of radioactive material into the environment which is the ultimate purpose of a radiological control organization.
    c. Outline - Introduction
        - Removable and fixed surface contamination
        - Components of the radiation monitoring program
        - Basic goal of the program
        - Basic principles
        - Possible engineering control methods
        - Use of protective clothing
        - Basic factors which determine protective clothing requirements
        - Exam

: 03845

4. Airborne Sampling Program/Methods (CL2.06) ≈ 4 hours

    a. Prerequisites - None
    b. Scope - This lesson provides an overview of the air sampling program and the methods for obtaining airborne radioactivity concentration in an area to ensure that the control measures assigned are effective and continue to be effective.
    c. Outline - Introduction
        - Primary objectives of air monitoring program
        - Three physical states of radiation contaminants
        - Ensuring a representative air sample
        - Defining "isokinetic sampling"
        - Six methods for obtaining samples and their principle of operation
        - Selection of air monitoring methods
        - Purpose of five types of samplers/monitors
        - Factors affecting accuracy of measurements
        - WIPP air monitoring program
        - Exam

5. Airborne Sampling Laboratory (CL2.06A) ≈ 4 hours

    a. Prerequisites - None
    b. Scope - This training laboratory provides the initial on-the-job training for the job performance measures (JPMs) pertaining to the Airborne Sampling Program/Methods.
    c. Outline - Introduction
        - Collecting FAS filters
        - Analyzing air sample for radioactivity
        - Changing 'Station A' FAS filters
        - Determining appropriate respiratory equipment based on air activity

6. Radiological Source Control (CL2.08) ≈ 4 hours

    a. Prerequisites - None
    b. Scope - This lesson provides an understanding of the purposes, uses, methods to control radioactive sources that are necessary at a nuclear facility.
    c. Outline - Introduction
        - N41.1 requirements for radioactive sources
        - WIPP sources that must be controlled
        - Packaging, marking and labeling requests
        - Storage area approval and posting requests
        - WIPP procedures for storage and accountability of radioactive sources
        - Exam

: 038346

7. Access Control and Work Area Setup (CL2.10) ≈ 4 hours

   a. Prerequisites - None
   b. Scope - This lesson presents instruction in Radiological Work Permits, various types of postings used in radiological areas, setting up radiological areas, access controls, and releasing of material from radiological areas.
   c. Outline - Introduction
      - Purpose and information on Radiological Work Permit (RWP) including WIPP classifications
      - Responsibilities in using or initiating RWP
      - WIPP document that governs our ALARA program
      - WIPP establishment of exposure/performance goals
      - WIPP conditions requiring a pre-job ALARA review
      - WIPP conditions requiring a post-job ALARA review
      - Purpose of postings, signs, labels and barricades; and RCTs responsibilities for them
      - WIPP postings, requirements for postings/barriers, and entry requests for various radiological areas
      - Setting up radiological areas
      - Containment device discrepancies
      - Setting up portable ventilation systems and count rate meters
      - Requirements while working in RBAs
      - Requirements for removing or releasing materials from any radiological area
      - Exam

8. Radiological Work Coverage (CL2.11) ≈ 4 hours

   a. Prerequisites - None
   b. Scope - This lesson covers the methods of job coverage by RCTs to assist radiological workers in keeping their radiation exposures ALARA.
   c. Outline - Introduction
      - Three purposes of job coverage
      - Continuous and intermittent job coverage
      - Conditions that require job coverage
      - Planning job coverage
      - Pre-job briefing discussions
      - Worker and technician exposure control techniques
      - WIPP in-progress radiological surveys
      - WIPP documentation of in-progress surveys
      - Actions taken for unexpected survey results
      - Contamination control techniques
      - Preventative job coverage techniques
      - Overall job control techniques
      - WP 12-5 reasons to stop radiological work activities
      - Exam

9. Shipment/Receipt of Radioactive Material (CL2.12) ≈ 4 hours

a. Prerequisites - None
b. Scope -
c. Outline - Introduction
   - Regulatory agencies for radioactive material transport
   - Defining the DOT terms: LSA, Limited Quantity, Transport Index, Exclusive Use, and Closed Transport Vehicle
     Determining radionuclide contents of a package
   - Radiation and contamination surveys and applicable limits performed on packages
   - Radiation and contamination surveys and applicable limits performed on exclusive use vehicles
   - Placement of placards on transport vehicles
   - WIPP shipment release inspection criteria
   - WIPP procedures for receipt and shipment
   - WIPP procedures for shipments exceeding limits
   - WIPP procedures for opening packages
   - Exam

10. Radiological Incidents and Emergencies (CL2.13) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson covers the necessary immediate and supplementary actions for responding to radiological emergencies and abnormal events. This lesson also reveals that, although most people do not take incident response planning seriously because they do not expect the unexpected, incidents do occur, and experience has shown that best response comes from workers who have prepared themselves with a plan for dealing with incidents.
c. Outline - Introduction
   - RCT general response and responsibilities
   - Emergency equipment and facilities, including location and contents of emergency equipment kits
   - RCT response to CAM alarm
   - RCT response to personnel contamination monitor alarm
   - RCT response to off scale or lost dosimetry
   - RCT response to radiation levels or area alarm
   - RCT response to dry or liquid spill
   - RCT response to fire in a radiological area or involving radioactive materials
   - RCT response to other incidents
   - Emergency response levels
   - Incident documentation procedures
   - Emergency response team structure

- Offsite incident support groups
- Plant incidents, including cause, prevention, and response
- Exam

11. Personnel Decontamination (CL2.14) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson outlines the best methods available to control or oversee the decontamination of a contaminated individual.
c. Outline - Introduction
   - Three factors in personnel decontamination
   - Required RCT preliminary actions and notifications for contaminated individual
   - RCT response to clothing contamination
   - RCT response to skin contamination
   - Using decontamination reagents to decontaminate personnel
   - Exam

12. Radiological Considerations for First Aid (CL2.15) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson introduces the special considerations for injuries in radiological areas. It is incumbent on the RCT to use his/her knowledge and training to make judgement calls based on available facts and conditions. Often there is more than one "right way" to handle the situation, with many alternatives which may all work equally well.
c. Outline - Introduction
   - Treatment of minor radiation injuries
   - Treatment of major radiation illness/injury
   - RCT's responsibility at scene of major radiation injury after arrival of medical personnel
   - WIPP treatment and transport of contaminated injured personnel
   - Exam

13. Radiation Survey Instrumentation (CL2.16) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson provides an understanding of radiation survey instruments to ensure the data obtained is accurate and appropriate for the source of radiation. This lesson contains information about widely used portable radiation survey instruments.
c. Outline - Introduction
   - Appropriate external radiation survey instruments and their selection
   - WIPP ion chamber instrument features and specifications
   - WIPP high range instrument features and specifications
   - WIPP neutron detection and measurement instrument features and specifications
   - Exam

14. Contamination Monitoring Instrumentation (CL2.17) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson provides an understanding of contamination monitoring (count rate) instruments to provide the basis for assignment of practical contamination and internal exposure controls, to establish the proper controls, and to identify personnel contamination prior to exiting radiological areas at the facility.
c. Outline - Introduction
   - Portable contamination monitoring equipment selection
   - WIPP beta/gamma and/or alpha survey count rate meter probe features and specifications
   - WIPP count rate instrument features and specifications
   - WIPP personnel contamination monitor features and specifications
   - WIPP contamination monitor (tool, bag, laundry monitors) features and specifications
   - Exam

15. Air Sampling Equipment (CL2.18) ≈ 4 hours

a. Prerequisites - None
b. Scope
c. Outline - Introduction
   - WIPP portable air sampler (PAS) selection
   - Physical and operating characteristics and limitation(s) of WIPP portable air samplers
   - Physical and operating characteristics and limitation(s) of WIPP motor air pumps
   - Pre-operational checkout of WIPP PASs
   - Physical and operating characteristics and limitation(s) of WIPP beta-gamma CAMs
   - Physical and operating characteristics and limitation(s) of WIPP alpha CAMs
   - Exam

16. Counting Room Equipment (CL2.19) ≈ 4 hours

a. Prerequisites - None
b. Scope - This lesson covers counting room equipment in relation to types used, purpose for, radiation monitored, operational requirements, and specific limitations and characteristics. The RCT uses information from these counting instruments to identify and assess the hazards presented by contamination and airborne radioactivity and establish protective requirements for work performed in radiological areas.
c. Outline - Introduction
   - WIPP Scintillation Alpha and Beta laboratory counter/scalers' features and specifications
   - WIPP low background auto alpha/beta proportional counting system features and specifications
   - Exam

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1

COURSE: Radiography (Level 1)

TYPE: Classroom/OJT

OBJECTIVES: Upon completion of this course and obtaining a grade of at least 80% on a comprehensive examination, the student will be able to review radiography records performed by another radiographer. Level 1 radiographers will perform a practical capability demonstration in the presence of an experienced, qualified radiography operator or trainer.

REFRESHER: Biennially

COURSE DESCRIPTION

Level 1 radiography operators shall be instructed in the specific waste generating practices and typical packaging configurations expected to be found in each Waste Matrix Code at each site shipping waste to WIPP. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography operator or trainer prior to qualification of the training candidate.

The Permittees' Level 1 radiography training program includes:

Formal Training

- Project Requirements
- State and Federal Regulations
- Basic Principles of Radiography
- Radiography of Waste Forms (including the ability to identify liquid and compressed gases which will be verified by a radiography subject matter expert)
- Waste Stream-Specific Instruction (e.g., specific waste generating processes, typical packaging configurations, waste material parameters)

On-the-Job Training

- System Operation (equipment and procedures used by Level 1 radiographers)
- Identification of Packaging Configurations
- Identification of Waste Material Parameters/Waste Matrix Codes
- Identification of liquid in excess of the limits in the TSDF-WAC, and compressed gases
- Verification of waste stream description

1

COURSE: Radiography (Level 2)

TYPE: Classroom/OJT

OBJECTIVES: Upon completion of this course, the student will be able to perform radiography in a safe manner and will be able to confirm whether waste contains ignitable, corrosive, or reactive waste.

Successfully pass a comprehensive exam based upon training enabling objectives. The comprehensive exam will address the radiography operation, documentation, and procedural elements stipulated in this WAP.

Perform practical capability demonstration in the presence of appointed site Permittee radiography subject matter expert.

REFRESHER: Biennially

COURSE DESCRIPTION

Level 2 radiography operators shall be instructed in the specific waste generating practices and typical packaging configurations expected to be found in each Waste Matrix Code at each site shipping waste to WIPP. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography operator prior to qualification of the training candidate.

The Permittees' Level 2 radiography training program includes:

Formal Training

- Project Requirements
- State and Federal Regulations
- Basic Principles of Radiography
- Radiographic Image Quality
- Radiographic Scanning Techniques
- Application Techniques
- Radiography of Waste Forms
- Standards, Codes, and Procedures for Radiography
- Waste Stream-Specific Instruction

On-the-Job Training

- System Operation
- Identification of Packaging Configurations
- Identification of Waste Material Parameters/Waste Matrix Codes
- Identification of liquid in excess of the TSDF-WAC limits and compressed gases
- Verification of waste stream description

A radiography training drum shall include items common to the waste streams to be confirmed by the Permittees. The training drums shall be divided into layers with varying packing densities or different drums may be used to represent different situations that may occur during radiography examination by the Permittees. The following elements will be in a radiography training drum(s):

- Aerosol can with puncture
- Horsetail bag
- Pair of coveralls
- Empty bottle
- Irregular shaped pieces of wood
- Empty one gallon paint can
- Full container
- Aerosol can with fluid
- One gallon bottle with three tablespoons of fluid
- One gallon bottle with one cup of fluid (upside down)
- Leaded glove or leaded apron
- Wrench

These items shall be successfully identified by the operator as part of the qualification process.

Requalification of operators shall be based upon evidence of continued satisfactory performance (primarily video/audio reviews) and shall be done at least every two years. Unsatisfactory performance will result in disqualification. Unsatisfactory performance is defined as the misidentification of liquid in excess of the limits (as defined in the TSDF-WAC) or compressed gases in a training drum or a score of less than eighty percent (80%) on the comprehensive exam. Retraining and demonstration of satisfactory performance are required before a disqualified operator is again allowed to operate the radiography system for the Permittees.

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COURSE: Visual Examination (Level 1)

TYPE: Classroom/OJT

OBJECTIVES: Upon completion of this course and obtaining a grade of at least 80% on a comprehensive examination, the student will be able to perform a review of visual examination records and will be able to confirm the Summary Category Group, Waste Matrix Code and whether waste contains ignitable, corrosive, or reactive waste. Level 1 visual examination personnel will perform a practical capability demonstration in the presence of an experienced, qualified visual examination expert or trainer.

REFRESHER: Biennially

COURSE DESCRIPTION

Level 1 visual examination personnel shall be instructed in the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code in the waste stream being confirmed using visual examination.

The OJT and apprenticeship shall be conducted by an operator experienced and qualified in visual examination or a qualified trainer prior to qualification of the candidate. The training shall be site waste stream specific to include the various waste configurations being confirmed. For example, the particular physical forms and packaging configurations at each site will vary and operators shall be trained on types of waste that are generated, stored, and/or characterized at that particular site.

Visual examination personnel shall be requalified once every two years.

The Level 1 visual examination training program includes:

Formal Training

- Project Requirements
- State and Federal Regulations
- Batch Data Report Forms
- Waste Stream-Specific Instruction (e.g., waste generating processes, typical packaging configurations, waste material parameters)

On-the-Job Training

- System Operation (equipment and procedures used by Level 1 visual examination personnel)
- Identification of Packaging Configurations
- Identification of Waste Material Parameters/Waste Matrix Codes
- Identification of liquid in excess of the limits in the TSDF-WAC and compressed gases
- Verification of waste stream description

1

COURSE: Visual Examination (Level 2)

TYPE: Classroom/OJT

OBJECTIVES: Upon completion of this course, the student will be able to perform visual examination or a review of visual examination records in a safe manner and will be able to confirm whether waste contains ignitable, corrosive, or reactive waste.

Successfully pass a comprehensive exam based upon training enabling objectives. The comprehensive exam will address the visual examination operation, documentation, and procedural elements stipulated in this WAP.

Perform practical capability demonstration in the presence of appointed site Permittee visual examination subject matter expert.

REFRESHER: Biennially

COURSE DESCRIPTION

Level 2 visual examination operators shall be instructed in the specific waste generating processes, typical packaging configurations, and waste material parameters expected to be found in each Waste Matrix Code in the waste stream being confirmed using visual examination.

The OJT and apprenticeship shall be conducted by an operator experienced and qualified in visual examination prior to qualification of the candidate. The training shall be site waste stream specific to include the various waste configurations being confirmed. For example, the particular physical forms and packaging configurations at each site will vary so operators shall be trained on types of waste that are generated, stored, and/or characterized at that particular site.

Visual examination personnel shall be requalified once every two years.

The Level 2 visual examination training program includes:

Formal Training

- Project Requirements
- State and Federal Regulations
- Batch Data Report Forms
- Application Techniques
- Waste Stream-Specific Instruction (e.g., specific waste generating processes, typical packaging configurations, waste material parameters)

On-the-Job Training

- Identification of Packaging Configurations
- Identification of Waste Material Parameters/Waste Matrix Code
- Identification of liquid in excess of the TSDF-WAC limits and compressed gases
- Verification of waste stream description

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Qualification Cards

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1

QUALIFICATION CARD: CH Waste Handling Technician (WH-01A, WH-01B)

CH Waste Handling Engineer (WH-02)

DURATION: Nine to twelve months

CLASSROOM TRAINING: Various classroom courses are utilized to provide operators the requisite training as part of the qualification process. The candidate must satisfactorily complete the classroom training courses prior to completion of the qualification card.

SCOPE: The CH Waste Handling Technician Qualification Card (WH-01A Backfill Technician, and Emplacement Technician, and WH-01B Waste Handling Technician) and CH Waste Handling Engineer Qualification Card (WH-02 Waste Handling Operations Qualification Card Guide Book [WH-GUIDE-1]).

REFERENCES: CH Waste Handling Technician Qualification Card (WH-01)
CH Waste Handling Engineer Qualification Card (WH-02)
Waste Handling Operations Qualification Card Guide Book (WH-GUIDE-1)

QUALIFICATION CARD DESCRIPTION (by category)

1. Equipment Knowledge Requirements

   Demonstrate knowledge of the following for the various pieces of CH waste handling equipment and systems:

   - General principle of equipment operation
   - Understanding of alarms, indications, and readings
   - Proper response to abnormal equipment conditions
   - Precautions, administrative requirements, and technical specification requirements
   - Basic safety requirements for equipment operation

2. Equipment Operation Practical Requirements

   Demonstrate competency in conducting CH waste handling equipment and system functional and operational inspections.

   Demonstrate competency in standard operation of CH waste handling equipment and systems.

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3. Integrated Process Knowledge Requirements

Demonstrate knowledge of the following for the various integrated support functions.

- Administrative activities for equipment/system isolation, modification and control
- Management of site derived waste
- Proper response to abnormal facility conditions
- Container storage area inspections
- Facility support systems

4. Integrated Process Practical Requirements

Demonstrate competency in performing administrative duties for equipment/system isolation and control.

Demonstrate competency in management of site derived waste.

Demonstrate competency in performing container storage area inspections.

Walkdown the various facility support systems that affect waste handling.

1

QUALIFICATION CARD: RH Waste Handling Technician (RH-01A, RH-01B, RH-01C)

RH Waste Handling Engineer (RH-02)

DURATION: Nine to twelve months

CLASSROOM TRAINING: Various classroom courses are utilized to provide operators the requisite training as part of the qualification process. The candidate must satisfactorily complete the classroom training courses prior to completion of the qualification card

SCOPE: The RH Waste Handling Technician Qualification Card (RH-01A, RH-01B, RH-01C) and RH Waste Handling Engineer Qualification Card (RH-02).

REFERENCES: RH Waste Handling Technician Qualification Card
RH Waste Handling Engineer Qualification Card
Waste Handling Operations Qualification Card Guide Book

QUALIFICATION CARD DESCRIPTION (by category)

1. Equipment Knowledge Requirements

   Demonstrate knowledge of the following for the various pieces of RH waste handling equipment and systems:

   - General principle of equipment operation
   - Understanding of alarms, indications, and readings
   - Proper response to abnormal equipment conditions
   - Precautions, administrative requirements, and technical specification requirements
   - Basic safety requirements for equipment operation

2. Equipment Operation Practical Requirements

   Demonstrate competency in conducting RH waste handling equipment and system functional and operational inspections.

   Demonstrate competency in standard operation of RH waste handling equipment and systems.

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3. Integrated Process Knowledge Requirements

Demonstrate knowledge of the following for the various integrated support functions.

- Administrative activities for equipment/system isolation, modification and control
- Management of site derived waste
- Proper response to abnormal facility conditions
- Container storage area inspections
- Facility support systems

4. Integrated Process Practical Requirements

Demonstrate competency in performing administrative duties for equipment/system isolation and control.

Demonstrate competency in management of site derived waste.

Demonstrate competency in performing container storage area inspections.

Walkdown the various facility support systems that affect waste handling.

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QUALIFICATION CARD: Radiological Control Technician (RCT)

DURATION: ≈9 working months

CLASSROOM TRAINING: Various classroom courses are utilized to reinforce the training received as part of the qualification card. The candidate is required to complete

SCOPE:

REFERENCES: WP 12-5, WIPP Radiological Control Manual
WP 12-HP, WIPP OHP Procedures Manual
WP 12-RE, Rad Engineering Procedures Manual

QUALIFICATION CARD DESCRIPTION (by category)

1. Academics Training

   There are 13 lessons associated with the core academics program and 15 lessons associated with the site academics program.

2. Practical Training

   There are 33 job performance measures associated with the practical training element of the RCT qualification program covering the following areas:

   Demonstrate generation of a Radiological Work Permit.

   Demonstrate how a radiological area should be posted.

   Demonstrate applicable emergency response to various events.

   Demonstrate competency in operating various types of monitoring equipment.

3. Written Examination

   This exam is administered after successful completion of academic lessons and practical lessons. Successful completion of the comprehensive written exam is necessary prior to participation in the oral examinations.

4. Oral Examination Board

   The oral board consists of members of Radiation Safety, Operational Health Physics, Facility Operations, and Technical Training. This board will assess the candidate's response to normal and emergency situations encountered by a Radiation Control Technician

1

QUALIFICATION CARD: EST-01 Emergency Services Technician

DURATION: 2 Years

PREREQUISITIES: The candidate must be current in CPR and possess an EMT-I License.

CLASSROOM TRAINING: Additional classroom training courses are required prior to completion of this qualification card.

SCOPE: This qualification card must be completed by all candidates prior to standing a watch unsupervised. Qualification is a six month process. The individual may perform duties without direct supervision only for those evolutions and/or operations for which training has been completed.

All signatures must be made by an approved Subject Matter Expert. The signatures indicate that the trainee has demonstrated satisfactory knowledge and performance of the task(s) indicated.

REFERENCES: Emergency Services Technician Qualification Card Guide Book (EST-01G)
WIPP Emergency Management Program (WP 12-9)
Emergency Fire Pump (WP 04-FP2202)
Inspection and Testing of Sprinkler Systems
1. Wet Pipe Fire Sprinkler System Testing (WP 12-FP0025)
2. NFPA 13, Installation of Sprinkler Systems

QUALIFICATION CARD DESCRIPTION (by category)

1. Knowledge Requirements

Demonstrate basic knowledge of emergency management procedures and protocols such as:

- The purpose and types of dry chemicals utilized in large and portable dry chemical systems.
- Inspection and testing principles of sprinkler systems, buildings, pull boxes, and fire detection systems.
- The general operation and hazards of fixed halon systems.
- Principles and procedures for operation of various fire and rescue apparatus.
- Selection and use of personal protective equipment.
- Selection and use of hazardous material equipment and supplies for control and mitigation.

2. Practical Requirements

Demonstrate competency in the following areas:

- Use of fire suppression apparatus and equipment.
- Use of rescue apparatus and equipment.
- Inspection and testing techniques and completion of corresponding forms.
- Operation of ambulance and operation and application of all ambulance equipment and supplies.
- Application of all hazardous materials equipment and supplies for control and mitigation.

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QUALIFICATION CARD: FPT-01 Fire Protection Technician

DURATION: 2 Years

PREREQUISITES: The candidate must be currently certified in CPR and possess an EMT-B License.

CLASSROOM TRAINING: Additional classroom training courses are required prior to completion of this qualification card.

SCOPE: This qualification card must be completed by all candidates prior to standing a watch unsupervised. Qualification is a six month process. The individual may perform duties without direct supervision only for those evolutions and/or operations for which training has been completed.

All signatures must be made by an approved Subject Matter Expert. The signatures indicate that the trainee has demonstrated satisfactory knowledge and performance of the task (s) indicated.

REFERENCES: Emergency Services Technician Qualification Card Guide Book (EST-01G)
WIPP Emergency Management Program (WP 12-9)

QUALIFICATION CARD DESCRIPTION (by category)

1. Knowledge Requirements

   Demonstrate basic knowledge of emergency management procedures and protocols such as:

   - The purpose and types of dry chemicals utilized in large and portable dry chemical systems.
   - Inspection and testing principles of sprinkler systems, buildings, pull boxes, and fire detection systems.
   - The general operation and hazards of fixed halon systems.
   - Principles and procedures for operation of various fire and rescue apparatus.
   - Selection and use of personal protective equipment.
   - Selection and use of hazardous material equipment and supplies for control and mitigation.

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2. Practical Requirements

Demonstrate competency in the following areas:

- Use of fire suppression apparatus and equipment.
- Use of rescue apparatus and equipment.
- Inspection and testing techniques and completion of corresponding forms.
- Operation of ambulance and operation and application of all ambulance equipment and supplies.
- Application of all hazardous materials equipment and supplies for control and mitigation.

1

QUALIFICATION CARD: Quality Assurance Inspector

DURATION: Six to nine months

CLASSROOM TRAINING: Various formal classroom courses are utilized to support the training received as part of the qualification card. The candidate is required to complete the classroom training courses, satisfactorily, prior to completion of the qualification card.

SCOPE: The Quality Assurance Qualification card establishes the minimum education, skill, training, knowledge, and experience requirements for Quality Assurance personnel who perform inspection activities.

REFERENCES: WP 13-1, Quality Assurance Program Description
QAI PD2-3, Qualification of Inspection Personnel

QUALIFICATION CARD DESCRIPTION (by category)

1. General Knowledge

   Demonstrate knowledge of the minimum site specific procedures:

   - ASME NQA-1
   - Quality Assurance Program Description
   - Safety Manual
   - Hoisting and Rigging Procedures
   - Work Authorization Procedures
   - Document Control Procedures

2. On-the-Job Training

   Perform at least 20 hours of the following activities while supervised by a qualified inspector:

   - Receiving inspection
   - Dimensional inspection
   - Mechanical inspection
   - Electrical inspection
   - Civil inspection

3. Qualification Card

Perform the following tasks:

- Receipt inspection
- Conduct an inspection
- Hold/witness point inspection
- Issuance of a corrective action request
- Hold tag issuance
- Verification of corrective action
- Conduct a corrective action receipt inspection

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QUALIFICATION CARD: Facility Operations Roving Watch

DURATION: Six to nine months

CLASSROOM TRAINING: Various classroom courses are utilized to reinforce the training received as part of the qualification card. The candidate is required to complete the classroom training courses, satisfactorily, prior to completion of the qualification card.

SCOPE: The Facility Operations Roving Watch qualification is the foundation for all of the Facility Operations qualifications. The qualifications developed utilizing the Facility Operations Roving Watch qualification are the Central Monitoring Room Operator Qualification (FO-CMRO-2) and the Facility Operations Shift Engineer Qualification (FO-FOSE-3) (for FSM). This qualification is used by all Facility Operations personnel qualifying. All of the requirements of the applicable qualifications must be completed by the candidate before operating any equipment or performing any operating evolutions without direct supervision of a qualified operator.

REFERENCES: Facility Operations Roving Watch Qualification Card (FO-RW-1)
WIPP Operations Watchstation Qualification Card Guide Book (FO-GUIDE-1)

QUALIFICATION CARD DESCRIPTION (by category)

1. System Knowledge

Demonstrate knowledge of the critical facility operating systems, such as:

- Theory of the system and equipment
- System design
- Differences in the various building systems around the facility
- Alarms and sequence of actions that follow alarms

The systems covered include:

- Facility electrical and backup electrical systems
- Heating, air conditioning, and ventilation systems
- Underground ventilation systems
- Domestic water and fire protection systems

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2. System Operation Practical Evaluation

   Demonstrate system startup/shutdown for the various facility systems according to procedures.

   Demonstrate maintenance of applicable records pertaining to the operation of facility systems.

   Demonstrate ability to conduct periodic required testing of facility systems.

   Demonstrate competency to respond to alarms and emergency situations according to procedures.

3. Integrated Plant Knowledge

   Discuss the site policies on equipment lockout/tagout.

   Discuss the process of notifications and authorizations that is involved in making temporary plant modifications.

   Discuss the site process for work authorization.

   Discuss the role and responsibilities of Facility Operations on the site.

   Discuss Conduct of Operations as it applies to Facility Operations.

4. Integrated Plant Practical Evaluation

   Demonstrate the lockout/tagout process.

   Prepare paperwork associated with a temporary plant modification.

   Demonstrate ability to maintain the Facility Operations logs.

   Demonstrate the actions that are taken in various facility emergencies.

   Demonstrate ability to stand watch as RW during various shifts.

5. Oral Qualification Exam

   This final portion of the qualification consists of an oral board exam conducted by board members who are knowledgeable in the qualification program areas.

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1

QUALIFICATION CARD: Central Monitoring Room Operator

DURATION: Three to five months

CLASSROOM TRAINING: Various classroom courses are utilized to reinforce the training received as part of the qualification card. The candidate is required to complete the classroom training courses, satisfactorily, prior to completion of the qualification card.

SCOPE: The Facility Operations Central Monitoring Room Operator Qualification (FO-CMRO-2) in conjunction with the Roving Watch qualification make up the support for the Facility Operations Shift Engineer Qualification (FO-FOSE-3). This qualification is used by Facility Operations personnel qualifying as CMR operators or Facility Operations Shift Supervisors. All of the requirements of the applicable qualifications must be completed by the candidate prior to operating any equipment or performing any operating evolutions without direct supervision of a qualified operator. Qualification are valid for two years.

REFERENCES: Central Monitoring Room Operator Qualification Card (FO-CMR-2)
WIPP Operations Watchstation Qualification Card Guide Book (FO-GUIDE-1)

QUALIFICATION CARD DESCRIPTION (by category)

1. System Knowledge

   Demonstrate knowledge of the following for the various systems in the Central Monitoring Room:

   - Theory of the system and equipment
   - System design
   - Alarms and sequence of actions that follow the alarms

2. System Operation Practical Evaluation

   Demonstrate competency in standard operation of the systems in the Central Monitoring Room including obtaining various pieces of information such as:

   - System status
   - Alarm Status
   - Meteorological data

   Demonstrate what actions are to take place in the event of an alarm.

   Demonstrate storage of information and subsequent retrieval.

3. Integrated Plant Knowledge

   State the actions that must be taken to remove a CMS point scan/alarm check.

   Discuss the sequence of events that must occur during a facility emergency.

4. Integrated Plant Practical Evaluation

   Demonstrate how the CMR log is maintained.

   Demonstrate the sequence of events that are involved in CMS point scan/alarm check removal.

   Demonstrate ability to stand watch as CMRO during different shifts.

   Demonstrate the sequence of events involved in a facility emergency.

5. Oral Qualification Exam

   This final portion of the qualification consists of an oral board exam conducted by board members who are knowledgeable in the qualification program areas.

1

QUALIFICATION CARD: Facility Operations Shift Supervisor

DURATION: Three to five months

CLASSROOM TRAINING: Various classroom courses are utilized to reinforce the training received as part of the qualification card. The candidate is required to complete the classroom training courses, satisfactorily, prior to completion of the qualification card

SCOPE: The Facility Operations Shift Engineer Qualification (FO-FOSE-3) is the final qualification developed from the Central Monitoring Room Operator Qualification and Roving Watch Qualification. This qualification is used by Facility Operations personnel, Facility Operations Engineer, and Facility Shift Manager. The candidate must be recommended by the Facility Operations Manager to perform this qualification. All of the requirements of the applicable qualifications must be completed by the candidate prior to operating any equipment or performing any operating evolutions without direct supervision of a qualified operator. Qualifications are valid for two years.

REFERENCES: Facility Operations Shift Engineer (FO-FOSE-3)
WIPP Operations Watchstation Qualification Card Guide Book (FO-GUIDE-1)

QUALIFICATION CARD DESCRIPTION (by category)

1. System Knowledge

   Completed qualification through Central Monitoring Room Operator Qualification and Roving Watch Qualification

2. System Operation Practical Evaluation

   Completed qualification through Central Monitoring Room Operator Qualification and Roving Watch Qualification

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3. Integrated Plant Knowledge

Discuss the site work authorization process and the role of the FSM.

Discuss the use of operator aids.

Discuss the responsibilities of the FSM.

Discuss the use of shift instructions.

Discuss the role of the FSM in facility emergencies and the actions that are to be taken by the FSM.

Discuss the role of the Quality Assurance and Safety programs on the site.

Discuss the Contingency Plan and its implementation.

Discuss site regulatory compliance as it applies to hazardous waste and hazardous materials.

4. Integrated Plant Knowledge Evaluation

Complete the required documentation for a lockout/tagout.

Complete the proper documentation relating to temporary plant modifications.

Perform various work authorization actions.

Demonstrate a review of the Facility Operations logs.

Demonstrate the response required for various facility emergencies.

Demonstrate ability to stand watch as FSM during different shifts.

5. Oral Qualification Exam

This final portion of the qualification consists of an oral board exam conducted by board members who are knowledgeable in the qualification program areas.

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QUALIFICATION CARD: WWIS Data Administrator

DURATION: Two years

CLASSROOM TRAINING: Various classroom courses are utilized to provide the WWIS Data Administrator with the knowledge and background on the WIPP waste operations. OJT connected with the everyday operation of the database will be provided by the WWIS SME. The candidate must satisfactorily complete the classroom training courses and the OJT prior to qualification.

SCOPE: The WWIS Qualification Card provides the minimum knowledge and competency requirements for qualification. The requirements of the qualification must be completed to the satisfaction of the current WWIS SME prior to the candidate performing any of the WWIS data functions without direct supervision by a qualified WWIS DA.

REFERENCES: WWIS Data Administrator Qualification Card

QUALIFICATION CARD DESCRIPTION (by category)

1. Equipment Knowledge Requirements

   Demonstrate knowledge of the following WWIS hardware and software systems:

   - General computer operation principles and communication terminal techniques
   - IBM PC and Internet techniques
   - Bar Code Reader System operation

2. Equipment Operation Practical

   - Obtain and maintain local and Internet IDs
   - Access WWIS and produce reports
   - Demonstrate operation of bar code reader interface to WWIS

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3. Integrated Process Knowledge Requirements

Demonstrate knowledge of the following project document data requirements:

- WIPP Waste Acceptance Criteria
- WIPP Quality Assurance Program Plan
- Waste Analysis Plan

Demonstrate knowledge of the following WWIS Specific documentation:

- WWIS Software Requirements Specification
- WWIS Software Configuration Management Plan
- WWIS Software Quality Assurance Plan
- WWIS Software Design Description

4. Integrated Process Practical Requirements

Demonstrate competency in performing the administrative duties of the WWIS DA

Demonstrate competency in accessing the local area network (LAN) and the Internet.

Demonstrate the WIPP data interface to the WWIS via a walkdown of the receipt and emplacement operations that provide data to the database.

1

QUALIFICATION CARD: Radioactive Transportation (TE-01)

Federal Motor Carrier Safety Regulations (TE-02)

Hazardous Materials (TE-03)

Hazardous Waste Shipments by Public Highway (TE-05)

DURATION: Six to twelve months

CLASSROOM TRAINING: Various classroom courses are utilized to provide candidates the requisite training as part of the qualification process. The candidate must satisfactorily complete the classroom training courses listed on the individual qualification card as a prerequisite to beginning that process.

SCOPE: The Transportation Engineer qualification cards (TE-01 through TE-05) provide the minimum knowledge and competency requirements for qualification. The requirements of the individual qualification cards must be completed by the candidate prior to performing those duties without direct supervision.

REFERENCES: Radioactive Transportation (TE-01)
Federal Motor Carrier Safety Regulations (TE-02)
Hazardous Materials (TE-03)
Hazardous Waste Shipments by Public Highway (TE-05)

QUALIFICATION CARD DESCRIPTION (by category)

1. Knowledge Requirements

   Demonstrate knowledge of the following regulatory arenas:

   - Radioactive Material Transportation
   - Federal Motor Carrier Safety Regulations
   - Hazardous Materials
   - Hazardous Waste Shipments by Public Highway

2. Practical Requirements

   Demonstrate competency in performing the following for a given shipment:

   - Determine the proper shipping name
   - Determine the proper labeling and placement requirements
   - Determine the proper application and marking requirements
   - Prepare the proper shipping documents (i.e., Hazardous Waste Manifest, Bill of Lading, LDR notification form, etc.)

1

QUALIFICATION CARD: Sampling Team (ST-01)

DURATION: 1 month

CLASSROOM TRAINING: HWW-101 - Hazardous Waste Worker/Hazardous Waste Responder

SCOPE: This qualification card must be completed by all candidates prior to performing sampling tasks without the direct supervision of a qualified person. This qualification ensures that the sampler will collect samples in a way that will protect the sampler and the integrity of the sample collected.

REFERENCES: WIPP Sampling Team Qualification Guide ST-01G
WP 02-EC.05 Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling
WP 02-EC.06 WIPP Site Effluent and Hazardous Materials Sampling Plan

QUALIFICATION CARD DESCRIPTION (by category)

1. Knowledge Requirements

   Demonstrate basic knowledge of hazardous waste sampling protocol such as:

   - Preventing cross-contamination of samples and equipment
   - Importance of the a chain-of-custody
   - Purpose of the field logbook and documentation
   - Labeling and sealing procedures
   - Methods of obtaining various sample types (i.e. TCLP organics, volatile organic compounds, TCLP metals)

2. Safety Requirements

   Demonstrate knowledge of the safety requirements for sampling activities such as:

   - Level of personal protective equipment (PPE) needed for various sampling situations
   - Actions to take when encountering damaged or bulging containers
   - Importance of the "Buddy System"

3. Practical Requirements

   - Correct and safe use of sampling equipment
   - Collection of a given sample preventing cross-contamination
   - Labeling and sealing sampling containers
   - Completion of the Chain-of-Custody form

1

QUALIFICATION CARD: Sampling Team Assistant (STA-01)

DURATION: 1 month

PREREQUISITES: HWW-101 - Hazardous Waste Worker/Hazardous Waste Responder

SCOPE: This qualification card must be completed by all candidates prior to performing sampling tasks without the direct supervision of a qualified person. This qualification ensures that the sampler will collect samples in a way that will protect the sampler and the integrity of the sample collected.

REFERENCES: WIPP Sampling Team Qualification Guide ST-01G
WP 02-EC.05 Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling
WP 02-EC.06 WIPP Site Effluent and Hazardous Materials Sampling Plan

QUALIFICATION CARD DESCRIPTION (by category)

1. Knowledge Requirements

   Demonstrate basic knowledge of hazardous waste sampling protocol such as:

   - Preventing cross-contamination of samples and equipment
   - Importance of the chain-of-custody
   - Purpose of the field logbook and documentation
   - Labeling and sealing procedures
   - Methods of obtaining various sample types (i.e., TCLP organics, volatile organic compounds, TCLP metals)

2. Safety Requirements

   Demonstrate knowledge of the safety requirements for sampling activities such as:

   - Level of personal protective equipment (PPE) needed for various sampling situations
   - Actions to take when encountering damaged or bulging containers
   - Importance of the "Buddy System"

3. Practical Requirements

   - Correct and safe use of sampling equipment
   - Collection of a given sample preventing cross-contamination
   - Labeling and sealing sampling containers
   - Completion of the Chain-of-Custody form

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QUALIFICATION CARD: Waste Handling Hoist Equipment Operator

DURATION: Approximately 12 to 15 months

SCOPE: The Waste Handling Hoist Equipment Operator Qualification (M-30) prepares the candidate to be a qualified man-hoist operator. All of the requirements for the applicable qualification must be completed prior to operating the Waste Handling Hoist unless under the direct supervision of a qualified operator.

REFERENCES: Waste Handling Hoist Equipment Operator Qualification Card Guide (M-30G)
Waste Handling Shaft Operation Procedure

QUALIFICATION CARD DESCRIPTION (by category)

1. Equipment Knowledge

   Demonstrate knowledge of the following systems associated with the Waste Hoist:

   - Major components of the Waste Hoist in the headframe and collar areas
   - Major components of the Waste Hoist electrical systems
   - Be able to describe the correct operations of all Waste Hoist systems and their interrelationships

2. Equipment Safety

   Demonstrate knowledge of all safety systems associated with the Waste Hoist and how their functions affect hoist operation.

   Describe the correct response of the operator when safety features are actuated.

3. Equipment Practical

   Perform normal startup and shutdown of all Waste Hoist systems.

   Perform normal hoisting operations for material and personnel in all modes of operation.

4. Classroom Training

   Receive formal training in electrical safety.

5. Required Reading

   Read the appropriate related procedures for waste hoist operation.

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QUALIFICATION CARD: Waste Handling Shaft Tender Operator

DURATION: Approximately 7 months

SCOPE: The Waste Handling Shaft Tender Operator Qualification (M-31) prepares the candidate to operate controls and systems located at both the collar area (surface) and the station area (underground) at the Waste Shaft. All the requirements for this qualification must be completed prior to operation of Waste Shaft systems unless under the direct supervision of a qualified operator.

REFERENCES: Waste Handling Shaft Tender Qualification Guide (M-31G)
Waste Handling Shaft Operation Procedure

QUALIFICATION CARD DESCRIPTION (by category)

1. Equipment Knowledge

   Demonstrate knowledge of the following Waste Shaft equipment at the collar and station:

   - Waste Shaft controls
   - Communication systems
   - Conveyance control panels
   - Cage and its capacity

2. Equipment Safety

   Demonstrate knowledge of all safety systems and devices associated with the Waste Hoist.

   Describe the position responsibilities with regard to shaft safety and who to contact during abnormal conditions

3. Personnel Safety

   Demonstrate knowledge of the requirements for all personnel who wish to enter the underground via the Waste Shaft.

   Demonstrate knowledge of actions required during all work in and around the Waste Shaft or surrounding areas.

4. Equipment Maintenance

   Describe the maintenance and inspection duties of both the collar and station tender.

5. Equipment Practical

Perform pre-shift inspections of the collar and station areas.

Perform all record keeping duties of the shaft tender.

Demonstrate proper operation of the Local Control Stations, Pivot Rail System, and Bell Systems.

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ATTACHMENT G

CLOSURE PLAN

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ATTACHMENT G

CLOSURE PLAN

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ATTACHMENT G

CLOSURE PLAN

Introduction

This Permit Attachment contains the Closure Plan that describes the activities necessary to close the Waste Isolation Pilot Plant (**WIPP**) individual units and facility. Since the current plans for operations extend over several decades, the Permittees will periodically reapply for an operating permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.10(h)). Consequently, this Closure Plan describes several types of closures. The first type is panel closure, which involves constructing closures in each of the underground hazardous waste disposal units (**HWDUs**) after they are filled. The second type is partial closure, which can be less than the entire facility and therefore less than an entire unit as described herein for the Waste Handling Building (**WHB**) Unit and the Parking Area Unit (**PAU**). The third type of closure is final facility closure at the end of the Disposal Phase, which will entail "clean" closure of all remaining surface storage units and construction of the four shaft seal systems. Finally, in the event a new permit is not issued prior to expiration of an existing permit, a modification to this Closure Plan will be sought to perform contingency closure. Contingency closure defers the final closure of waste management facilities such as the Waste Handling Building Container Storage Unit (**WHB Unit**), the conveyances, the shafts, and the haulage ways because these will be needed to continue operations with non-mixed Transuranic (**TRU**) waste.

The hazardous waste management units (**HWMUs**) addressed in this Closure Plan include the aboveground HWMU in the WHB, the parking area HWMU, and Panels 1 through 8, each consisting of seven rooms.

This plan was submitted to the New Mexico Environment Department (**NMED**) and the U.S. Environmental Protection Agency (**EPA**) in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(13)). Closure at the panel level will include the construction of barriers to limit the emission of hazardous waste constituents from the panel into the mine ventilation air stream below levels that meet environmental performance standards[1] and to mitigate the impacts of methane buildup and deflagration that may be postulated for some closed panels. The Post-Closure Plan (Permit Attachment H) includes the implementation of institutional controls to limit access and groundwater monitoring to assess disposal system performance. Until final closure is complete and has been certified in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.115), a copy of the approved Closure Plan and all approved revisions will be on file at the WIPP facility and will be available to the Secretary of the NMED or the EPA Region VI Administrator upon request.

[1] The mechanism for air emissions prior to closure is different than the mechanism after closure. Prior to closure, volatile organic compounds (VOC) will diffuse through drum filters based on the concentration gradient between the disposal room and the drum headspace. These VOCs are swept away by the ventilation system, thereby maintaining a concentration gradient that is assumed to be constant. Hence, the VOCs in the ventilation stream are a function of the number of containers only. After closure, the panel air will reach an equilibrium concentration with the drum headspace and no more diffusion will occur. The only mechanism for release into the mine ventilation system is due to pressure that builds up in the closed panel. This pressure arises from the creep closure mechanism that is reducing the volume of the rooms and from the postulated generation of gas as the result of microbial degradation of organic matter in the waste. Consequently, the emissions after panel closure are a direct function of pressurization processes and rates within the panel.

G-1 Closure Plan

This Closure Plan is prepared in accordance with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subparts G, I, and X), Closure and Post-Closure, Use and Management of Containers, and Miscellaneous Units. The WIPP underground HWDUs, including Panels 1 through 8 on Figure G-1, will be closed under this permit to meet the performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). The WIPP surface facilities, including Waste Handling Building Container Storage Unit and the Parking Area Container Storage Unit, will be closed in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.178). The Permittees may perform partial closure of the WHB and PAU HWMUs prior to final facility closure and certification. For final facility closure, this plan also includes closure of future waste disposal areas including Panels 9 and 10 and closure and sealing of the facility shafts in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.601).

Following completion of waste emplacement in each underground HWDU, the HWDU will be closed. The Permittees will notify the NMED of the closure of each underground HWDU as specified in the schedule in Figure G-2. For the purpose of this Closure Plan, panel closure is defined as the process of rendering underground HWDUs in the repository inactive and closed according to the facility Closure Plan. The Post-Closure Plan (Permit Attachment H) addresses requirements for future monitoring that are deemed necessary for the post-closure period, including monitoring closed panels prior to final facility closure.

For the purposes of this Closure Plan, final facility closure is defined as closure that will occur when all waste disposal areas are filled or when the WIPP achieves its capacity of 6.2 million cubic feet (ft^3) (175,564 cubic meters (m^3)) of TRU waste. At final facility closure, the surface container storage areas will be closed, and equipment that can be decontaminated and used at other facilities will be cleaned and sent off site. Equipment that cannot be decontaminated plus any derived waste resulting from decontamination will be placed in the last open underground HWDU. Stockpiled salt may be placed in the underground; it may be used as the core material for the berm component of the permanent marker system; or it must be otherwise disposed of in accordance with Sections 2 and 3 of the Minerals Act of 1947 (30 U.S.C. §§602 and 603). In addition, shafts and boreholes which lie within the WIPP Site Boundary and penetrate the Salado will be plugged and sealed, and surface and subsurface facilities and equipment will be decontaminated and removed. Final facility closure will be completed to demonstrate compliance with the Closure Performance Standards contained in 20.4.1.500 NMAC (incorporating 40 CFR §264.111, 178, and 601).

In the event the Permittees fail to obtain an extension of the hazardous waste permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.51) or fail to obtain a new permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.10(h)), the Permittees will seek a modification to this Closure Plan in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42) to accommodate a contingency closure. Under contingency closure, storage units will undergo clean closure in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.178); waste handling equipment, shafts, and haulage ways will be inspected for hazardous waste residues (using, among other techniques, radiological surveys to indicate potential hazardous waste releases as described in Permit Attachment G3) and decontaminated as necessary; and underground HWDUs that contain radioactive mixed waste will be closed in accordance with the panel closure design described in this Closure Plan. Final facility closure, however, will be redefined and a request for a time extension for final closure will be requested. A copy of this Closure Plan will be maintained by the Permittees at the WIPP facility and at the

U.S. Department of Energy (**DOE**) Carlsbad Field Office. The primary contact person at the WIPP facility is:

Manager, Carlsbad Field Office
U.S. Department of Energy
Waste Isolation Pilot Plant
P. O. Box 3090
Carlsbad, New Mexico 88221-3090
(575) 234-7300

G-1a Closure Performance Standard

The closure performance standard specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.111), states that the closure shall be performed in a manner that minimizes the need for further maintenance; that minimizes, controls, or eliminates the escape of hazardous waste; and that conforms to the closure requirements of §264.178 and §264.601. These standards are discussed in the following paragraphs.

G-1a(1) Container Storage Units

Final or partial closure of the permitted container storage units (the Waste Handling Building Unit and Parking Area Unit) will be accomplished by removing all waste and waste residues. Indication of waste contamination will be based, among other techniques, on the use of radiological surveys as described in Permit Attachment G3. Radiological surveys use very sensitive radiation detection equipment to indicate if there has been a potential release of TRU mixed waste, including hazardous waste components, from a container. This allows the Permittees to indicate potential releases that are not detectable from visible evidence such as stains or discoloration. Visual inspection and operating records will also be used to identify areas where decontamination is necessary. Contaminated surfaces will be decontaminated until radioactivity is below free release limits[2]. Once surfaces are determined to be free of radioactive waste constituents, they will be tested for hazardous waste contamination. These surface decontamination activities will ensure the removal of waste residues to levels protective of human health and the environment. The facility is expected to require no decontamination at closure because any waste spilled or released during operations will be contained and removed immediately. Solid waste management units listed in Attachment K, Table K-4 will be subject to closure. In the event portions of these units which require decontamination cannot be decontaminated, these portions will be removed and the resultant wastes will be managed as appropriately.

Once the container storage units are decontaminated and certified by the Permittees to be clean, no further maintenance is required. The facilities and equipment in these units will be reused for other purposes as needed.

[2] The free release criteria for items, equipment, and areas is < 20 dpm/100 cm^2 for alpha radioactivity and < 200 dpm/100 cm^2 for beta-gamma radioactivity.

G-1a(2) Miscellaneous Unit

Post-closure migration of hazardous waste or hazardous waste constituents to ground or surface waters or to the atmosphere, above levels that will harm human health or the environment, will not occur due to facility engineering and the geological isolation of the unit. The engineering aspects of closure are centered on the use of panel closures on each of the underground HWDUs and final facility seals placed in the shafts. The design of the panel closure system is based on the criteria that the closure system for closed underground HWDUs will prevent migration of hazardous waste constituents in the air pathway in concentrations above health-based levels beyond the WIPP land withdrawal boundary during the 35 year operational and facility closure period and to withstand any flammable gas deflagration that may occur prior to final facility closure.

Consistent with the definitions in 20.4.1.101 NMAC (incorporating 40 CFR §260.10), the process of panel closure is considered partial closure because it is a process of rendering a part of the repository inactive and closed according to the approved underground HWDU partial closure plan. Panel closure will be complete when the panel closure system is emplaced and operational, when that underground HWDU and related equipment and structures have been decontaminated (if necessary), and when the NMED has been notified of the closure.

Shaft seals are designed to provide effective barriers to the inward migration of ground water and the outward migration of gas and contaminated brine over two discrete time periods. Several components become effective immediately and are expected to function for 100 years. Other components become effective more slowly, but provide permanent isolation of the waste. The final shaft seal design is specified in Permit Attachment G2.

The facility will be finally closed (i.e., decontaminated and decommissioned) to minimize the need for continued maintenance. Protection of human health and the environment includes, but is not limited to:

Prevention of any releases that may have adverse effects on human health or the environment due to the migration of waste constituents in the groundwater or in the subsurface environment [20.4.1.500 NMAC, incorporating 40 CFR §264.601(a)].

Prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in surface water, in wetlands, or on the soil surface [20.4.1.500 NMAC, incorporating 40 CFR §264.601(b)].

Prevention of any release that may have adverse effects on human health or the environment due to migration of waste constituents in the air [20.4.1.500 NMAC, incorporating 40 CFR §264.601(c)].

As part of final facility closure, surface recontouring and reclamation will establish a stable vegetative cover, and further surface maintenance will not be necessary to protect human health and the environment. Prior to cessation of active controls, monuments will be emplaced to serve as long-term site markers to discourage activities that would penetrate the facility or impair the ability of the salt formation to isolate the waste from the surface environment for at least 10,000 years. The Federal government will maintain administrative responsibility for the repository site in perpetuity and will limit future use of the area.

If, during panel or final facility closure activities, unexpected events require modification of this Closure Plan to demonstrate compliance with closure performance standards, a Closure Plan amendment will be submitted in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

G-1a(3) Post-Closure Care

The post-closure care period will begin after completion of the first panel closure and will continue for 30 years after final facility closure. The post-closure care period may be shortened or lengthened at the discretion of the regulatory agency based on evidence that human health and the environment are being protected or that they are at risk. During the post-closure period, the WIPP shall be maintained in a manner that complies with the environmental performance standards in 20.4.1.500 NMAC (incorporating 40 CFR §264.601). Post-closure activities are described in Permit Attachment H.

G-1b Requirements

The Permit specifies a sequential process for the closure of individual HWMUs at the WIPP. Each underground HWDU will undergo panel closure when waste emplacement in that panel is complete. Following waste emplacement in each underground HWDU, construction-side ventilation will be terminated and waste-disposal-side ventilation will be established in the next underground HWDU to be used, and the underground HWDU containing the waste will be closed. The Permittees will notify the NMED of the closure of each of the underground HWDUs as they are sequentially filled on a HWDU-by-HWDU basis. The HWMUs in the WHB and in the parking area will be closed as part of final facility closure of the WIPP facility.

The Permittees will notify the Secretary of the NMED in writing at least 60 days prior to the date on which closure activities are scheduled to begin.

G-1c Maximum Waste Inventory

The WIPP will receive no more than 6.2 million ft^3 (175,564 m^3) of TRU mixed waste, which may include up to 250,000 ft^3 (7,079 m^3) of remote-handled (**RH**) TRU mixed waste. Excavations are mined as permitted when needed during operations to maintain a reserve of disposal areas. The amount of waste placed in each room is limited by structural and physical considerations of equipment and design. Waste volumes include waste received from off-site generator locations as well as derived waste from disposal and decontamination operations. The maximum volume of TRU mixed waste in a disposal panel is established in Permit Part 4, Table 4.1.1. For closure planning purposes, a maximum achievable volume of 685,100 ft^3 (19,400 m^3) of TRU mixed waste per panel is used. This equates to 662,150 ft^3 (18,750 m^3) of contact-handled (**CH**) TRU mixed waste and 22,950 ft^3 (650 m^3) of RH TRU mixed waste per panel.

The maximum extent of operations during the term of this permit is expected to be Panels 1 through 8 as shown on Figure G-1, the WHB Container Storage Unit, and the Parking Area Container Storage Unit. Note that panels 9 and 10 are scheduled for excavation only under this permit. If other waste management units are permitted during the Disposal Phase, this Closure Plan will be revised to include the additional waste management units. At any given time during disposal operations, it is possible that multiple rooms may be receiving TRU mixed waste for disposal at the same time. Underground HWDUs in which disposal has been completed (i.e., in

which CH and RH TRU mixed waste emplacement activities have ceased) will undergo panel closure.

G-1d Schedule for Closure

For the purpose of establishing a schedule for closure, an operating and closure period of no more than 35 years (25 years for disposal operations and 10 years for closure) is assumed. This operating period may be extended or shortened depending on a number of factors, including the rate of waste approved for shipment to the WIPP facility and the schedules of TRU mixed waste generator sites, and future decommissioning activities.

G-1d(1) Schedule for Panel Closure

The anticipated schedule for the closure of the underground HWDUs known as Panels 3 through 8 is shown in Figure G-2. This schedule assumes there will be little contamination within the exhaust drift of the panel. Underground HWDUs should be ready for closure according to the schedule in Table G-1. These dates are estimates for planning and permitting purposes. Actual dates may vary depending on the availability of waste from the generator sites.

In the schedule in Figure G-2, notification of intent to close occurs 30 days before placing the final waste in a panel. Once a panel is full, the Permittees will initially block ventilation through the panel as described in Permit Attachment A2 and then will assess the closure area for ground conditions and contamination so that a definitive schedule and closure design can be determined. If as the result of this assessment the Permittees determine that a panel closure cannot be emplaced in accordance with the schedule in this Closure Plan, a modification will be submitted requesting an extension to the time for closure.

The Permittees will initially block ventilation through Panel 5 as described in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures," once Panel 5 is full. The Permittees will then install the explosion-isolation wall portion of the panel closure system that is described in Permit Attachment G1, Section 3.3.2, "Explosion- and Construction-Isolation Walls." Construction of the explosion-isolation wall shall be completed within 180 days after the last receipt of waste in Panel 5. Final closure of Panels 1, 2, and 5 will be completed as specified in this Permit no later than January 31, 2016.

To ensure continued protection of human health and the environment, the Permittees will initially block ventilation through Panels 3 through 7 as described in Permit Attachment A2, Section A2-2a(3), after waste disposal in each panel has been completed. The Permittees shall continue VOC monitoring in such panels until final panel closure. If the measured concentration, as confirmed by a second sample, of any VOC in a panel exceeds the "95% Action Level" in Permit Part 4, Table 4.6.3.2, the Permittees will initiate closure of that panel by installing the 12-foot explosion-isolation wall as described in Section G-1e(1) and submit a Class 1* permit modification request to extend closure of that panel, if necessary. Regardless of the outcome of disposal room VOC monitoring, final closure of Panels 3 through 7 will be completed as specified in this Permit no later than January 31, 2016.

G-1d(2) Schedule for Final Facility Closure

The Disposal Phase for the WIPP facility is expected to require a period of 25 years beginning with the first receipt of TRU waste at the WIPP facility and followed by a period ranging from 7

to 10 years for decontamination, decommissioning, and final closure. The Disposal Phase may therefore extend until 2024, and the latest expected year of final closure of the WIPP facility (i.e., date of final closure certification) would be 2034. If, as is currently projected, the WIPP facility is dismantled at closure, all surface and subsurface facilities (except the hot cell portion of the WHB, which will remain as an artifact of the Permanent Marker System [**PMS**]) will be disassembled and either salvaged or disposed in accordance with applicable standards. In addition, asphalt and crushed caliche that was used for paving will be removed, and the area will be recontoured and revegetated in accordance with a land management plan. A detailed closure schedule will be submitted in writing to the Secretary of the NMED, along with the notification of closure. Throughout the closure period, all necessary steps will be taken to prevent threats to human health and the environment in compliance with all applicable Resource Conservation and Recovery Act (**RCRA**) permit requirements. Figure G-3 presents an estimate of a final facility closure schedule based on 84 months to implement final closure.

The schedule for final facility closure is considered to be a best estimate because closure of the facility is driven by policies and practices established for the decontamination, if necessary, and decommissioning of radioactively contaminated facilities. These required activities include extensive radiological contamination surveys and hazardous constituent surveys using, among other techniques, radiological surveys to indicate potential hazardous waste releases. Both types of surveys will be performed at all areas of the WIPP site where hazardous waste were managed. These surveys, along with historical radiological survey records, will provide the basis for release of structures, equipment, and components for disposal or decontamination for release off site. Specifications will be developed for each structure to be removed. A cost benefit analysis will be needed to evaluate decontamination options if extensive decontamination is necessary. Individual equipment surveys, structure surveys, and debris surveys will be required prior to disposition. Size-reduction techniques may be required to dispose of mixed or radioactive waste at the WIPP site. Current DOE policy, as reflected in the WIPP facility Safety Analysis Report (**SAR**) (DOE 1997), requires the preparation of a final decommissioning and decontamination (**D&D**) plan immediately prior to final facility closure. In this way, the specific conditions of the facility at the time D&D is initiated will be addressed. Section G-1e(2) provides a more detailed discussion of final facility closure activities.

Figure G-3 shows the schedule for the final facility closure consisting of decontamination, as needed, of the TRU waste-handling equipment, and of the aboveground equipment and facilities, including closure of surface HWMUs; decontamination of the shaft and haulage ways; disposal of decontamination derived wastes in the last open underground HWDU; and subsequent closure of this underground HWDU. Subsequent activities will include installation of repository shaft seals.

An overall schedule for final facility closure, showing currently scheduled dates for the start and end of final facility closure activities is shown in Table G-2. The dates assume a start up date of March 1999 and continued permitting of the WIPP facility until it is filled. Details for panel closures are shown on Table G-1.

G-1d(3) Extension for Closure Time

As indicated by the closure schedule presented in Figure G-3, the activities necessary to perform facility closure of the WIPP facility will require more than 180 days to complete because of additional stringent requirements for managing radioactive materials. Therefore, the Permit provides an extension of the 180-day final closure requirement in accordance with 20.4.1.500

NMAC (incorporating 40 CFR §264.113). During the extended closure period, the Permittees will continue to demonstrate compliance with applicable permit requirements and will take all steps necessary to prevent threats to human health and the environment as a result of TRU mixed waste management at the WIPP facility including all of the applicable measures in Part 2.10 (Preparedness and Prevention).

In addition, according to the schedules in Figure G-3, the final derived wastes that are generated as the result of decontamination activities will not be disposed of for 16 months after the initiation of final facility closure. In accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.113(a)), the Permit provides an extension of the 90-day limit to dispose of final derived waste resulting from the closure process. This provision is necessitated by the fact that the radioactive nature of the derived waste makes placement in the WIPP the best disposition, and the removal of these wastes will, by necessity, take longer than 90 days in accordance with the closure schedules. During this extended period of time, the Permittees will take all steps necessary to prevent threats to human health and the environment, including compliance with all applicable permit requirements. These steps include all of the applicable preparedness and prevention measures in Permit Attachment A.

Finally, in the event the hazardous waste permit is not renewed as assumed in the schedule, the Permittees will submit a modification to the Closure Plan to implement a contingency closure that will allow the Permittees to continue to operate for the disposal of non-mixed TRU waste. This modification will include a request for an extension of the time for final facility closure. This modified Closure Plan will be submitted to the NMED for approval.

G-1d(4) Amendment of the Closure Plan

If it becomes necessary to amend the Closure Plan for the WIPP facility, the Permittees will submit, in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42), a written notification of or request for a permit modification describing any change in operation or facility design that affects the Closure Plan. The written notification or request will include a copy of the amended Closure Plan for approval by the NMED. The Permittees will submit a written notification of or request for a permit modification to authorize a change in the approved plan, if:

- There are changes in operating plans or in the waste management unit facility design that affect the Closure Plan
- There is a change in the expected year of closure
- Unexpected events occur during panel or final facility closure that require modification of the approved Closure Plan
- Changes in State or Federal laws affect the Closure Plan
- Permittees fail to obtain permits for continued operations as discussed above

The Permittees will submit a written request for a permit modification with a copy of the amended Closure Plan at least 60 days prior to the proposed change in facility design or operation or within 60 days of the occurrence of an unexpected event that affects the Closure Plan. If the unexpected event occurs during final closure, the permit modification will be requested within 30 days of the occurrence. If the Secretary of the NMED requests a

modification of the Closure Plan, a plan modified in accordance with the request will be submitted within 60 days of notification or within 30 days, if the change in facility condition occurs during final closure.

G-1e Closure Activities

Closure activities include those instituted for panel closure (i.e., closure of filled underground HWDUs), contingency closure (i.e., closure of surface HWMUs and decontamination of other waste handling areas), and final facility closure (i.e., closure of surface HWMUs, D&D of surface facilities and the areas surrounding the WHB, and placement of repository shaft seals). Panel closure systems will be emplaced to separate areas of the facility and to isolate panels. Permit Attachments G1 and G2 provide panel closure system and shaft seal designs. All closure activities will meet the applicable quality assurance (**QA**)/quality control (**QC**) program standards in place at the WIPP facility. Facility monitoring procedures in place during operations will remain in place through final closure, as applicable.

G-1e(1) Panel Closure

Following completion of waste emplacement in each underground HWDU, disposal-side ventilation will be established in the next panel to be used, and the panel containing the waste will be closed. A panel closure system will be emplaced in the panel access drifts, in accordance with the design in Permit Attachment G1 and the schedule in Figure G-2 and Table G-1. The panel closure system is designed to meet the following requirements that were established by the DOE for the design to comply with 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)):

- the panel closure system shall limit the migration of VOCs to the compliance point so that compliance is achieved by at least one order of magnitude
- the panel closure system shall consider potential flow of VOCs through the disturbed rock zone (**DRZ**) in addition to flow through closure components
- the panel closure system shall perform its intended functions under loads generated by creep closure of the tunnels
- the panel closure system shall perform its intended function under the conditions of a postulated methane explosion
- the nominal operational life of the closure system is 35 years
- the panel closure system for each individual panel shall not require routine maintenance during its operational life
- the panel closure system shall address the most severe ground conditions expected in the waste disposal area
- the design class of the panel closure system shall be IIIb (which means that it is to be built to generally accepted national design and construction standards)
- the design and construction shall follow conventional mining practices

structural analysis shall use data acquired from the WIPP underground

materials shall be compatible with their emplacement environment and function

treatment of surfaces in the closure areas shall be considered in the design

thermal cracking of concrete shall be addressed

during construction, a QA/QC program shall be established to verify material properties and construction practices

construction of the panel closure system shall consider shaft and underground access and services for materials handling

The performance standard for air emissions from the WIPP facility is established in Permit Part 4 and Permit Attachment A2. Releases shall be below these limits for the facility to remain in compliance with standards to protect human health and the environment. The following panel closure design has been shown, through analysis, to meet these standards, if emplaced in accordance with the specifications in Permit Attachment G1.

The approved design for the panel closure system calls for a composite panel barrier system consisting of a rigid concrete plug with removal of the DRZ, and an explosion-isolation wall. The design basis for this closure is such that the migration of hazardous waste constituents from closed panels during the operational and closure period would result in concentrations well below health-based standards. The source term used as the design basis included the average concentrations of VOCs from CH waste containers as measured in headspace gases through January 1995. The VOCs are assumed to have been released by diffusion through the container vents and are assumed to be in equilibrium with the air in the panel. Emissions from the closed panel occur at a rate determined by gas generation within the waste and creep closure of the panel.

Figures G-4 and G-5 show a diagram of the panel closure design and installation envelopes. Permit Attachment G1 provides the detailed design and the design analysis for the panel closure system. Although the permit application proposed several panel closure design options, depending on the gas generated by wastes and the age of the mined openings, the NMED and EPA determined that only the most robust design option (D) would be approved. This decision does not prevent the Permittees from continuing to collect data on the behavior of the wastes and mined openings, or proposing a modification to the Closure Plan in the future, using the available data to support a request for reconsideration of one or more of the original design options. If a design different from Option D as defined in Permit Attachment G1 is proposed, the appropriate permit modification will be sought.

G-1e(2) Decontamination and Decommissioning

Decontamination is defined as those activities which are performed to remove contamination from surfaces and equipment that are not intended to be disposed of at the WIPP facility. The policy at the WIPP will be to decontaminate as many areas as possible, consistent with radiation protection policy. Decontamination is part of all closure activities and is a necessary activity in the clean closure of the surface container management units. Decontamination determinations are based upon radiological and hazardous constituent surveys.

Decommissioning is the process of removing equipment, facilities, or surface areas from further use and closing the facility. Decommissioning is part of final facility closure only and will involve the removal of equipment, buildings, closure of the shafts, and establishing active and passive institutional controls for the facility. Passive institutional controls are not included in the Permit.

The objective of D&D activities at the WIPP facility is to return the surface to as close to the preconstruction condition as reasonably possible, while protecting the health and safety of the public and the environment. Major activities required to accomplish this objective include, but are not limited to the following:

1. Review of operational records for historical information on releases
2. Visual examination of surface structures for evidence of spills or releases
3. Performance of site contamination surveys
4. Decontamination, if necessary, of usable equipment, materials, and structures including surface facilities and areas surrounding the WHB.
5. Disposal of equipment/materials that cannot be decontaminated but that meet the treatment, storage, and disposal facility waste acceptance criteria (**TSDF-WAC**) in an underground HWDU
6. Emplacement of final panel closure system
7. Emplacement of shaft seals[3]
8. Regrading the surface to approximately original contours
9. Initiation of active controls

This Closure Plan will be amended prior to the initiation of closure activities to specify the methods to be used.

Health and Safety

Before final closure activities begin, health physics personnel will conduct a hazards survey of the unit(s) being closed. A release of radionuclides could also indicate a release of hazardous constituents. If radionuclides are not detected, sampling for hazardous constituents will still be performed if there is documentation or visible evidence that a spill or release has occurred. The purpose of the hazards survey will be to identify potential contamination concerns that may present hazards to workers during the closure activities and to specify any control measures necessary to reduce worker risk. This survey will provide the information necessary for the health physics personnel to identify worker qualifications, personal protective equipment (**PPE**), safety awareness, work permits, exposure control programs, and emergency coordination that will be required to perform closure related activities.

[3] For the purposes of planning, the conclusion of shaft sealing is used by the DOE as the end of closure activities and the beginning of the Post-Closure Care Period.

G-1e(2)(a) Determine the Extent of Contamination

The first activities performed as part of decontamination include those needed to determine the extent of any contamination that needs to be removed prior to decommissioning a facility. This includes activities 1 to 3 above and, as can be seen by the schedules in Figures G-3 and G-4 (Items B and C), these surveys are anticipated to take 10 months to perform, including obtaining the results of any sample analyses. The process of identifying areas that require decontamination include three sources of information. First, operating records will be reviewed to determine where contamination has previously been found as the result of historical releases and spills. Even though releases and spills will have been cleaned up at the time of occurrence, newer equipment and technology may allow further cleaning. Second, surfaces of facilities and structures will be examined visually for evidence of spills or releases. Finally, extensive detailed contamination surveys will be performed to document the level of cleanliness for all surface structures and equipment. If equipment or areas are identified as contaminated, the Permittees will notify NMED as specified in Permit Part 1, and a plan and procedure(s) will be developed and implemented to address decontamination-related questions, including:

Should the component be decontaminated or disposed of as waste?
What is the most cost-effective method of decontaminating the component?
Will the decontamination procedures adequately contain the contamination?

Radiological and hazardous constituent surveys will be used in determining the presence of hazardous waste and hazardous waste residues in areas where spills or releases have occurred. Radiological surveys are described in Permit Attachment G3. Once cleanup of the radioactivity has been completed, the surface will be sampled for hazardous constituents specified in Permit Attachment B to determine that they, too, have been cleaned up. Sampling and analysis protocols will be consistent with EPA's document SW-846 (EPA, 1996).

G-1e(2)(b) Decontamination Activities

Once the extent of contamination is known, decontamination activities will be planned and performed. Radiological control and the control of hazardous waste residues are the primary criteria used in the design of decontamination activities. Radiation control procedures require that careful planning and execution be used in decontamination activities to prevent the exposure of workers beyond applicable standards and to prevent the further spread of contamination. Careful control of entry, cleanup, and ventilation are vital components of radiation decontamination. The level of care mandated by DOE orders and occupational protection requirements results in closure activities that will exceed the 180 days allowed in 20.4.1.500 NMAC (incorporating 40 CFR §264.113(b)). Decontamination activities are included as item 4 above and are shown on the schedules for contingency closure and final facility closure (Figures G-3 and G-4) as activities D, E, and F. These activities are anticipated to have a duration of 20 months for both contingency closure and for final facility closure. The result of these activities is the clean closure of the surface container management units. Under contingency closure, the other areas that have been decontaminated will not be closed. Instead they will remain in use for continued waste management activities involving non-mixed waste. Under final facility closure, other areas that are decontaminated are eligible for closure.

The "Start Clean—Stay Clean" operating philosophy of the WIPP Project will provide for minimum need for decontamination. However, the need for decontamination techniques may arise.

Decontamination activities will be coordinated with closure activities so that areas that have been decontaminated will not be recontaminated. All waste resulting from decontamination activities will be surveyed and analyzed for the presence of radioactive contamination and hazardous constituents specified in Permit Attachment B. The waste will be characterized as hazardous, mixed, or radioactive and will be packaged and handled appropriately. Mixed and radioactive waste will be classified as TRU mixed waste managed in accordance with the applicable Permit requirements. Derived mixed waste collected during decontamination activities that are generated before repository shafts have been sealed will be emplaced in the facility, if appropriate, or will be managed together with decontamination derived waste collected after the underground is closed. This waste will be classified and shipped off site to an appropriate, permitted facility for treatment, if necessary, and for disposal.

Removal of Hazardous Waste Residues

Because of the type of waste management activities that will occur at the WIPP facility, waste residues that may be encountered during the operation of the facility and at closure may include derived waste. Derived wastes result from the management of the waste containers or may be collected as part of the closure activities (such as those during which wipes were used to sample the containers and equipment for potential radioactive contamination or those involving solidified decontamination solutions, the handling of equipment designated for disposal, and the handling of residues collected as a result of spill cleanup). Derived wastes collected during the operation and closure of the WIPP facility will be identified and managed as TRU mixed wastes. These wastes will be disposed in the active underground HWDU. D&D derived wastes and equipment designated for disposal will be placed in the last underground HWDU panel before closure of that unit.

Surface Container Storage Units

The procedures employed for waste receipt at the WIPP facility minimize the likelihood for any waste spillage to occur outside the WHB. TRU mixed waste is shipped to the WIPP facility in approved shipping containers (i.e., Contact-Handled or Remote-Handled Packages) that are not opened until they are inside the WHB. Therefore, it is unlikely that soil in the Parking Area Unit or elsewhere in the vicinity of the WHB will become contaminated with TRU mixed waste constituents as a result of TRU mixed waste management activities. An evaluation of the soils in the vicinity of the WHB will only be necessary if a documented event resulting in a release has occurred outside the WHB.

The "Start Clean—Stay Clean" operating philosophy of the WIPP Project will minimize the need for decontamination of the WHB during decommissioning and closure. Procedures for opening shipping containers in the WHB limit the opportunity for waste spillage.

Should the need for decontamination of the WHB arise, the following methods may be employed, as appropriate, for the hazardous constituent/contaminant type and extent:

- Chemical cleaning (e.g., water, mild detergent cleanser, and polyvinyl alcohol)
- Nonchemical cleaning (e.g., sandblasting, grinding, high-pressure water spray, scabbler pistons and needle scalers, ice-blast technology, dry-ice blasting)
- Removal of contaminated components such as pipe and ductwork

Waste generated as a result of WHB decontamination activities will be managed as derived waste in accordance with applicable permit requirements and will be emplaced in the last open underground HWDU for disposal.

Waste Handling Equipment and

The waste shaft conveyance and associated waste handling equipment will be decontaminated to background or be disposed as derived waste as part of both contingency and final facility closure. Procedures for detection and sampling will be as described above. Equipment cleanup will be as above using chemical or nonchemical techniques.

Personnel Decontamination

PPE worn by personnel performing closure activities in areas determined to be contaminated will be disposed of appropriately. Disposable PPE used in such areas will be placed into containers and managed as TRU mixed waste. Non-disposable PPE will be decontaminated, if possible. Non-disposable PPE that cannot be decontaminated will be managed as TRU mixed waste.

In accordance with DOE policy, TRU mixed waste PPE will be considered to be contaminated with all of the hazardous waste constituents contained in the containers that have been managed within the unit being closed. Wastes collected as a result of closure activities and that may be contaminated with radioactive and hazardous constituents will be considered TRU mixed wastes. These wastes will be managed as derived wastes, as described in Permit Attachment A2. Such waste, collected as the result of closure of the WIPP facility, will be disposed of in the final open underground HWDU.

Cleanup Criteria

Radiation decontamination will be less than or equal to the following levels, or to whatever lesser levels that may be established by DOE Order at the time of cleanup:

Contamination Type	Loose[4]	Fixed plus removable
alpha contamination (α)	20 dpm/100 cm^2	500 dpm/100 cm^2
beta-gamma contamination (β-γ)	200 dpm/100 cm^2	1000 dpm/100 cm^2

Hazardous waste decontamination will be conducted in accordance with standards in 20.4.1.500 NMAC (incorporating 40 CFR §264) or as incorporated into the Permit.

Final Contamination Sampling and Quality Assurance

Verification samples will be analyzed by an approved laboratory that has been qualified by the DOE according to a written program with strict criteria. The QA requirements of EPA/SW-846, "Test Methods for Evaluating Solid Waste" (EPA, 1986), will be met for hazardous constituent sampling and analyses.

[4] The unit "dpm" stands for "disintegration per minute" and is the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

Quality Assurance/Quality Control

Because decisions about closure activities may be based, in part, on analyses of samples of potentially contaminated surfaces and media, a program to ensure reliability of analytical data is essential. Data reliability will be ensured by following a QA/QC program that mandates adequate precision and accuracy of laboratory analyses. Field documentation will be used to document the conditions under which each sample is collected. The documented QA/QC program in place at the WIPP facility will meet applicable RCRA QA requirements.

Field blanks and duplicate samples will be collected in the field to determine potential errors introduced in the data from sample collection and handling activities. To determine the potential for cross-contamination, rinsate blanks (consisting of rinsate from decontaminated sampling equipment) will be collected and analyzed. At least one rinsate blank will be collected for every 20 field samples. Duplicate samples will be collected at a frequency of one duplicate sample for every ten field samples. In no case will less than one rinsate blank or duplicate sample be collected for a field-sampling effort. These blank and duplicate samples will be identified and treated as separate samples. Acceptance criteria for QA/QC hazardous constituent sample analyses will adhere to the most recent version of EPA SW-846 or other applicable EPA guidance.

G-1e(2)(c) Dismantling

Final facility closure will include dismantling of structures on the surface and in the underground. These are items 6 and 7 above and are represented as Activity G in the final facility closure schedule in Figure G-4. During dismantling, priority will be given to contaminated structures and equipment that cannot be decontaminated to assure these are properly disposed of in the remaining open underground HWDU in a timely manner. All such facilities and equipment are expected to be removed and disposed of 16 months after the initiation of closure. Dismantling of the balance of the facility, including those structures and equipment that are not included in the application and are not used for TRU mixed waste management, is anticipated to take an additional 66 months. It should be noted that the placement of D&D waste into the final underground HWDU may, by necessity, involve the placement of uncontainerized bulk materials such as concrete components, building framing, structural members, disassembled or partially disassembled equipment, or containerized materials in non-standard waste boxes. Such placement will only occur if it can be shown that it is protective of human health and the environment and all items are described in an amendment to the Closure Plan. Identification of bulk items is not possible at this time since their size and quantity will depend on the extent of non-removable contamination.

G-1e(2)(d) Closure of Open Underground HWDU

The closure of the final underground HWDU is shown by Activity H in Figure G-3. This closure will be consistent with the description in Section G-1e(1) and the design in Permit Attachment G1. Detailed closure schedules for underground HWDUs are given in Figure G-2 and Table G-1.

G-1e(2)(e) Final Facility Closure

Final facility closure includes several activities designed to assure both the short-term isolation of the waste and the long-term integrity of the disposal system. These include the placement of

plugs in boreholes that penetrate the salt and the placement of the repository sealing system. In addition, the surface will be returned to as near its original condition as practicable, and will be readied for the construction of markers and monuments that will provide permanent marking of the repository location and contents.

Figure G-6 identifies where three existing boreholes overlie the proximate area of the repository footprint. Of these identified boreholes in Figure G-6, all but ERDA-9 are terminated hundreds of feet above the repository horizon. Only ERDA-9, which is accounted for in long-term performance modeling, is drilled through the repository horizon, near the WIPP excavations.

To mitigate the potential for migration beyond the repository horizon, the DOE has specified that borehole seals be designed to limit the volume of water that could be introduced to the repository from the overlying water-bearing zones and to limit the volume of contaminated brine released from the repository to the surface or water-bearing zones.

Borehole plugging activities have been underway since the 1970s, from the early days of the development of the WIPP facility. Early in the exploratory phase of the project, a number of boreholes were sunk in Lea and Eddy counties. After the WIPP site was situated in its current location, an evaluation of all vertical penetrations was made by Christensen and Peterson (1981).

As an initial criterion, any borehole that connects a fluid-producing zone with the repository horizon becomes a plugging candidate.

Grout plugging procedures are routinely performed in standard oil-field operations; however, quantitative measurements of plug performance are rarely obtained. The Bell Canyon Test reported by Christensen and Peterson (1981) was a field test demonstration of the use of cementitious plugging materials and modification of existing industrial emplacement techniques to suit repository plugging requirements. Cement emplacement technology was found to be "generally adequate to satisfy repository plugging requirements." Christensen and Peterson (1981) also report "that grouts can be effective in sealing boreholes, if proper care is exercised in matching physical properties of the local rock with grout mixtures. Further, the reduction in fluid flow provided by even limited length plugs is far in excess of that required by bounding safety assessments for the WIPP." The governing regulations for plugging and/or abandonment of boreholes are summarized in Table G-3.

The proposed repository sealing system design will prevent water from entering the repository and will prevent gases or brines from migrating out of the repository. The proposed design includes the following subsystems and associated principal functions:

Near-surface: to prevent subsidence at and around the shafts

Rustler Formation: to prevent subsidence at and around the shafts and to ensure compliance with Federal and State of New Mexico groundwater protection requirements

Salado Formation: to prevent transporting hazardous waste constituents beyond the point of compliance specified in Permit Part 5

The repository sealing system will consist of natural and engineered barriers within the WIPP repository that will withstand forces expected to be present because of rock creep, hydraulic pressure, and probable collapses in the repository and will meet the closure requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.601 and §264.111). Permit Attachment G2 presents the final repository sealing system design.

Once shaft sealing is completed, the Permittees will consider closure complete and will provide the NMED with a certification of such within 60 days.

G-1e(2)(f) Final Contouring and Revegetation

In the preparation of its Final Environmental Impact Statement (DOE, 1980), the DOE committed to restore the site to as near to its original condition as is practicable. This involves removal of access roads, unneeded utilities, fences, and any other structures built by the DOE to support WIPP operations. Provisions would be left for active post-closure controls of the site and for the installation of long-term markers and monuments for the purpose of permanently marking the location of the repository and waste. Permit Attachment H-1a(1) discusses the active and long-term controls proposed for the WIPP. Installation of borehole seals are anticipated to take 12 months, shaft seals 52 months, and final surface contouring 8 months.

G-1e(2)(g) Closure, Monuments, and Records

A record of the WIPP Project shall be listed in the public domain in accordance with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.116). Active access controls will be employed for at least the first 100 years after final facility closure. In addition, a passive control system consisting of monuments or markers will be erected at the site to inform future generations of the location of the WIPP repository (see "Permanent Marker Conceptual Design Report" [DOE, 1995b]).

This Permit requires only a 30 year post-closure period. This is the maximum post-closure time frame allowed in an initial Permit for any facility, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.117(a)). The Secretary of the NMED may shorten or extend the post-closure care period at any time in the future prior to completion of the original post-closure period (30 years after the completion of construction of the shaft seals). The Permanent Marker Conceptual Design Report and other provisions during the first 100 years after closure are addressed under another Federal regulatory program.

Closure of the WIPP facility will contribute to the following:

- Prevention of the intrusion of fluids into the repository by sealing the shafts
- Prevention of human intrusion after closure
- Minimization of future physical and environmental surveillance

Detailed records shall be filed with local, State, and Federal government agencies to ensure that the location of the WIPP facility is easily determined and that appropriate notifications and restrictions are given to anyone who applies to drill in the area. This information, together with land survey data, will be on record with the U.S. Geological Survey and other agencies. The Federal government will maintain permanent administrative authority over those aspects of land management assigned by law. Details of post-closure activities are in Permit Attachment H.

G-1e(3) Performance of the Closed Facility

20.4.1.500 NMAC (incorporating 40 CFR §264.601) requires that a miscellaneous unit be closed in a manner that protects human health and the environment. The RCRA Part B permit application addressed the expected performance of the closed facility during the 30 year post closure period. Groundwater monitoring will provide information on the performance of the closed facility during the post-closure care period, as specified in Section H-1a(2) (Monitoring) of Permit Attachment H.

The principal barriers to the movement of hazardous constituents from the facility or the movement of waters into the facility are the halite of the Salado Formation (natural barrier) and the repository seals (engineered barrier). Data and calculations that support this discussion were presented in the permit application. The majority of the calculations performed for the repository are focused on long-term performance and making predictions of performance over 10,000 years. In the short term, the repository is reaching a steady state configuration where the hypothetical brine inflow rate is affected by the increasing pressure in the repository due to gas generation and creep closure. These three phenomena are related in the numerical modeling performed to support the permit application. The modeling parameters, assumptions and methodology were described in detail in the permit application.

G-2 Notices Required for Disposal Facilities

G-2a Certification of Closure

Within 60 days after completion of closure activities for a HWMU (i.e., for each storage unit and each disposal unit), the Permittees will submit to the Secretary of the NMED a certification that the unit (and, after completion of final closure, the facility) has been closed in accordance with the specifications of this Closure Plan. The certification will be signed by the Permittees and by an independent New Mexico registered professional engineer. Documentation supporting the independent registered engineer's certification will be furnished to the Secretary of the NMED with the certification.

G-2b Survey Plat

Within 60 days of completion of closure activities for each underground HWDU, and no later than the submission of the certification of closure of each underground HWDU, the Permittees will submit to the Secretary of the NMED a survey plat indicating the location and dimensions of hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat will be prepared and certified by a professional land surveyor and will contain a prominently displayed note that states the Permittees' obligation to restrict disturbance of the hazardous waste disposal unit. In addition, the land records in the Eddy County Courthouse, Carlsbad, New Mexico, will be updated through filing of the final survey plats.

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TABLES

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Table G-1
Anticipated Earliest Closure Dates for the Underground HWDUs

HWDU	OPERATIONS START	OPERATIONS END	CLOSURE START	CLOSURE END
PANEL 1	3/99*	3/03*	3/03*	7/03* SEE NOTE 5
PANEL 2	3/03*	10/05*	10/05*	3/06* SEE NOTE 5
PANEL 3	4/05*	2/07*	2/07*	2/07* SEE NOTE 6
PANEL 4	1/07*	5/09*	5/09*	8/09* SEE NOTE 6
PANEL 5	3/09*	7/11*	7/11*	1/12 SEE NOTE 5
PANEL 6	3/11*	1/13	2/13	8/13
PANEL 7	1/13	1/15	2/15	8/15
PANEL 8	1/15	1/17	2/17	8/17
PANEL 9	1/17	1/28	2/28	SEE NOTE 4
PANEL 10	1/28	9/30	10/30	SEE NOTE 4

* Actual date

NOTE 1: Only Panels 1 to 4 will be closed under the initial term of this permit. Closure schedules for Panels 5 through 10 are projected assuming new permits will be issued in 2009 and 2019.

NOTE 2: The point of closure start is defined as 60 days following notification to the NMED of closure.

NOTE 3: The point of closure end is defined as 180 days following placement of final waste in the panel.

NOTE 4: The time to close these areas may be extended depending on the nature and extent of the disturbed rock zone. The excavations that constitute these panels will have been opened for as many as 40 years so that the preparation for closure may take longer than the time allotted in Figure G-2. If this extension is needed, it will be requested as an amendment to the Closure Plan.

NOTE 5: Installation of the 12-foot explosion-isolation wall for Panels 1, 2, and 5 must be completed by the closure end date. Final closure of Panels 1, 2, and 5 will be completed as specified in this Permit no later than January 31, 2016.

NOTE 6: Final closure of Panels 3 and 4 will be completed as specified in this Permit no later than January 31, 2016.

Table G-2
Anticipated Overall Schedule for Closure Activities

ACTIVITY	FINAL FACILITY CLOSURE	
	START	STOP
Notify NMED of Intent to Close WIPP (or to Implement Contingency Closure)	October 2030	N/A
Perform Contamination Surveys in both Surface Storage Areas	October 2030	April 2031
Sample Analysis	December 2030	July 2031
Decontamination as Necessary of both Surface Storage Areas	June 2031	January 2032
Final Contamination Surveys of both Surface Storage Areas	February 2032	September 2032
Sample Analysis	June 2032	January 2033
Prepare and Submit Container Management Unit Closure Certification	February 2033	May 2033
Dispose of Closure-Derived Waste	November 2030	January 2032
Closure of Open Underground HWDU panel	February 2032*	September 2032
Install Borehole Seals	October 2032	September 2033
Install Repository Seals	June 2033	September 2037
Recontour and Revegetate	October 2037	May 2038
Prepare and Submit Final (Contingency) Closure Certification	October 2037	May 2038
Post-closure Monitoring	July 2038	N/A

N/A--Not Applicable

Refer to Figures G-3 and G-4 for precise activity titles.

*This assumes the final waste is placed in this unit in January 2032 and notification of closure for this HWDU is submitted to the NMED in December 2031.

Table G-3
Governing Regulations for Borehole Abandonment

Federal or State Land	Type of Well or Borehole	Governing Regulation	Summary of Requirements
Both	Groundwater Surveillance	State and Federal regulation in effect at time of abandonment	Monitor wells no longer in use shall be plugged in such a manner as to preclude migration of surface runoff or groundwater along the length of the well. Where possible, this shall be accomplished by removing the well casing and pumping expanding cement from the bottom to the top of the well. If the casing cannot be removed, the casing shall be ripped or perforated along its entire length if possible, and grouted. Filling with bentonite pellets from the bottom to the top is an acceptable alternative to pressure grouting.
Federal	Oil and Gas Wells	43 CFR Part 3160, §§ 3162.3-4	The operator shall promptly plug and abandon, in accordance with a plan first approved in writing or prescribed by the authorized officer.
Federal	Potash	43 CFR Part 3590, § 3593.1	(b) Surface boreholes for development or holes for prospecting shall be abandoned to the satisfaction of the authorizing officer by cementing and/or casing or by other methods approved in advance by the authorized officer. The holes shall also be abandoned in a manner to protect the surface and not endanger any present or future underground operation, any deposit of oil, gas, or other mineral substances, or any aquifer.
State	Oil and Gas Well Outside the Oil-Potash Area	State of New Mexico, Oil Conservation Division, Rule 202 (eff. 3-1-91)	B. Plugging (1) Prior to abandonment, the well shall be plugged in a manner to permanently confine all oil, gas, and water in the separate strata where they were originally found. This can be accomplished by using mud-laden fluid, cement, and plugs singly or in combination as approved by the Division on the notice of intention to plug. (2) The exact location of plugged and abandoned wells shall be marked by the operator with a steel marker not less than four inches (4") in diameter, set in cement, and extending at least four feet (4') above mean ground level. The metal of the marker shall be permanently engraved, welded, or stamped with the operator name, lease name, and well number and location, including unit letter, section, township, and range.
State	Oil and Gas Wells Inside the Oil-Potash Area	State of New Mexico, Oil Conservation Division, Order No. R-111-P (eff. 4-21-88)	F. Plugging and Abandonment of Wells (1) All existing and future wells that are drilled within the potash area, shall be plugged in accordance with the general rules established by the Division. A solid cement plug shall be provided through the salt section and any water-bearing horizon to prevent liquids or gases from entering the hole above or below the salt selection. It shall have suitable proportions—but no greater than three (3) percent of calcium chloride by weight—of cement considered to be the desired mixture when possible.

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FIGURES

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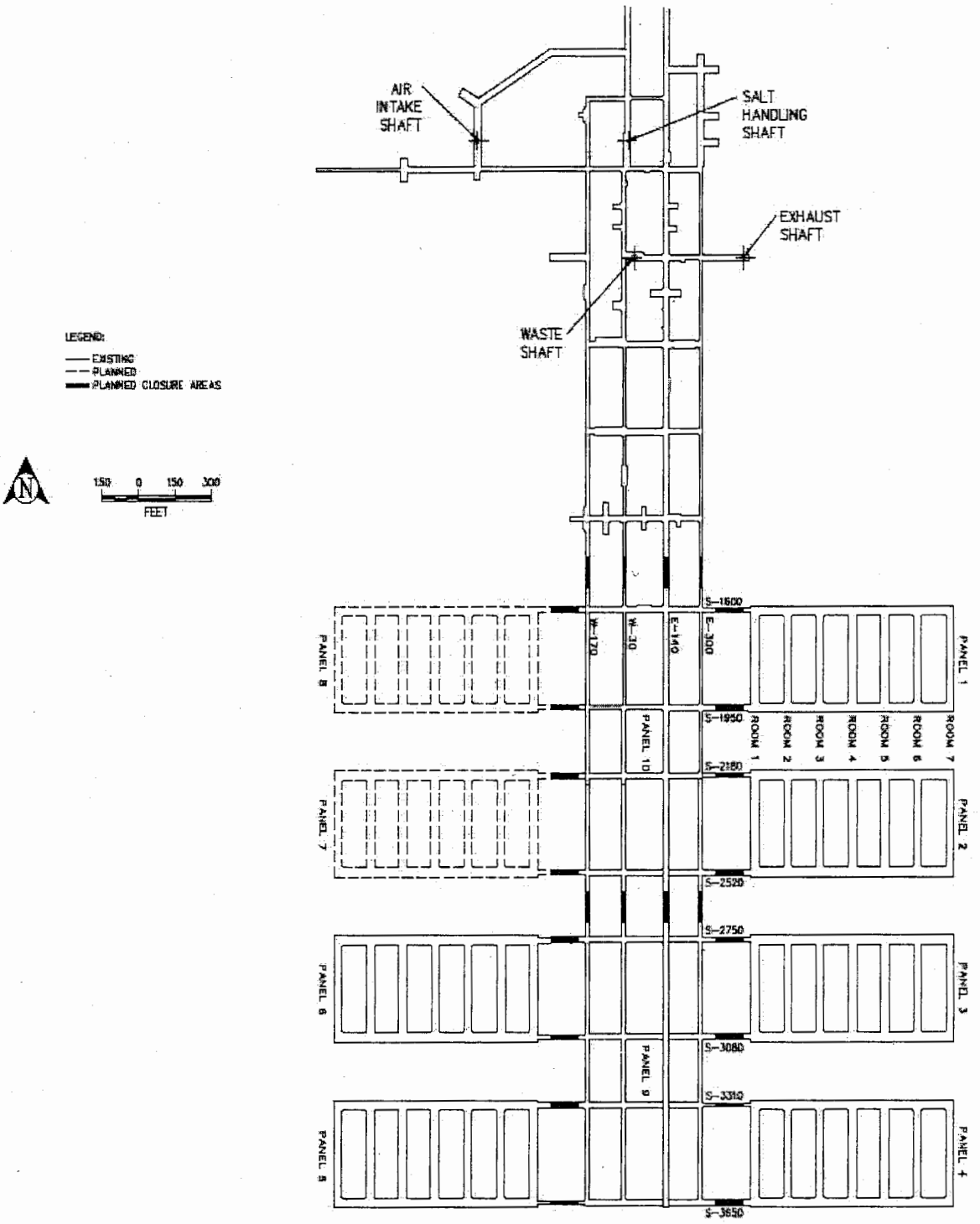

Figure G-1
Location of Underground HWDUs and Anticipated Closure Locations

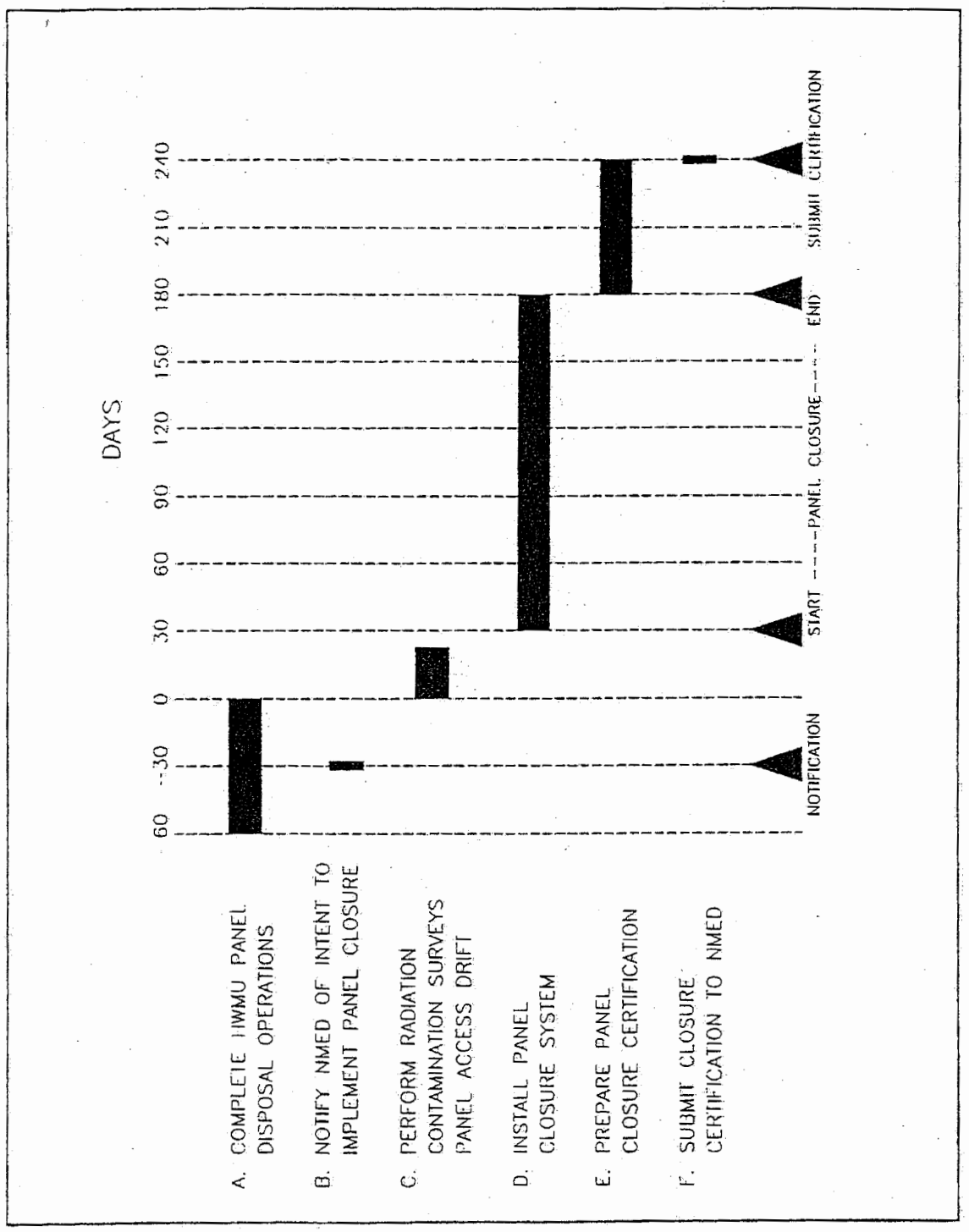

Figure G-2
WIPP Panel Closure Schedule

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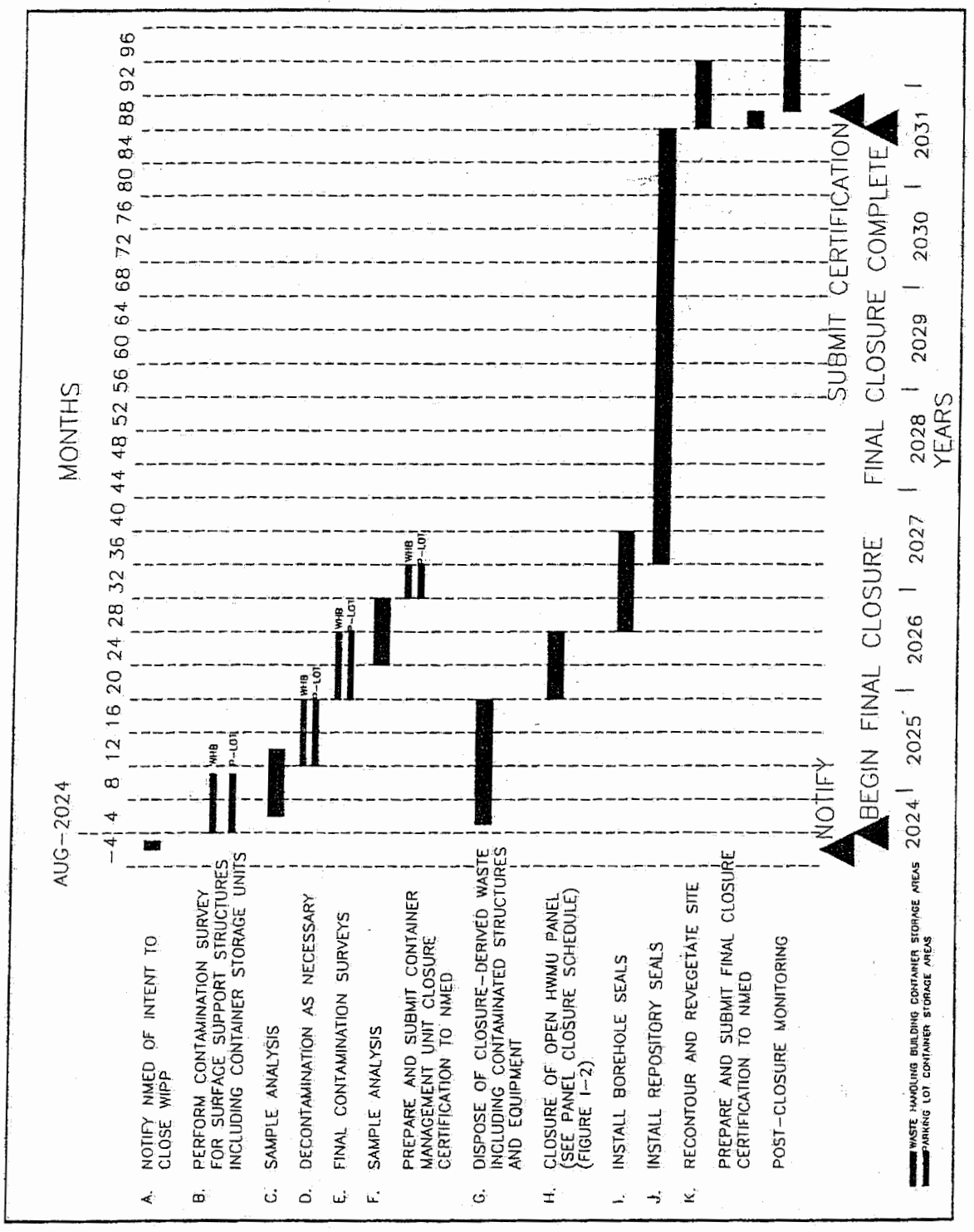

Figure G-3
WIPP Facility Final Closure 84-Month Schedule

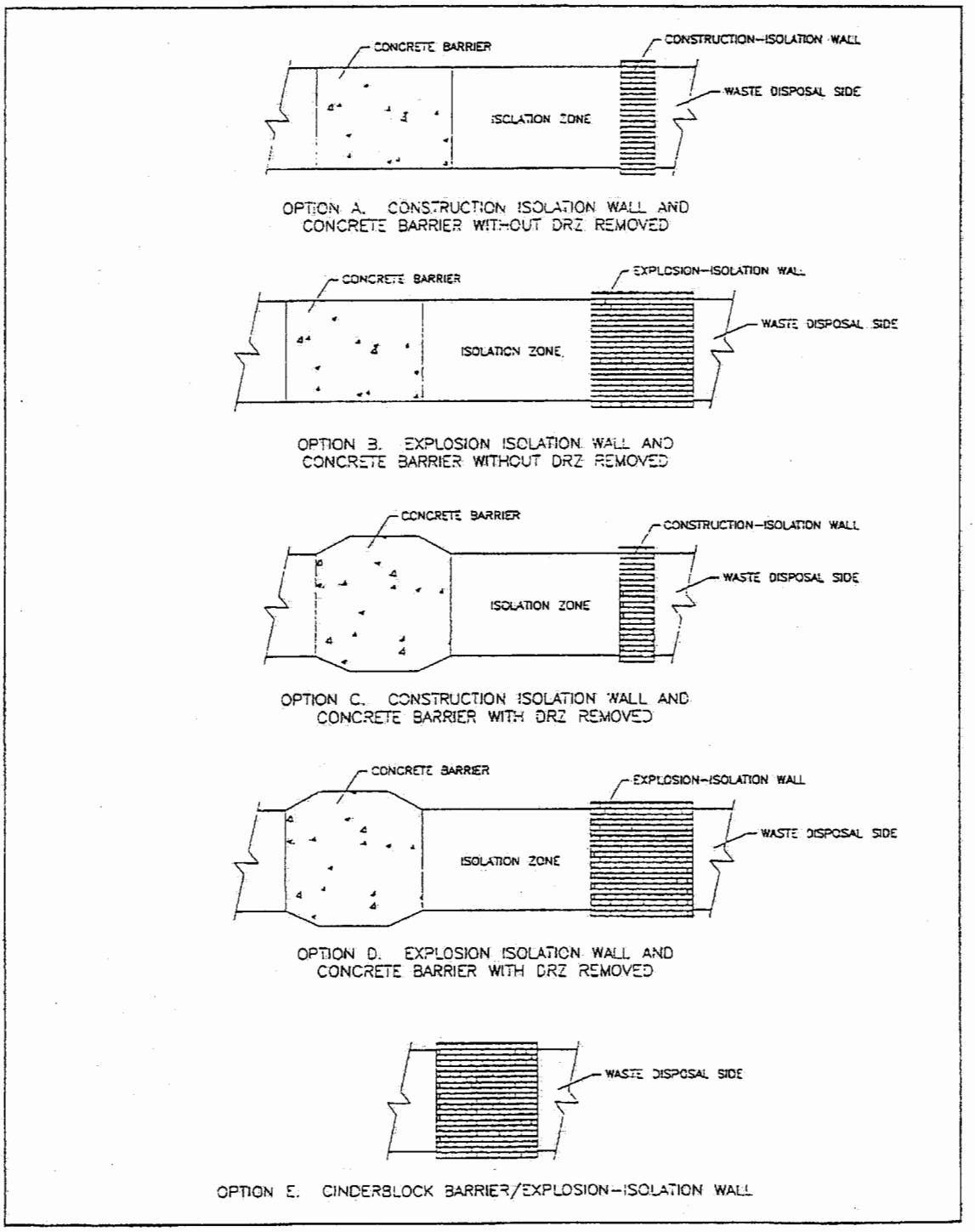

Figure G-4
Design of a Panel Closure System

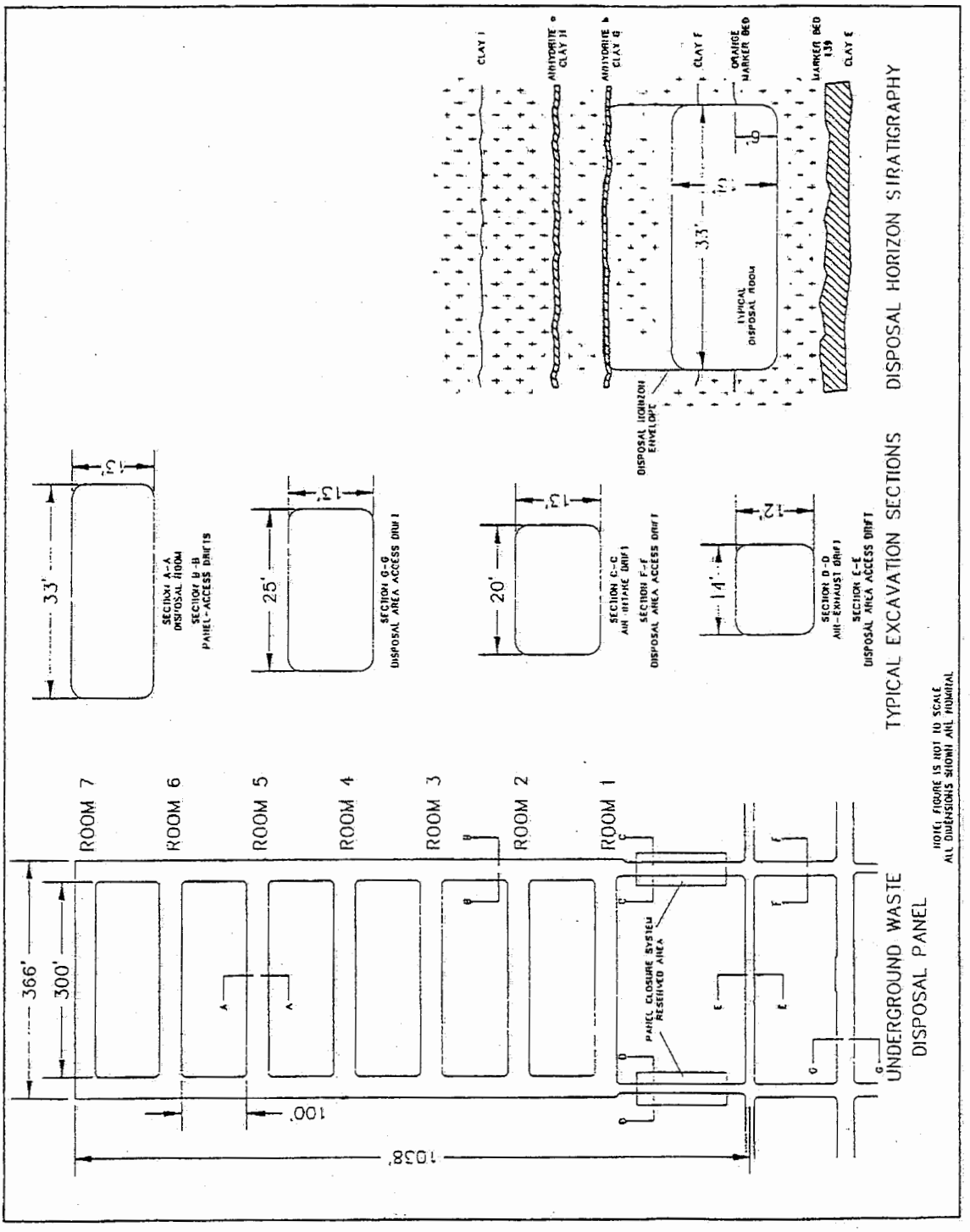

Figure G-5
Typical Disposal Panel

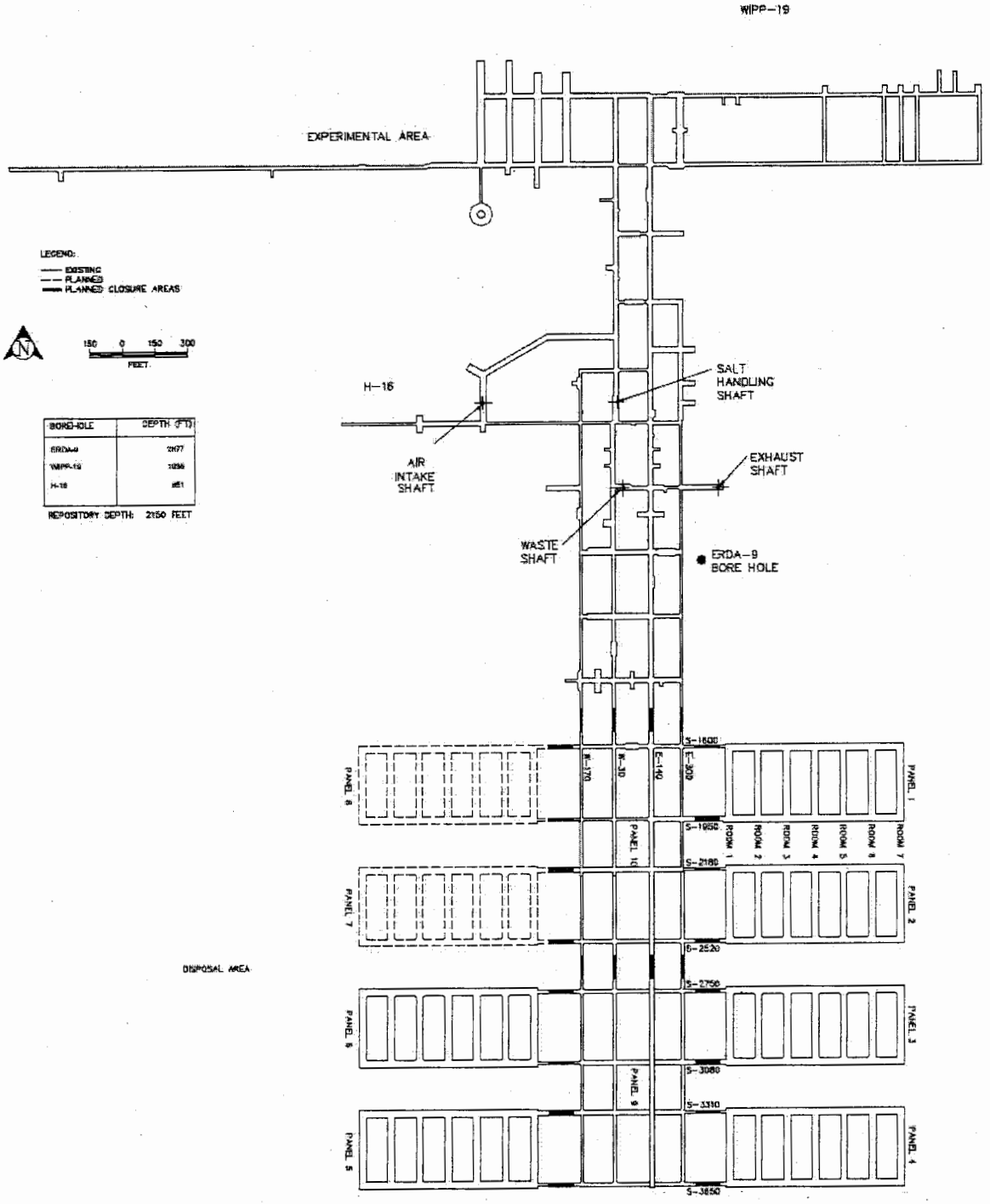

Figure G-6
Approximate Locations of Boreholes in Relation to the WIPP Underground

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ATTACHMENT G1

DETAILED DESIGN REPORT FOR AN OPERATION PHASE PANEL CLOSURE SYSTEM

Adapted from DOE/WIPP 96-2150

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ATTACHMENT G1

DETAILED DESIGN REPORT FOR AN OPERATION PHASE PANEL CLOSURE SYSTEM

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Figure G1-7	Grouting Details

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LIST OF ABBREVIATIONS/ACRONYMS

ACI	American Concrete Institute
AISC	American Institute for Steel Construction
*CFR	Code of Federal Regulations
cm	centimeter
°C	degrees celsius
°F	degrees Fahrenheit
DOE	U.S. Department of Energy
DRZ	disturbed rock zone
EEP	Excavation Effects Program
ESC	expansive salt-saturated concrete
FLAC	Fast Lagrangian Analysis of Continua
ft	foot (feet)
GPR	ground-penetrating radar
Kips	1,000 pounds
m	meter(s)
MB 139	Marker Bed 139
MOC	Management and Operating Contractor (Permit Section 1.5.3)
MPa	megapascal(s)
MSHA	Mine Safety and Health Administration
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NaCl	sodium chloride
NMVP	no-migration variance petition
psi	pound(s) per square inch
RCRA	Resource Conservation and Recovery Act
SMC	Salado Mass Concrete
TRU	transuranic
VOC	volatile organic compound(s)
WIPP	Waste Isolation Pilot Plant

: 03923

ATTACHMENT G1

DETAILED DESIGN REPORT FOR AN OPERATION PHASE PANEL CLOSURE SYSTEM

Executive Summary

Scope. Under contract to the Management and Operating Contractor (**MOC**), IT Corporation has prepared a detailed design of a panel-closure system for the Waste Isolation Pilot Plant (**WIPP**). Preparation of this detailed design of an operational-phase closure system is required to support a Resource Conservation and Recovery Act (**RCRA**) Part B permit application. This report describes the detailed design for a panel-closure system specific to the WIPP site. The recommended panel-closure system will adequately isolate the waste-emplacement panels for at least 35 years.

The report was modified to make it a part of the RCRA Permit issued by the New Mexico Environment Department. The primary change required in the original report was to specify that Panel Closure Design Options A, B, C and E are not approved as part of the facility Permit. Option D is the most robust of the original group of options, and it was specified in the Permit as the design to be constructed for all panel closures. The concrete to be used for panel closures is salt-saturated Salado Mass Concrete as specified in Permit Attachment G1, Appendix G, instead of the proposed plain concrete. The Permittees may submit proposals to modify the Permit (Part 2), the Closure Plan (Permit Attachment G) and this Appendix (identified as Permit Attachment G1) in the future, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

Other changes included in this version of the report revised for the permit are minor edits to regulatory citations, deletion of references to the No Migration Variance Petition (no longer required under 40 CFR §268.6), and movement of all figures to the end of the document. Appendices A through F in the original document are not included in this Permit Attachment. Although those Appendices were important in demonstrating that the panel closures will meet the performance standards in the hazardous waste regulations, they do not provide design details or plans to be implemented as Permit requirements. References to these original Appendices were modified to indicate that they were part of the permit application, but are not included in the Permit. In contrast, Appendix G (Technical Specifications) and Appendix H (Design Drawings) are necessary components of future activities and are retained as parts of this Permit Attachment.

Purpose. This report provides detailed design and material engineering specifications for the construction, emplacement, and interface-grouting associated with a panel-closure system at the WIPP repository, which would ensure that an effective panel-closure system is in place for at least 35 years. The panel-closure system provides assurance that the limit for the migration of volatile organic compounds (**VOC**) will be met at the point of compliance, the WIPP site boundary. This assurance is obtained through the inherent flexibility of the panel-closure system. The panel-closure system will be located in the air-intake and air-exhaust drifts (Figure G1-1). The system components have been designed to maintain their intended functional requirements under loads generated from salt creep, internal pressure, and a postulated methane explosion. The design complies with regulatory requirements for a panel-closure system promulgated by RCRA and the Mine Health and Safety Administration (**MSHA**). The design uses common construction practices according to existing standards.

Background. The engineering design considers a range of expected subsurface conditions at the location of a panel-closure system. The geology is predominantly halite with interbedded anhydrite at the repository horizon. During the operational period, the panel-closure system would be subject to creep from the surrounding host rock that contains trace amounts of brine.

During the conceptual design stage, two air-flow models were evaluated: (1) unrestricted flow and (2) restricted flow through the panel-closure system. The "unrestricted" air flow model is defined as a model in which the gas pressure that develops is at or very near atmospheric pressure such that there exists no back pressure in the disposal areas. Flow is unrestricted in this model. The "restricted" air flow model is defined as a model in which the back pressure in the waste emplacement panels develops due to the restriction of flow through the barrier, and the surrounding disturbed rock zone. The analysis was based on an assumed gas generation rate of 8,200 moles per panel per year (0.1 moles per drum per year) due to microbial degradation, an expected volumetric closure rate of 28,000 cubic feet (800 cubic meters) per year due to salt creep, the expected headspace concentration for a series of nine VOCs, and the expected air dispersion from the exhaust shaft to the WIPP site boundary. The analysis indicated that the panel-closure system would limit the concentration of each VOC at the WIPP site boundary to a small fraction of the health-based exposure limits during the operational period.

Alternate Designs. Various options were evaluated considering active systems, passive systems, and composite systems. Consideration of the aforementioned factors led to the selection of a passive panel-closure system consisting of an enlarged tapered concrete barrier which will be grouted at the interface and an explosion-isolation wall. This system provides flexibility for a range of ground conditions likely to be encountered in the underground repository. No other special requirements for engineered components beyond the normal requirements for fire suppression and methane explosion or deflagration containment exist for the panel-closure system during the operational period.

The panel-closure system design incorporates mitigative measures to address the treatment of fractures and therefore minimizes the potential migration of contaminants. The design includes excavating the disturbed rock zone (**DRZ**) and emplacing an enlarged concrete barrier.

To be effective, the excavation and installation of the panel-closure system must be completed within a short time frame to minimize disturbance to the surrounding salt. A rigid concrete barrier will promote interface stress buildup, as fractures are expected to heal with time. For this purpose, the main concrete barrier would be tapered to reduce shear stress and to increase compressive stress along the interface zone.

Design Classification. Procedure WP 09-CN3023 (Westinghouse, 1995a) was used to establish a design classification for the panel-closure system. It uses a decision-flow-logic process to designate the panel-closure system as a Class IIIB structure. This is because during the methane explosion the concrete barrier would not fail.

Design Evaluations. To investigate several key design issues, design evaluations were performed. These design evaluations can be divided into those that satisfy (1) the operational requirements of the system and (2) the structural and material requirements of the system.

The conclusions reached from the evaluations addressing the operational requirements are as follows:

- Based on an air-flow model used to predict the mass flow rate of carbon tetrachloride through the panel-closure system for the alternatives, the air-flow analysis suggests that the fully enlarged barrier provides the highest protection for restricting VOCs during the operational period of 35 years.

- Results of the Fast Lagrangian Analysis of Continua (**FLAC**) analyses show that the recommended enlarged configuration is a circular rib-segment excavated to Clay G and under MB 139. Interface grouting would be performed at the upper boundary of the concrete barrier.

- The results of the transverse plane-strain models show that higher stresses would form in MB 139 following excavation, but that after installation of the panel-closure system, the barrier confinement will result in an increase in barrier-confining stress and a reduction in shear stress. The main concrete barrier would provide substantial uniform confining stresses as the barrier is subjected to secondary salt creep.

- The removal of the fractured salt prior to installation of the main concrete barrier would reduce the potential for flexure. The fracturing of MB 139 and the attendant fracturing of the floor could reduce structural load resistance (structural stiffness), which could initially result in barrier flexure and shear. With the removal of MB 139, the fractured salt stiffens the surrounding rock and results in the development of more uniform compression.

- The trade-off study also showed that a panel-closure system with an enlarged concrete barrier with the removal of the fractured salt roof and anhydrite in the floor was found to be the most protective.

The conclusions reached from the design evaluations addressing the structural and material requirements of the panel-closure system are as follows:

- Existing information on the heat of hydration of the concrete supports placing concrete with a low cement content to reduce the temperature rise associated with hydration. Plasticizers might be used to achieve the required slump at the required strength. A thermal analysis, coupled with a salt creep analysis, suggests installation of the enlarged barrier at or below ambient temperatures to adequately control hydration temperatures.

- In addition to installation at or below ambient temperatures, the concrete used in the main barrier would exhibit the following:

  - An 8 inch (0.2 meter) slump after 3 hours of intermittent mixing

  - A less-than-25-degree Fahrenheit heat rise prior to installation

  - An unconfined compressive strength of 4,000 pounds per square inch (psi) (28 megapascals [MPa]) after 28 days

- Volume stability
- Minimal entrained air.

- The trace amounts of brine from the salt at the repository horizon will not degrade the main concrete barrier for at least 35 years.

- In 20 years, the open passage above the waste stack would be reduced in size. Further, rooms with bulkheads at each end would be isolated in the panel. It is unlikely that a long passage with an open geometry would exist; therefore, the dynamic analysis considered a deflagration with a peak explosive pressure of 240 psi (1.7 MPa).

- The heat-transfer analysis shows that elevated temperatures would occur within the salt and the explosion-isolation wall; however, the elevated temperatures will be isolated by the panel-closure system. Temperature gradients will not significantly affect the stability of the wall.

- The fractures in the roof and floor could be affected by expanding gas products reaching pressures on the order of 240 psi (1.7 MPa). Because the peak internal pressure from the deflagration is only one fifth of the pressure, fractures could not propagate beyond the barrier.

A composite system is selected for the design with various components to provide flexibility. These design options are described below.

Design Options. Figure G1-2 illustrates the options developed to satisfy the requirements for the panel-closure system. The basis for selecting an option depends on conditions at the panel-closure system locations as would be documented by future subsurface investigations. As noted earlier, Option D is the only option approved for construction as part of the facility permit issued by the NMED.

While no specific requirements exist for barricading inactive waste areas under the MSHA, their intent is to safely isolate these abandoned areas from active workings using barricades of "substantial construction." A previous analysis (DOE, 1995) examined the issue of methane gas generation from transuranic waste and the potential consequence in closed areas. The principal concern is whether an explosive mixture of methane with an ignition source would result in deflagration. A concrete block wall of sufficient thickness will be used to resist dynamic and salt creep loads.

It was shown (DOE, 1995) that an explosive atmosphere may exist after approximately 20 years.

Design Components. The enlarged concrete barrier location within the air-intake and air-exhaust drifts will be determined following observation of subsurface conditions. The enlarged concrete barrier will be composed of salt-saturated Salado Mass Concrete with sufficient unconfined compressive strength. The barrier will consist of a circular rib segment excavated into the surrounding salt where the central portion of the barrier will extend just beyond Clay G and MB 139. FLAC analyses showed that plain concrete will develop adequate confined compressive strength.

The enlarged concrete barrier will be placed in four cells, with construction joints formed perpendicular to the direction of potential air flow. The concrete will be placed through 6-inch (15.2 centimeter) diameter steel pipes and will be vibrated from outside the formwork. The formwork is designed to withstand the hydrostatic loads that would occur during installation with minimal bracing onto exposed salt surfaces. This will be accomplished by a series of steel plates that are stiffened by angle iron, with load reactions carried by spacer rods. Some exterior bracing will be required when the concrete is poured into the first cell at the location for the enlarged concrete barrier. All structural steel will be American Society of Testing and Materials [grade] A36 in conformance with the latest standards specified by the American Institute for Steel Construction. After concrete placement, the formwork will be left in place and will stiffen the enlarged concrete barrier if nonuniform reactive loadings should occur after panel closure.

After completion of the enlarged concrete barrier installation, it will be grouted through a series of grout supply and air return lines that terminate in grout boxes. The boxes will be mounted near the top of the barrier. The grout will be injected through one set of lines and returned through a second set of air lines.

An explosion-isolation wall, constructed with concrete-blocks, will mitigate the effects of a methane explosion. The explosion-isolation wall would consist of 3,500 psi (24 MPa) concrete blocks mortared together with a bonding agent. The concrete-block wall design complies with MSHA requirements, because it consists of noncombustible materials of "substantial construction." The concrete-block walls will be keyed into the salt. For the WIPP, an explosion-isolation wall is designed to resist loading from salt creep.

The compliance of the detailed design was evaluated against the design requirements established for the panel-closure system. The design complies with all aspects of the design basis established for the panel-closure system.

1.0 Introduction

The Waste Isolation Pilot Plant (**WIPP**) repository, a U.S. Department of Energy (**DOE**) research facility located near Carlsbad, New Mexico, is approximately 2,150 feet (ft) (655 meters [m]) below the surface, in the Salado Formation. The WIPP facility consists of a northern experimental area, a shaft-pillar area, and a waste-emplacement area. The WIPP facility will be used to dispose transuranic (**TRU**) mixed waste.

One important aspect of future repository operations at the WIPP is the activities associated with closure of waste-emplacement panels. Each panel consists of air-intake and air-exhaust drifts, panel-access drifts, and seven rooms (Figure G1-1). After completion of waste-emplacement activities, each panel will be closed, while waste emplacement may be occurring in the other panel(s). The closure of individual panels during the operational period will be conducted in compliance with project-specific health, safety, and environmental performance criteria.

1.1 Scope

This report provides information on the detailed design and material engineering specifications for the construction, installation, and interface grouting associated with a panel-closure system for a minimum operational period of 35 years. The panel-closure system design provides assurance that the limit for the migration of volatile organic compounds (**VOC**) will be met at the

point of compliance, the WIPP site boundary. This assurance is obtained through the inherent flexibility of the panel closure system. The panel-closure system will be located in the air-intake and air-exhaust drifts to each panel (Figure G1-1). The panel-closure system design maintains its intended functional requirements under loads generated from salt creep, internal panel pressure, and a postulated methane explosion. The design complies with regulatory requirements for a panel-closure system promulgated by the Resource Conservation and Recovery Act (**RCRA**) and Mine Safety and Health Administration (**MSHA**) (see citations in Section 1.3 below).

Figure G1-3 illustrates the design process used for preparing the detailed design. The design process commenced with the evaluation of the performance requirements of the panel-closure system through review of the work performed in developing the conceptual design and the "Underground Hazardous Waste Management Unit Closure Criteria for the Waste Isolation Pilot Plant Operation Phase" (Westinghouse, 1995b). The various design evaluations were performed to address specific design-implementation issues identified by the project. The results of these design evaluations are presented in this report.

1.2 Design Classification

Procedure WP 09-CN3023 (Westinghouse, 1995a) was used to establish a design classification for the panel-closure system. The design classification for the panel-closure system evolved from addressing the short-term operational issues regarding the reduction of VOC migration. Figure G1-4 shows the decision flow logic process used to designate the panel-closure system as a Class IIIB structure.

1.3 Regulatory Requirements

The following subsections discuss the regulatory requirements specified in RCRA and MSHA for the panel-closure system.

1.3.1 Resource Conservation and Recovery Act (40 CFR §264 and §270)

In accordance with 20.4.1.500 NMAC, incorporating Title 40, Code of Federal Regulations (**CFR**), Part 264, Subpart X (40 CFR §264, Subpart X), "Miscellaneous Units," and 20.4.1.900 NMAC, incorporating 40 CFR §270.23, "Specific Part B Information Requirements for Miscellaneous Units," a RCRA Part B permit application has been submitted for the WIPP facility.

1.3.2 Protection of the Environment and Human Health

The WIPP RCRA Part B permit application indicates that VOCs must not exceed health-based standards beyond the WIPP site boundary. Worker exposure to VOCs, and VOC emissions to non-waste workers or to the nearest resident will not pose greater than a 10^{-6} excess cancer risk in order to meet health-based standards. The panel-closure system design incorporates measures to mitigate VOC migration for compliance with these standards.

1.3.3 Closure Requirements 20.4.1.500 NMAC

The Permittees will notify the Secretary of the New Mexico Environment Department in writing at least 60 days prior to the date on which partial and final closure activities are scheduled to begin.

1.3.4 Mining Safety and Health Administration

The significance of small natural-gas occurrences within the WIPP repository is within the classification of Category IV for natural gas under the MSHA (30 CFR 57, Subpart T) (MSHA, 1987). These regulations include the hazards of methane gas and volatile dust. Category IV "applies to mines in which non-combustible ore is extracted and which liberate a concentration of methane that is not explosive nor capable of forming explosive mixtures with air based on the history of the mine or the geological area in which the mine is located." For "barriers and stoppings," the regulations provide for noncombustible materials (where appropriate) for the specific mine category and require that "barriers and stoppings" be of "substantial construction." Substantial construction implies construction of such strength, material, and workmanship that the barrier could withstand air blasts, methane detonation or deflagration, blasting shock, and ground movement expected in the mining environment.

1.4 Report Organization

This report presents the engineering package for the detailed design of the panel-closure system. Chapter 2.0 presents the design evaluations. Chapter 3.0 describes the design and Chapter 4.0 presents the Constructability Design Calculations Index. Chapter 5.0 shows the technical specifications. Chapter 6.0 presents the design drawings. The conclusions are presented in Chapter 7.0 and the references presented in Chapter 8.0. Appendices to this report provide detailed information to support the information contained in Chapters 2.0 through 7.0 of this report.

2.0 Design Evaluations

This chapter in the Part B permit application presented the results of the various design evaluations that support the panel-closure system: (1) analyses addressing the operational requirements, and (2) analyses addressing the structural and material requirements. These evaluations were important in demonstrating that the panel closures will adequately restrict releases of VOCs and will be structurally stable during the operations phase of the WIPP. However, these evaluations are not necessary as part of the facility permit and have been deleted from this edited document.

3.0 Design Description

This chapter presents the final design selected from the evaluations performed in the previous chapter. It presents design modifications to cover a range of conditions that may be encountered in the underground and describes the design components for the panel-closure system. Finally, information is presented on the proposed construction for the panel-closure system.

3.1 Design Concept

The composite panel-closure system proposed in the permit application included (1) a standard concrete barrier, rectangular in shape, or (2) an enlarged tapered concrete barrier. Options (1) and (2) were both proposed to be grouted along the interface and may contain explosion- or construction-isolation walls. Figure G1-2 illustrates these design components. The construction methods and materials to be used to implement the design have been proven in previous mining and construction projects. The standard concrete barrier without DRZ removal was intended to apply to future panel air-intake and air-exhaust drifts where the time duration between excavation and barrier emplacement is short. The enlarged concrete barrier with DRZ removal and explosion-isolation wall is the only option approved in the RCRA facility Permit. The design concept for the enlarged concrete barrier incorporates:

- A concrete barrier that is tapered to promote the rapid stress buildup on the host rock. The stiffness was selected to provide rapid buildup of compressive stress and reduction in shear stress in the host rock.

- The enlarged barrier requires DRZ removal just beyond Clay G and MB 139, and to a corresponding distance in the ribs to keep the tapered shape approximately spherical. The design includes DRZ removal and thereby limits VOC flow through the panel-closure system.

- The design of the approved panel-closure system includes an explosion-isolation wall designed to provide strength and deformational serviceability during the operational period. The length was selected to assure that uniform compression develops over a substantial portion of the structure and that end-shear loading that might result in fracturing of salt into the back is reduced.

3.2 Design Options

The design options consist of the following:

- An enlarged concrete barrier with the DRZ removed and a construction-isolation wall

- An enlarged concrete barrier with the DRZ removed and an explosion-isolation wall (This is the only option approved in the RCRA facility Permit.)

- A rectangular concrete barrier without the DRZ removed and a construction-isolation wall

- A rectangular concrete barrier without the DRZ removed and an explosion-isolation wall.

In each case, interface grouting will be used for the upper barrier/salt interface to compensate for any void space between the top of the barrier and the salt. The process for selecting these options was proposed to depend on the subsurface conditions at the panel-closure system locations described in the following subsections.

Observation boreholes will be drilled into the roof or floor of the new air-intake and air-exhaust drifts and will be used for observation of fractures and bed separation. Observations can be made in the boreholes using a small video camera, or a scratch rod. A scratch rod survey will be performed in accordance with the current Excavation Effects Program (**EEP**) procedure.

The EEP was initiated in 1986 with the occurrence of fractures in Site and Preliminary Design Validation Room 3. The purpose of the EEP is to study fractures that develop as a result of underground excavation at the WIPP and to monitor those fractures. Borehole inspections have been successful for determining the fracturing and bed separation in the host rock. These inspections have been performed since 1983 (Francke and Terrill, 1993). This technique in addition to the above will be used to determine the optimum location for the panel-closure system.

Since the enlarged barrier is required to be constructed for all panel closures, the proposed DRZ investigations are not required as part of the RCRA facility Permit.

3.3 Design Components

The following subsections present system and components design features.

3.3.1 Concrete Barrier

The enlarged concrete barrier consists of Salado Mass Concrete, with sufficient unconfined compressive strength and with an approximately circular cross-section excavated into the salt over the central portion of the barrier (Figure G1-5). The enlarged concrete barrier will be located at the optimum locations in the air-intake and air-exhaust drifts with the central portion extending just beyond Clay G and MB 139.

The enlarged concrete barrier will be placed in four cells, with construction joints perpendicular to the direction of potential air flow. The concrete strength will be selected according to the standards specified by the latest edition of the ACI code for plain concrete. The concrete will be placed through 6-inch- (15-cm)-diameter steel pipes and vibrated from outside the formwork. The formwork is designed to withstand the hydrostatic loads during construction, with minimal bracing onto exposed salt surfaces. This will be accomplished by placing a series of steel plates that are stiffened by angle iron, with load reactions carried by spacer rods. The spacer rods will be staggered to reduce potential flow along the rod surfaces through the barrier. Some exterior bracing will be required when the first cell is poured. All structural steel will be ASTM A36, with detailing, fabrication, and erection of structural steel in conformance with the latest edition of the AISC steel manual (AISC, 1989). After concrete placement, the formwork will be left in place.

The above design is for the most severe conditions expected to be encountered at the WIPP.

3.3.2 Explosion- and Construction-Isolation Walls

An explosion-isolation wall, consisting of concrete-blocks, will mitigate the effects of a postulated methane explosion. The explosion-isolation wall consists of 3,500-psi (24-MPa) concrete blocks mortared together with cement (Figure G1-6).

The concrete block wall design complies with MSHA requirements (MSHA, 1987) because it uses incombustible materials of substantial construction. The explosion-isolation wall will be placed into the salt for support. The explosion-isolation walls are designed to resist creep loading from salt deformation. In the absence of the postulated methane explosion, the design was proposed to be simplified to a construction-isolation wall. The construction-isolation wall design provides temporary isolation during the time the main concrete barrier is being constructed. The construction-isolation wall was not approved as part of the RCRA facility Permit.

3.3.3 Interface Grouting

After construction of the main concrete barrier, the interface between the main concrete barrier and the salt will be grouted through a series of grout-supply and air-return lines that will terminate in grout distribution collection boxes. The openings in these boxes will be protected during concrete placement (Figure G1-7). The grout boxes will be mounted near the top of the barrier. The grout will be injected through one distribution system, with air and return grout flowing through a second distribution system.

3.4 Panel-Closure System Construction

The construction methods and materials to be used to implement the design have been proven in previous mining and construction projects. The design uses common construction practices according to existing standards. The proposed construction sequence follows completion of the waste-emplacement activities in each panel: (1) Perform subsurface exploration to determine the optimum location for the panel closure system, (2) select the appropriate design option for the location, (3) prepare surfaces for the construction- or explosion-isolation walls, (4) install these walls, (5) excavate for the enlarged concrete barrier (if required), (6) install concrete formwork, (7) emplace concrete for the first cell, (8) grout the completed cell, and (9) install subsequent formwork, concrete and grout until completion of the enlarged concrete barrier. (Step 2 above is not required as part of the RCRA facility Permit, because there are no design options to choose between.)

The explosion-isolation wall will be located approximately 30 feet from the main concrete barrier. The host rock will be excavated 6 inches (15 cms) around the entire perimeter prior to installing the explosion-isolation wall. The surface preparation will produce a level surface for placing the first layer of concrete blocks. Excavation may be performed by either mechanical or manual means.

Excavation for the enlarged concrete barrier will be performed using mechanical means, such as a cutting head on a suitable boom. The existing roadheader at the main barrier location in each drift is capable of excavating the back and the portions of the ribs above the floor level. Some manual excavation may be required in this situation as well. If mechanical means are not available, drilling boreholes and an expansive agent can be used to fragment the rock (Fernandez et al., 1989). Excavation will follow the lines and grades established for the design.

The roof will be excavated to just above Clay G and then the floor to just below MB 139 to remove the DRZ. The tolerances for the enlarged concrete-barrier excavation are +6 to 0 inches (+15 to 0 cm). In addition, loose or spalling rock from the excavation surface will be removed to provide an appropriate surface abutting the enlarged concrete barrier. The excavations will be performed according to approved ground control plans.

Following completion of the roof excavation for the enlarged barrier, the floor will be excavated. If mechanical means are not available, drilling boreholes and using an expansive agent to fragment the rock (Fernandez et al., 1989) is a method that can be used. Expansive agents would load the rock salt and anhydrite, producing localized tensile fracturing in a controlled manner, to produce a sound surface.

A batch plant at the surface or underground will be prepared for batching, mixing, and delivering the concrete to the underground in sufficient quantity to complete placement of the concrete within one form cell. The placement of concrete will be continuous until completion, with a time for completing one section not to exceed 10 hours, allowing an additional 2 hours for cleanup of equipment.

Pumping equipment suitable for placing the concrete into the forms will be provided at the main concrete barrier location. After transporting, and prior to pumping, the concrete will be remixed to compensate for segregation of aggregate during transport. Batch concrete will be checked at the surface at the time of mixing and again at the point of transfer to the pump for slump and temperature. Admixtures may be added at the remix stage in accordance with the batch design.

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4.0 Design Calculations

Table G1-1 summarizes calculations to support the construction details for an explosion-isolation wall, construction-isolation wall, and structural steel formwork for concrete barriers up to 29-ft high. The codes for the explosion-isolation and construction-isolation wall are specified by the Uniform Building Code (International Conference of Building Officials, 1994), with related seismic design requirements. The external loads for the solid block wall are as developed in the methane-explosion and fracture propagation design evaluations.

Table G1-1
Constructability Design Calculations Index

Section	Design Area	Category
1.0	Explosion-isolation wall	W
2.0	Explosion-isolation wall seismic check	S
3.0	Formwork design	F

The structural formwork for all cells is designed in accordance with the AISC guidelines on allowable stress (AISC, 1989). Lateral pressures are developed using ACI 347R-88, using a standard concrete weighing 150 pounds per cubic foot (2,410 kg/m^3) with a slump of 8 inches (20 cm) or less. Design loadings reflect full hydrostatic head of concrete, with lifts spaced at 4 ft (1.2 m) intervals from bottom to top through portals, with no external vibration. All forms will remain in place.

5.0 Technical Specifications

The specifications are in the engineering file room at the WIPP and are the property of the MOC. These specifications are included as an attachment in Appendix G and summarized in Table G1-2.

Table G1-2
Technical Specifications for the WIPP Panel-Closure System

Division 1 - General Requirements	
Section 01010	Summary of Work
Section 01090	Reference Standards
Section 01400	Contractor Quality Control
Section 01600	Material and Equipment
Division 2 - Site Work	
Section 02010	Mobilization and Demobilization
Section 02222	Excavation
Section 02722	Grouting
Division 3 - Concrete	
Section 03100	Concrete Formwork
Section 03300	Cast-in-Place Concrete
Division 4 - Masonry	
Section 04100	Mortar
Section 04300	Unit Masonry System

: 03943

6.0 Drawings

The drawings (Appendix H) are in the engineering file room at the WIPP and are the property of the MOC and summarized in Table G1-3.

Table G1-3
Panel-Closure System Drawings

Drawing Number	Title
762447-E1	Title Sheet
762447-E2	Underground Waste Disposal Plan
762447-E3	Air Intake Drift Construction Details
762447-E4	Air Exhaust Drift Construction Details
762447-E5	Construction and Explosion Barrier Construction Details
762447-E6	Grouting and Miscellaneous Details

7.0 Conclusions

This chapter presents the conclusions for the detailed design activities of the panel-closure system. A design basis, including the operational requirements, the structural and material requirements, and the construction requirements, was developed that addresses the governing regulations for the panel-closure system. Table G1-4 summarizes the design basis for the panel-closure system and the compliance with the design basis. The panel-closure system design incorporates mitigative measures to address the treatment of fractures and therefore counter the potential migration of VOCs. Several alternatives were evaluated for the treatment of fractures. These included excavation and emplacement of a fully enlarged barrier with removal of the DRZ, excavation of the roof and emplacement of a partially enlarged barrier, and emplacement of a standard barrier with formation grouting.

To investigate several key design issues and to implement the design, design evaluations were performed. These design evaluations can be divided into evaluations satisfying the operational requirements of the system and evaluations satisfying the structural and materials requirements of the system. The conclusions reached from the evaluations addressing the operational requirements are as follows:

- Based on an air-flow model used to predict the mass flow rate of carbon tetrachloride through the panel-closure system for the alternatives, the air-flow analysis suggests that the fully enlarged barrier is the most protective for restricting VOCs during the operational period of 35 years.

- Results of the FLAC analyses show that the recommended enlarged configuration is a circular rib-segment excavated to Clay G and under MB 139. Interface grouting would be performed at the upper boundary of the concrete barrier.

- The results of the transverse plane-strain models show that high stresses would form in MB 139 following excavation, but that after installation of the panel-closure system, an increase in barrier-confining stress and a reduction in shear stress would result. The concrete barrier would provide substantial uniform confining stresses as the barrier is subjected to secondary salt creep.

- The removal of the fractured salt prior to installation of the main concrete barrier would reduce the potential for flexure. With the removal of MB 139, the fractured salt stiffens the surrounding rock and results in the development of more uniform compression.

- The trade-off study also showed that a panel-closure system with an enlarged concrete barrier with the removal of the fractured salt roof and anhydrite in the floor was found to be the most protective.

Table G1-4
Compliance of the Design with the Design Requirements

Type of Requirement	Requirement	Section	Compliance with Requirement	Notes on Compliance
Operational	Individual panels shall be closed in accordance with the schedule of actual waste emplacement.	2.1.1	Complies	Gas-flow models used for design are based on the waste-emplacement operational schedule.
	The panel-closure system shall provide assurance that the limit for the migration of volatile organic compounds (**VOC**) of concern will be met at the point of compliance. To achieve this assurance, the design shall consider the potential flow of VOCs through the several components of the disturbed rock zone and the panel-closure system.	2.1.1, 2.1.2	Complies	Gas-flow modeling shows that the VOC flow is less than the design migration limit.
	The panel-closure system shall comply with its intended functional requirements under loads generated from creep closure and any internal pressure that might develop in the disposal panel under reasonably anticipated conditions.	2.1.2, 4.0	Complies	Stress analyses and design calculations show that the panel-closure system performs as intended.
	The panel-closure system shall comply with its intended functional requirements under a postulated methane explosion.	2.2.3, 2.2.4, 4.0	Complies	The methane explosion studies, fracture propagation studies, and supporting design calculations show that the panel-closure system performs as intended.
	The operational life of the panel-closure system shall be at least 35 years.	2.1.1	Complies	Gas-flow modeling and analyses shows satisfactory performance for at least 35 years.
	The panel-closure system for each individual panel shall not require routine maintenance during its operational life.	3.2	Complies	Passive design components require no routine maintenance.
	The panel-closure system shall address the most severe ground conditions expected in the panel entries. If actual conditions are found to be more favorable, this design can be simplified and still satisfy the operational requirements of the system.	2.1.1 2.1.3 3.2	Complies	Design is based upon flow and structural analyses for the most severe expected ground conditions. If conditions are less severe, simpler design options are used. The various design options accommodate all expected conditions.

Type of Requirement	Requirement	Section	Compliance with Requirement	Notes on Compliance
Design configuration and essential features	The panel-closure system shall be emplaced in the air-intake and air-exhaust drifts identified by Westinghouse (1995c)	3.2	Complies	The design shows placement in the designated areas for panel closure.
	The panel-closure system shall consist of a concrete barrier and construction-isolation and explosion-isolation walls with dimensions to satisfy the operational requirements of the system.	3.2, 3.3	Complies	The panel-closure system design uses the identified components with dimensions to satisfy the operational requirements of the system.
Safety	The design class for the panel-closure system shall be IIIb. Design and construction shall follow conventional mining and construction practices.	3.4	Complies	Components are designed according to Class IIIb. The construction sequence for the design followed conventional mining practices.
	The structural analysis for the underground shall use the empirical data acquired from the WIPP Excavation Effects Program.	2.1.2	Complies	The structural analysis uses properties that model creep closure for stress analyses from data acquired in the WIPP Excavation Effects Program.
Structural and material	The panel-closure system materials shall be compatible with their emplacement environment and function. Surface treatment between the host rock and the panel-closure system shall be considered in the design.	2.2.1	Complies	The material compatibility studies showed no degradation of materials and no need for surface treatment.
	The selection and placement of concrete in the concrete barrier shall address potential thermal cracking due to the heat of hydration.	2.2.2	Complies	The heat generation studies show that hydration temperatures are controlled by appropriate selection of cement type and placement temperature.
	The panel-closure system shall sustain the dynamic pressure and subsequent temperature generated by a postulated methane explosion.	2.2.3, 2.2.4, 4.0	Complies	The methane explosion study shows that the explosion-isolation wall protects the concrete barrier from pressure loading and thermal loading. The fracture propagation study shows that the system performs as intended.

Type of Requirement	Requirement	Section	Compliance with Requirement	Notes on Compliance
Construction	The panel-closure system shall use to the extent possible normal construction practices according to existing standards.	3.4	Complies	The specifications include normal construction practices used in the underground at WIPP and according to the most current steel and concrete specifications.
	During construction of the panel-closure system, a quality assurance/quality control program shall be established to verify material properties and construction practices.	3.4	Complies	The specifications include materials testing to verify material properties and construction practices.
	The construction specification shall take into account the shaft and underground access capacities and services for materials handling.	3.4	Complies	The specifications allow construction within the capacities of underground access.

The conclusions reached from the design evaluations addressing the structural and material requirements of the panel-closure system are as follows:

- Existing information on the heat of hydration of the concrete supports placing concrete with a low cement content to reduce the temperature rise associated with hydration. The slump at the required strength would be achieved through the use of plasticizers. A thermal analysis coupled with a salt creep analysis suggest installation of the enlarged barrier at or below ambient temperatures to adequately control hydration temperatures.

- In addition to installation at or below ambient temperatures, the concrete used in the main concrete barrier would exhibit the following:

  - An 8 inch (0.2 meter) slump after 3 hours of intermittent mixing
  - A less-than-25-degree Fahrenheit heat rise prior to installation
  - An unconfined compressive strength of 4,000 psi (28 MPa) after 28 days
  - Volume stability
  - Minimal entrained air.

- The trace amounts of brine from the salt at the repository horizon should not degrade the main concrete barrier for at least 35 years.

- In 20 years, the open passage above the waste stack would be reduced in size. Further, rooms with bulkheads at each end would be isolated in the panel. It is unlikely that a long passage with an open geometry would exist; therefore, the dynamic analysis considered a deflagration with a peak explosive pressure of 240 psi (1.7 MPa).

- The heat-transfer analysis shows that elevated temperatures would occur within the salt and the explosion-isolation wall; however, the elevated temperatures will be isolated by the panel-closure system. Temperature gradients will not significantly affect the stability of the wall.

- The fractures in the roof and floor could be affected by expanding gas products reaching pressures of the order of 240 psi (1.7 MPa). Because the peak internal pressure from the deflagration is only one fifth of the pressure, fractures could not propagate beyond the wall.

The design options proposed to satisfy the design requirements for the panel-closure system include (1) a standard barrier, rectangular in shape, or (2) an enlarged concrete barrier, approximately spherical in shape. Options (1) and (2) will be grouted at the interface and may contain explosion- or construction-isolation walls. Only the enlarged barrier with an explosion-isolation wall is approved as part of the RCRA facility Permit.

The design provides flexibility to satisfy the design migration limit for the flow of VOCs out of the panels. An enlarged concrete barrier would be selected where the air-intake and air-exhaust drifts have aged and where there is fracturing resulting in significant flow of VOCs. These conditions apply to the most severe ground conditions in the air-intake and air-exhaust drifts of Panel 1. If ground conditions are more favorable, such as might be the case for future panel

entries, the design was proposed to be simplified to a standard concrete barrier rectangular in shape, with a construction isolation wall. GPR and observation boreholes are available for detecting the location and extent of fractures in the DRZ. These methods may be used to select the optimum location within each entry and exhaust drift for the enlarged barrier panel-closure system.

The design is presented in this report as a series of calculations, engineering drawings, and technical performance specifications. The drawings illustrate the construction details for the system. The technical performance specifications cover the general requirements of the system, site work, concrete, and masonry. Information on the proposed construction method is also presented.

The design complies with all aspects of the design basis established for the WIPP panel-closure system. The design can be constructed in the underground environment with no special requirements at the WIPP.

8.0 References

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FIGURES

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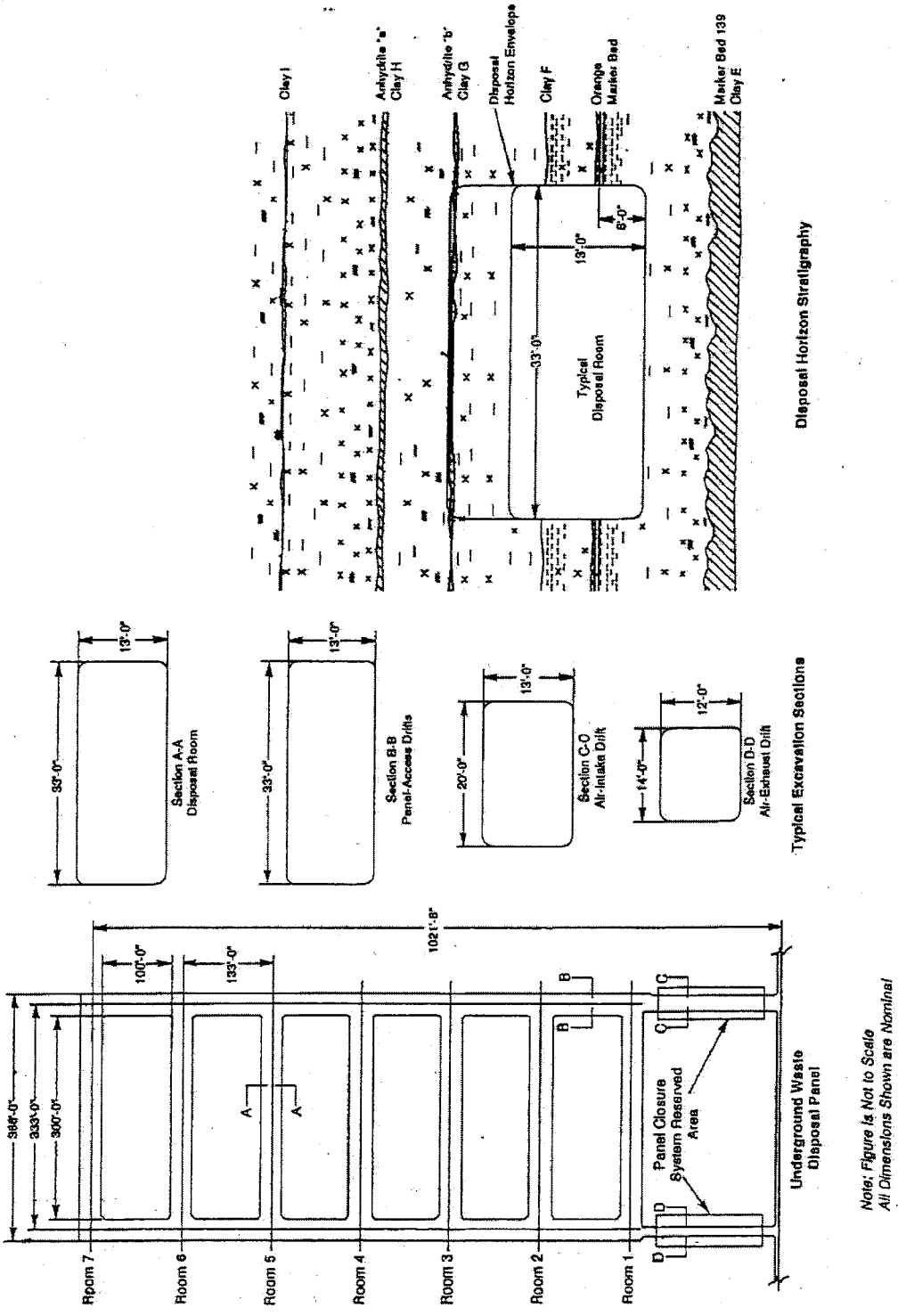
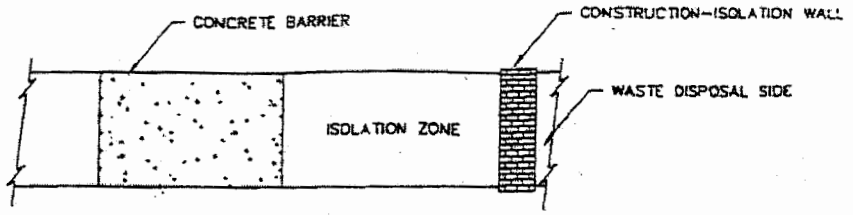
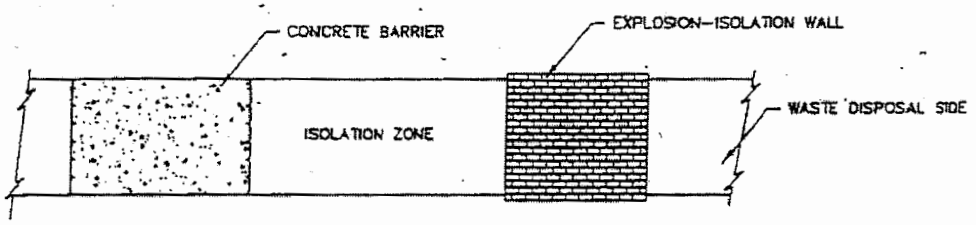


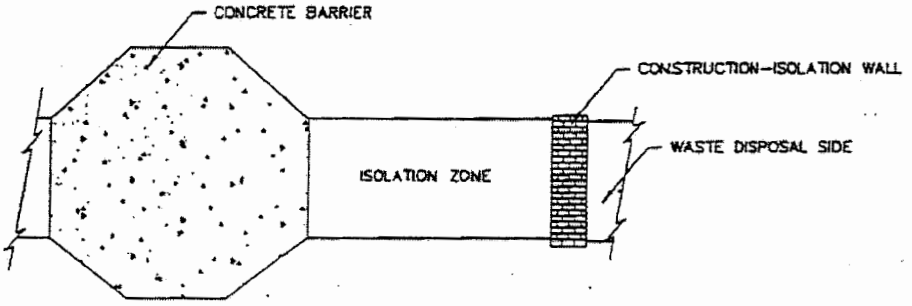
Figure G1-1
Typical Facilities—Typical Disposal Panel



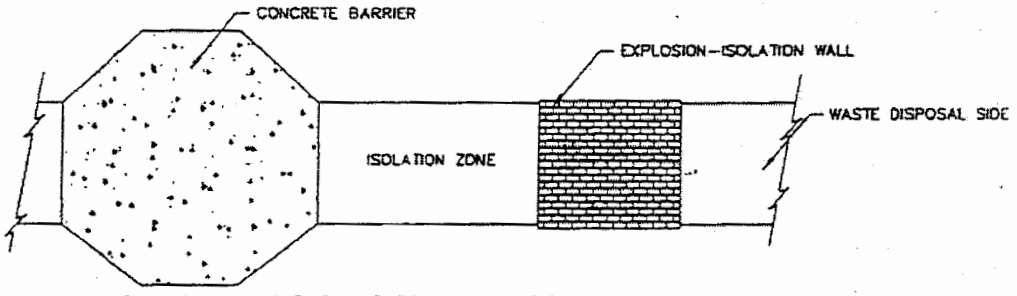
A. CONCRETE BARRIER WITHOUT DRZ REMOVED AND CONSTRUCTION ISOLATION WALL



B. CONCRETE BARRIER WITHOUT DRZ REMOVED AND EXPLOSION ISOLATION WALL



C. CONCRETE BARRIER WITH DRZ REMOVED AND CONSTRUCTION ISOLATION WALL



D. CONCRETE BARRIER WITH DRZ REMOVED AND EXPLOSION ISOLATION WALL

Figure G1-2
Main Barrier with Wall Combinations

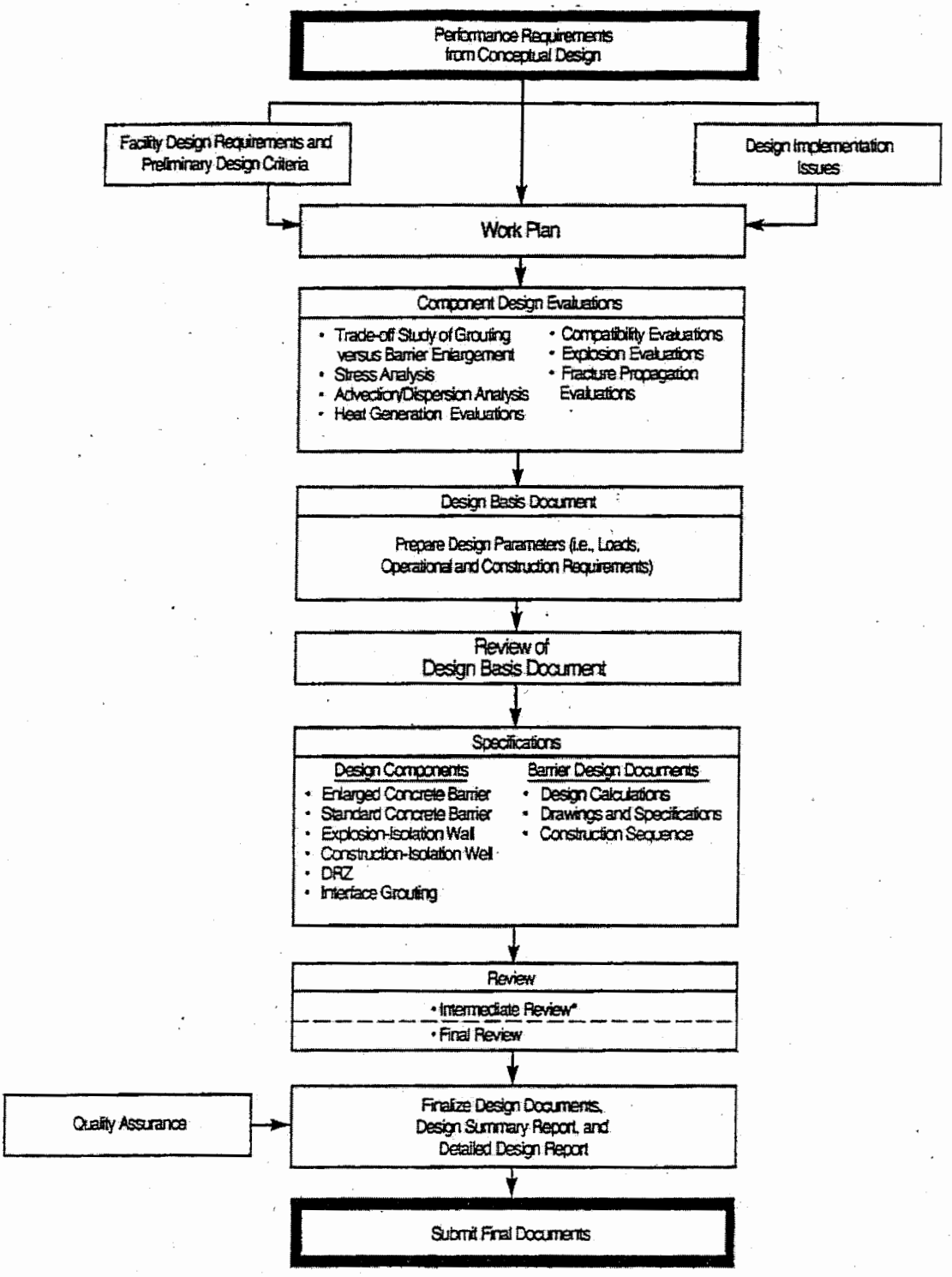


Figure G1-3
Design Process for the Panel-Closure System

A. Select a system structure or component for classification. (Start with a mitigating item)

B. Is the system, structure, or component required to mitigate the consequences of an accident?

C. Would the system, structure, or component failure result in loss of safety functions of a Design Class I components?

D. Does the system, structure, or component provide any function related to nuclear materials?

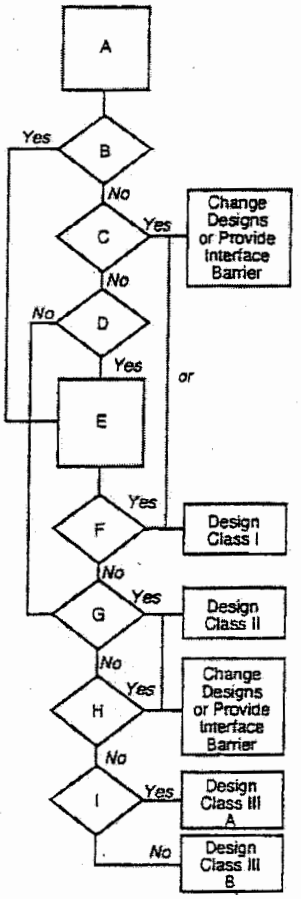
E. Select a conservative accident scenario and perform safety analysis.

F. Does the cumulative radiological consequences following the accident exceed 25 Rem whole body or 75 Rem organ dose commitment to an individual at the Zone I boundary

G. Does the structure, system, operation or component conform to the Class II criteria as defined in Attachment 2?

H. Would the structure, system, operation or component failure result in loss of the required function of a Class II component?

I. Are special design requirements necessary to ensure that failure of the system, structure, or component will NOT result in a significant shutdown of the facility or inhibit accessibility or maintainability of required equipment or have special significance to health and safety of operations personnel?



B. _____YES __X__ NO
Describe requirement

C. _____YES __X__ NO
Failure mode and affected class I component

D. _____YES __X__ NO
Describe function

E. _____YES __N/A__ NO
Attach safety analysis

F. _____YES _____NO
Calculate dose rates
N/A
(Attach calculations to this form)

G. _____YES __X__ NO
Criteria
N/A

H. _____YES __X__ NO
Failure mode and affected Class II component

I. _____YES __X__ NO
Requirements

Figure G1-4
Design Classification of the Panel-Closure System

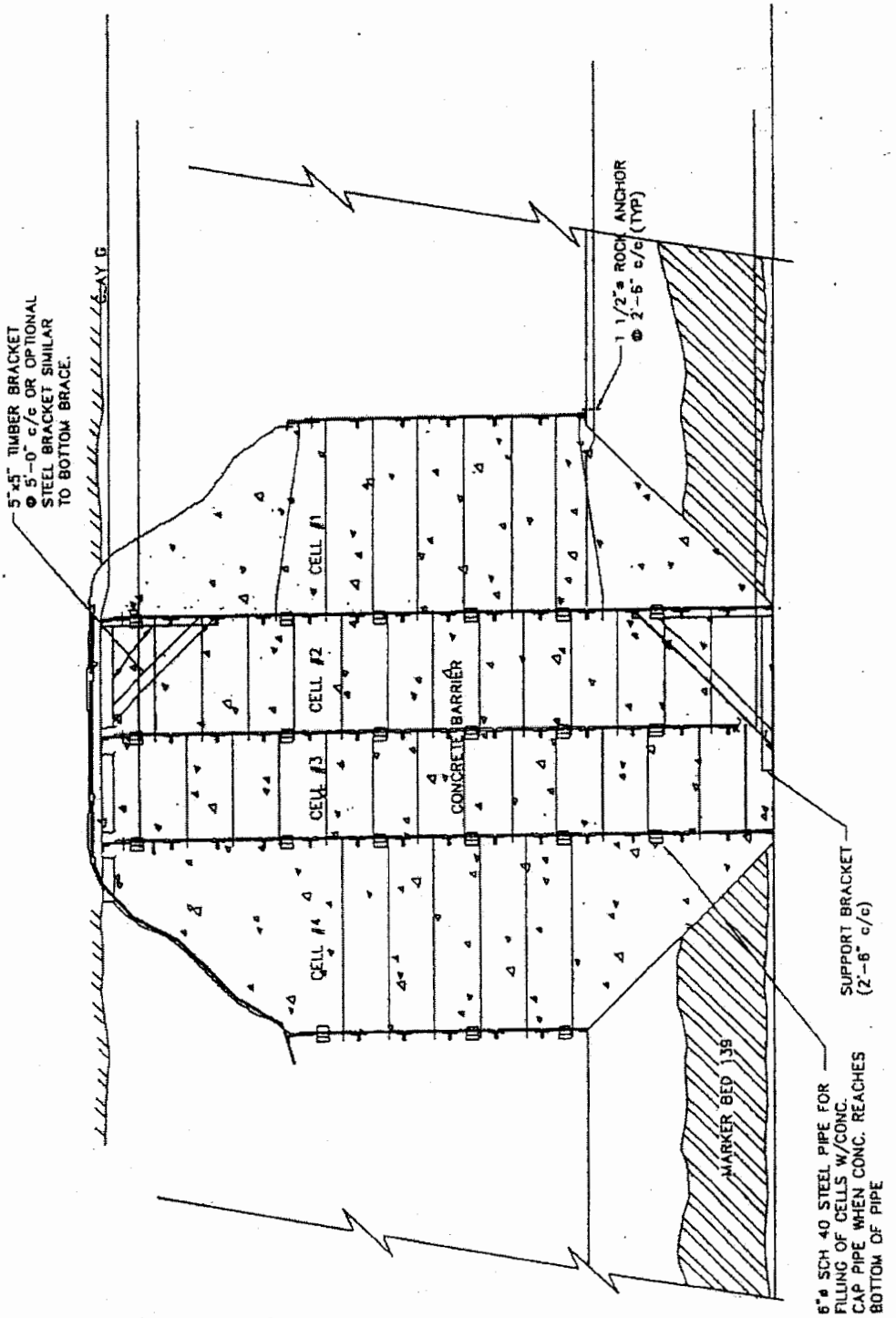


Figure G1-5
Concrete Barrier with DRZ Removal

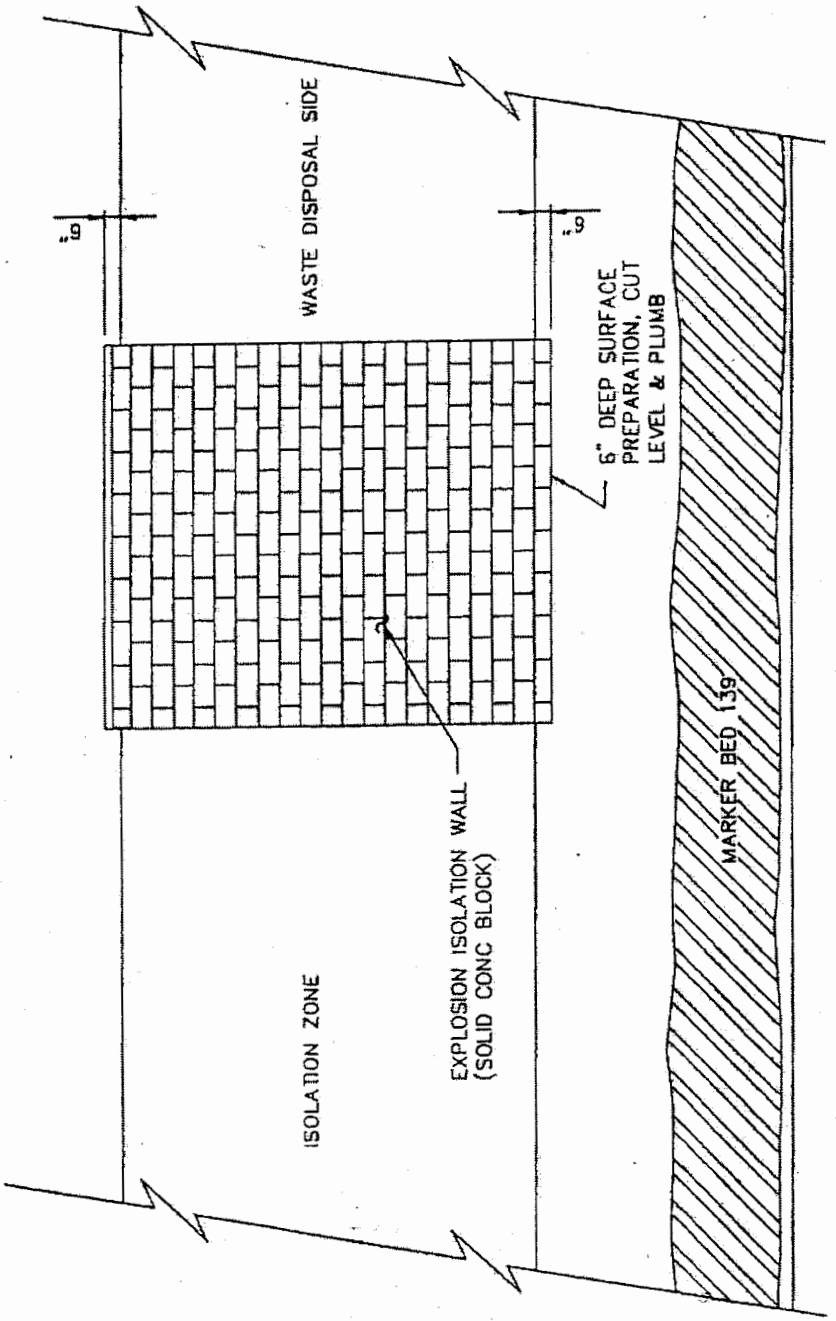


Figure G1-6
Explosion-Isolation Wall

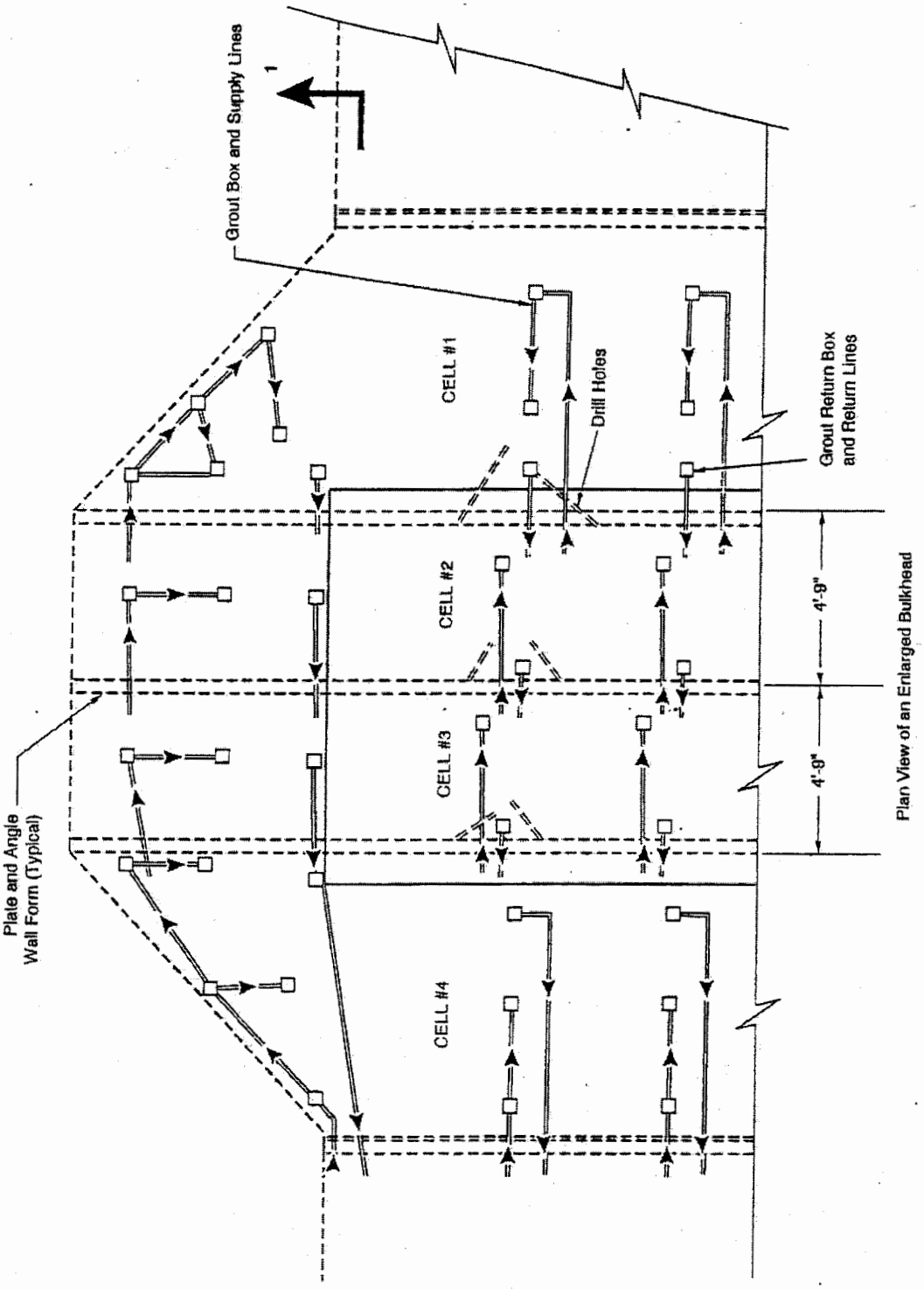


Figure G1-7
Grouting Details

1

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ATTACHMENT G1
APPENDIX G

TECHNICAL SPECIFICATIONS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

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ATTACHMENT G1
APPENDIX G

TECHNICAL SPECIFICATIONS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

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DIVISION 1 - GENERAL REQUIREMENTS

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Section 01010 - Summary of Work

Part 1 - General

1.1 Scope

This section includes:

- Scope of Work
- Definitions and Abbreviations
- Drawings
- Work by Others
- Contractors Use of Site
- Contractors Use of Facilities
- Work Sequence
- Work Plan
- Submittals

1.2 Scope of Work

The Contractor shall furnish all labor, materials, equipment and tools to perform operations in connection with the construction of two (2) panel closure systems for each panel, one of each to be installed in the air intake drift and the air exhaust drift of a waste-emplacement panel, as shown on the drawings and called for in these specifications.

Four (4) possible arrangements of the concrete barrier and isolation walls are shown on the attached Figure G1-1 "Plan Variations."

- Concrete barrier without disturbed rock zone (**DRZ**) removal in combination with construction isolation wall (Sketch A).
- Concrete barrier without DRZ removal in combination with an explosion isolation wall (Sketch B).
- Concrete barrier with DRZ removal up through clay seam G and down through marker bed 139 (**MB 139**) in combination with a construction isolation wall (Sketch C).
- Concrete barrier with DRZ removal in combination with an explosion isolation wall (Sketch D) (This is the only approved configuration in this Permit).

The scope of work shall include but not be limited to the following units of work:

- Develop work plan, health and safety plan (**HASP**) and contractors quality control plan (**CQCP**)
- Prepare and submit all plans requiring approval
- Mobilize to site

- Coordinate construction with operations
- Perform the following for the air intake entry and the air exhaust entry.
  - Excavate the surface preparation for the explosion isolation wall
  - Construct the explosion isolation wall
  - Excavate the DRZ
  - Install the form work for the concrete barrier
  - Place concrete for the concrete barrier
  - Grout the interface of concrete barrier/back wall
  - Provide contact grouting along the contact surface (if required by the engineer)
- Clean up construction areas in underground and above ground
- Submit all required record documents
- Demobilize from site

1.3 Definitions and Abbreviations

Definitions

Contact-handled waste—Contact-handled defense transuranic (**TRU**) waste with a surface dose rate not to exceed 200 millirem per hour.

Concrete barrier—A barrier placed in the access drifts of a panel to restrict the mass flow rate of volatile organic compounds (**VOC**).

Concrete block—Concrete used for construction of either an explosion-isolation wall or a construction-isolation wall.

Construction-isolation wall—A wall immediately adjacent to the panel waste-emplacement area that is made of concrete block, with mortar or steel frame to isolate construction personnel from coming into contact with the waste.

Creep—Plastic deformation of salt under deviatoric stress.

Design migration limit—A mass flow rate that is at least 1 order of magnitude below the health-based levels for VOCs during the Waste Isolation Pilot Plant (**WIPP**) operational period.

Disturbed rock zone (**DRZ**)—A zone surrounding underground excavations where stress redistribution occurs with attendant dilation and fracturing.

Explosion-isolation wall—A concrete-block wall adjacent to the panel waste-emplacement area with mortar that can sustain the pressure and temperature transients of a methane explosion.

Health-based concentration level—The concentration level for a VOC in air that must not be exceeded at the point of compliance during the WIPP operational period.

Health-based migration limit—The mass flow rate of a VOC from all closed panels that results in the health-based concentration level at the point of compliance.

Hydration temperature—The temperature developed by a cementitious material due to the hydration of the cement.

Interface grouting—Grouting performed through grout boxes and pipe lines to fill the void at the concrete barrier/back-wall interface.

Methane explosion—A postulated deflagration caused by the buildup of methane gas to explosive levels.

Partial closure—The process of rendering a part of the underground repository inactive and closed according to approved facility closure plans. The partial-closure process is considered complete after partial-closure activities are performed in accordance with approved Resource Conservation and Recovery Act (**RCRA**) partial closure plans.

Point of compliance—The operating point of compliance for VOC levels at the WIPP, which is the 16-section land withdrawal boundary.

Remote-handled waste—Any of the various forms of high beta-gamma defense TRU waste requiring remote-handling and with a surface dose rate exceeding 200 millirem per hour.

Standard barrier—A concrete barrier emplaced into the panel-access drifts without major excavation of the surrounding rock.

Volatile Organic Compound (**VOC**)—Any VOC comprising the land-disposal-restricted indicator VOC constituents in the WIPP waste inventory.

Abbreviations/Acronyms

ACI	American Concrete Institute
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DRZ	Disturbed rock zone
EPA	U.S. Environmental Protection Agency
MB 139	Marker Bed 139
MSHA	U.S. Mine Safety and Health Administration
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
MOC	Management and Operating Contractor (Permit Section 1.5.3)
RCRA	Resource Conservation and Recovery Act
SMC	Salado Mass Concrete
USACE	U.S. Army Corps of Engineers
WIPP	Waste Isolation Pilot Plant

1.4 List of Drawings

The following drawings are made apart of this specification:

762447-E1	Panel closure system, air intake and exhaust drifts, title sheet
762447-E2	Panel closure system, underground waste-emplacement panel plan
762447-E3	Panel closure system, air intake drift, construction details
762447-E4	Panel closure system, air exhaust drift, construction details
762447-E5	Panel closure system, construction and explosion walls, construction details
762447-E6	Panel closure system, air intake and exhaust drifts, grouting and miscellaneous details

1.5 Work by Others

Survey

All survey work to locate the barriers and walls, control and confirm excavation, and complete the work will be supplied by the Permittees. All survey measurements for record purposes will also be performed/supplied by the Permittees. The Contractor shall be responsible for verifying the excavation dimensions to develop the form work to fit the excavation.

Excavation

The Permittees may elect to perform certain portions of the work, notably the excavation. The work performed by the Permittees will be defined prior to the contract.

1.6 Contractor's Use of Site

Site Conditions

The site is located near Carlsbad, New Mexico, as shown on the site location maps and the title sheet drawing. The underground arrangements and location of the WIPP waste-emplacement panels are shown on the plan view drawing. The work described above is to construct the concrete barriers in the air intake and exhaust drifts of one of the panels upon completion of the disposal phase of that panel. The waste-emplacement panels are located approximately 2,150 feet below the ground surface. The Contractor shall visit the site and become familiar with the site and site conditions prior to preparing his bid proposal.

Contractor's Use of Site

Areas at the ground surface will be designated for the Contractor's use in assembling and storing his equipment and materials. The Contractor shall utilize only those areas designated.

Limited space within the underground area will be designated for the Contractor's use for storage of material and setup of equipment.

Coordination of Contractor's Work

The Contractor is advised that on-going waste emplacement and excavation operations are being conducted throughout the period of construction of the panel barrier system. The

Contractor shall coordinate his construction operations with that of the waste emplacement and mining operations. All coordination shall be through the Engineer.

1.7 Contractor's Use of Facilities

Existing facilities at the site which are available for use by the Contractor are:

- WIPP roadheader
- Waste shaft conveyance
- Salt skip hoist
- (1) 20 ton forklift
- (1) 40 ton forklift
- 460 volt AC, 3 phase power
- Water (underground, at waste shaft only) (above ground, at location designated by Engineer)

Additional information on these facilities is presented in Section 02010.

1.8 Work Sequence

Work Sequence shall be as shown on the drawings and directed by the Engineer.

1.9 Work Plan

The Contractor shall prepare and submit for approval by the Engineer a Work Plan fully describing his proposed construction operation. The work plan shall define all proposed equipment. The work plan shall also include the method of excavation, grouting, and pumping concrete. The work plan shall also contain such items as control of surface dust emissions. No work shall be performed prior to approval of the Work Plan.

1.10 Submittals

Submittals to the Permittees shall be in accordance with the Permittees' Submittal Procedures and as required by the individual specifications. Approval by the Permittees shall not constitute approval by NMED. Any submittals that propose a change to the panel closure requirements of this Permit (e.g., changes in grout composition, detailed design, etc.) shall be submitted to NMED as required by 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

Part 2 - Products

Not used.

Part 3 - Execution

Not Used.

End of Section

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Section 01090 - Reference Standards

Part 1 - General

1.1 Scope

This section includes:

- Provision of Reference Standards at Site.
- Acronyms used in Contract Documents for Reference Standards. Source of Reference Standards.

1.2 Quality Assurance

For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

Conform to reference by date of issue current on the date of the agreement between the Permittees and the contractor.

The Contractor shall obtain copy of the standards referenced in the individual specification sections. Maintain a copy at jobsite during submittals, planning, and progress of the specific work, until completion of work.

Should specified reference standards conflict with the contract documents, request clarification from the Engineer before proceeding.

1.3 Schedule of References

Various publications are referenced in other sections of the specifications to establish requirements for the work. These referenced are identified by documents number and title. The addresses of the organizations whose publications are referenced are listed below.

ACI	ACI International P.O. Box 19150 Detroit, MI 48219-0150 Ph: 313-532-2600 Fax: 313-533-4747
AITC	American Institute of Timber Construction 7012 So. Revere Parkway, Suite 140 Englewood, CO 80112 Ph: 303-792-9559 Fax: 303-792-0669
AISC	American Institute of Steel Construction One E. Wacker Dr., Suite 3100 Chicago, IL 60601-2001

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	Ph: 312-670-2400 Fax: 312-670-5403
ANSI	American National Standards Institute 11 West 42nd St. New York NY 10036 Ph: 212-642-4900 Fax: 212-302-1286
API	American Petroleum Institute 1220 L. St., NW Washington, DC 20005 Ph: 202-682-8375 Fax: 202-962-4776
ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103 Ph: 215-299-5585 Fax: 215-977-9679
AWS	American Welding Society 550 LeJeune Road Miami, FL 33135 Ph: 800-443-9353 Fax: 305-443-7559
CFR	Code of Federal Regulations Government Printing Office Washington, DC 20402 Ph: 202-783-3238 Fax: 202-223-7703
EPA	Environmental Protection Agency Public Information Center Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460 Ph: 202-272-0167
FTM-STO	Federal Test Method Standards Standardization Documents Order Desk Bldg. 4D 700 Robbins Ave. Philadelphia, PA 19111-5094 Ph: 215-697-2179 Fax: 215-697-2978
NRMCA	National Ready-Mixed Concrete Association 900 Spring St.

Silver Spring, MD 20910
Ph: 301-587-1400
Fax: 301-585-4219

NTIS — National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161
(703) 487-4650

PCA — Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

USACE — U.S. Army Corps of Engineers
U.S. Army Engineer Waterway Experiment Station
ATTN: Technical Report Distribution Section, Services Branch, TIC
3909 Halls Ferry Rd.
Vicksburg, MS 39180-6199
Ph: 601-634-2355
Fax: 601-634-2506

MOC — Nuclear Waste Partnership LLC
PO Box 2078
Carlsbad, New Mexico 88221

End of Section

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Section 01400 - Contractor Quality Control

Part 1 - General

1.1 Scope

This section includes:

- Contractor Quality Control Plan (**CQCP**)
- Reference Standards
- Quality Assurance
- Tolerances
- Testing Services
- Inspection Services
- Submittals

1.2 Related Sections

- 01090 - Reference Standards
- 01600 - Material and Equipment
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork
- 03300 - Cast-in-Place Concrete
- 04100 - Mortar
- 04300 - Unit Masonry System

1.3 Contractor Quality Control Plan

The Contractor shall prepare and submit for approval by the Engineer, a Quality Control Plan, as described in Section 3.2. No work shall be performed prior to approval of the Contractor's Quality Control Plan.

1.4 References and Standards

Refer to individual specification sections for standards referenced therein, and to Section 01090 - Reference Standards for general listing.

Standards referenced in this section are as follows:

ASTM C1077	Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C1093	Practice for Accreditation of Testing Agencies for Unit Masonry
ASTM E329	Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction

ASTM E543	Practice for Determining the Qualification of Nondestructive Testing Agencies
ASTM E548	Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies

1.5 Quality Assurance

- Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality
- Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship
- Perform work by persons qualified to produce required and specified quality
- Verify that field measurements are as indicated on shop drawings
- Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.6 Tolerances

Monitor excavation fabrication and installation tolerance control of work and products to produce acceptable work. Do not permit tolerances to accumulate.

Adjust products to appropriate dimensions; position before securing products in place.

1.7 Testing Services

Unless otherwise indicated by the Engineer, the Contractor shall employ an independent firm to perform the testing services and other services specified in the individual specification sections, and as required by the Engineer. Testing and source quality control may occur on or off the project site.

The testing laboratory shall comply with applicable sections of the reference standards and shall be authorized to operate in the state in which the project is located.

Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

1.8 Inspection Services

The Contractor shall employ an independent firm to perform inspection services as a supplement to the Contractor's quality control as specified in the individual specification sections, and as required by the Engineer. Inspection may occur on or off the project site.

The inspection firm shall comply with applicable sections of the reference standards.

1.9 Submittals

The Contractor shall submit a Contractors' Quality Control Plan as described herein.

Prior to start of work, the Contractor shall submit for approval, the testing laboratory name, address, telephone number and name of responsible officer of the firm. He shall also submit a copy of the testing laboratory compliance with the reference ASTM standards, and a copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards with memorandum of remedies of any deficiencies reported by the inspection.

Prior to start of work, the Contractor shall submit for approval the inspection firm name, address, telephone number and name of responsible officer of the firm. He shall also submit the personnel proposed to perform the required inspection, along with their individual qualifications and certifications (Example: Certified AWS Welding Inspector.)

Part 2 - Products

Not used.

Part 3 - Execution

3.1 General

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on site and off site, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 Quality Control Plan

3.2.1 General

The Contractor shall furnish for review and approval by the Engineer, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (**CQC**) Plan proposed to implement the requirements of the Contract. The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. Construction will be permitted to begin only after acceptance of the CQC Plan.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both on site and off site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

- The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

- Description of the CQC System Manager's responsibilities and delegation of authority to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities.

- Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with the Permittees' Submittal Procedures.

- Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be subject to approval by the Engineer.)

- Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

- Reporting procedures, including proposed reporting formats.

- A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon by the Engineer.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Permittees reserve the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

3.3 Quality Control Organization

3.3.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel supplemented by independent testing and inspection firms as required by the specifications, to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Engineer.

3.3.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, with a minimum of five years construction experience on construction similar to this contract. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager.

3.3.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel or third party inspectors to assist the CQC System Manager. These individuals shall be employed by the prime Contractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience. These individuals shall have no other duties other than quality control.

3.3.4 Organizational Changes

The Contractor shall maintain his CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Engineer for acceptance at the Contractors' expense.

3.4 Tests

3.4.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Engineer duplicate samples of test specimens for possible testing

by the Engineer. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of an approved testing laboratory. The Contractor shall perform the following activities and record and provide the following data:

- Verify that testing procedures comply with contract requirements.
- Verify that facilities and testing equipment are available and comply with testing standards.
- Check test instrument calibration data against certified standards.
- Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Engineer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an off site or commercial test facility will be provided directly to the Engineer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.5 Testing Laboratory

The testing laboratory shall provide qualified personnel to perform specified sampling and testing of products in accordance with specified standards, and ascertain compliance of materials and mixes with requirements of Contract Documents. The testing laboratory shall promptly notify the Engineer and Contractor of any observed irregularities or non-conformance of Work or Products.

Reports indicating results of tests, and compliance (or noncompliance) with the contract documents will be submitted in accordance with the Permittees' submittal procedures.

The Contractor shall cooperate with the independent testing firm, furnish samples, storage, safe access, and assistance by incidental labor as required. Testing by the independent firm does not relieve the contractor of the responsibility to perform the work to the contract requirements.

The laboratory may not:

- Release, revoke, alter, or enlarge on requirements of the contract
- Approve or accept any portion of the work
- Assume any duties of the Contractor.

The laboratory has no authority to stop the work.

3.6 Inspection Services

The inspection firm shall provide qualified personnel at site to supplement the Contractor's Quality Control Program to perform specified inspection of Products in accordance with

specified standards. He shall ascertain compliance of materials and mixes with requirements of Contract Documents, and promptly notify the CQC System Manager, the Engineer and the Contractor of observed irregularities or non-conformance of Work or Products. The inspector does not have the authority to stop the work. The inspector shall refer such cases to the CQC System Manager who has the authority to stop work (see Section 3.2.2).

Reports indicating results of the inspection and compliance (or noncompliance) with the contract documents will be submitted in accordance with the Permittees' submittal procedures.

The Contractor shall cooperate with the independent inspection firm, furnish samples, storage, safe access and assistance by incidental labor, as requested.

Inspection by the independent firm does not relieve the Contractor of the responsibility to perform the work to the contract requirements.

3.7 Completion Inspection

3.7.1 Pre-Final Inspection

At the completion of all work the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Once this is accomplished the Contractor shall notify the Engineer that the facility is complete and is ready for the "Prefinal" inspection. The Engineer will perform this inspection to verify that the facility is complete. A "Final Punch List" will be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and notify the Engineer so that a "Final" inspection can be scheduled. Any items noted on the "Final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work.

3.7.2 Final Acceptance Inspection

The final acceptance inspection will be formally scheduled by the Engineer based upon notice from the Contractor. This notice will be given to the Engineer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

3.8 Documentation

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- Contractor/subcontractor and their area of responsibility.
- Operating plant/equipment with hours worked, idle, or down for repair.

- Work performed each day, giving location, description, and by whom.
- Test and/or quality control activities performed with results and references to specifications/drawings requirements. List deficiencies noted along with corrective action.
- Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- Submittals reviewed, with contract reference, by whom, and action taken.
- Off-site surveillance activities, including actions taken.
- Instructions given/received and conflicts in plans and/or specifications.
- Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Engineer daily. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.9 Notification of Noncompliance

The Engineer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of section.

Section 01600 - Material and Equipment

Part 1 - General

1.1 Scope

This section includes:

- Equipment
- Products
- Transportation and handling
- Storage and protection
- Substitutions

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 02010 - Mobilization and Demobilization
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork
- 03300 - Cast-in-Place Concrete
- 04100 - Mortar
- 04300 - Unit Masonry System

1.3 Equipment

The Contractor shall specify his proposed equipment in the Work Plan. Power equipment for use underground shall be either electrical or diesel engine driven. All diesel engine equipment shall be certified for use underground.

1.4 Products

The Contractor shall specify in the Work Plan, or in subsequently required submittals the proposed products including, but not limited to the grout mix and its components, concrete mix and its components, mortar mix and its components, formwork, and masonry. The proposed products shall be supported by laboratory test results as required by the specifications. All products shall be subject to approval by the Engineer.

1.5 Transportation and Handling

- Transport and handle products in accordance with manufacturer's instructions.
- Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.6 Storage and Protection

- Store and protect products in accordance with manufacturers' instructions.
- Store with seals and labels intact and legible.
- Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- For exterior storage of fabricated products, place on sloped supports above ground.
- Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.7 Substitutions

1.7.1 Equipment Substitutions

The Contractor may substitute equipment for that proposed in the Work Plan subject to the Engineer's approval. The Contractor shall demonstrate the need for the substitution, and the applicability of the proposed substitute equipment.

1.7.2 Product Substitutions

The Contractor may not substitute products after the proposed products have been approved by the Engineer unless he can demonstrate that the supplier/source of that product no longer exists in which case he shall submit alternate products with lab test results to the Engineer for approval. In the case that product is a component in a mix, the Contractor shall perform mix testing using that component and submit laboratory test results.

Part 2 - Products

Not used.

Part 3 - Execution

Not used.

End of section.

DIVISION 2 - SITE WORK

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Section 02010 - Mobilization and Demobilization

Part 1 - General

1.1 Scope

This section includes:

- Mobilization of equipment and facilities to site
- Contractor use of site
- Use of existing facilities
- Demobilization of equipment and facilities
- Site cleanup

1.2 Related Sections

- 01010 - Summary of Work
- 01600 - Material and Equipment

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Mobilization of Equipment and Facilities to Site

Upon authorization to proceed, the Contractor shall mobilize his equipment and facilities to the jobsite. Equipment and facilities shall be as specified, and as defined in the Contractor's Work Plan. The Contractor shall erect the batch plant and assemble his equipment and materials in the areas designated by the Engineer. Facilities shall be located as near as practical to the existing utilities.

The Permittees will provide utilities (460 volt AC, 3 phase, and water) at designated locations. The Contractor shall be responsible for all hookups and tie-ins required for his operations.

The Contractor shall be responsible for providing his own office, storage, and sanitary facilities.

Areas will be designated for the Contractor's use in the underground area in the vicinity of the panel closure system installation. These areas are limited.

3.2 Use of Site

The Contractor shall use only those areas specifically designated for his use by the Engineer. The Contractor shall limit his on-site travel to the specific routes required for performance of his work, and designated by the Engineer.

3.3 Use of Existing Facilities

Existing facilities at the site which are available for use by the Contractor are:

- WIPP roadheader
- Waste shaft conveyance
- Salt skip hoist
- (1) 20 ton forklift
- (1) 40-ton forklift
- 460 Volt AC, 3 phase power
- Water (in mine, at waste shaft only-above ground at location designated by the Engineer).

The Contractor shall arrange for use of the facilities with the Engineer and coordinate his actions/requirements with that of the ongoing operations.

Use of water in the underground will be restricted. No washout or cleanup will be permitted in the underground. Above ground washout/cleanup or equipment will be allowed in the areas designated by the Engineer.

The Contractor is cautioned to be aware of the physical dimensions of the waste conveyance and the air lock (see Figures G1-2 and G1-3, attached).

The Contractor shall be responsible for any damage incurred by the existing site facilities as a result of his operations. Any damage shall be reported immediately to the Engineer and repaired at the Contractor's cost.

3.4 Demobilization of Equipment and Facilities

At completion of this work, the Contractor shall demobilize his equipment and facilities from the job site. The batch plant shall be disassembled and removed along with any unused material. All Contractor's equipment and materials shall be removed from the mine and all disturbed areas restored. Utilities shall be removed to their connection points unless otherwise directed by the Engineer.

3.5 Site Cleanup

At conclusion of the work, the Contractor shall remove all trash, waste, debris, excess construction materials, and restore the affected areas to its prior condition, to the satisfaction of the Engineer. A final inspection of the areas will be conducted by the Engineer and the Contractor before final payment is approved.

End of section.

Section 02222 - Excavation

Part 1 - General

1.1 Scope

This section includes:

- Excavation for main concrete barrier
- Excavation for surface preparation and leveling of base areas for isolation walls
- Disposition of excavated materials.

1.2 Related Sections

- 01010 - Summary of Work
- 01600 - Material and Equipment
- 03100 - Concrete Form Work
- 04300 - Unit Masonry System.

1.3 Reference Documents

"Reference Stratigraphy and Rock Properties for the Waste Isolation Pilot Plant (WIPP) Project" by R.D. Krieg-Sandia National Laboratory Document Sand 83-1908. [Available through National Technical Information Service (**NTIS**).]

1.4 Field Measurements and Survey

All surveys required for performance of the work will be provided by the Permittees. To develop the concrete formwork to fit the excavation, the Contractor shall be responsible for verifying the excavation dimensions.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Excavating for Concrete Barrier

Excavation for the main concrete barrier shall be performed to the lines and grades shown on the drawings. Excavate the back a minimum of 1 inch to 3 inches beyond clay seam G, and the floor a minimum of 1 inch to 3 inches below the anhydride marker bed 139 (**MB-139**) to assure removal of the disturbed rock zone (**DRZ**). Excavation shall be performed utilizing mechanical means such as a cutting head on a suitable boom, by drilling boreholes and using an expansive agent to fragment the rock or other competent equipment or methods submitted to the Engineer for review and approval. The use of explosives is prohibited. The existing WIPP roadheader mining machine may also be available for use. The Contractor is to determine availability and coordinate proposed use of the roadheader with the Engineer. The existing roadheader is capable of excavating the back and the portions of the ribs above the floor level. However, it is not capable of excavating the portion below floor level.

The tolerances for the concrete barrier excavation shall be +6 inches, to 0 inch. In addition, the Contractor is to remove all loose or spalling rock from the excavation surface to provide a sound surface abutting the concrete barrier. The Contractor shall provide and install roof bolts for support as required for personnel protection and approved ground control plans.

3.2 Excavating for Surface Preparation and leveling of Base Areas for Isolation Walls

The Contractor shall excavate a 6-inch surface preparation around the entire perimeter of the isolation walls. The surface preparation in the floor shall be made level to produce a surface for placing the first course of block in the isolation walls. Tolerances for the leveled portion of the surface preparation are ±1 inch. Excavation may be performed by either mechanical or manual means. Use of explosives is prohibited.

3.3 Disposition of Excavated Materials

The Contractor shall remove all excavated materials from the panel-access drift where they are excavated. Excavated materials shall be removed from the mine via the salt skip to the surface, where they will be disposed on site at a location as directed by the Engineer.

3.4 Field Measurements and Survey

All survey required for performance of the work will be provided by the Permittees. The Contractor shall protect all survey control points, bench marks, etc., from damage by his operations. MOC will verify by survey that the Contractor has excavated to the required lines and grades. The Contractor shall be responsible for verifying the excavation dimensions to develop concrete formwork to fit the excavation. No form work or block work is to be erected until this survey is completed. The Contractor is to coordinate the survey work with his operations to assure against lost time. The Contractor shall notify the Engineer at least 24 hours prior to the time surveying is required

End of section.

Section 02722 - Grouting

Part 1 - General

1.1 Scope

This section includes:

- Grouting of concrete barrier.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 03100 - Concrete Form Work
- 03300 - Cast-in-Place Concrete

1.3 References

ASTM C1107 Standard Specification for Nonshrink Grout

ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars

1.4 Submittals for Review and Approval

Thirty days prior to the initiation of grouting, the Contractor shall submit to the Engineer for review and approval, the following:

- Type of grout proposed
- Product data:
  - Manufacturer's specification and certified laboratory tests for the manufactured grout, if proposed
  - Certified laboratory tests for the salt-saturated grout, if proposed, using project-specific materials
- Proposed grouting method, including equipment and materials and construction sequence in Work Plan.

1.5 Submittals for Construction

Daily grouting report indicating the day, date, time of mixing and delivery, quantity of grout placed, water used, pressure required, problems encountered, action taken, quality control data, testing results, etc., no later than 24 hours following construction.

Part 2 - Products

2.1 Grout Materials

Grout used for grouting in connection with fresh water/plain cement concrete shall be nonshrink, cement-based grout, Five Star 110 as manufactured by Five Star Products Inc., 425 Stillson Road, Fairfield, Connecticut 06430 or approved equal. Mixing and installation shall be in accordance with the manufacturer's recommendations.

As an alternate to the above grout, in connection with the Salado Mass concrete mix, the Contractor shall use, subject to the approval of the Engineer, a salt saturated grout. The following formulation is suggested to the Contractor as an initiation point for selection of the grout mix. Salt saturated grout strength shall be 4500 psi at 28 days.

Salt-Saturated Grout (BCT-1F)

Component	Percent of total Mass (wt.)
Class H Cement	48.3
Class C Fly Ash	16.2
Cal Seal (Plaster - from Halliburton)	5.7
Sodium chloride	7.9
Dispersant	0.78
Defoamer	0.02
Water	21.1

Water for mixing shall be of potable quality, free from injurious amounts of oil, acid, alkali, salt, or organic matter, sediments, or other deleterious substances, as specified for concrete, Section 03300-2.3.

2.2 Product Data

If the Contractor proposes to utilize a manufactured nonshrink cement-based grout, he shall submit complete manufacturer's specifications for the product, along with certified laboratory test results of the material.

If the Contractor proposes to utilize the salt-saturated grout in connection with the Salado Mass concrete mix, he shall submit manufacturer's/supplier's specifications for the component materials, and certified laboratory test results for the resultant mix.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material, equipment, and tools to perform all operations in connection with the grouting.

Grout delivery and return lines for interface grouting shall be installed in the form work or in the area to be grouted to provide uniform distribution of the grout as shown on the drawings. The

exact location of the boxes and lines shall be determined in the field. Additional grout delivery and return lines and boxes may be required by the Engineer.

Pumps shall be positive displacement piston type pump designed for grouting service capable of operating at a discharge pressure of 100 psi. The Contractor shall supply a standby pump to be utilized in the event of a breakdown of the primary unit.

Mixers shall be high velocity "colloidal" type with a rotary speed of 1,200 to 1,500 rpm. Grout shall be mixed to a pumpable mix as per the manufacturer's recommendations.

Mixing water shall be accurately metered to control the consistency of the grout.

The Contractor shall provide all necessary valves, gages, and pressure hoses.

Water for mixing is available at the waste shaft. The Contractor is cautioned that no free water discharges or spills are permitted in the mine. All cleanup and washout operations shall be performed at the ground surface.

Potential spill areas in the underground shall be identified by the Contractor in the work plan. The Contractor shall provide adequate containment for potential spills. Isolation measures shall include, but are not limited to, lining with a membrane material (PVC, hypalon, HDPE), draped curtains (polyethylene, PVC, etc.), corrugated sheet metal protective walls or a combination of these and other measures.

If salt-saturated grout is selected for use, the Contractor shall make provisions to accurately proportion the components. Proportioning shall be by weighing. Sufficient quantities of dry components shall be developed prior to initiation of the grouting to perform the work so as not to incur delays during the mixing/placing sequence.

3.2 Interface Grouting of Concrete Barrier

After each cell of the concrete barrier has been allowed to cure for a period of seven days, or as directed by the Engineer, the Contractor shall interface grout the remaining space between the back wall and the top surface of the concrete barrier.

Each cell of the concrete barrier shall be grouted before the next adjacent cell is formed and concrete placed. Grout delivery and return lines shall be installed with the form work as shown and called for on the drawings, or as directed by the Engineer.

The placing of grout, unless otherwise directed by the Engineer shall be continuous until completed. Grouting shall progress from lower to higher grout pipes. Grouting shall proceed through a single delivery line until grout escapes from the adjacent return line. The Contractor shall then secure these lines and move to the next adjacent set of delivery and return lines. Pressure shall be adjusted to adequately deliver the grout to the forms, as witnessed by grout in the return line.

The grouting operation shall be conducted in a manner such that it does not affect the stability of the concrete barrier structure.

3.3 Contact Grouting

After completion of interface grouting if directed by the Engineer, the Contractor shall contact grout to fill any remaining voids at the concrete barrier/back wall interface. Contact grouting includes all operations to drill, clean, and grout holes installed in the concrete barrier.

The Contractor shall drill and grout the interface zone to the main concrete barrier as directed by the Engineer.

The location, direction, and depth of each grout hole shall be as directed by the Engineer. The order in which the holes are drilled and the manner in which each hole is drilled and grouted, the proportions of the water used in the grout, the time of grouting, the pressures used in grouting, and all other details of the grouting operations shall be as directed by the Engineer.

Wherever required, contact grouting will entail drilling the hole to a limited depth, installing a packer, and performing grouting.

3.3.1 Drilling

The holes shall be drilled with rotary-type drills. Drilling grout holes with percussion-type drills will not be permitted except as approved by the Engineer.

The requirements as to location, depth, spacing, and direction of the holes shall be as directed by the Engineer.

The minimum diameter shall be approximately 11/2 inches.

When the drilling of each hole or stage of has been completed, compressed air will be used to flush out drill cuttings. The hole shall then be temporarily capped or otherwise suitably protected to prevent the hole from becoming clogged or obstructed until it is grouted.

3.3.2 Materials for Contact Grouting

Standard weight black steel pipe conforming to ASTM A-53 shall be set in the concrete in the locations as directed by the Engineer. All pipe and fittings shall be furnished by the Contractor.

The size of the grout pipe for each hole and the depth of the holes for setting pipe for grouting shall be as directed by the Engineer. Care shall be taken to avoid clogging or obstructing the pipes before being grouted, and any pipe that becomes clogged or obstructed from any cause shall be cleaned satisfactorily or replaced.

The packers shall be furnished by the Contractor and shall consist of expansible tubes or rings of rubber, leather, or other suitable material attached to the end of the grout supply pipe. The packers shall be designed so that they can be expanded to seal the drill hole at the specified locations and when expanded shall be capable of withstanding without leakage, for a period of 5 minutes, air pressure equal to the maximum grout pressures to be used.

3.3.3 Grouting Procedures

Different grouting pressures will be required for grouting different sections of the grout holes. Pressures as high as necessary to deliver the grout but which, as determined by trial, are safe against concrete displacement shall be used in the grouting.

If, during the grouting of any hole, grout is found to flow from adjacent grout holes or connections in sufficient quantity to interfere seriously with the grouting operation or to cause appreciable loss of grout, such grout holes and connections shall be capped temporarily. Where such capping is not essential, inaugurated holes shall be left open to facilitate the escape of air as the grout is forced into other holes. Before the grout has set, the grout pump shall be connected to adjacent capped holes and to other holes from which grout flow was observed, and grouting of all holes shall be completed. If during the grouting of any hole, grout is found to flow from points in the barrier, any parts of the concrete structure, or other locations, such flows or leaks shall be plugged or caulked by the Contractor as directed by the Engineer.

As a safeguard against concrete displacement, excessive grout travel, or while grout leaks are being caulked, the Engineer may require the reduction of the pumping pressure, intermittent pumping, or the discontinuance of pumping.

The consistency of the grout mix shall be varied, as directed by the Engineer, depending on the conditions encountered. Where the grout hole or connection continues to take a large amount of grout after the mix has been thickened, the Engineer may require that pumping be done intermittently, waiting up to 8 hours between pumping periods to allow grout in the barrier to set. After the grouting is complete, the pressure shall be maintained by means of stopcocks, or other suitable valve that it will be retained in the holes or connections being grouted.

3.4 Cleanup

No clean-up or washing of equipment with water is allowed in the underground. No free water spills are permitted. All clean out or wash out requiring water will be performed above ground at the location approved by the Engineer. See note above regarding potential spill areas in Section 3.1 - General.

3.5 Quality Control

The Contractor shall provide a third-party quality control inspector at the site throughout the grout placement operations. The inspector shall determine that the grout mix is properly proportioned and properly mixed to the approved consistency. The inspector shall sample and make one set of grout cubes for compression testing for every 50 cubic feet of grout placed, or fraction thereof, for each day of grout placement.

End of section.

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1 **DIVISION 3 - CONCRETE**

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Section 03100 - Concrete Formwork

Part 1 - General

1.1 Scope

This section includes:

- Formwork for cast-in-place concrete with shoring, bracing, and anchorage
- Accessory items, grout pipes, concrete delivery pipes.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 02722 - Grouting
- 03300 - Cast-in-Place Concrete
- 04300 - Unit Masonry System

1.3 References

ACI 301	Specifications for Structural Concrete for Buildings
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Recommended Practice for Concrete Formwork
ASTM A-36	Standard Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black, and Hot-Dipped Zinc Coated
ASTM A-325	High Strength, Structural Bolts
ASTM A-615	Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcements
AWS A3.0	Welding Terms and Definitions
AWS A5.1	Specification for Mild Steel Covered Arc Welding Electrodes
AWS D1.1	Structural Welding Code-Steel
AISC	Manual of Steel Construction Latest Edition

1.4 Submittals

The Contractor shall submit the following 30 days prior to initiation of work at site.

Shop detail drawings with appropriate calculations to support the adequacy or the formwork.

Mill test certification of materials utilized in construction of the forms.

Details of installation contained in the Contractor's Work Plan.

1.5 Quality Assurance

Design and detail the formwork under direct supervision of a professional structural Engineer experienced in design of this work and licensed in the state of New Mexico.

Perform work in accordance with ACI 301, 318, and 347, AISC and AWS standards. Maintain one copy of all standards at site.

Perform all fabrication in accordance with AISC manual of steel construction.

Perform all welding in accordance with AWS D1.1 structural welding code.

Perform all bolting in accordance with AISC specification for structural joints using ASTM A325 or A490 bolts.

Part 2 - Products

2.1 Form Materials

Forms for the concrete barrier shall be constructed of ASTM A-36 steel.

Pipe inserts shall be ASTM A-53 black standard weight pipe.

Form spacers shall be ASTM A-36 round stock.

Bolts shall be ASTM A325 high strength structural bolts.

Grout pipes shall be ASTM A-53 standard weight pipe or flex conduit as shown on the drawings.

Rock anchors shall develop strength equal to or greater than ASTM A-36 round stock.

Welding electrodes shall conform to AWS A5.1.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material equipment and tools to perform all operations in connection with the design, detail, fabrication and erection of the formwork and the fabrication and installation of grout pipes for the main concrete barrier.

The Contractor may, at his option submit an alternate design or modify the design shown on the drawings, subject to the approval of the Engineer. All designs must be supported by design calculations stamped and sealed by a registered professional engineer.

The Contractor shall furnish, fabricate and install all grout pipes and grout boxes for both the concrete barrier and the isolation walls.

3.2 Shop Drawings

The Contractor shall design and detail all formwork for the concrete barrier, complete with any required bracing and shoring for the concrete barrier as shown on the drawings, in accordance with ACI 318 and 347 and the AISC manual of steel construction.

The details shall incorporate provision for adjusting and modifying the formwork to suit the excavation. Excavation tolerances are given in Section 02222 Excavation.

The Contractor shall be responsible for verifying the excavation dimensions to develop the concrete formwork to fit the excavation.

Prior to fabrication, the Contractor shall submit shop drawings complete with supporting calculations for review/approval by the Engineer 30 days prior to initiating work. The contractor shall incorporate all Engineer's comments, revisions, resolve all questions and resubmit drawings for final approval prior to proceeding with fabrication.

3.3 Fabrication

The Contractor shall fabricate all formwork and ancillary items in accordance with the latest edition of the AISC Manual of Steel Construction and the approved detail drawings.

Formwork shall contain all inserts for grouting and pumping concrete. Sufficient valving shall be provided on inserts to allow shut off of concrete and grout to prevent back flow through the form work.

All welding shall be in accordance with AWS D1.1 structural welding code including operator and procedure certifications. Elements shall be welded using E-7018 low hydrogen electrodes. Panels shall be piece marked to correspond to the erection drawing(s) and sequence at fabrication.

3.4 Installation

3.4.1 Grout Pipes

The Contractor shall furnish, fabricate, and install all grout pipes and boxes as approved by the Engineer. Grout pipes and boxes shall be attached to the back surface using masonry anchors as shown on the drawings or other approved methods. Grout pipes shall be connected to the inserts installed in the permanent forms and securely fastened to the formwork. All grout pipes will be blown out with compressed air after installation and prior to closure of the formwork to assure they are clean and free from debris or obstructions. Grout pipes shall then be temporarily capped to prevent entry of foreign matter until ready for grouting. The Contractor shall apply masking tape to the grout box openings to prevent concrete infiltration during concrete placement.

3.4.2 Formwork

The steel formwork for the concrete barrier is to remain in place at completion of each segment of the barrier, therefore all formwork shall be free from oil, grease, rust, dirt, mud or other material that would prevent bonding by the concrete. Forms will not be oiled or receive application of release agent.

The Contractor shall install formwork at the locations shown on the drawings to the lines and grades shown. Forms are to be mortar tight. The Contractor shall adjust the formwork to suit the contour of the excavation. Rock may be trimmed or chipped to suit where interferences are encountered. Where overexcavation has occurred in excess of the designed-in adjustability of the formwork, modifications shall be proposed to the Engineer for his approval prior to installation. Installation of the formwork shall be reviewed and approved by the Engineer prior to proceeding with concrete installation.

The Contractor shall provide a sealant or gasket material on mating surfaces to provide mortar-tite joints.

3.5 Quality Control

The Contractor shall arrange for and contract with an approved third party inspector to provide inspection/testing services for the fabrication and installation of the formwork and ancillary items, as required by the QA/QC plan.

The Contractor shall furnish certified mill test reports for all materials utilized in the fabrication.

All welding shall be in accordance with AWS D1.1 structural welding code. The Contractor shall furnish welding operator and procedure certifications for all operators and procedures utilized.

Fabricated components shall be inspected for dimension and overall quality. Welds shall be inspected by an AWS certified welding inspector.

The inspector shall visually inspect the installation for fit-up and dimensionally for location.

3.6 Handling, Shipping, Storage

The Contractor shall handle, ship, and store fabricated components with care to avoid damage. Stored components shall be placed on timbers or pallets off the ground to keep the units clean. Components shall be tarped while in outdoor storage. Components that become spattered or contaminated with mud will be thoroughly cleaned before delivering to the mine for installation. Damaged components will be rejected by the inspector and replaced by the contractor at his cost.

End of section.

: 04008

Section 03300 - Cast-in-Place Concrete

Part 1 - General

1.1 Scope

This section includes:

- Cast-in-place concrete for concrete barrier
- Concrete mix design.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork

1.3 References

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete
ACI 318.1	Building Code Requirements for Structural Plain Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Standard Specification for Slump of Portland Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 186	Standard Test Method for Heath of Hydration of Hydraulic Cement
ASTM C 403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C 618	Fly ash and Raw or Calcined Natural Pozzolan for Use as an Admixture in Portland Cement Concrete

: 04009

ASTM D 2216	Standard Test Method for Laboratory Determination of Water (moisture) Content of Soil and Rock
USACE CRD-C 36	Method of Test for Thermal Diffusivity of Concrete
USACE CRD-C 48	Standard Test Method for Water Permeability of Concrete
API 10	Cements
NRMCA	Check List for Certification of Ready Mixed Concrete Production Facilities
NRMCA	Concrete Plant Standards

MOC Standards

WIPP-DOE-71	Design Criteria Waste Isolation Pilot Plant, Revised Mission Concept -- IIA (DOE, 1984)
WP 03-1	WIPP Startup and Acceptance Test Program (Westinghouse, 1993b)
WP 09-010	Design Development Testing (Westinghouse, 1991)
WP 09-CN3021	Component Numbering (Westinghouse, 1994a)
WP 09-024	Configuration Management Board/Engineering Change Proposal (**ECP**) (Westinghouse, 1994b)

1.4 Submittals for Review/Approval

The Contractor shall submit the following for approval 30 days prior to initiating any work at the site.

Specific sources of supply and detailed product information for each component of the concrete mix is specified in Section 2.6 below.

Product Data - Laboratory test data and trial mix data for the proposed concrete to be utilized for the concrete barrier.

Proposed method of installation, including equipment and materials in work plan.

1.5 Submittals at Completion

Laboratory test data developed during the installation of the concrete barrier.

1.6 Quality Assurance

Perform work in accordance with the Contractor's Quality Control Plan and referenced ACI and ASTM standards.

Acquire cement, aggregate and component materials from the same source throughout the work.

Part 2 - Products

2.1 Cement

Portland cement shall conform to API 10 Class H oil well cements. The source of the cement to be used shall be indicated and manufacturer's certification that the cement complies to the applicable standard shall be provided with each shipment.

2.2 Aggregates

Aggregates shall be quartz aggregates conforming to the requirements of ASTM C33.

Fine aggregate shall meet the requirements of ASTM C33 having a fineness modules in the range of 2.80 to 3.00.

Coarse aggregate maximum size shall be 1 ½ inches and shall be clean, cubical, angular, 100 percent crushed aggregate without flat or elongated particles.

The source of the aggregate is to be indicated and test reports certifying that the aggregate complies with the applicable standard are to be submitted for approval with the trial mix data.

2.3 Water

Water used in mixing concrete shall be of potable quality, free of injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

Water shall conform to the provisions in ASTM C94, and in addition, shall conform to the following:

- pH not less 6.0 or greater than 8.0
- Carbonates and/or bicarbonates of sodium and potassium: 1000 ppm maximum
- Chloride ions (C1): 250 ppm maximum
- Sulfate ions (SO_4): 1000 ppm maximum
- Iron content: 0.3 ppm maximum
- Total solids: 2000 ppm maximum

When ice is used in concrete mix, the water used for making ice shall meet all of the above requirements.

The source of water is to be indicated and certified copies of test data from an approved laboratory confirming that the water to be used meets the above requirements shall be submitted for approval with the trial mix data.

2.4 Admixtures

Pozzolan shall conform to ASTM C618. Sampling and testing of pozzolans shall conform to ASTM C311. Approximately 5 percent by weight of pozzolan may be used to replace cement in the mixes when approved.

The source of any admixtures proposed are to be indicated and certified copies of test data from an approved laboratory shall be submitted for approval with the trial mix.

2.5 Concrete Mix Properties

The Contractor shall develop and proportion a Salado Mass Concrete mix for use in constructing the concrete barrier. Cement utilized in the mix shall be Class H. The Contractor shall demonstrate by trial mix that the proposed concrete meets the following properties:

Target properties for Barrier Concrete

Property	Comment
4-hr working time	Indicated by 8-inch slump (ASTM C 142) after 3-hr intermittent mixing. Max 10-inch slump at mixing.
Nonsegregating	Aggregates do not readily separated from cement paste during handling
Less than 25°F heat rise prior to placement	Difference between initial condition and temperature after 4 hr.
4,500 psi compressive strength (f'_c)	At 28 days after casting (ASTM C39)
Volume stability	Length change between +0.05 percent and -0.02 percent (ASTM C 490)
Minimal entrained air	2 percent to 3 percent air

The Contractor shall provide certified copies of test data from an approved laboratory demonstrating compliance with the above target properties.

In addition to the target properties the Contractor shall provide certified test data for the trial mix for the following properties:

- Heat of hydration ASTM C-186
- Concrete Set ASTM C-403
- Thermal Diffusivity USACE CRD-C36
- Water Permeability USACE CRD-C43

2.6 Salado Mass Concrete

The Contractor shall utilize the Salado Mass concrete. The Contractor shall demonstrate that the Salado Mass concrete meets the target properties shown above. Recommended initial proportioning of the Salado Mass concrete is as follows:

Component	Percent of Total Mass
Class H Cement	4.93
Chem Comp III	2.85
Class F fly ash	6.82
Fine aggregate	33.58
Coarse aggregate	43.02
Sodium chloride	2.18
Defoaming agent	0.15
Sodium citrate	0.09
Water	6.38

The Contractor shall prepare a trial mix and provide certified test data from an approved testing laboratory for slump, compressive strength, heat rise, heat of hydration, concrete set time, thermal diffusivity, and water permeability as indicated above for the plain concrete mix.

Part 3 - Execution

3.1 General

The Contractor shall provide all labor material, equipment and tools necessary to develop, supply, mix, transport and place mass concrete in the forms as shown on the drawings and called for in these specifications

The Contractor will be required to provide and erect on the site a batch plant, suitable to store, handle, weight and deliver the proposed concrete mix. The batch plant shall be certified to NRMCA standards. The batch plant shall be erected on site in the location as directed by the Engineer.

The Contractor shall batch, mix, and deliver to the underground, sufficient quantity of concrete to complete placement of concrete within one form section, as shown on the drawings. Once begun, placement of concrete in a section shall be continuous until completed. The time for concreting one section will not exceed ten hours.

It is expected that addition of water to the dry materials and mixing of the concrete will occur at the ground surface with transport of wet concrete to a pump at the underground level where it will be pumped into the forms.

The Contractor is to provide all transport vehicles or means to transfer the wet concrete from the mixer truck to the pump. It is expected that the Contractor will use the waste conveyance hoist to transfer from the ground surface to the mine level. The Contractor is to familiarize himself with the dimensions of the waste conveyance and the airlock in order to provide suitable transport vehicles. The Contractor is also to familiarize himself with the capacity and speed of the conveyance to allow transfer of sufficient concrete to sustain the continuing placement of concrete. (See Figures G1-2 and G1-3, attached).

The Contractor shall determine the horizontal distance to the entry where placement of the concrete barrier is to occur, and develop a route, with the approval of the Engineer for traffic flow within the underground.

Details of the logistics for handling the concrete shall be included in the Contractors' Work Plan, and submitted to the Engineer for approval prior to start of work at the site.

Potential spill areas in the underground shall be identified by the Contractor in the Work Plan. The Contractor shall provide measures to contain and isolate any water from contact with the halite in these areas. Suitable containment isolation measures shall include but are not limited to, lining with a membrane material (PVC, hypalon, HDPE), draped curtains (polyethylene, PVC, etc.), corrugated sheet metal protective walls or a combination of these and other measures.

3.2 Pumping Concrete

The Contractor shall provide pumping equipment suitable for placing the concrete into the forms. The Contractor at a minimum, shall provide an operating and a spare pump, to be used in the event of breakdown of the primary unit. After transporting and prior to pumping the concrete shall be remixed to compensate for segregation of aggregate during transport. The Contractor shall indicate the equipment proposed for pumping (manufacturer, model, type, capacity, pressure and remixing at the point of delivery in the Work Plan).

Each batch of concrete shall be checked at the surface at the time of mixing and again at the point of transfer to the pump for slump and temperature, and shall conform to the following:

- Maximum slump at mixing - 10 inches
- Maximum slump at delivery to pump - 8 inches
- Maximum mix temperature at placement = 70°F

Note: No water is to be added to the mix after the initial mixing and slump are determined.

The Contractor shall connect to the pipe ports fabricated into the forms for delivery of the concrete, beginning with the lowest ports first. Pumping shall continue until concrete is seen in the adjacent port at which time the delivery hose will be transferred to that port and the first port capped.

Pumping shall continue moving laterally then upward until the entire form is filled and the pour is completed.

3.3 Coordination of Work

The Contractor is to coordinate his work mixing, transporting, and placing the mass concrete with the on-going operations in the underground. Coordination of use of the facilities and existing equipment shall be through the Engineer.

3.4 Clean-Up

No clean up or washing of equipment with water will be allowed in the underground. No free water spills are permitted in the underground. All clean-out or wash-out requiring water will be performed above ground at the location approved by the Engineer.

3.5 Quality Control

The Contractor shall provide a third-party quality control inspector at the site throughout the concrete placement. The inspector shall be responsible for determining that the batch plant is proportioning the mix according to the approved proportions. The batch plant shall provide a print out of batch quantities for each truck delivered to the mine. The inspector shall also determine the slump for each batch as it is mixed and allow additional water to be added until the initial slump is achieved. No additional water is to be added after this time. Temperature will also be recorded at this time.

The inspector shall also determine the slump and temperature following the remixing when concrete is transferred to the pump. Concrete not meeting or exceeding the specification is to be rejected and removed from the underground.

Concrete test cylinders to determine unconfined compression strength shall be taken by the inspection at the delivery from remixer to the pump in the underground. Four (4) cylinders shall be made for each 50 cubic yards of concrete placed. Cylinders shall be sealed with polyethylene and taped and field cured at ambient temperatures in the mine adjacent to the concrete barrier area. Two (2) samples shall be tested at 7 days and the remaining two (2) at 28 days.

End of section.

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1 **DIVISION 4 - MASONRY**

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Section 04100 - Mortar

Part 1 - General

1.1 Scope

This section includes:

- Mortar for Isolation Wall Construction.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 04300 - Unit Masonry System

1.3 References

ASTM C91	Standard Specification for Masonry Cement
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	Standard Specification for Mortar for Unit Masonry
ASTM C7805	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C1142	Ready-Mixed Mortar for Unit Masonry
ASTM E447	Test Methods for Compressive Strength of Masonry Prisms

1.4 Submittals for Review and Approval

The Contractor shall submit for approval the following 30 days prior to the initiation of work at the site:

Design mix.

Certified laboratory tests for the proposed design mix, indicating conformance of mortar to property requirements of ASTM C270, and test and evaluation reports to ASTM C780.

1.5 Submittals at Completion

Certified laboratory test results for the construction testing of mortar mix.

1.6 Quality Assurance

Perform work in accordance with the Contractor's Quality Control Plan and referenced ASTM standards. Acquire cement, aggregate, and component materials from the same source throughout the work.

1.7 Delivery Storage Handling

Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

Part 2 - Products

2.1 Mortar Mix

The Contractor shall provide mortar for Isolation Walls, which shall be in conformance with ASTM C270 type M, using the property specification (3,000 psi at 28 days).

Sand for mortar shall conform to ASTM C144.

Water used for mixing mortar shall be of potable quality, free of injurious amounts of oil, acid alkali, organic matter, sediments, or other deleterious substances, as specified for Concrete, Section 03300 2.3.

The supply of materials as defined in the design mix shall remain the same throughout the job.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material equipment and tools to perform all operations in connection with supplying and mixing mortar for constructing the isolation walls.

The Contractor shall fully describe his proposed mortar mixing operation, including proposed equipment and materials in the Work Plan.

3.2 Mortar Mixing

Mortar shall be machine-mixed with sufficient water to achieve satisfactory workability. Maintain sand uniformly damp immediately before the mixing process. If water is lost by evaporation, retemper only within one and one half hours of mixing. Use mortar within two hours of mixing at ambient temperature of 85° in the mine.

3.3 Installation

The Contractor shall install mortar to the requirements of Section 04300 Unit Masonry System.

3.4 Field Quality Control

The Contractor shall provide a third party Quality Control Inspector to perform all sampling and testing to confirm that the mortar mix conforms to the proposed mix properties developed in the design mix.

Construction testing of mortar mix shall be in accordance with ASTM C780 for compression strength. Four (4) prism specimens shall be taken for each 50 cu. ft. of mortar or fraction thereof placed each day.

End of Section.

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Section 04300 - Unit Masonry System

Part 1 - General

1.1 Scope

This section includes:

- Concrete Masonry Units

1.2 Related Sections

- 01010 Summary of Work
- 01400 Contractor Quality Control
- 01600 Material and Equipment
- 02722 Grouting
- 03100 Concrete Formwork
- 04100 Mortar

1.3 References

ASTM C55 Standard Specification for Concrete Building Brick

ASTM C140 Standard Method of Sampling and Testing Concrete Masonry Units

1.4 Submittals for Revision and Approval

The Contractor shall submit for approval the following 30 days prior to initiation of the work at the site.

Certified laboratory test results for the proposed solid masonry units.

1.5 Quality Assurance

Perform the work in accordance with the Contractor's Quality Control Plan.

Part 2 - Products

2.1 Concrete Masonry Units

Concrete masonry units shall be solid (no cavities or cores), load bearing high-strength units having a minimum compressive strength of 3500 psi. Concrete masonry units shall be tested in accordance with ASTM C140. All other aspects of the concrete masonry units shall comply with ASTM C55, Type I Moisture Controlled.

Nominal modular size shall be 8 x 8 x 16 inches, or as otherwise approved by the Engineer.

Concrete brick shall comply with ASTM C55, Grade N, Type I (moisture controlled) having a minimum compressive strength of 3500 psi (Avg. 3 units) or 3000 psi for individual unit.

2.2 Mortar

Mortar shall be as specified in Section 04100 Mortar.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor, material, equipment and tools to perform all operations of installing Unit Masonry Isolation Walls to the lines and grades shown on the drawings.

The Contractor shall examine the excavation of the entry to affirm that the keys have been properly leveled and cut to the appropriate depths, at the proper locations prior to any to any work.

3.2 Installation

The Contractor shall install the isolation walls using concrete masonry units as specified above. Masonry units shall be installed with 3/8-inch mortar joints with full mortar bedding and full head joints. Masonry units shall be installed in running bond with headers every third course. Masonry units shall be mortared tight to the ribs and the back wall to provide a seal all around the isolation wall.

Concrete brick may be used as required for fit-up around grout pipes, or minimizing the dimensional fit-up at the top or sides of the isolation walls as approved by the Engineer. The interface between the top of the isolation wall and the back wall shall be completely mortared to provide full contact between the back and the block wall.

3.3 Field Quality Control

The Contractor shall provide a third-party Quality Control Inspector to inspect the installation of the Concrete Masonry Unit Isolation Walls. Inspection and testing of the mortar shall be in accordance with Section 04100 Mortar.

End of Section

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FIGURES

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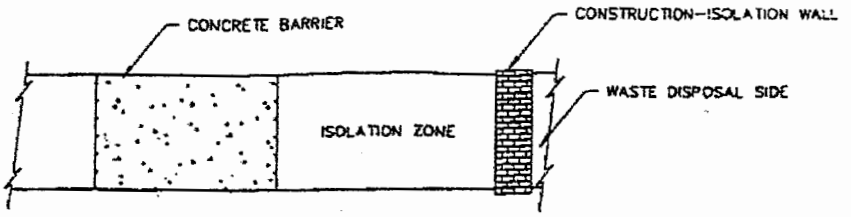
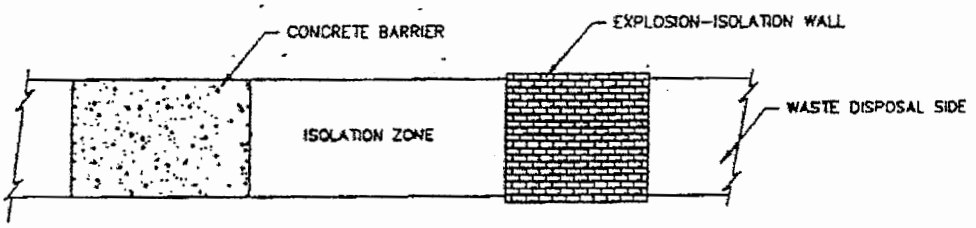


A. CONCRETE BARRIER WITHOUT DRZ REMOVED AND CONSTRUCTION ISOLATION WALL



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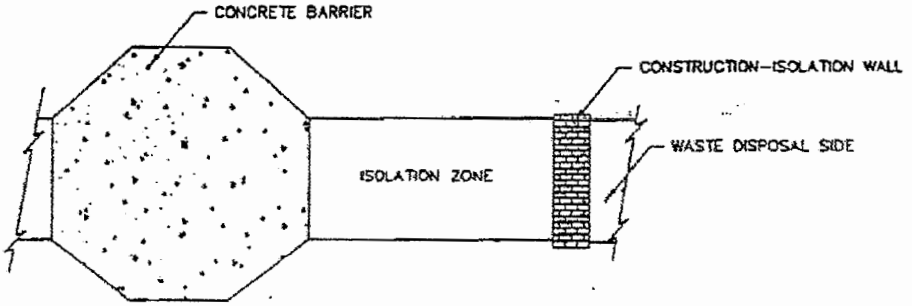

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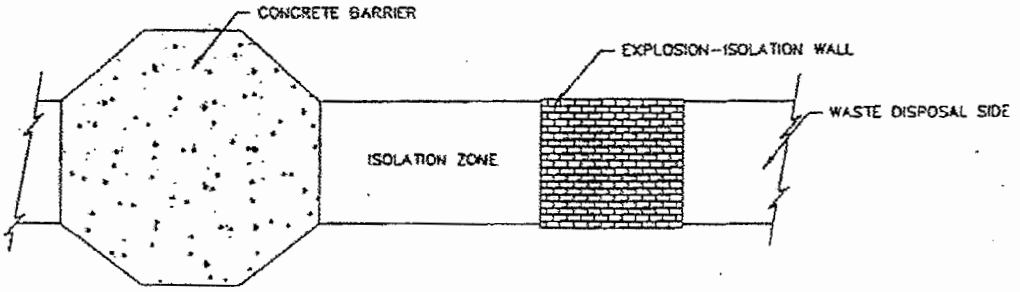

D. CONCRETE BARRIER WITH DRZ REMOVED AND EXPLOSION ISOLATION WALL

Figure G1G-1
Plan Variations

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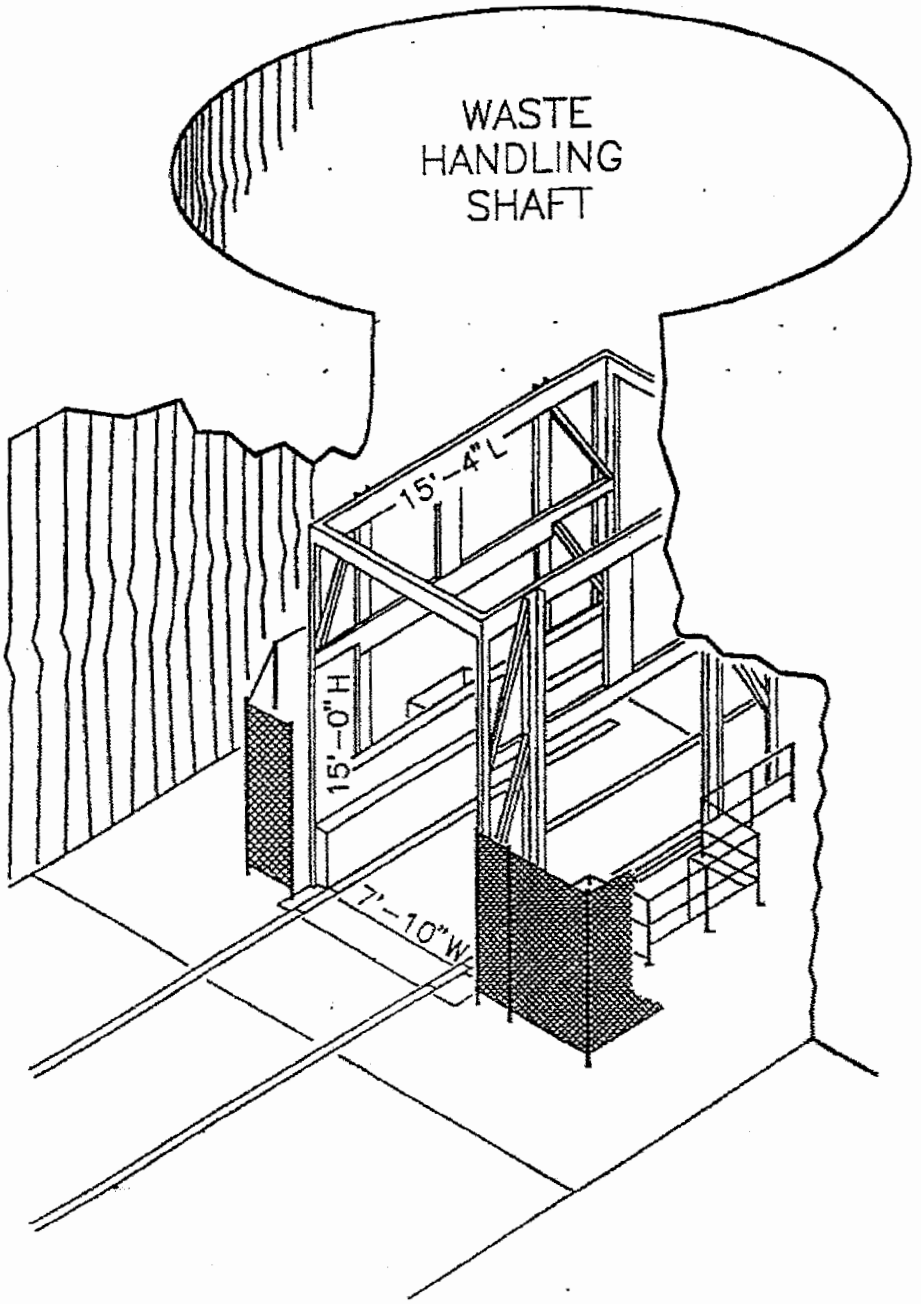

Figure G1G-2
Waste Handling Shaft Cage Dimensions

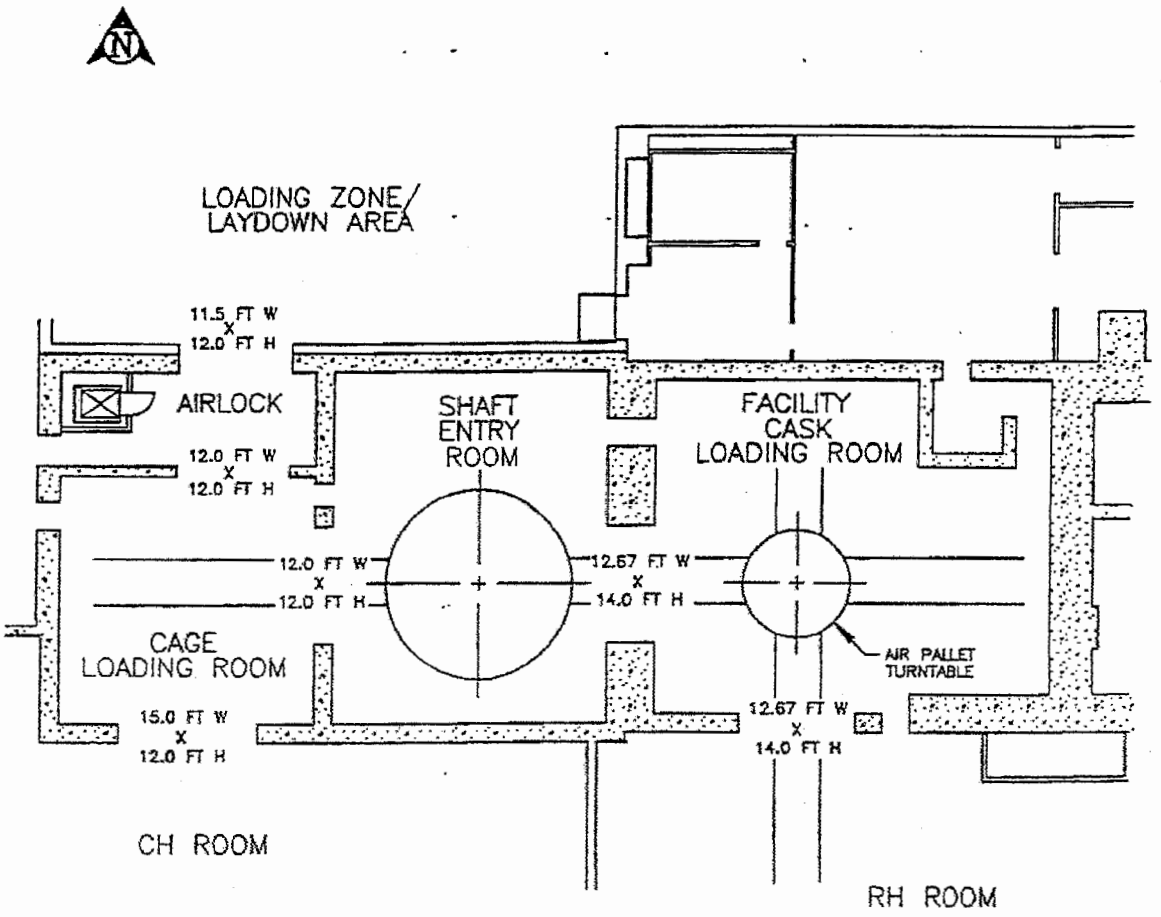

Figure G1G-3
Waste Shaft Collar and Airlock Arrangement

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ATTACHMENT G1
APPENDIX H

DESIGN DRAWINGS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

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ATTACHMENT G1
APPENDIX H

DESIGN DRAWINGS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

Drawing	Title
762447-E1	Panel closure system, air intake and exhaust drifts, title sheet
762447-E2	Panel closure system, underground waste-emplacement panel plan
762447-E3	Panel closure system, air intake drift, construction details
762447-E4	Panel closure system, air exhaust drift, construction details
762447-E5	Panel closure system, construction and explosion walls, construction details
762447-E6	Panel closure system, air intake and exhaust drifts, grouting and miscellaneous details

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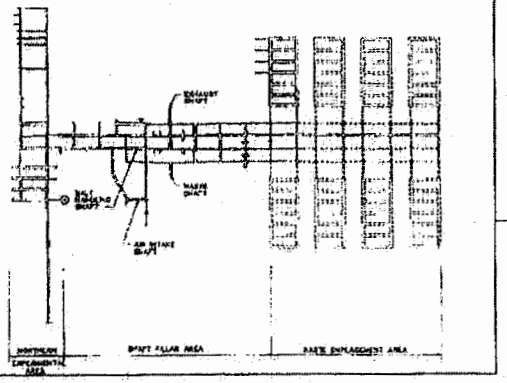
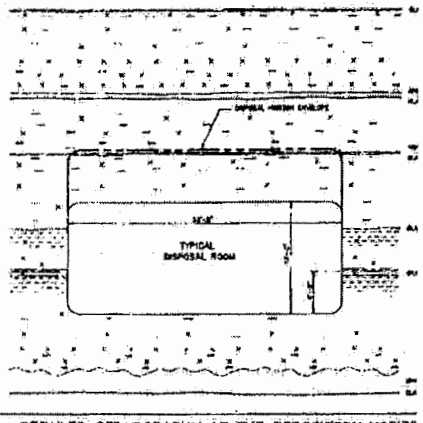


UNDERGROUND REPOSITORY LAYOUT PLAN

762447-E1	TITLE SHEET
762447-E2	UNDERGROUND WASTE DISPOSAL PANEL--PLAN
762447-E3	PANEL CLOSURE SYSTEM--AIR INTAKE DRIFT--CONSTRUCTION DETAILS
762447-E4	PANEL CLOSURE SYSTEM--AIR EXHAUST DRIFT--CONSTRUCTION DETAILS
762447-E5	PANEL CLOSURE SYSTEM--CONSTRUCTION AND EXPLOSION WALLS--CONSTRUCTION DETAILS
762447-E6	PANEL CLOSURE SYSTEM--AIR ENTRANCE AND EXHAUST DRIFT GROUTING AND MISCELLANEOUS DETAILS

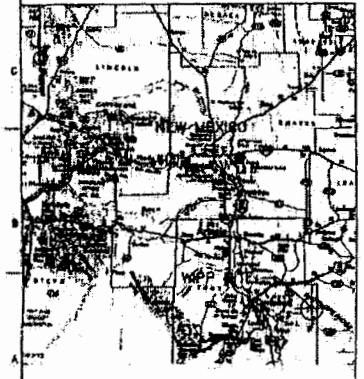


DETAILED STRATIGRAPHY AT THE REPOSITORY HORIZO

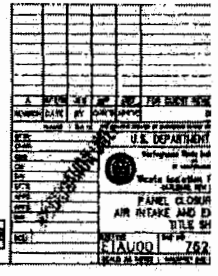
WASTE ISOLATION PILOT PLANT
PANEL CLOSURE SYSTEM
CARLSBAD, NEW MEXICO

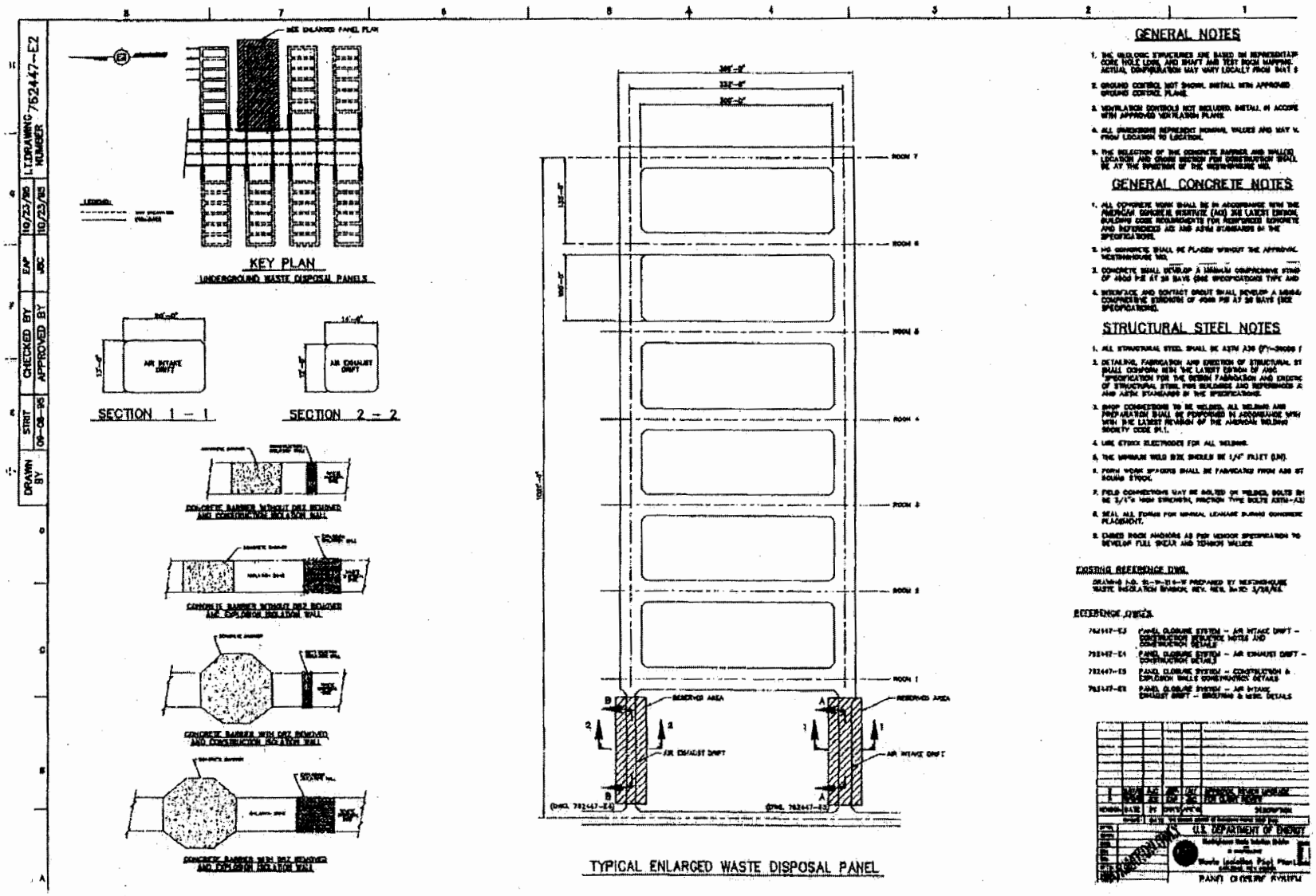
prepared by

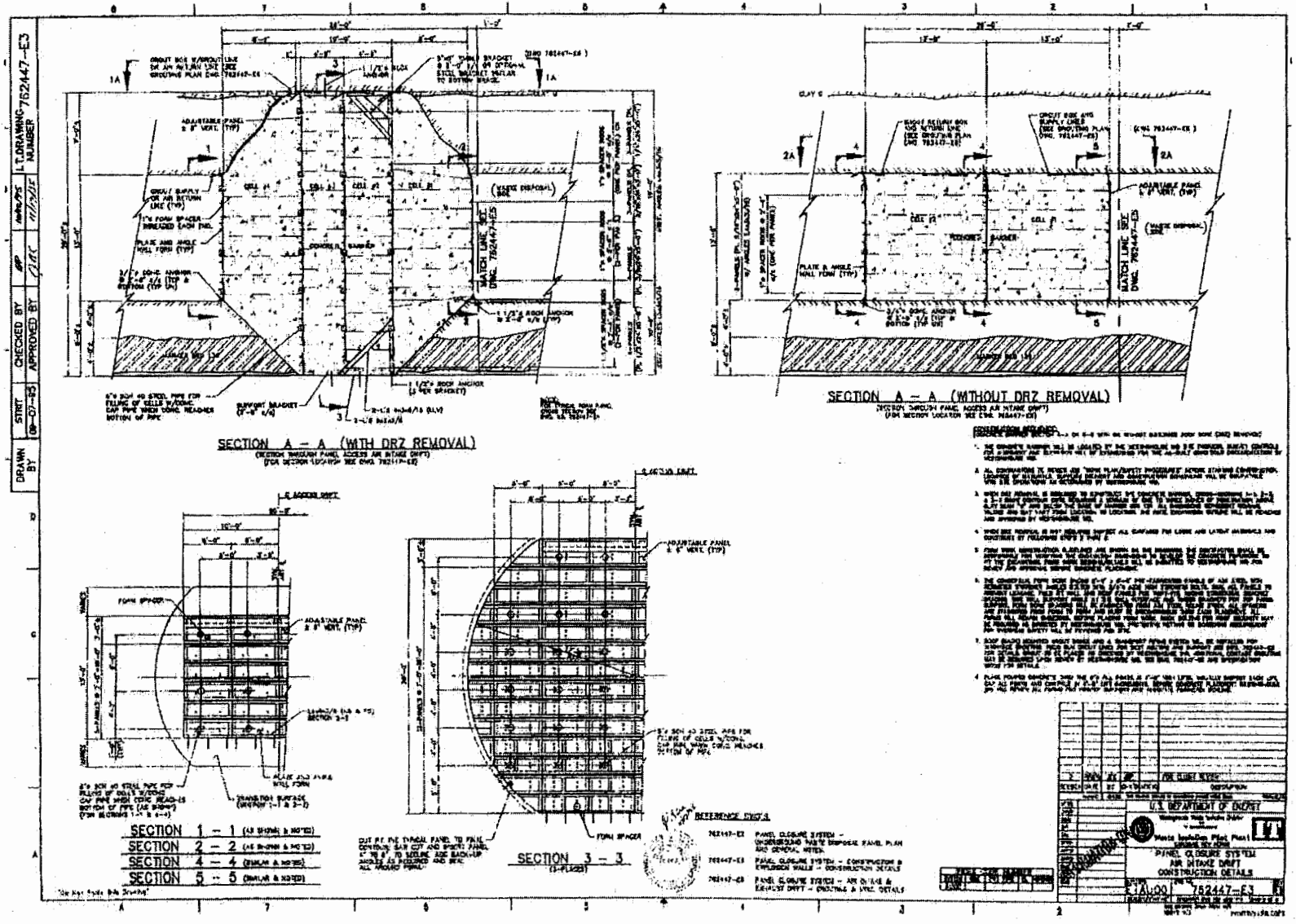
IT CORPORATION
ALBUQUERQUE, NEW MEXICO



GENERAL LOCATION MAP




KEY PLAN
UNDERGROUND WASTE DISPOSAL PANELS
SECTION 1 – 1
SECTION 2 – 2
AIR INTAKE DRIFT
AIR EXHAUST DRIFT
TYPICAL ENLARGED WASTE DISPOSAL PANEL
ROOM 7
ROOM 6
ROOM 5
ROOM 4
ROOM 3
ROOM 2
ROOM 1
RESERVED AREA
GENERAL NOTES
GENERAL CONCRETE NOTES
STRUCTURAL STEEL NOTES
EXISTING REFERENCE DWG.
REFERENCE DWGS.
U.S. DEPARTMENT OF ENERGY
PANEL CLOSURE SYSTEM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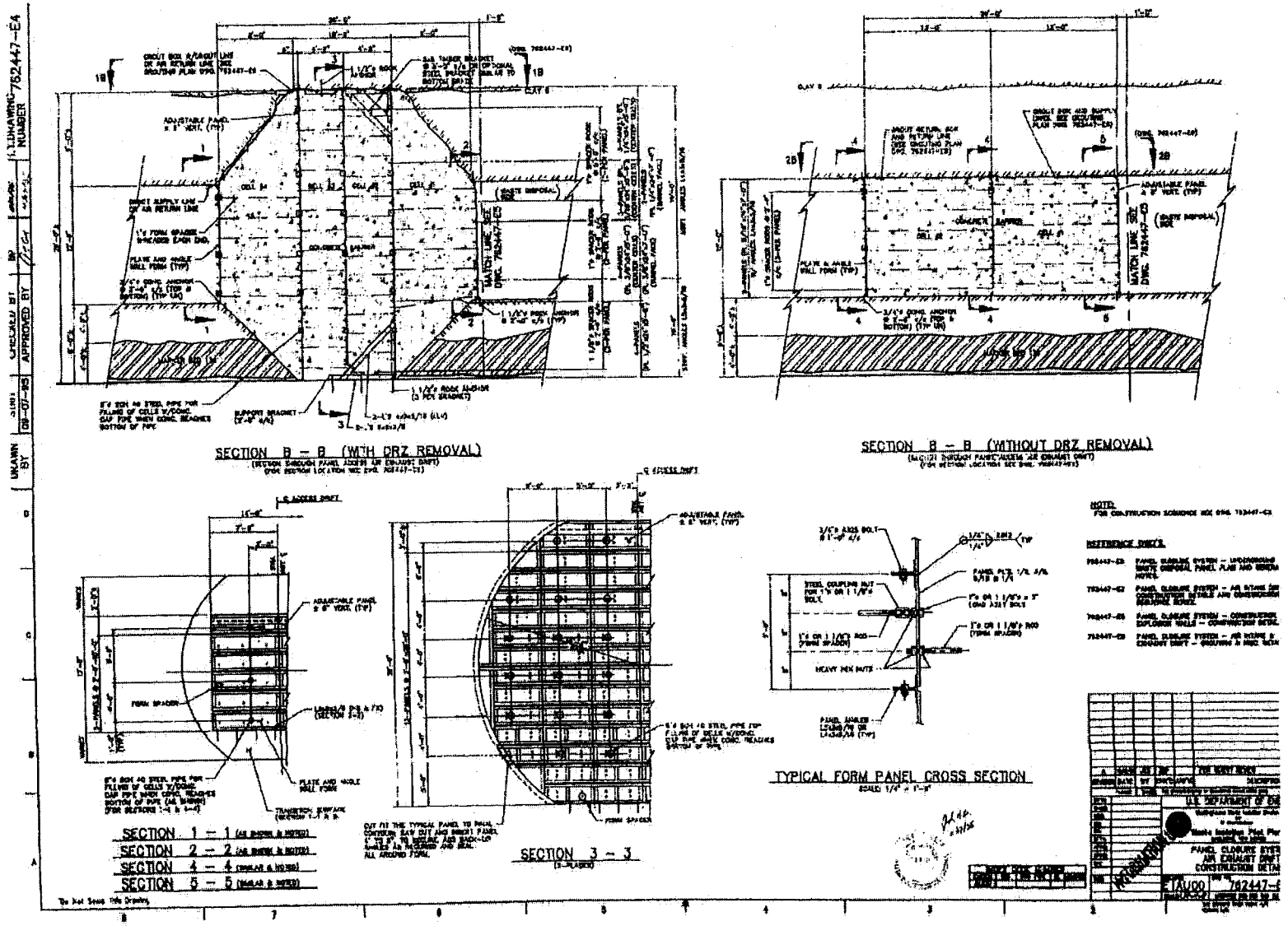
SECTION A – A (WITHOUT DRZ REMOVAL)
SECTION 1 – 1
SECTION 2 – 2
SECTION 4 – 4
SECTION 5 – 5
SECTION 3 – 3
PANEL CLOSURE SYSTEM
AIR INTAKE DRIFT
CONSTRUCTION DETAILS
U.S. DEPARTMENT OF ENERGY
Waste Isolation Pilot Plant
DRAWN BY
START
CHECKED BY
APPROVED BY
I.T. DRAWING NUMBER
752447-E3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SECTION B – B (WITHOUT DRZ REMOVAL)
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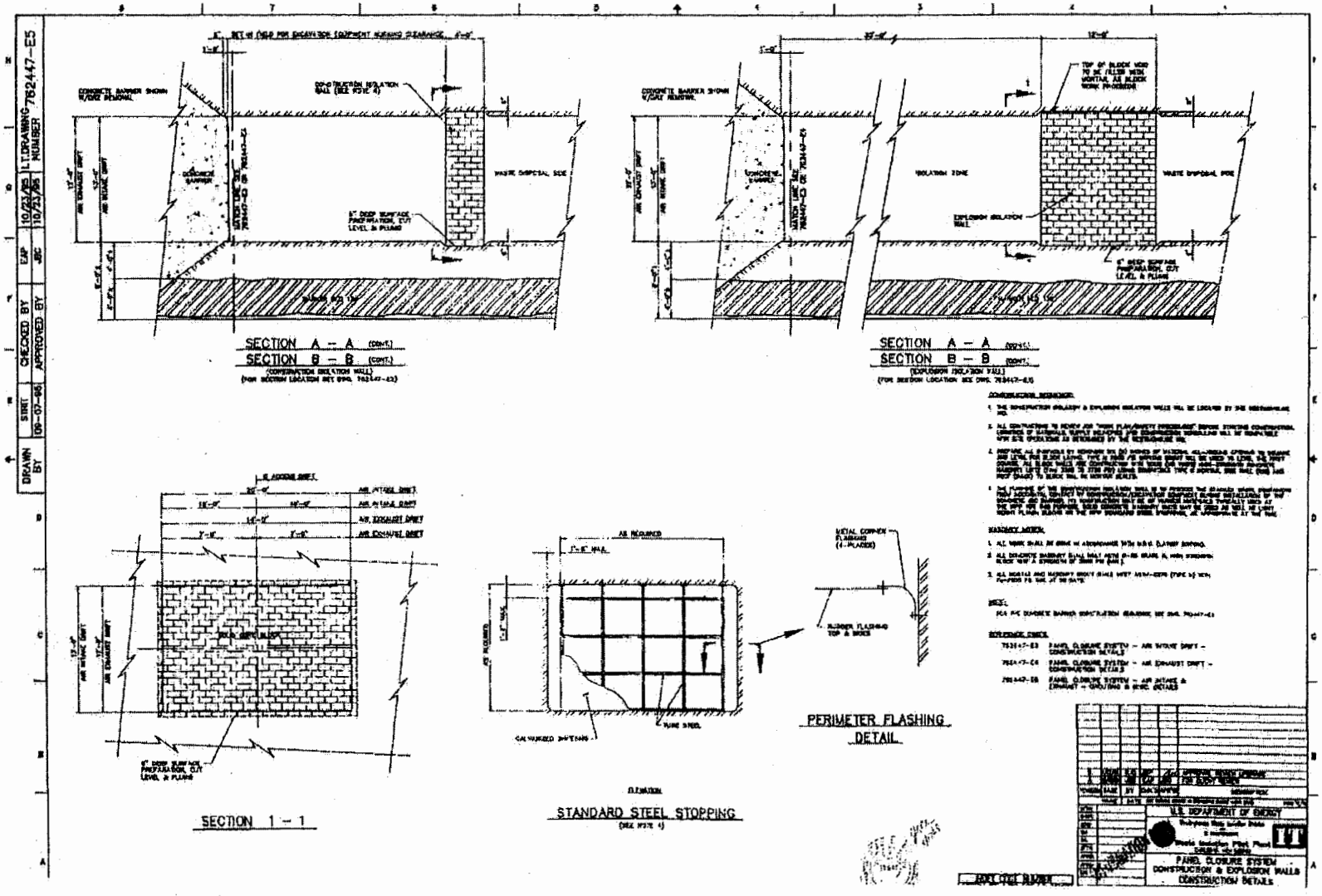
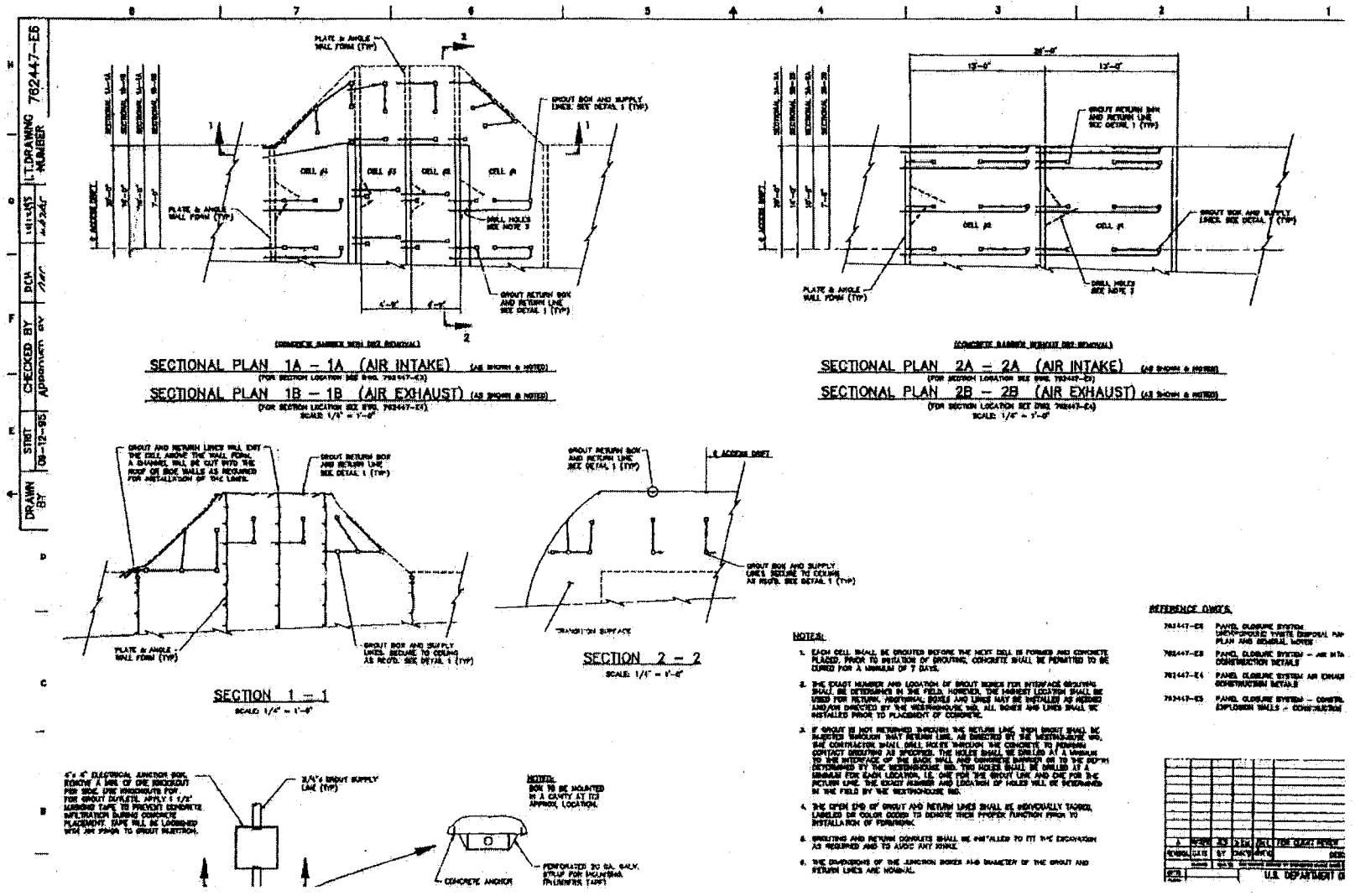
SECTION 2 – 2
SECTION 4 – 4
SECTION 5 – 5
SECTION 3 – 3
TYPICAL FORM PANEL CROSS SECTION


SECTION A – A (CONT.)
SECTION B – B (CONT.)
SECTION A – A
SECTION B – B
SECTION 1 – 1
STANDARD STEEL STOPPING
PERIMETER FLASHING DETAIL
U.S. DEPARTMENT OF ENERGY
PANEL CLOSURE SYSTEM
CONSTRUCTION & EXPLOSION WALLS
CONSTRUCTION DETAILS


T.DRAWING NUMBER 762447-E6
CHECKED BY
DRAWN BY
SECTIONAL PLAN 1A – 1A (AIR INTAKE)
SECTIONAL PLAN 1B – 1B (AIR EXHAUST)
SECTIONAL PLAN 2A – 2A (AIR INTAKE)
SECTIONAL PLAN 2B – 2B (AIR EXHAUST)
SECTION 1 – 1
SECTION 2 – 2
NOTES:
REFERENCE DWGS.

ATTACHMENT G2

WASTE ISOLATION PILOT PLANT
SHAFT SEALING SYSTEM COMPLIANCE
SUBMITTAL DESIGN REPORT

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ATTACHMENT G2

WASTE ISOLATION PILOT PLANT
SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

ADAPTED FROM:

SAND96-1326/1
DISTRIBUTION UNLIMITED
RELEASE CATEGORY UC-721
PRINTED AUGUST 1996

WASTE ISOLATION PILOT PLANT
SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

VOLUME 1 OF 2: MAIN REPORT
APPENDICES A AND B

REPOSITORY ISOLATION SYSTEMS DEPARTMENT
SANDIA NATIONAL LABORATORIES
ALBUQUERQUE, NM 87185

Abstract

This report describes a shaft sealing system design for the Waste Isolation Pilot Plant (WIPP), a proposed nuclear waste repository in bedded salt. The system is designed to limit entry of water and release of contaminants through the four existing shafts after the WIPP is decommissioned. The design approach applies redundancy to functional elements and specifies multiple, common, low-permeability materials to reduce uncertainty in performance. The system comprises 13 elements that completely fill the shafts with engineered materials possessing high density and low permeability. Laboratory and field measurements of component properties and performance provide the basis for the design and related evaluations. Hydrologic, mechanical, thermal, and physical features of the system are evaluated in a series of calculations. These evaluations indicate that the design guidance is addressed by effectively limiting transport of fluids within the shafts, thereby limiting transport of hazardous material to regulatory boundaries. Additionally, the use or adaptation of existing technologies for placement of the seal components combined with the use of available, common materials assure that the design can be constructed.

This report was modified to make it a part of the RCRA Facility Permit issued by the New Mexico Environment Department (NMED). The modifications included removal of Appendices C and D from the original document. Although they were important to demonstrate compliance with the performance standards in the hazardous waste regulations, they do not provide plans or procedures that will be implemented under the authority of the Permit. Appendices A, B and E are retained as Attachments to the Permit (Attachments G2-A, G2-B and G2-E). The Figures

: 04042

in this report, which were interspersed in the text in the original document, have been moved to a common section following the References.

Acknowledgments

The work presented in this document represents the combined effort of a number of individuals at Sandia National Laboratories, Parsons Brinckerhoff (under contract AG-4909), INTERA (under contract AG-4910), RE/SPEC (under contract AG-4911), and Tech Reps. The Sandian responsible for the preparation of each section of the report and the lead individual(s) at firms under contract to Sandia that provided technical expertise are recognized below.

Section	Author(s)
Executive Summary	F. D. Hansen, Sandia
Section 1, Introduction	J. R. Tillerson, Sandia
Section 2, Site Geologic, Hydrologic, & Geochemical Setting	A. W. Dennis and S. J. Lambert, Sandia
Section 3, Design Guidance	A. W. Dennis, Sandia
Section 4, Design Description	A. W. Dennis, Sandia
Section 5, Material Specifications	F. D. Hansen, Sandia
Section 6, Construction Techniques	E. H. Ahrens, Sandia
Section 7, Structural Analyses of Shaft Seals	L. D. Hurtado, Sandia; M. C. Loken and L.L. Van Sambeek, RE/SPEC
Section 8, Hydrologic Evaluation of the Shaft Seal System	M. K. Knowles, Sandia; V.A. Kelley, INTERA
Section 9, Conclusions	J. R. Tillerson and A. W. Dennis, Sandia
Appendix A, Material Specifications	F. D. Hansen, Sandia
Appendix B, Shaft Sealing Construction Procedures	E. H. Ahrens, Sandia, with the assistance of Parsons Brinckerhoff Construction and Scheduling staff
Appendix C, Fluid Flow Analyses	M. K. Knowles, Sandia; V.A. Kelley, INTERA
Appendix D, Structural Analyses	L. D. Hurtado, Sandia; M. C. Loken and L. L. Van Sambeek, RE/SPEC

Appendix E, Design Drawings	A. W. Dennis, Sandia; C. D. Mann, Parsons Brinckerhoff, with the assistance of the Parsons Brinckerhoff Design staff

Design reviews provided by Malcolm Gray, Atomic Energy Canada Ltd., Whiteshell Laboratory; Stephen Phillips, Phillips Mining, Geotechnical & Grouting, Inc.; and John Tinucci, Itasca Consulting Group. Inc. are appreciated, as are document reviews provided by Don Galbraith, U.S. Department of Energy Carlsbad Area Office; William Thompson, Carlsbad Area Office Technical Assistance Contractor; Robert Stinebaugh, Palmer Vaughn, Deborah Coffey, and Wendell Weart, Sandia.

T. P. Peterson and S. B. Kmetz, Tech Reps, served as technical editors of this document.

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ACRONYMS

AIS	Air Intake Shaft
AMM	asphalt mastic mix
CFR	Code of Federal Regulations
DOE	Department of Energy
DRZ	disturbed rock zone
EPA	Environmental Protection Agency
HMAC	hot mix asphalt concrete
MDCF	Multimechanism Deformation Coupled Fracture
MD	Munson-Dawson
NMED	New Mexico Environment Department
NMVP	No Migration Variance Petition
PA	performance assessment
PTM	Plug Test Matrix
QA	quality assurance
SMC	Salado Mass Concrete
SPVD	Site Preliminary Design Validation
SSSPT	Small Scale Seal Performance Test
SWCF	Sandia WIPP Central Files
TRU	transuranic
WIPP	Waste Isolation Pilot Plant

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Executive Summary

Introduction

This report documents a shaft seal system design developed as part of a submittal to the Environmental Protection Agency (**EPA**) and the New Mexico Environment Department (**NMED**) that will demonstrate regulatory compliance of the Waste Isolation Pilot Plant (**WIPP**) for disposal of transuranic waste. The shaft seal system limits entry of water into the repository and restricts the release of contaminants. Shaft seals address fluid transport paths through the opening itself, along the interface between the seal material and the host rock, and within the disturbed rock surrounding the opening. The entire shaft seal system is described in this Permit Attachment and its three appendices, which include seal material specifications, construction methods, rock mechanics analyses, fluid flow evaluations, and the design drawings. The design represents a culmination of several years of effort that has most recently focused on providing to the EPA and NMED a viable shaft seal system design. Sections of this report and the appendices explore function and performance of the WIPP shaft seal system and provide well documented assurance that such a shaft seal system could be constructed using available materials and methods. The purpose of the shaft seal system is to limit fluid flow within four existing shafts after the repository is decommissioned. Such a seal system would not be implemented for several decades, but to establish that regulatory compliance can be achieved at that future date, a shaft seal system has been designed that exhibits excellent durability and performance and is constructable using existing technology. The design approach is conservative, applying redundancy to functional elements and specifying various common, low-permeability materials to reduce uncertainty in performance. It is recognized that changes in the design described here will occur before construction and that this design is not the only possible combination of materials and construction strategies that would adequately limit fluid flow within the shafts.

Site Setting

One of the U.S. Department of Energy's (**DOE's**) site selection criteria is a favorable geologic setting which minimizes fluid flow as a transport mechanism. Groundwater hydrology in the proximity of the WIPP site is characterized by geologic strata with low transmissivity and low hydrologic gradients, both very positive features with regard to sealing shafts. For purposes of performance evaluations, hydrological analyses divide lithologies and requirements into the Rustler Formation (and overlying strata) and the Salado Formation, comprised mostly of salt. The principal design concern is fluid transport phenomena of seal materials and lithologies within the Salado Formation. The rock mechanics setting is an important consideration in terms of system performance. Rock properties affect hydrologic response of the shaft seal system. The stratigraphic section contains lithologies that exhibit brittle and ductile behavior. A zone of rock around the shafts is disturbed owing to the creation of the opening. The disturbed rock zone (**DRZ**) is an important design consideration because it possesses higher permeability than intact rock. Host rock response and its potential to fracture, flow, and heal around WIPP shaft openings are relevant to the performance of the shaft seal system.

Design Guidance

Use of both engineered and natural barriers to isolate wastes from the accessible environment is required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.601) and 40 CFR §191.14(d). The use of engineered barriers to prevent or substantially delay movement of water,

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hazardous constituents, or radionuclides toward the accessible environment is required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.601) and 40 CFR §194.44. Hazardous constituent release performance standards are specified in Permit Part 5 and 20.4.1.500 NMAC (incorporating 40 CFR §§264.111(b), 264.601(a), and 264 Subpart F). Radionuclide release limits are specified in 40 CFR §191 for the entire repository system (EPA, 1996a; 1996b). Design guidance for the shaft seal system addresses the need for the WIPP to comply with system requirements and to follow accepted engineering practices using demonstrated technology. Design guidance is categorized below:

- limit hazardous constituents reaching regulatory boundaries,
- restrict groundwater flow through the sealing system,
- use materials possessing mechanical and chemical compatibility,
- protect against structural failure of system components,
- limit subsidence and prevent accidental entry, and
- utilize available construction methods and materials.

Discussions of the design presented in the text of this report and the details presented in the appendices respond to these qualitative design guidelines. The shaft seal system design was completed under a Quality Assurance program that includes review by independent, qualified experts to assure the best possible information is provided to the DOE on selection of engineered barriers (40 CFR §194.27). Technical reviewers examined the complete design including conceptual, mathematical, and numerical models and computer codes (40 CFR §194.26). The design reduces the impact of uncertainty associated with any particular element by using multiple sealing system components and by using components constructed from different materials.

Design Description

The shaft sealing system comprises 13 elements that completely fill the shaft with engineered materials possessing high density and low permeability. Salado Formation components provide the primary regulatory barrier by limiting fluid transport along the shaft during and beyond the 10,000-year regulatory period. Components within the Rustler Formation limit commingling between brine-bearing members, as required by state regulations. Components from the Rustler to the surface fill the shaft with common materials of high density, consistent with good engineering practice. A synopsis of each component is given below.

Shaft Station Monolith. At the bottom of each shaft a salt-saturated concrete monolith supports the local roof. A salt-saturated concrete, called Salado Mass Concrete (**SMC**), is specified and is placed using a conventional slickline construction procedure where the concrete is batched at the surface. SMC has been tailored to match site conditions. The salt-handling shaft and the waste-handling shaft have sumps which also will be filled with salt-saturated concrete as part of the monolith.

Clay Columns. A sodium bentonite is used for three compacted clay components in the Salado and Rustler Formations. Although alternative construction specifications are viable, labor-intensive placement of compressed blocks is specified because of proven performance. Clay columns effectively limit brine movement from the time they are placed to beyond the 10,000-year regulatory period. Stiffness of the clay is sufficient to promote healing of fractures in the surrounding rock salt near the bottom of the shafts, thus removing the proximal DRZ as a

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potential pathway. The Rustler clay column limits brine communication between the Magenta and Culebra Members of the Rustler Formation.

Concrete-Asphalt Waterstop Components. Concrete-asphalt waterstop components comprise three elements: an upper concrete plug, a central asphalt waterstop, and a lower concrete plug. Three such components are located within the Salado Formation. These concrete-asphalt waterstop components provide independent shaft cross-section and DRZ seals that limit fluid transport, either downward or upward. Concrete fills irregularities in the shaft wall, while use of the salt-saturated concrete assures good bonding with salt. Salt creep against the rigid concrete components establishes a compressive stress state and promotes early healing of the salt DRZ surrounding the concrete plugs. The asphalt intersects the shaft cross section and the DRZ.

Compacted Salt Column. Each shaft seal includes a column of compacted WIPP salt with 1.5 percent weight water added to the natural material. Construction demonstrations have shown that mine-run WIPP salt can be dynamically compacted to a density equivalent to approximately 90% of the average density of intact Salado salt. The remaining void space is removed through consolidation caused by creep closure. The salt column becomes less permeable as density increases. The location of the compacted salt column near the bottom of the shaft assures the fastest achievable consolidation of the compacted salt column after closure of the repository. Analyses indicate that the salt column becomes an effective long-term barrier in under 100 years.

Asphalt Column. An asphalt-aggregate mixture is specified for the asphalt column, which bridges the Rustler/Salado contact and provides a seal essentially impermeable to brine for the shaft cross-section and the shaft wall interface. All asphalt is placed with a heated slickline.

Concrete Plugs. A concrete plug is located just above the asphalt column and keyed into the surrounding rock. Mass concrete is separated from the cooling asphalt column with a layer of fibercrete, which permits work to begin on the overlying clay column before the asphalt has completely cooled. Another concrete plug is located near the surface, extending downward from the top of the Dewey Lake Redbeds.

Earthen Fill. The upper shaft is filled with locally available earthen fill. Most of the fill is dynamically compacted (the same method used to construct the salt column) to a density approximating the surrounding lithologies. The uppermost earthen fill is compacted with a sheepsfoot roller or vibratory plate compactor.

Structural Analysis

Structural issues pertaining to the shaft seal system have been evaluated. Mechanical, thermal, physical, and hydrological features of the system are included in a broad suite of structural calculations. Conventional structural mechanics applications would normally calculate load on system elements and compare the loads to failure criteria. Several such conventional calculations have been performed and show that the seal elements exist in a favorable, compressive stress state that is low in comparison to the strength of the seal materials. Thermal analyses have been performed to examine the effects of concrete heat of hydration and heat transfer for asphalt elements. Coupling between damaged rock and fluid flow and between the density and permeability of the consolidating salt column is evaluated within the scope of structural calculations. The appendices provide descriptions of various structural calculations

conducted as part of the design study. The purpose of each calculation varies; however, the calculations generally address one or more of the following concerns: (1) stability of the component, (2) influences of the component on hydrological properties of the seal and surrounding rock, or (3) construction methods. Stability calculations address:

- potential for thermal cracking of concrete;
- structural loads on seal components resulting from salt creep, gravity, swelling clay, dynamic compaction, or possible repository-generated gas pressures.

Structural calculations defining input conditions to hydrological calculations include:

- spatial extent of the DRZ within the Salado Formation salt beds as a function of depth, time, and seal material;
- fracturing and DRZ development within Salado Formation interbeds;
- shaft-closure induced consolidation of compacted salt columns; and
- impact of pore pressures on salt consolidation.

Construction analyses examine:

- placement and structural performance of asphalt waterstops, and
- potential subsidence reduction through backfilling the shaft station areas.

Structural calculations model shaft features including representation of the host rock and its damaged zone as well as the seal materials themselves. Two important structural calculations discussed below are unique to shaft seal applications.

DRZ Behavior. The development and subsequent healing of a DRZ that forms in the rock mass surrounding the WIPP shafts is a significant concern in the seal design. It is well known that a DRZ will develop in rock salt adjacent to the shaft upon excavation. Placement of rigid components in the shaft promotes healing within the salt DRZ as seal elements restrain inward creep and reduce the stress difference. Two computer models to calculate development and extent of the salt DRZ are used. The first model uses a ratio of stress invariants to predict fracture; the second approach uses a damage stress criterion. The temporal and spatial extent of the DRZ along the entire shaft length is evaluated. Several analyses are performed to examine DRZ behavior of the rock salt surrounding the shaft. The time-dependent DRZ development and subsequent healing in the Salado salt surrounding each of the four seal materials are considered. All seal materials below a depth of about 300 m provide sufficient rigidity to heal the DRZ, a phenomenon that occurs quickly around rigid components near the shaft bottom. An extensive calculation is made of construction effects on the DRZ during placement of the asphalt-concrete waterstops. The time-dependent development of the DRZ within anhydrite and polyhalite interbeds of the Salado Formation is calculated. For all interbeds, the factor of safety against shear or tensile fracturing increases with depth into the rock surrounding the shaft wall. These results indicate that a continuous DRZ will not develop in nonsalt Salado rocks. Rock mechanics analysis also determines which of the near surface

lithologies fracture in the proximity of the shaft. Results from these rock mechanics analyses are used as input conditions for the fluid-flow analyses.

Compacted Salt Behavior. Unique application of crushed salt as a seal component required development of a constitutive model for salt reconsolidation. The model developed includes a nonlinear elastic component and a creep consolidation component. The nonlinear elastic modulus is density-dependent, based on laboratory test data performed on WIPP crushed salt. Creep consolidation behavior of crushed salt is based on three candidate models whose parameters are obtained from model fitting to hydrostatic and shear consolidation test data gathered for WIPP crushed salt. The model for consolidating crushed salt is used to predict permeability of the salt column. The seal system prevents fluid transport to the consolidating salt column to ensure that pore pressure does not unacceptably inhibit the reconsolidation process. Calculations made to estimate fractional density of the crushed salt seal as a function of time, depth, and pore pressure show consolidation time increases as pore pressure increases, as expected. At a constant pore pressure of one atmosphere, compacted salt will increase from its initial fractional density of 90% to 96% within 40, 80, and 120 years after placement at the bottom, middle, and top of the salt component, respectively. At a fractional density of 96%, the permeability of reconsolidating salt is approximately 10^{-18} m^2. A pore pressure of 2 MPa increases times required to achieve a fractional density of 96% to 92 years, 205 years, and 560 years at the bottom, middle, and top of the crushed salt column, respectively. A pore pressure of 4 MPa would effectively prevent reconsolidation of the crushed salt within 1,000 years. Fluid flow calculations show only minimal transport of fluids to the salt column, so pore pressure equilibrium in the consolidating salt does not occur before low permeabilities (~10^{-18} m^2) are achieved.

Hydrologic Evaluations

The ability of the shaft seal system to satisfy design guidance is determined by the performance of the actual seal components within the physical setting in which they are constructed. Important elements of the physical setting are hydraulic gradients of the region, properties of the lithologic units surrounding a given seal component, and potential gas generation within the repository. Hydrologic evaluations focus on processes that could result in fluid flow through the shaft seal system and the ability of the seal system to limit any such flow. Transport of radiological or hazardous constituents will be limited if the carrier fluids are similarly limited. Physical processes that could impact seal system performance have been incorporated into four models. These models evaluate: (1) downward migration of groundwater from the Rustler Formation, (2) gas migration and reconsolidation of the crushed salt seal component, (3) upward migration of brines from the repository, and (4) flow between water-bearing zones in the Rustler Formation.

Downward Migration of Rustler Groundwater. The shaft seal system is designed to limit groundwater flowing into and through the shaft sealing system. The principal source of groundwater to the seal system is the Culebra Member of the Rustler Formation. No significant sources of groundwater exist within the Salado Formation; however, brine seepage has been noted at a number of the marker beds and is included in the models. Downward migration of Rustler groundwater is limited to ensure that liquid saturation of the compacted salt column does not impact the consolidation process and to limit quantities of brine reaching the repository horizon. Consolidation of the compacted salt column will be most rapid immediately following seal construction. Simulations conducted for the 200-year period following closure demonstrate that, during this initial period, downward migration of Rustler groundwater is insufficient to

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impact the consolidation process. Rock mechanics analyses show that this period encompasses the reconsolidation process. Lateral migration of brine through the marker beds is quantified in the analysis and shown to be inconsequential. At steady-state, the flow rate is most dependent on permeability of the system. Potential flow paths within the seal system consist of the seal material, an interface with the surrounding rock, and the host rock DRZ. Low permeability is specified for the engineered materials, and construction methods ensure a tight interface. Thus the flow path most likely to impact performance is the DRZ. Effects of the DRZ and sensitivity of the seal system performance to both engineered and host rock barriers show that the DRZ is successfully mitigated by the proposed design.

Gas Migration and Salt Column Consolidation. A multi-phase flow model of the lower seal system evaluates the performance of components extending from the middle concrete-asphalt waterstop located at the top of the salt column to the repository horizon for 200 years following closure. During this time period, the principal fluid sources to the model consist of potential gas generated by the waste and lateral brine migration within the Salado Formation. The predicted downward migration of a small quantity of Rustler groundwater (discussed above) is included in this analysis. Effects of gas generation are evaluated for three different repository repressurization scenarios, which simulate pressures as high as 14 MPa. Model results predict that high repository pressures do not produce appreciable differences in the volume of gas migration over the 200-year simulation period. Relatively low gas flow is a result of the low permeability and rapid healing of the DRZ around the lower concrete-asphalt waterstop.

Upward Migration of Brine. The Salado Formation is overpressurized with respect to the measured heads in the Rustler, and upward migration of contaminated brines could occur through an inadequately sealed shaft. Results from the model discussed above demonstrate that the crushed salt seal will reconsolidate to a very low permeability within 100 years following repository closure. Structural results show that the DRZ surrounding the long-term clay and crushed salt seal components will completely heal within the first several decades. Model calculations predict that very little brine flows from the repository to the Rustler/Salado contact.

Intra-Rustler Flow. Based on head differences between the various members of the Rustler Formation, nonhydrostatic conditions exist within the Rustler Formation. Therefore, the potential exists for vertical flow within water-bearing strata within the Rustler. The two units with the greatest transmissivity within the Rustler are the Culebra and the Magenta dolomites, which have the greatest potential for interflow. The relatively low undisturbed permeabilities of the mudstone and anhydrite units separating the Culebra and the Magenta naturally limit crossflow. However, the construction and subsequent closure of the shaft provide a potentially permeable vertical conduit connecting water-bearing units. The primary motivation for limiting formation crossflow within the Rustler is to prevent mixing of formation waters within the Rustler, as required by State of New Mexico statute. Commonly, such an undertaking would limit migration of higher dissolved solids (high-density) groundwater into lower dissolved solids groundwater. In the vicinity of the WIPP site, the Culebra has a higher density groundwater than the Magenta, and the potential for fluid migration between the two most transmissive units is from the unit with the lower total dissolved solids to the unit with the higher dissolved solids. This calculation shows that potential flow rates between the Culebra and the Magenta are insignificant. Under expected conditions, intra-Rustler flow is expected to be of such a limited quantity that (1) it will not affect either the hydraulic or chemical regime within the Culebra or the Magenta and (2) it will not be detrimental to the seal system itself.

Concluding Remarks

The principal conclusion is that an effective, implementable shaft seal system has been designed for the WIPP. Design guidance is addressed by limiting any transport of fluids within the shaft, thereby limiting transport of hazardous material to regulatory boundaries. The application or adaptation of existing technologies for placement of seal components combined with the use of available, common materials provide confidence that the design can be constructed. The structural setting for seal elements is compressive, with shear stresses well below the strength of seal materials. Because of the favorable hydrologic regime coupled with the low intrinsic permeability of seal materials, long-term stability of the shaft seal system is expected. Credibility of these conclusions is bolstered by the basic design approach of using multiple components to perform each sealing function and by using extensive lengths within the shafts to effect a sealing system. The shaft seal system adequately meets design requirements and can be constructed.

1. Introduction

1.1 Purpose of Compliance Submittal Design Report

This report documents the detailed design of the shaft sealing system for the Waste Isolation Pilot Plant (**WIPP**). The design documented in this report builds on the concepts and preliminary evaluations presented in the Sealing System Design Report issued in 1995 (DOE, 1995). The report contains a detailed description of the design and associated construction procedures, material specifications, analyses of structural and fluid flow performance, and design drawings. The design documented in this report forms the basis for the shaft sealing system which will be constructed under the authority of the hazardous waste facility Permit issued by NMED and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111(b) and 264.601(a)).

1.2 WIPP Description

The WIPP is designed as a full-scale, mined geological repository for the safe management, storage, and disposal of transuranic (**TRU**) radioactive wastes and TRU mixed wastes generated by US government defense programs. The facility is located near Carlsbad, New Mexico, in the southeastern portion of the state. The underground facility (Figure G2-1) consists of a series of shafts, drifts, panels, and disposal rooms. Four shafts, ranging in diameter from 3.5 to 6.1 m, connect the disposal horizon to the surface. Sealing of these four shafts is the focus of this report.

The disposal horizon is at a depth of approximately 655 m in bedded halite within the Salado Formation. The Salado is a sequence of bedded evaporites approximately 600 m thick that were deposited during the Permian Period, which ended about 225 million years ago. Salado salt has been identified as a good geologic medium to host a nuclear waste repository because of several favorable characteristics. The characteristics present at the WIPP site include very low permeability, vertical and lateral stratigraphic extent, tectonic stability, and the ability of salt to creep and ultimately entomb material placed in excavated openings. Creep closure also plays an important role in the shaft sealing strategy.

The WIPP facility must be determined to be in compliance with applicable regulations prior to the disposal of waste. After the facility meets the regulatory requirements, disposal rooms will be filled with containers holding TRU wastes of various forms. Wastes placed in the drifts and

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disposal rooms will be at least 150 m from the shafts. Regulatory requirements include use of both engineered and natural barriers to limit migration of hazardous constituents from the repository to the accessible environment. The shaft seals are part of the engineered barriers.

1.3 Performance Objective for WIPP Shaft Seal System

Each of the four shafts from the surface to the underground repository must be sealed to limit hazardous material release to the accessible environment and to limit groundwater flow into the repository. Although the seals will be permanent, the regulatory period applicable to the repository system analyses is 10,000 years.

1.4 Sealing System Design Development Process

This report presents a conservative approach to shaft sealing system design. Shaft sealing system performance plays a crucial role in meeting regulatory radionuclide and hazardous constituents release requirements. Although all engineering materials have uncertainties in properties, a combination of available, low-permeability materials can provide an effective sealing system. To reduce the impact of system uncertainties and to provide a high level of assurance of compliance, numerous components are used in this sealing system. Components in this design include long columns of clay, densely compacted crushed salt, a waterstop of asphaltic material sandwiched between massive low-permeability concrete plugs, a column of asphalt, and a column of earthen fill. Different materials perform identical functions within the design, thereby adding confidence in the system performance through redundancy.

The design is based on common materials and construction methods that utilize available technologies. When choosing materials, emphasis was given to permeability characteristics and mechanical properties of seal materials. However, the system is also chemically and physically compatible with the host formations, enhancing long-term performance.

Recent laboratory experiments, construction demonstrations, and field test results have been added to the broad and credible database and have supported advances in modeling capability. Results from a series of multi-year, in situ, small-scale seal performance tests show that bentonite and concrete seals maintain very low permeabilities and show no deleterious effects in the WIPP environment. A large-scale dynamic compaction demonstration established that crushed salt can be successfully compacted. Laboratory tests show that compacted crushed salt consolidates through creep closure of the shaft from initial conditions achieved in dynamic compaction to a dense salt mass with regions where permeability approaches that of in situ salt. These technological advances have allowed more credible analysis of the shaft sealing system.

The design was developed through an interactive process involving a design team consisting of technical specialists in the design and construction of underground facilities, materials behavior, rock mechanics analysis, and fluid flow analysis. The design team included specialists drawn from the staff of Sandia National Laboratories, Parsons Brinckerhoff Quade and Douglas, Inc. (contract number AG-4909), INTERA, Inc. (contract number AG-4910), and RE/SPEC Inc. (contract number AG-4911), with management by Sandia National Laboratories. The contractors developed a quality assurance program consistent with the Sandia National Laboratories Quality Assurance Program Description for the WIPP project. All three contractors received quality assurance support visits and were audited through the Sandia National Laboratories audit and assessment program. Quality assurance (**QA**) documentation is maintained in the Sandia National Laboratories WIPP Central Files. Access to project files for

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each contractor can be accomplished using the contract numbers specified above. In addition to the contractor support, technical input was obtained from consultants in various technical specialty areas.

Formal preliminary and final design reviews have been conducted on the technical information documented in the report. In addition, technical, management, and QA reviews have been performed on this report. Documentation is in the WIPP Central File.

It is recognized that additional information, such as on specific seal material or formation characteristics, on the sensitivity of system performance to component properties, on placement effectiveness, and on long-term performance, could be used to simplify the design and perhaps reduce the length or number of components. Such design optimization and associated simplifications are left to future research that may be used to update the compliance evaluations completed between now and the time of actual seal emplacement.

1.5 Organization of Document

This report contains an Executive Summary, 10 sections, and 5 appendices. The body of the report does not generally contain detailed backup information; this information is incorporated by reference or in the appendices.

The Executive Summary is a synopsis of the design and the supporting discussions related to seal materials, construction procedures, structural analyses, and fluid flow analyses. Introductory material in Section 1 sets the stage for and provides a "road map" to the remainder of the report.

Site characteristics that detail the setting into which the seals would be placed are documented in Section 2. These characteristics include the WIPP geology and stratigraphy for both the region and the shafts as well as a brief discussion of rock mechanics considerations of the site that impact the sealing system. Regional and local characteristics of the hydrologic and geochemical settings are also briefly discussed.

Section 3 presents the design guidance used for development of the shaft sealing system design. Seal-related guidance from applicable regulations is briefly described. The design guidance is then provided along with the design approach used to implement the guidance. The guidance forms the basis both for the design and for evaluations of the sealing system presented in other sections.

The shaft sealing system is documented in Section 4; detailed drawings for the design are provided in Appendix G2-E. The seal components, their design, and their functions are discussed for the Salado, the Rustler, and the overlying formations.

The sealing materials are described briefly in Section 5, with more detail provided in the materials specifications (Appendix G2-A). The materials used in the various seal components are discussed along with the reasons they are expected to function as intended. Material properties including permeability, strength, and mechanical constitutive response are given for each material. Brief discussions of expected compatibility, performance, construction techniques, and other characteristics relevant to the WIPP setting are also given.

Section 6 contains a brief description of the construction techniques proposed for use. General site and sealing preparation activities are discussed, including construction of a multi-deck stage for use throughout the placement of the components. Construction procedures to be used for the various types of components are then summarized based on the more detailed discussions provided in Appendix G2-B.

Section 7 summarizes structural analyses performed to assess the ability of the shaft sealing system to function in accordance with the design guidance provided in Section 3 and to provide input to hydrological calculations. The methods and computer programs, the models used to simulate the behavior of the seal materials and surrounding salt, and the results of the analyses are discussed. Particular emphasis is placed on the evaluations of the behavior of the disturbed rock zone. Details of the structural analyses are presented in Appendix D of *Waste Isolation Pilot Plant Shaft Sealing System Compliance Submittal Design Report ("Compliance Submittal Design Report")* (Sandia, 1996). Section 8 summarizes fluid flow analyses performed to assess the ability of the shaft sealing system to function in accordance with the design guidance provided in Section 3. Hydrologic evaluations are focused on processes that could result in fluid flow through the shaft seal system and the ability of the seal system to limit such flow. Processes evaluated are downward migration of groundwater from the overlying formation, gas migration and reconsolidation of the crushed salt component, upward migration of brines from the repository, and flow between water-bearing zones in the overlying formation. Hydrologic models are described and the results are discussed as they relate to satisfying the design guidance, with extensive reference to Appendix C of the Compliance Submittal Design Report (Sandia, 1996) that documents details of the flow analyses. Conclusions drawn about the performance of the WIPP shaft sealing system are described in Section 9. The principal conclusion that an effective, implementable design has been presented is based on the presentations in the previous sections. A reference list that documents principal references used in developing this design is then provided.

The three appendices that follow provide details related to the following subjects:

Appendix G2-A — Material Specification
Appendix G2-B — Shaft Sealing Construction Procedures
Appendix G2-E — Design Drawings (separate volume)

1.6 Systems of Measurement

Two systems of measurement are used in this document and its appendices. Both the System International d'Unites (SI) and English Gravitational (*fps* units) system are used. This usage corresponds to common practice in the United States, where SI units are used for scientific studies and *fps* units are used for facility design, construction materials, codes, and standards. Dual dimensioning is used in the design description and other areas where this use will aid the reader.

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2. Site Geologic, Hydrologic, and Geochemical Setting

The site characteristics relevant to the sealing system are discussed in this section. The location and geologic setting of the WIPP are discussed first to provide background. The geology and stratigraphy, which affect the shafts, are then discussed. The hydrologic and geochemical settings, which influence the seals, are described last.

2.1 Introduction

The WIPP site is located in an area of semiarid rangeland in southeastern New Mexico. The nearest major population center is Carlsbad, 42 km west of the WIPP. Two smaller communities, Loving and Malaga, are about 33 km to the southwest. Population density close to the WIPP is very low: fewer than 30 permanent residents live within a 16-km radius.

2.2 Site Geologic Setting

Geologically the WIPP is located in the Delaware Basin, an elongated depression that extends from just north of Carlsbad southward into Texas. The Delaware Basin is bounded by the Capitan Reef (see Figure G2-2). The basin covers over 33,000 km^2 and is filled with sedimentary rocks to depths of 7,300 m (Hills, 1984). Rock units of the Delaware Basin (representing the Permian System through the Quaternary System) are listed in Figure G2-3.

Minimal tectonic activity has occurred in the region since the Permian Period (Powers et al., 1978). Faulting during the late Tertiary Period formed the Guadalupe and Delaware Mountains along the western edge of the basin. The most recent igneous activity in the area occurred during the mid-Tertiary Period about 35 million years ago and is evidenced by a dike in the subsurface 16 km northwest of the WIPP. Major volcanic activity last occurred more than 1 billion years ago during Precambrian time (Powers et al., 1978). None of these processes affected the Salado Formation at the WIPP. Therefore, seismic-related design criteria are not included in the current seal systems design guidelines.

2.2.1 Regional WIPP Geology and Stratigraphy

The Delaware Basin began forming with crustal subsidence during the Pennsylvanian Period approximately 300 million years ago. Relatively rapid subsidence over a period of about 14 million years resulted in the deposition of a sequence of deep-water sandstones, shales, and limestones rimmed by shallow-water limestone reefs such as the Capitan Reef (see Figure G2-2). Subsidence slowed during the late Permian Period. Evaporite deposits of the Castile Formation and the Salado Formation (which hosts the WIPP underground workings) filled the basin and extended over the reef margins. The evaporites, carbonates, and clastic rocks of the Rustler Formation and the Dewey Lake Redbeds were deposited above the Salado Formation near the end of the Permian Period. The Santa Rosa and Gatuña Formations were deposited after the close of the Permian Period.

From the surface downward to the repository horizon the stratigraphic units are the Quaternary surface sand sediments, Gatuña Formation, Santa Rosa Formation, Dewey Lake Redbeds, Rustler Formation, and Salado Formation. Three principal stratigraphic units (the Dewey Lake Redbeds, the Rustler Formation, and the Salado Formation) comprise all but the upper 15 to 30 m (50 to 100 ft) of the geologic section above the WIPP facility.

The Dewey Lake Redbeds consist of alternating layers of reddish-brown, fine-grained sandstone and siltstone cemented with calcite and gypsum (Vine, 1963). The Rustler Formation lies below the Dewey Lake Redbeds; this formation, the youngest of the Late Permian evaporite sequence, includes units that provide potential pathways for radionuclide migration from the WIPP. The five units of the Rustler, from youngest to oldest, are: (1) the Forty-niner Member, (2) the Magenta Dolomite Member, (3) the Tamarisk Member, (4) the Culebra Dolomite Member, and (5) an unnamed lower member.

The 250-million-year-old Salado Formation lies below the Rustler Formation. This unit is about 600 m thick and consists of three informal members. From youngest to oldest, they are: (1) an upper member (unnamed) composed of reddish-orange to brown halite interbedded with polyhalite, anhydrite, and sandstone, (2) a middle member (the McNutt Potash Zone) composed of reddish-orange and brown halite with deposits of sylvite and langbeinite; and (3) a lower member (unnamed) composed of mostly halite with lesser amounts of anhydrite, polyhalite, and glauberite, with some layers of fine clastic material. These lithologic layers are nearly horizontal at the WIPP, with a regional dip of less than one degree. The WIPP repository is located in the unnamed lower member of the Salado Formation, approximately 655 m (2150 ft) below the ground surface.

2.2.2 Local WIPP Stratigraphy

The generalized stratigraphy of the WIPP site, with the location of the repository, is shown in Figure G2-4. To establish the geologic framework required for the design of the WIPP facility shaft sealing system, an evaluation was performed to assess the geologic conditions existing in and between the shafts, where the individual shaft sealing systems will eventually be emplaced (DOE, 1995: Appendix G2-A). The study evaluated shaft stratigraphy, regional groundwater occurrence, brine occurrence in the exposed Salado Formation section, and the consistency between recorded data and actual field data.

Four shafts connect the WIPP underground workings to the surface, the (1) Air Intake Shaft (**AIS**), (2) Exhaust Shaft, (3) Salt Handling Shaft, and (4) Waste Shaft. Stratigraphic correlation and evaluation of the unit contacts show that lithologic units occur at approximately the same levels in all four shaft locations. Some stratigraphic contact elevations vary because of regional structure and stratigraphic thinning and thickening of units. However, the majority of the stratigraphic contacts used to date are suitable for engineering design reference because they intersect all four shafts.

2.2.3 Rock Mechanics Setting

The WIPP stratigraphy includes rock types that exhibit both brittle and ductile behaviors. The majority of the stratigraphy intercepted by the shafts consists of the Salado Formation, which is predominantly halite. The primary mechanical behavior of halitic rocks is creep. Except near free surfaces (such as the shaft wall), the salt rocks will remain tight and undisturbed despite the long-term creep deformation they sustain. The other rock types within the Salado Formation are anhydrites and polyhalites. These two rock types are typically brittle, stiff, and exhibit high strength in laboratory tests. The structural strength of particular anhydritic rock layers, however, depends on the thickness of the layers, which range from thin (<1 m) to fairly thick (10 m or more). Brittle failure of these noncreeping rocks can occur as they restrain, or attempt to restrain, the creep of the salt above and below the stiff layer. Although thick layers can resist the

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induced stresses, thin layers are fractured in tension by the salt creep. Because the deformation in the bounding salt is time dependent, the damage in the brittle rock is also time dependent.

Above the Salado Formation, the Rustler Formation stratigraphy consists of relatively strong limestones and siltstones. The shaft excavation is the only significant disturbance to these rocks. Any subsurface subsidence (deformation) or loading induced by the presence of the repository are negligible in a rock mechanics sense.

Regardless of rock type, the shafts create a disturbed zone in the surrounding rock. Microfracturing will occur in the rock adjacent to the shaft wall, where confining stresses are low or nonexistent. The extent of the zone depends on the rock strength and the prevailing stress state, which is depth dependent. In the salt rocks, microfracturing occurs to form the disturbed zone both at the time of excavation and later as dilatant creep deformations occur. In the brittle rocks, the disturbance occurs at the time of excavation and does not worsen with time. The extent of disturbed zones in the salt and brittle rocks can be calculated, as will be described in Section 7 and Appendix D in the Compliance Submittal Design Report (Sandia, 1996).

Preventing the salt surrounding the shafts from creeping causes reintroduction of stresses that reverse the damage process and cause healing (Van Sambeek et al., 1993). The seal system design relies on this principle for sealing the disturbed zone in salt. In the brittle rocks, grouting of the damage is a viable means of reducing the interconnected fractures that increase the permeability of the rock.

2.3 Site Hydrologic Setting

The WIPP shafts penetrate approximately 655 m (2150 ft) of sediments and rocks. From a hydrogeologic perspective, relevant information includes the permeability of the water-bearing units, the thickness of the water-bearing units, and the observed vertical pressure (head) gradients expected to exist after shaft construction and ambient pressure recovery. This section will discuss these three aspects of the site hydrogeology. The geochemistry of the pore fluids adjacent to the shaft system is also important hydrogeologic information and will be provided in Section 2.4.

2.3.1 Hydrostratigraphy

The WIPP shafts penetrate Quaternary surface sediments, the Gatuña Formation, the Santa Rosa Formation, the Dewey Lake Redbeds, the Rustler Formation, and the Salado Formation. The Rustler Formation contains the only laterally-persistent water-bearing units in the WIPP vicinity. As a result, flow-field characterization, regional flow-modeling, and performance assessment off-site release scenarios focus on the Rustler Formation. The hydrogeology of the stratigraphic units in contact with the upper portion of the AIS sealing system is fairly well known from detailed hydraulic testing of the Rustler Formation at well H-16 located 17 m from the AIS (Beauheim, 1987). The H-16 borehole was drilled in July and August 1987 to monitor the hydraulic responses of the Rustler members to the drilling and construction of the AIS. During the drilling of H-16, each member of the Rustler Formation was cored. In addition, detailed drill-stem, pulse, and slug hydraulic tests were performed in H-16 on the members of the Rustler. Through the detailed testing program at H-16, the permeability of each of the Rustler members was estimated. Detailed mapping of the AIS by Holt and Powers (1990) and other investigators provided information on the location of wet zones and weeps within the Salado Formation. This

information will be summarized below. The reader, unless particularly interested in this subject, should proceed to Section 2.3.2.

Water-bearing zones have been observed in units above the Rustler Formation in the WIPP site vicinity. However, drilling in the Dewey Lake Redbeds has not identified any continuous saturated units at the WIPP site. Water-bearing units within stratigraphic intervals above the Rustler are typically perched saturated zones of very low yield. Thin perched groundwater intervals have been encountered in WIPP wells H-1, H-2, and H-3 (Mercer and Orr, 1979). The only Dewey Lake Redbed wells that have sufficient yields for watering livestock are the James Ranch wells, the Pocket well, and the Fairfield well (Brinster, 1991). These wells are located to the south of the WIPP and are not in the immediate vicinity of the WIPP shafts.

The Dewey Lake Redbeds overlie the Rustler Formation. The Rustler is composed of five members defined by lithology. These are, in ascending order, the unnamed lower member, the Culebra dolomite, the Tamarisk, the Magenta dolomite, and the Forty-niner (see Figure G2-4). Of these five members, the unnamed lower member, the Culebra, and the Magenta are the most transmissive units in the Rustler. The Tamarisk and the Forty-niner are aquitards within the Rustler and have very low permeabilities relative to the three members listed above.

To the east of the shafts in Nash Draw, the Rustler/Salado contact has been observed to be permeable and water-bearing. This contact unit has been referred to as the "brine aquifer" (Mercer, 1983). The brine aquifer is not reported to exist in the vicinity of the shafts. The hydraulic conductivity of the Rustler/Salado contact in the vicinity of the shafts is reported to be approximately 4×10^{-11} m/s, which is equivalent to a permeability of 6×10^{-18} m^2 using reference brine fluid properties (Brinster, 1991). The unnamed lower member was hydraulic tested at well H-16 in close proximity to the AIS. The maximum permeability of the unnamed lower member was interpreted to be 2.2×10^{-18} m^2 and was attributed to the unnamed lower member claystone by Beauheim (1987), which correlates to the transition and bioturbated clastic zones of Holt and Powers (1990).

The Culebra Dolomite Member is the most transmissive member of the Rustler Formation in the vicinity of the WIPP site and is the most transmissive saturated unit in contact with the shaft sealing system. The Culebra is an argillaceous dolomicrite which contains secondary porosity in the form of abundant vugs and fractures. The permeability of the Culebra varies greatly in the vicinity of the WIPP and is controlled by the condition of the secondary porosity (fractures). The permeability of the Culebra in the vicinity of the shafts is approximately 2.1×10^{-14} m^2.

The Tamarisk Member is composed primarily of massive, lithified anhydrite, including anhydrite 2, mudstone 3, and anhydrite 3. Testing of the Tamarisk at H-16 was unsuccessful. The estimated transmissivity of the Tamarisk at H-16 is one to two orders of magnitude lower than the least-transmissive unit successfully tested at H-16, which results in a permeability range from 4.6×10^{-20} to 4.6×10^{-19} m^2. Anhydrites in the Rustler have an approximate permeability of 1×10^{-19} m^2. The permeability of mudstone 3 is 1.5×10^{-19} m^2 (Brinster, 1991).

The Magenta is a dolomite that is typically less permeable than the Culebra. The Magenta Dolomite Member overlies the Tamarisk Member. The Magenta is an indurated, gypsiferous, arenaceous, dolomite that Holt and Powers (1990) classify as a dolarenite. The dolomite grains are primarily composed of silt to fine sand-sized clasts. Wavy to lenticular bedding and ripple cross laminae are prevalent through most of the Magenta. Holt and Powers (1990) estimate that

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inflow to the shaft from the Magenta during shaft mapping was less than 1 gal/min. The Magenta has a permeability of approximately 1.5×10^{-15} m^2 (Saulnier and Avis, 1988).

The Forty-niner Member is divided into three informal lithologic units. The lowest unit is anhydrite 4, a laminated anhydrite having a gradational contact with the underlying Magenta. Mudstone 4 overlies anhydrite 4 and is composed of multiple units containing mudstones, siltstones, and very fine sandstones. Anhydrite 5 is the uppermost informal lithologic unit of the Forty-niner Member. The permeability of mudstone 4, determined from the pressure responses in the Forty-niner interval of H-16 to the drilling of the AIS, is 3.9×10^{-16} m^2 (referred to as the Forty-niner claystone by Avis and Saulnier, 1990).

The Salado Formation is a very low permeability formation that is composed of bedded halite, polyhalite, anhydrite, and mudstones. Inflows in the shafts have been observed over select intervals during shaft mapping, but flows are below the threshold of quantification. In some cases these weeps are individual, lithologically distinct marker beds, and in some cases they are not. Directly observable brine flow from the Salado Formation into excavated openings is a short-lived process. Table G2-1 lists the brine seepage intervals identified by Holt and Powers (1990) during their detailed mapping of the AIS. Seepage could be indicated by a wet rockface or by the presence of precipitate from brine evaporation on the shaft rockface. The zones listed in Table G2-1 make up less than 10% of the Salado section that is intersected by the WIPP shafts.

Table G2-1
Salado Brine Seepage Intervals[1]

Stratigraphic Unit	Lithology	Thickness (m)
Marker Bed 103	Anhydrite	5.0
Marker Bed 109	Anhydrite	7.7
Vaca Triste	Mudstone	2.4
Zone A	Halite	2.9
Marker Bed 121	Polyhalite	0.5
Union Anhydrite	Anhydrite	2.3
Marker Bed 124	Anhydrite	2.7
Zone B	Halite	0.9
Zone C	Halite	2.7
Zone D	Halite	3.2
Zone E	Halite	0.6
Zone F	Halite	0.9
Zone G	Halite	0.6
Zone H	Halite	1.8
Marker Bed 129	Polyhalite	0.5
Zone I	Halite	1.7
Zone J	Halite	1.2

[1] After US DOE, 1995.

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To gain perspective into the important stratigraphic units from a hydrogeologic view, the permeability and thickness of the units adjacent to the shafts can be compared. Table G2-2 lists the lithologic units in the Rustler and the Salado Formations with their best estimate permeabilities and their thickness as determined from the AIS mapping. The stratigraphy of the units overlying the Rustler is not considered in Table G2-2 because these units are typically not saturated in the vicinity of the WIPP shafts. The overlying sediments account for approximately 25% of the stratigraphy column adjacent to the shafts.

Because permeability varies over several orders of magnitude, the log of the permeability is also listed to simplify comparison between units. Table G2-2 shows that by far the two most transmissive zones occur in the Rustler Formation; these are the Culebra and Magenta dolomites. These units are relatively thin when compared to the combined Rustler and Salado thickness adjacent to the shafts (3% of Rustler and Salado combined thickness). The Magenta and the Culebra are the only two units that are known to possess permeabilities higher than 1×10^{-18} m^2.

Table G2-2
Permeability and Thickness of Hydrostratigraphic Units in Contact with Seals

Formation	Member/Lithology	Undisturbed Permeability (m^2)	Thickness (m)
Rustler	Anhydrite[(1)]	1.0×10^{-19}	46.7
Rustler	Mudstone 4	3.9×10^{-16}	4.4
Rustler	Magenta	1.5×10^{-15}	7.8
Rustler	Mudstone 3	1.5×10^{-19}	2.9
Rustler	Culebra	2.1×10^{-14}	8.9
Rustler	Transition/ Bioturbated Clastics	2.2×10^{-18}	18.7
Salado	Halite	1.0×10^{-21}	356.6
Salado	Polyhalite	3.0×10^{-21}	10.9
Salado	Anhydrite	1.0×10^{-19}	28.2

[(1)] Anhydrite 5, Anhydrite 4, Anhydrite 3, and Anhydrite 2

The vast majority (97%) of the rocks adjacent to the shaft in the Rustler and the Salado Formations are low permeability ($<1 \times 10^{-18}$ m^2). The conclusion that can be drawn from reviewing Table G2-2 is that the shafts are located hydrogeologically in a low permeability, low groundwater flow regime. Inflow measurements have historically been made at the shafts, and observable flow is attributed to leakage from the Rustler Formation.

Flow modeling of the Culebra has demonstrated that depressurization has occurred as a result of the sinking of the shafts at the site. Maximum estimated head drawdown in the Culebra at the centroid of the shafts was estimated by Haug et al. (1987) to be 33 m in the mid-1980s. This drawdown in the permeable units intersected by the shafts is expected because the shafts act as long-term constant pressure (atmospheric) sinks. Measurements of fluid flow into the WIPP shafts when they were unlined show a range from a maximum of 0.11 L/s (3,469 m^3/yr) measured in the Salt Handling Shaft on September 13, 1981 to a minimum of 0.008 L/s (252 m^3/yr) measured at the Waste Handling Shaft on August 6, 1987 (LaVenue et al., 1990).

The following summary of shaft inflow rates from the Rustler is based on a review of LaVenue et al. (1990) and Cauffman et al. (1990). Shortly after excavation and prior to grouting and liner installation, the inflow into the Salt Handling Shaft was 0.11 L/s (3,469 m^3/yr). The average flow rate measured after shaft lining for the period from mid-1982 through October 1992 was 0.027 L/s (851 m^3/yr). The average flow rate into the Waste Handling Shaft during the time when the shaft was open and unlined was about 0.027 L/s (851 m^3/yr). Between the first and second grouting events (July 1984 to November 1987) the average inflow rate was 0.016 L/s (505 m^3/yr). No estimates were found after the second grouting. Inflow to the pilot holes for the Exhaust Shaft averaged 0.028 L/s (883 m^3/yr). In December 1984 a liner plate was grouted across the Culebra. After this time, a single measurement of inflow from the Culebra was 0.022 L/s (694 m^3/yr). After liner plate installation, three separate grouting events occurred at the Culebra. No measurable flow was reported after the third grouting event in the summer of 1987. Flow into the AIS when it was unlined and draining averaged 0.044 L/s (1,388 m^3/yr). Since the Rustler has been lined, flow into the AIS has been negligible.

The majority of the flow represented by these shaft measurements originates from the Rustler. This is clearly evident by the fact that lining of the WIPP shafts was found to be unnecessary in the Salado Formation below the Rustler/Salado contact. When the liners were installed, flow rates diminished greatly. Under sealed conditions, hydraulic gradients in rocks adjacent to the shaft will diminish as the far-field pressures approach ambient conditions. The low-permeability materials sealing the shaft combined with the reduction in lateral hydraulic gradients will likely result in flow rates into the shaft that are several orders of magnitude less than observed under open shaft or lined shaft conditions.

2.3.2 Observed Vertical Gradients

Hydraulic heads within the Rustler and between the Rustler and Salado Formations are not in hydrostatic equilibrium. Mercer (1983) recognized that heads at the Rustler Salado transition (referred to as the brine aquifer and not present in the vicinity of the WIPP shafts) indicate an upward hydraulic gradient from that zone to the Culebra. Later, with the availability of more head measurements within the Salado and Rustler members, Beauheim (1987) provided additional insight into the potential direction of vertical fluid movement within the Rustler. He reported that the hydraulic data indicate an upward gradient from the Salado to the Rustler.

Formation pressures in the Salado Formation have been decreased in the near vicinity of the WIPP underground facility. The highest, and thought to be least disturbed, estimated formation fluid pressure from hydraulic testing is 12.55 MPa estimated from interpretation of testing within borehole SCP01 in Marker Bed 139 (**MB139**) just below the underground facility horizon (Beauheim et al., 1993). The fresh-water head within MB139, based on the estimated static formation pressure of 12.55 MPa, is 1,663.6 m (5,458 ft) above mean sea level (**msl**).

Hydraulic heads in the Rustler have also been impacted by the presence of the WIPP shafts. Impacts in the Culebra were significant in the 1980s with a large drawdown cone extending away from the shafts in the Culebra (Haug et al., 1987). The undisturbed head of the Rustler Salado contact in the vicinity of the AIS is estimated to be about 936.0 m (3,071 ft) msl (Brinster, 1991). The undisturbed head in the Culebra is estimated to be approximately 926.9 m (3,041 ft) msl in the vicinity of the AIS (LaVenue et al., 1990). The undisturbed head in the Magenta is estimated to be approximately 960.1 m (3,150 ft) msl (Brinster, 1991).

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The disturbed and undisturbed heads in the Rustler are summarized in Table G2-3. Also included is the freshwater head of MB139 based on hydraulic testing in the WIPP underground. Consistent with the vertical flow directions proposed by previous investigators, estimated vertical gradients in the vicinity of the AIS before the shafts were drilled indicate a hydraulic gradient from the Magenta to the Culebra and from the Rustler/Salado contact to the Culebra. There is also the potential for flow from the Salado Formation to the Rustler Formation.

Table G2-3
Freshwater Head Estimates in the Vicinity of the Air Intake Shaft

Hydrologic Unit	Freshwater Head (m asl)		Reference
	Undisturbed	Disturbed	
Magenta Member	960.1[1]	948.8[2] (H-16)	Brinster (1991) Beauheim (1987)
Culebra Member	926.9[1]	915.0[2] (H-16)	LaVenue et al. (1990) Beauheim (1987)
Lower Unnamed Member	—	953.4[2] (H-16)	Beauheim (1987)
Rustler/Salado Contact	936.0 - 940.0[1]	—	Brinster (1991)
Salado MB139	1,663.6[2]	—	Beauheim et al. (1993)

[1] Estimated from a contoured head surface plot based principally on well data collected prior to shaft construction.

[2] Measured through hydraulic testing and/or long-term monitoring.

2.4 Site Geochemical Setting

2.4.1 Regional and Local Geochemistry in Rustler Formation and Shallower Units

The Rustler Formation, overlying the Salado Formation, consists of interbedded anhydrite/gypsum, mudstone/siltstone, halite east of the WIPP site, and two layers of dolomite. Principal occurrences of $NaCl/MgSO_4$ brackish to briny groundwater in the Rustler at the WIPP site and to the north, west, and south are found (1) at the lower member near its contact with the underlying Salado and (2) in the two dolomite members having a variable fracture-induced secondary porosity. The mineralogy of the Rustler Formation is summarized in Table G2-4.

The five members of the Rustler Formation are described as follows: (1) The Forty-niner Member is similar in lithology to the other non-dolomitic units but contains halite east of the WIPP site. (2) The Magenta Member is another variably fractured dolomite/sulfate unit containing sporadic occurrences of groundwater near and west of the WIPP site. (3) The Tamarisk Member is dominantly anhydrite (locally altered to gypsum) with subordinate fine-grained clastics, containing halite to the east of the WIPP site. (4) The Culebra Dolomite Member is dominantly dolomite with subordinate anhydrite and/or gypsum, having a variable fracture-induced secondary porosity containing regionally continuous occurrences of groundwater at the WIPP site and to the north, west, and south. (5) An unnamed lower member consists of sandstone, siltstone, mudstone, claystone, and anhydrite locally altered to gypsum, and containing halite under most of the WIPP site and occurrences of brine at its base, mostly west of the WIPP site.

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Table G2-4
Chemical Formulas, Distributions, and Relative Abundance of Minerals in the Rustler and Salado Formations (after Lambert, 1992)

Mineral	Formula	Occurrence/Abundance
Amesite	$(Mg_4Al_2)(Si_2Al_2)O_{10}(OH)_8$	S, R
Anhydrite	$CaSO_4$	SSS, RRR
Calcite	$CaCO_3$	S, RR
Carnallite	$KMgCl_3 \cdot 6H_2O$	SS†
Chlorite	$(Mg,Al,Fe)_{12}(Si,Al)_8O_{20}(OH)_{16}$	S‡, R‡
Corrensite	Mixed-layer chlorite/smectite	S‡, R‡
Dolomite	$CaMg(CO_3)_2$	RR
Feldspar	$(K,Na,Ca)(Si,Al)_4O_8$	S‡, R‡
Glauberite	$Na2Ca(SO_4)_2$	S
Gypsum	$CaSO_4 \cdot 2H_2O$	S, RRR
Halite	NaCl	SSS, RRR
Illite	$K_{1-1.5}Al_4(Si_{7-6.5}Al_{1-1.5}O_{20})(OH)_4$	S‡, R‡
Kainite	$KMgClSO_4 \cdot 3H_2O$	SS†
Kieserite	$MgSO_4 \cdot H_2O$	SS†
Langbeinite	$K_2Mg_2(SO_4)_3$	S*
Magnesite	$MgCO_3$	S, R
Polyhalite	$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$	SS, R
Pyrite	FeS_2	S, R
Quartz	SiO_2	S‡, R‡
Serpentine	$Mg_3Si_2O_5(OH)_4$	S‡, R‡
Smectite	$(Ca_{1/2},Na)_{0.7}(Al,Mg,Fe)_4(Si,Al)_8O_{20}(OH)_4 \cdot nH_2O$	S‡, R‡
Sylvite	KCl	SS*

Key to Occurrence/Abundance notations:

S = Salado Formation; R = Rustler Formation; 3x = abundant, 2x = common, 1x = rare or accessory; * = potash-ore mineral (never near surface); † = potash-zone non-ore mineral; ‡ = in claystone interbeds.

The Dewey Lake Redbeds, overlying the Rustler Formation, are the uppermost Permian unit; they consist of siltstones and claystones locally transected by concordant and discordant fractures that may contain gypsum. The Dewey Lake Redbeds contain sporadic occurrences of groundwater that may be locally perched, mostly in the area south of the WIPP site. The Triassic Dockum Group (undivided) rests on the Dewey Lake Redbeds in the eastern half of the WIPP site and thickens eastward; it is a locally important source of groundwater for agricultural and domestic use.

The Gatuña Formation, overlying the Dewey Lake Redbeds, occurs locally as channel and alluvial pond deposits (sands, gravels, and boulder conglomerates). The pedogenic Mescalero caliche is commonly developed on top of the Gatuña Formation and on many other erosionally

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truncated rock types. Surficial dune sand, which may be intermittently damp, covers virtually all outcrops at and near the WIPP site. Siliceous alluvial deposits southwest of the WIPP site also contain potable water. The geochemistry of groundwater found in the Rustler Formation and Dewey Lake Redbeds is summarized in Table G2-5.

Table G2-5
Major Solutes in Selected Representative Groundwater from the Rustler Formation and Dewey Lake Redbeds, in mg/L (after Lambert, 1992)

Well	Date	Zone	Ca	Mg	Na	K	SO_4	Cl
WIPP-30	July 1980	R/S	955	2770	121,000	2180	7390	192,000
WIPP-29	July 1980	R/S	1080	2320	36,100	1480	12,000	58,000
H-5B	June 1981	Cul	1710	2140	52,400	1290	7360	89,500
H-9B	November 1985	Cul	590	37	146	7	1900	194
H-2A	April 1986	Cul	743	167	3570	94	2980	5310
P-17	March 1986	Cul	1620	1460	28,300	782	6020	48,200
WIPP-29	December 1985	Cul	413	6500	94,900	23,300	20,000	179,000
H-3B1	July 1985	Mag	1000	292	1520	35	2310	3360
H-4C	November 1986	Mag	651	411	7110	85	7100	8460
Ranch	June 1986	DL	420	202	200	4	1100	418

Key to Zone:

R/S = "basal brine aquifer" near the contact between the Rustler and Salado Formations; Cul = Culebra Member, Rustler Formation; Mag = Magenta Member, Rustler Formation; DL = Dewey Lake Redbeds.

2.4.2 Regional and Local Geochemistry in the Salado Formation

The Salado Formation consists dominantly of halite, interrupted at intervals of meters to tens of meters by beds of anhydrite, polyhalite, mudstone, and local potash mineralization (sylvite or langbeinite, with or without accessory carnallite, kieserite, kainite and glauberite, all in a halite matrix). Some uniquely identifiable non-halite units, 0.1 to 10 m thick, have been numbered from the top down (100 to 144) for convenience as marker beds to facilitate cross-basinal stratigraphic correlation. The WIPP facility was excavated just above Marker Bed 139 in the Salado Formation at a depth of about 655 m.

Although the most common Delaware Basin evaporite mineral is halite, the presence of less soluble interbeds (dominantly anhydrite, polyhalite, and claystone) and more soluble admixtures (e.g. sylvite, glauberite, kainite) has resulted in chemical and physical properties significantly different from those of pure NaCl. Under differential stress produced near excavations, brittle interbeds (anhydrite, polyhalite, magnesite, dolomite) may fracture, whereas under a similar stress regime pure NaCl would undergo plastic deformation. Fracturing of these interbeds has locally enhanced the permeability, allowing otherwise nonporous rock to carry groundwater (e.g., the fractured polyhalitic anhydrite of Marker Bed 139 under the floor of the WIPP excavations).

Groundwater in evaporites represents the exposure of chemical precipitates to fluids that may be agents (as in the case of dissolution) or consequences of postdepositional alteration of the

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evaporites (as in the cases of dehydration of gypsum and diagenetic dewatering of other minerals). Early in the geological studies of the WIPP site, groundwater occurrences that could be hydrologically characterized were identified.

Since the beginning of conventional mining in the Delaware Basin, relatively short-lived seeps (pools on the floor, efflorescences on the walls, and stalactitic deposits on the ceiling) have been known to occur in the Salado Formation where excavations have penetrated. These brine occurrences are commonly associated with the non-halitic interbeds whose porosity is governed either by fracturing (as in brittle beds) or mineralogical discontinuities (as in "clay" seams).

The geochemistry of brines encountered in the Salado Formation is summarized in Table G2-6. The relative abundance of minerals was summarized in Table G2-4.

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Table G2-6
Variations in Major Solutes in Brines from the Salado Formation, in mg/L (after Lambert, 1992)

Source of Brine	Date	Ca	Mg	K	Na	Cl	SO_4
Room G Seep	Sep-87	278	14800	15800	99000	188000	29500
	Nov-87	300	18700	15400	97100	190000	32000
	Feb-88	260	18200	17100	94100	186000	36200
	Mar-88	280	17000	16200	92100	187000	34800
	Jul-88	292	13000	14800	96600	188000	29300
	Sep-88	273	14700	13700	86500	185000	28000
	Apr-91	240	14400	12900	95000	189000	28000
	Jul-91	239	14100	13100	93000	190000	27700
	Oct-91	252	14700	14100	95000	189000	27100
Marker Bed 139 (under repository)		300	18900	14800	67700	155900	14700
		300	17100	15600	72700	158900	13400
		300	17600	15800	71600	182200	14700
Room J		230	17700	13500	63600	167000	15100
		210	27400	22400	56400	168000	19600
		220	17900	15600	73400	165000	9300
		250	22200	18300	63000	165000	31100
		190	31000	19900	46800	170000	24600
		100	35400	27800	40200	173000	30000
		270	18900	14500	59900	166000	16200
		280	20200	17000	70400	165000	10600
Room Q		279	31500	22600	68000	205000	19400
		288	31100	24100	68000	203000	19200
		257	34000	26300	63000	205000	23500
AIS Sump (accumulation in bottom of sump)	Jul-88	960	1040	1720	118000	187000	6170
	May-89	900	500	600	83100	122700	7700
	May-89	1000	800	1100	82400	114200	8800
McNutt Potash Zone							
Duval mine		640	55400	30000	27500	236500	3650
Miss. Chem. mine		200	44200	45800	43600	226200	12050

3. Design Guidance

3.1 Introduction

The WIPP is subject to regulatory requirements contained in applicable portions of the New Mexico Hazardous Waste Act, specifically 20.4.1.500 NMAC and .900 (incorporating 40 CFR §264 and §270), and requirements contained in 40 CFR §191 and 40 CFR §194. The use of both engineered and natural barriers to isolate wastes from the accessible environment is required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.601) and 40 CFR §191.14(d). The use of engineered barriers to prevent or substantially delay the movement of water, hazardous constituents, or radionuclides toward the accessible environment is required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.601) and 40 CFR §194.44. Hazardous constituent release performance standards are specified in Permit Part 5 and 20.4.1.500 NMAC (incorporating 40 CFR §§264.111(b), 264.601(a), and 264 Subpart F). Quantitative requirements for potential releases of radioactive materials from the repository system are specified in 40 CFR §191. The regulations impose quantitative release requirements on the total repository system, not on individual subsystems of the repository system, for example, the shaft sealing subsystem.

3.2 Design Guidance and Design Approach

The guidance described for the design of the shaft sealing system addresses the need for the WIPP to comply with system requirements and to follow accepted engineering practices using demonstrated technology. The design guidance addresses the need to limit:

1. radiological or other hazardous constituents reaching the regulatory boundaries,
2. groundwater flow into and through the sealing system,
3. chemical and mechanical incompatibility,
4. structural failure of system components,
5. subsidence and accidental entry, and
6. development of new construction technologies and/or materials.

For each element of design guidance, a design approach has been developed. Table G2-7 contains qualitative design guidance and the design approach used to implement it.

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Table G2-7
Shaft Sealing System Design Guidance

Qualitative Design Guidance	Design Approach
The shaft sealing system shall limit:	*The shaft sealing system shall be designed to meet the qualitative design guidance in the following ways:*
1. the migration of radiological or other hazardous constituents from the repository horizon to the regulatory boundary during the 10,000-year regulatory period following closure;	1. In the absence of human intrusion, brine migrating from the repository horizon to the Rustler Formation must pass through a low permeability sealing system.
2. groundwater flowing into and through the shaft sealing system;	2. In the absence of human intrusion, groundwater migrating from the Rustler Formation to the repository horizon must pass through a low permeability sealing system.
3. chemical and mechanical incompatibility of seal materials with the seal environment;	3. Brine contact with seal elements is limited and materials possess acceptable mechanical properties.
4. the possibility for structural failure of individual components of the sealing system;	4. State of stress from forces expected from rock creep and other mechanical loads is favorable for seal materials.
5. subsidence of the ground surface in the vicinity of the shafts and the possibility of accidental entry after sealing;	5. The shaft is completely filled with low-porosity materials, and construction equipment would be needed to gain entry.
6. the need to develop new technologies or materials for construction of the shaft sealing system.	6. Construction of the shaft sealing system is feasible using available technologies and materials.

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4. Design Description

4.1 Introduction

The design presented in this section was developed based on (1) the design guidance outlined in Section 3.0, (2) past design experience, and (3) a desire to reduce uncertainties associated with the performance of the WIPP sealing system. The WIPP shaft sealing system design has evolved over the past decade from the initial concepts presented by Stormont (1984) to the design concepts presented in this document. The past designs are:

- the plugging and sealing program for the WIPP (Stormont, 1984),
- the initial reference seal system design (Nowak et al., 1990),
- the seal design alternative study (Van Sambeek et al., 1993),
- the WIPP sealing system design (DOE, 1995).

The present design changes were implemented to take advantage of knowledge gained from small-scale seals tests conducted at the WIPP (Knowles and Howard, 1996), advances in the ability to predict the time-dependent mechanical behavior of compacted salt rock (Callahan et al., 1996), large-scale dynamic salt compaction tests and associated laboratory determination of the permeability of compacted salt samples (Hansen and Ahrens, 1996; Brodsky et al., 1996), field tests to measure the permeability of the DRZ surrounding the WIPP AIS (Dale and Hurtado, 1996), and around seals (Knowles et al., 1996). A summary paper (Hansen et al., 1996) describing the design has been prepared.

The shaft sealing system is composed of seals within the Salado Formation, the Rustler Formation, and the Dewey Lake Redbeds and overlying units. All components of the sealing system are designed to meet Items 3, 4, and 6 of the Design Guidance (Table G2-7.); that is, all sealing system components are designed to be chemically and mechanically compatible with the seal environment, structurally adequate, and constructable using currently available technology and materials. The seals in the Salado Formation are also designed to meet Items 1 and 2 of the Design Guidance. These seals will limit fluid migration upward from the repository to the Rustler Formation and downward from the Rustler Formation to the repository. Migration of brine upward and downward is discussed in Sections 8.5 and 8.4 respectively. The seals in the Rustler Formation are designed to meet Item 2 in addition to Items 3, 4, and 6 of the Design Guidance. The seals in the Rustler Formation limit migration of Rustler brines into the shaft cross-section and also limit cross-flow between the Culebra and Magenta members. The principal function of the seals in the Dewey Lake Redbeds and overlying units is to meet Item 5 of the Design Guidance, that is, to limit subsidence of the ground surface in the vicinity of the shafts and to prevent accidental entry after repository closure. Entry of water (surface water and any groundwater that might be present in the Dewey Lake Redbeds and overlying units) into the sealing system is limited by restraining subsidence and by placing high density fill in the shafts.

4.2 Existing Shafts

The WIPP underground facilities are accessed by four shafts commonly referred to as the Waste, Air Intake, Exhaust, and Salt Handling Shafts. These shafts were constructed between 1981 and 1988. All four shafts are lined from the surface to just below the contact of the Rustler and Salado Formations. The lined portion of the shafts terminates in a substantial concrete structure called the "key," which is located in the uppermost portion of the Salado Formation.

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Drawings showing the configuration of the existing shafts are included in Appendix G2-E and listed below in Table G2-8. Table G2-9 contains a summary of information describing the existing shafts.

The upper portions of the WIPP shafts are lined. The Waste, Air Intake, and Exhaust shafts have concrete linings; the Salt Handling Shaft has a steel lining with grout backing. In addition, during shaft construction, steel liner plates, wire mesh, and pressure grouting were used to stabilize portions of the shaft walls in the Rustler Formation and overlying units. Seepage of groundwater into the lined portions of the shafts has been observed. This seepage was expected; in fact, the shaft keys (massive concrete structures located at the base of each shaft liner) were designed to collect the seepage and transport it through a piping system to collection points at the repository horizon. In general, the seepage originates in the Magenta and Culebra members of the Rustler Formation and in the interface zone between the Rustler and Salado formations. It flows along the interface between the shaft liner and the shaft wall and through the DRZ immediately adjacent to the shaft wall. In those cases where seepage through the liner occurred, it happened where the liner offered lower resistance to flow than the interface and DRZ, for example, at construction joints. Maintenance grouting, in selected areas of the WIPP shafts, has been utilized to reduce seepage.

Table G2-8
Drawings Showing Configuration of Existing WIPP Shafts (Drawings are in Appendix G2-E)

Shaft	Drawing Title	Sheet Number of Drawing SNL-007
Waste	Near-Surface/Rustler Formation Waste Shaft Stratigraphy & As-Built Elements	2 of 28
Waste	Salado Formation Waste Shaft Stratigraphy & As-Built Elements	3 of 28
AIS	Near-Surface/Rustler Formation Air Intake Shaft Stratigraphy & As-Built Elements	7 of 28
AIS	Salado Formation Air Intake Shaft Stratigraphy & As-Built Elements	8 of 28
Exhaust	Near-Surface/Rustler Formation Exhaust Shaft Stratigraphy & As-Built Elements	12 of 28
Exhaust	Salado Formation Exhaust Shaft Stratigraphy & As-Built Elements	13 of 28
Salt Handling	Near-Surface/Rustler Formation Salt Handling Shaft Stratigraphy & As-Built Elements	17 of 28
Salt Handling	Salado Formation Salt Handling Shaft Stratigraphy & As-Built Elements	18 of 28

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Table G2-9
Summary of Information Describing Existing WIPP Shafts

	Shafts			
	Salt Handling	**Waste**	**Air Intake**	**Exhaust**
A. Construction Method				
i. Sinking method	Blind bored	Initial 6′ pilot hole slashed by drill & blast (smooth wall blasting)	Raise bored	Initial 6′ pilot hole slashed by drill & blast (smooth wall blasting)
ii. Dates of shaft sinking	7/81-10/81	Drilled 12/81-2/82 Slashed 10/83-6/84	12/87-8/88	9/83-11/84
iii. Ground treatment in water-bearing zone	Grout behind steel liner during construction	Grouted 1984 & 1988	Grouted 1993	Grouted 1985, 1986, & 1987
iv. Sump construction	Drill & blast	Drill & blast	No sump	No sump
B. Upper Portion of Shaft *				
i. Type of liner	Steel	Concrete	Concrete	Concrete
ii. Lining diameter (ID)	10′-0″	19′-0″	18′-0″/16′-7″	14′-0″
iii. Excavated diameter	11′-10″	20′-8″ to 22′-4″	20′-3″	15′-8″ to 16′-8″
iv. Installed depth of liner	838.5′	812′	816′	846′
C. Key Portion of Shaft *				
i. Construction material	Reinf. conc. w/chem. seals	Reinf. concrete w/chem. seals	Reinf. concrete w/chem. seals	Reinf. concrete w/chem. seals
ii. Liner diameter (ID)	10′-0″	19′-0″	16′-7″	14′-0″
iii. Excavated diameter	15′-0″ to 18′-0″	27′-6″ to 31′-0″	29′-3″ to 35′-3″	21′-0″ to 26′-0″
iv. Depth-top of Key	844′	836′	834′	846′
v. Depth-bottom of Key	883′	900′	897′	910′
vi. Dow Seal #1 depth	846′ to 848′	846′ to 849′	839′ to 842′	853′ to 856′
vii. Dow Seal #2 depth	853′ to 856′	856′ to 859′	854′ to 857′	867′ to 870′
viii. Dow Seal #3 depth	868 to 891′	NA	NA	NA
ix. Top of salt (Rustler/Salado contact)	851′	843′	841′	853′

	Shafts			
	Salt Handling	**Waste**	**Air Intake**	**Exhaust**
D. Lower Shaft (Unlined) *				
i. Type of support	Unlined	Chain link mesh	Unlined	Chain link mesh
ii. Excavated diameter	11′-10″	20′-0″	20′-3″	15′-0″
iii. Depth-top of "unlined"	882′	900′	904′	913′
iv. Depth-bottom of "unlined"	2144′	2142′	2128′	2148′
E. Station *				
i. Type of support	Wire mesh		Wire mesh	Wire mesh
ii. Principal dimensions	21H × 31W	12H × 30W	25H × 36W	12H × 23W
iii. Depth-top of station	2144′	2142′	2128′	2148′
iv. Depth-floor of station	2162′	2160′	2150′	2160′
F. Sump *				
Depth-top of sump	2162′	2160′	No sump	No sump
Depth-bottom of sump	2272′	2286′		
G. Shaft Duty	Construction hoisting of excavated salt; personnel hoisting	Hoisting shaft for lowering waste containers; personnel hoisting until waste receipt	Ventilation shaft for intake (fresh) air; personnel hoisting	Exhaust air ventilation shaft

*This information is from the MOC drawings identified on Sheets 2, 3, 7, 8, 12, 13, 17, and 18 of Drawing SNL-007 (see Appendix G2-E).

4.3 Sealing System Design Description

This section describes the shaft sealing system design, components, and functions. The shaft sealing system consists of three essentially independent parts:

1. The seals in the Salado Formation provide the primary regulatory barrier. They will limit fluid flow into and out of the repository throughout the 10,000-year regulatory period.

2. The seals in the Rustler Formation will limit flow from the water-bearing members of the Rustler Formation and limit commingling of Magenta and Culebra groundwaters.

3. The seals in the Dewey Lake Redbeds and the near-surface units will limit infiltration of surface water and preclude accidental entry through the shaft openings.

The same sealing system is used in all four shafts. Therefore an understanding of the sealing system for one shaft is sufficient to understand the sealing system in all shafts. Only minor differences exist in the lengths of the components, and the component diameters differ to accommodate the existing shaft diameters.

The shaft liner will be removed in four locations in each shaft. All of these locations are within the Rustler Formation. Additionally, the upper portion of each shaft key will be eliminated. The portion of the shaft key that will be eliminated spans the Rustler/Salado interface and extends into the Salado Formation. The shaft liner removal locations are

1. from 10 ft above the Magenta Member to the base of the Magenta (removal distances vary from 34–39 ft because of different member thickness at shaft locations),

2. for a distance of 10 ft in the anhydrite of the Tamarisk Member,

3. through the full height of the Culebra (17–24 ft), and

4. from the top anhydrite unit in the unnamed lower member to the top of the key (67–85 ft).

Additionally, the concrete will be removed from the top of the key to the bottom of the key's lower chemical seal ring (23 to 29 ft). Drawing SNL-007, Sheets 4, 9, 14, and 19 in Appendix G2-E show shaft liner removal plans, and Sheet 23 shows key removal plans.

The decision to abandon portions of the shaft lining and key in place is based on two factors. First, no improvements in the performance of the sealing system associated with removal of these isolated sections of concrete have been identified. Second, because the keys are thick and heavily reinforced, their removal would be costly and time consuming. No technical problems are associated with the removal of this concrete; thus, if necessary, its removal can be incorporated in any future design.

The DRZ will be pressure grouted throughout the liner and key removal areas and for a distance of 10 ft above and below all liner removal areas. The pressure grouting will stabilize the DRZ during liner removal and shaft sealing operations. The grouting will also control groundwater seepage during and after liner removal. The pressure grouting of the DRZ has not been

assigned a sealing function beyond the construction period. It is likely that this grout will seal the DRZ for an extended period of time. However, past experience with grout in the mining and tunneling industries demonstrates that groundwater eventually opens alternative pathways through the media and reestablishes seepage patterns (maintenance grouting is common in both mines and tunnels). Therefore, post-closure sealing of the DRZ in the Rustler Formation has not been assumed in the design.

The compacted clay sealing material (bentonite) will seal the shaft cross-section in the Rustler Formation. In those areas where the shaft liner has been removed, the compacted clay will confine the vertical movement of groundwater in the Rustler to the DRZ. Sealing the shaft DRZ is accomplished in the Salado Formation. It is achieved initially through the interruption of the halite DRZ by concrete-asphalt waterstops and on a long-term basis through the natural process of healing the halite DRZ. The properties of the compacted clay are discussed in Section 5.3.2. The concrete-asphalt waterstops and DRZ healing in the Salado are discussed in Sections 7.6.1 and 7.5.2 respectively.

Reduction of the uncertainty associated with long-term performance is addressed by replacing the upper and lower Salado Formation salt columns used in some of the earlier designs with compacted clay columns and by adding asphalt sealing components in the Salado Formation. Use of disparate materials for sealing components reduces the uncertainty associated with a common-mode failure.

The compacted salt column provides a seal with an initial permeability several orders of magnitude higher than the clay or asphalt columns; however, its long-term properties will approach those of the host rock. The permeability of the compacted salt, after consolidation, will be several orders of magnitude lower than that of the clay and comparable to that of the asphalt. The clay provides seals of known low permeability at emplacement, and asphalt provides an independent low permeability seal of the shaft cross-section and the shaft wall interface at the time of installation. Sealing of the DRZ in the Rustler Formation during the construction period is accomplished by grouting, and initial sealing of the DRZ in the Salado Formation is accomplished by three concrete-asphalt waterstops.

In the following sections, each component of each of the three shaft segments is identified by name and component number (see Figure G2-5 for nomenclature). Associated drawings in Appendix G2-E are also identified. Drawings showing the overall system configurations for each shaft are listed in Table G2-10.

4.3.1 Salado Seals

The seals placed in the Salado Formation are composed of (1) consolidated salt, clay, and asphalt components that will function for very long periods, exceeding the 10,000-year regulatory period; and (2) salt saturated concrete components that will function for extended periods. The specific components that comprise the Salado seals are described below.

4.3.1.1 Compacted Salt Column

The compacted salt column (Component 10 in Figure G2-5, and shown in Drawing SNL-007, Sheet 25) will be constructed of crushed salt taken from the Salado Formation. The length of the salt column varies from 170 to 172 m (556 to 564 ft) in the four shafts. The compacted salt column is sized to allow the column and concrete-asphalt waterstops at either end to be placed

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between the Vaca Triste Unit and Marker Bed 136. The salt will be placed and compacted to a density approaching 90% of the average density of intact Salado salt. The effects of creep closure will cause this density to increase with time, further reducing permeability.

The salt column will offer limited resistance to fluid migration immediately after emplacement, but it will become less permeable as creep closure further compacts the salt. Salt creep increases rapidly with depth; therefore, at any time, creep closure of the shaft will be greater at greater depth. The location and initial compaction density of the compacted salt column were chosen to assure consolidation of the compacted salt column in the 100 years following repository closure. The state of salt consolidation, results of analyses predicting the creep closure of the shaft, consolidation and healing of the compacted salt, and healing of the DRZ surrounding the compacted salt column are presented in Sections 7.5 and 8.4 of this document. These results indicate that the salt column will become an effective long-term barrier within 100 years.

Table G2-10
Drawings Showing the Sealing System for Each Shaft (Drawings are in Appendix G2-E)

Shaft	Drawing Title	Sheet Number of Drawing SNL 007
Waste	Near-Surface/Rustler Formation Waste Shaft Stratigraphy & Sealing Subsystem Profile	4 of 28
Waste	Salado Formation Waste Shaft Stratigraphy & Sealing Subsystem Profile	5 of 28
AIS	Near-Surface/Rustler Formation Air Intake Shaft Stratigraphy & Sealing Subsystem Profile	9 of 28
AIS	Salado Formation Air Intake Shaft Stratigraphy & Sealing Subsystem Profile	10 of 28
Exhaust	Near-Surface/Rustler Formation Exhaust Shaft Stratigraphy & Sealing Subsystem Profile	14 of 28
Exhaust	Salado Formation Exhaust Shaft Stratigraphy & Sealing Subsystem Profile	15 of 28
Salt Handling	Near-Surface/Rustler Formation Salt Handling Shaft Stratigraphy & Sealing Subsystem Profile	19 of 28
Salt Handling	Salado Formation Salt Handling Shaft Stratigraphy & Sealing Subsystem Profile	20 of 28

4.3.1.2 Upper and Lower Salado Compacted Clay Columns

The upper and lower Salado compacted clay columns (Components 8 and 12 respectively in Figure G2-5) are shown in detail on Drawing SNL-007, Sheet 24. A commercial well-sealing grade sodium bentonite will be used to construct the upper and lower Salado clay columns. These clay columns will effectively limit fluid movement from the time they are placed and will provide an effective barrier to fluid migration throughout the 10,000-year regulatory period and thereafter. The upper clay column ranges in length from 102 to 107 m (335 to 351 ft), and the lower clay column ranges in length from 29 to 33 m (94 to 107 ft) in the four shafts. The locations for the upper and lower clay columns were selected based on the need to limit fluid migration into the compacting salt column. The lower clay column stiffness is sufficient to

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promote early healing of the DRZ, thus removing the DRZ as a potential pathway for fluids (Appendix D in the Compliance Submittal Design Report (Sandia, 1996), Section 5.2.1).

4.3.1.3 Upper, Middle, and Lower Concrete-Asphalt Waterstops

The upper, middle, and lower concrete-asphalt waterstops (Components 7, 9, and 11 respectively in Figure G2-5) are identical and are composed of three elements: an upper concrete plug, a central asphalt waterstop, and a lower concrete plug. These components are also shown on Drawing SNL-007, Sheet 22. The concrete specified is a specially developed salt-saturated concrete called Salado Mass Concrete (**SMC**). In all cases the component's overall design length is 15 m (50 ft).

The upper and lower concrete plugs of the concrete-asphalt waterstop are identical. They fill the shaft cross-section and have a design length of 7 m (23 ft). The plugs are keyed into the shaft wall to provide positive support for the plug and overlying sealing materials. The interface between the concrete plugs and the surrounding formation will be pressure grouted. The upper plug in each component will support dynamic compaction of the overlying sealing material if compaction is specified. Dynamic compaction of the salt column is discussed in Section 6.

The asphalt waterstop is located between the upper and lower concrete plugs. In all cases a kerf extending one shaft radius beyond the shaft wall is cut in the surrounding salt to contain the waterstop. The kerf is 0.3 m (1 ft) high at its edge and 0.6 m (2 ft) high at the shaft wall. The kerf, which cuts through the existing shaft DRZ, will result in the formation of a new DRZ along its perimeter. This new DRZ will heal shortly after construction of the waterstop, and thereafter the waterstop will provide a very low permeability barrier to fluid migration through the DRZ. The formation and healing of the DRZ around the waterstop are addressed in Section 7.6.1. The asphalt fill for the waterstop extends two feet above the top of the kerf to assure complete filling of the kerf. The construction procedure used assures that shrinkage of the asphalt from cooling will not result in the creation of voids within the kerf and will minimize the size of any void below the upper plug.

Concrete-asphalt waterstops are placed at the top of the upper clay column, the top of the compacted salt column, and the top of the lower clay column. The concrete-asphalt waterstops provide independent seals of the shaft cross-section and the DRZ. The SMC plugs (and grout) will fill irregularities in the shaft wall, bond to the shaft wall, and seal the interface. Salt creep against the rigid concrete components will place a compressive load on the salt and promote early healing of the salt DRZ surrounding the SMC plugs. The asphalt waterstop will seal the shaft cross-section and the DRZ.

The position of the concrete components was first determined by the location of the salt and clay columns. The components were then moved upward or downward from their initial design location to assure the components were located in regions where halite was predominant. This positioning, coupled with variations in stratigraphy, is responsible for the variations in the lengths of the salt and clay columns.

4.3.1.4 Asphalt Column

An asphalt-aggregate mixture is specified for the asphalt column (Component 6 in Figure G2-5). This column is 42 to 44 m (138 to 143 ft) in length in the four shafts, as shown in Drawing SNL-007, Sheet 23. The asphalt column is located above the upper concrete-asphalt waterstop; it

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extends approximately 5 m (16 ft) above the Rustler/Salado interface. A 6-m (20-ft) long concrete plug (part of the Rustler seals) is located just above the asphalt column.

The existing shaft linings will be removed from a point well above the top of the asphalt column to the top of the shaft keys. The concrete shaft keys will be removed to a point just below the lowest chemical seal ring in each key. The asphalt column is located at the top of the Salado Formation and provides an essentially impermeable seal for the shaft cross section and along the shaft wall interface. The length of the asphalt column will decrease slightly as the column cools. The procedure for placing the flowable asphalt-aggregate mixture is described in Section 6.

4.3.1.5 Shaft Station Monolith

A shaft station monolith (Component 13) is located at the base of the each shaft. Because the configurations of each shaft differ, drawings of the shaft station monoliths for each shaft were prepared. These drawings are identified in Table G2-11. The shaft station monoliths will be constructed with SMC. The monoliths function to support the shaft wall and adjacent drift roof, thus preventing damage to the seal system as the access drift closes from natural processes.

Table G2-11
Drawings Showing the Shaft Station Monoliths (Drawings are in Appendix G2-E)

Shaft	Drawing Title	Sheet Number of Drawing SNL-007
Waste	Waste Shaft Shaft Station Monolith	6 of 28
AIS	Air Intake Shaft Shaft Station Monolith	11 of 28
Exhaust	Exhaust Shaft Shaft Station Monolith	16 of 28
Salt Handling	Salt Handling Shaft Shaft Station Monolith	21 of 28

4.3.2 Rustler Seals

The seals in the Rustler Formation are composed of the Rustler compacted clay column and a concrete plug. The concrete plug rests on top of the asphalt column of the Salado seals. The clay column extends from the concrete plug through most of the Rustler Formation and terminates above the Rustler's highest water-bearing zone in the Forty-niner Member.

4.3.2.1 Rustler Compacted Clay Column

The Rustler compacted clay column (Component 4 in Figure G2-5) is shown on Drawing SNL-007, Sheet 27 for each of the four shafts. A commercial well-sealing-grade sodium bentonite will be used to construct the Rustler clay column, which will effectively limit fluid movement from the time of placement and provide an effective barrier to fluid migration throughout the 10,000-year regulatory period and thereafter. Design length of the Rustler clay column is about 71 m (234 to 235 ft) in the four shafts.

The location for the Rustler clay columns was selected to limit fluid migration into the shaft cross-section and along the shaft wall interface and to limit mixing of Culebra and Magenta waters. The clay column extends from above the Magenta Member to below the Culebra

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Member of the Rustler Formation. The Magenta and Culebra are the water-bearing units of the Rustler. The members above the Magenta (the Forty-niner), between the Magenta and Culebra (the Tamarisk), and below the Culebra (the unnamed lower member) are aquitards in the vicinity of the WIPP shafts.

4.3.2.2 Rustler Concrete Plug

The Rustler concrete plug (Component 5 in Figure G2-5) is constructed of SMC. The plugs for the four shafts are shown on Drawing SNL-007, Sheet 26. The plug is 6 m (20 ft) long and will fill the shaft cross-section. The plug is placed directly on top of the asphalt column of the Salado seals. The plug will be keyed into the surrounding rock and grouted. The plug permits work to begin on the overlying clay column before the asphalt has completely cooled. The option of constructing the overlying clay columns using dynamic compaction (present planning calls for construction using compressed clay blocks) is also maintained by keying the plug into the surrounding rock.

4.3.3 Near-Surface Seals

The near-surface region is composed of dune sand, the Mescalero caliche, the Gatuña Formation, the Santa Rosa Formation, and the Dewey Lake Redbeds. This region extends from the ground surface to the top of the Rustler Formation—a distance of about 160 m (525 ft). All but about 15 m (50 ft) of this distance is composed of the Dewey Lake Redbeds Formation. The near-surface seals are composed of two earthen fill columns and a concrete plug. The upper earthen fill column (Component 1) extends from the shaft collar through the surficial deposits downward to the top of the Dewey Lake Redbeds. The concrete plug (Component 2) is placed in the top portion of the Dewey Lake Redbeds, and the lower earthen fill column (Component 3) extends from the concrete plug into the Rustler Formation. These components are shown on Drawing SNL-007, Sheet 28.

This seal will limit the amount of surface water entering the shafts and will limit the potential for any future groundwater migration into the shafts. The near surface seals will also completely close the shafts and prevent accidental entry and excessive subsidence in the vicinity of the shafts. As discussed in Section 4.3.2, the existing shaft linings will be abandoned in place throughout the near-surface region.

4.3.3.1 Near-Surface Upper Compacted Earthen Fill

This component (Component 1 in Figure G2-5) will be constructed using locally available fill. The fill will be compacted to a density near that of the surrounding material to inhibit the migration of surface waters into the shaft cross-section. The length of this column varies from 17 to 28 m (56 to 92 ft) in the four shafts. In all cases, this portion of the WIPP sealing system may be modified as required to facilitate decommissioning of the WIPP surface facilities.

4.3.3.2 Near-Surface Concrete Plug

Current plans call for an SMC plug (Component 2 in Figure G2-5). However, freshwater concrete may be used if found to be desirable at a future time, and if approved by NMED through the Permit modification process specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The plug extends 12 m (40 ft) downward from the top of the Dewey Lake Redbeds. It is placed inside the existing shaft lining, and the interface is grouted.

4.3.3.3 Near-Surface Lower Compacted Earthen Fill

This component (Component 3 in Figure G2-5) will be constructed using locally available fill, which will be placed using dynamic compaction (the same method used to construct the salt column). The fill will be compacted to a density equal to or greater than the surrounding materials to inhibit the migration of surface waters into the shaft cross-section. The length of this column varies from 136 to 148 m (447 to 486 ft) in the four shafts.

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5. Material Specification

Appendix G2-A provides a body of technical information for each of the WIPP shaft seal materials. The materials specification characterizes each seal material, establishes the adequacy of its function, states briefly the method of component placement, and quantifies expected characteristics (particularly permeability) pertinent to a WIPP-specific shaft seal design. The goal of the materials specifications is to substantiate why materials used in this seal system design will limit fluid flow within the shafts and thereby limit releases of hazardous constituents from the WIPP site at the regulatory boundary.

This section summarizes materials characteristics for shaft seal system components designed for the WIPP. The shaft seal system will not be constructed for decades; however, if it were to be constructed in the near term, materials specified could be placed in the shaft and meet performance specifications using current materials and construction techniques. Construction methods are described in Appendix G2-B. Materials specifications and construction specifications are not to be construed as the only materials or methods that would suffice to seal the shafts effectively. Undoubtedly, the design will be modified, perhaps simplified, and construction alternatives may prove to be advantageous during the years before seal construction proceeds. Nonetheless, a materials specification is necessary to establish a frame of reference for shaft seal design and analysis, to guide construction specifications, and to provide a basis for seal material parameters.

Design detail and other characteristics of the geologic, hydrologic, and chemical setting are provided in the text, appendices, and references. The four shafts will be entirely filled with dense materials possessing low permeability and other desirable engineering and economic attributes. Seal materials include concrete, clay, asphalt, and compacted salt. Other construction and fill materials include cementitious grout and earthen fill. Concrete, clay, and asphalt are common construction materials used extensively in sealing applications. Their descriptions, drawn from literature and site-specific references, are given in Appendix G2-A. Compaction and natural reconsolidation of crushed salt are uniquely applied here. Therefore, crushed salt specification includes discussion of constitutive behavior and sealing performance, specific to WIPP applications. Cementitious grout is also specified in some detail. Only rudimentary discussion of earthen fill is given here and in Appendices A and B. Specifications for each material are discussed in the following order:

- functions,
- material characteristics,
- construction,
- performance requirements,
- verification methods.

Seal system components are materials possessing high durability and compatibility with the host rock. The system contains functional redundancy and uses differing materials to reduce uncertainty in performance. All materials used in the shaft seal system are expected to maintain their integrity for very long periods. Some sealing components reduce fluid flow soon after placement while other components are designed to function well beyond the regulatory period.

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5.1 Longevity

A major environmental advantage of the WIPP locale is an overall lack of groundwater to seal against. Even though very little regional water is present in the geologic setting, the seal system reflects great concern for groundwater's potential influence on the shaft seal system. If the hydrologic system sustained considerable fluid flow, brine geochemistry could impact engineered materials. Brine would not chemically change the compacted salt column, but mechanical effects of pore pressure are of concern to reconsolidation. The geochemical setting, as further discussed in Section 2.4, will have little influence on concrete, asphalt, and clay shaft seal materials. Each material is durable because the potential for degradation or alteration is very low.

Materials used to form the shaft seals are the same as those identified in the scientific and engineering literature as appropriate for sealing deep geologic repositories for radioactive wastes. Durability or longevity of seal components is a primary concern for any long-term isolation system. Issues of possible degradation have been studied throughout the international community and within waste isolation programs in the USA. Specific degradation studies are not detailed in this document because longevity is one of the over-riding attributes of the materials selected and degradation is not perceived to be likely. However, it is acknowledged here that microbial degradation, seal material interaction, mineral transformation, such as silicification of bentonite, and effects of a thermal pulse from asphalt or hydrating concrete are areas of continuing investigations.

Among longevity concerns, degradation of concrete is the most recognized. At this stage of the design, it is established that only small volumes of brine ever reach the concrete elements (see Section C4 of the Compliance Submittal Design Report (Sandia, 1996)). Further analysis concerned with borehole plugging using cementitious materials shows that at least 100 pore volumes of brine in an open system would be needed to begin degradation processes. In a closed system, such as the hydrologic setting in the WIPP shafts, phase transformations create a degradation product of increased volume. Net volume increase owing to phase transformation in the absence of mass transport would decrease rather than increase permeability of concrete seal elements.

Asphalt has existed for thousands of years as natural seeps. Longevity studies specific to DOE's Hanford site have utilized asphalt artifacts buried in ancient ceremonies to assess long-term stability (Wing and Gee, 1994). Asphalt used as a seal component deep in the shaft will inhabit a benign environment, devoid of ultraviolet light or an oxidizing atmosphere. Additional assurance against possible microbial degradation in asphalt elements is provided with addition of lime. For these reasons, it is believed that asphalt components will possess their design characteristics well beyond the regulatory period.

Natural bentonite is a stable material that generally will not change significantly over a period of ten thousand years. Bentonitic clays have been widely used in field and laboratory experiments concerned with radioactive waste disposal. As noted by Gray (1993), three internal mechanisms, illitization, silicification and charge change, could affect sealing properties of bentonite. Illitization and silicification are thermally driven processes and, following discussion by Gray (1993), are not possible in the environment or time-frame of concern at the WIPP. The naturally occurring Wyoming bentonite which is the specified material for the WIPP shaft seal is well over a million years old. It is, therefore, highly unlikely that the metamorphism of bentonite enters as a design concern.

5.2 Materials

5.2.1 Mass Concrete

Concrete has low permeability and is widely used for hydraulic applications. The specification for mass concrete presents a special design mixture of a salt-saturated concrete called Salado Mass Concrete (**SMC**). Performance of SMC and similar salt-saturated mixtures has been established through analogous industrial applications and in laboratory and field testing. The documentation substantiates adequacy of SMC for concrete applications within the WIPP shafts.

The function of the concrete is to provide durable components with small void volume, adequate structural compressive strength, and low permeability. SMC is used as massive plugs, a monolith at the base of each shaft, and in tandem with asphalt waterstops. Concrete is a rigid material that will support overlying seal components while promoting natural healing processes within the salt DRZ. Concrete is one of the redundant components that protects the reconsolidating salt column. The salt column will achieve low permeabilities in fewer than 100 years, and concrete will no longer be needed at that time. However, concrete will continue to provide good sealing characteristics for a very long time.

Salt-saturated concrete contains sufficient salt as an aggregate to saturate hydration water with respect to NaCl. Salt-saturated concrete is required for all uses within the Salado Formation because fresh water concrete would dissolve part of the host rock. The concrete specified for the shaft seal system has been tailored for the service environment and includes all the engineering properties of high quality concrete, as described in Appendix G2-A. Among these are low heat of hydration, high compressive strength, and low permeability. Because SMC provides material characteristics of high-performance concrete, it will likely be the concrete of choice for all seal applications at the WIPP.

Construction involves surface preparation and slickline placement. A batching and mixing operation on the surface will produce a wet mixture having low initial temperatures. Placement uses a tremie line, where the fresh concrete exits the slickline below the surface level of the concrete being placed. Placed in this manner, the SMC will have low porosity (about 5%) with or without vibration. Tremie line placement is a standard construction method in mining operations.

Specifications of concrete properties include mixture proportions and characteristics before and after hydration. SMC strength is much greater than required for shaft seal elements, and the state of stress within the shafts is compressional with little shear stress developing. Volume stability of the SMC is also excellent; this, combined with salt-saturation, assures a good bond with the salt. Permeability of SMC is very low, consistent with most concrete (Pfeifle et al., 1996). Because of a favorable state of stress and isothermal conditions, the SMC will remain intact. Because little brine is available to alter concrete elements, minimal degradation is possible. These favorable attributes combine to assure concrete elements within the Salado will remain structurally sound and possess very low permeability (between 2×10^{-21} and 1×10^{-17} m^2) for exceedingly long periods. A permeability distribution function and associated discussion are given in Appendix G2-A.

Standard ASTM specifications are made for the green and hydrated concrete properties. Quality control and a history of successful use in both civil construction and mining applications assure proper placement and performance.

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5.2.2 Compacted Clay

Compacted clays are commonly proposed as primary sealing materials for nuclear waste repositories and have been extensively investigated against rigorous performance requirements. Advantages of clays for sealing purposes include low permeability, demonstrated longevity in many types of natural environments, deformability, sorptive capacity, and demonstrated successful utilization in practice for a variety of sealing purposes.

Compacted clay as a shaft sealing component functions as a barrier to brine flow and possibly to gas flow (see alternative construction methods in Appendix G2-B). Compacted bentonitic clay can generate swelling pressure and clays have sufficient rigidity to promote healing of any DRZ in the salt. Wetted swelling clay will seal fractures as it expands into available space and will ensure tightness between the clay seal component and the shaft walls.

The Rustler and Salado compacted clay columns are specified to be constructed of dense sodium bentonite blocks. An extensive experimental data base exists for the permeability of sodium bentonites under a variety of conditions. Many other properties of sodium bentonite, such as strength, stiffness, and chemical stability, are established. Bentonitic clays heal when fractured and can penetrate small fractures or irregularities in the host rock. Further, bentonite is stable in the seal environment. These properties, noted by international waste isolation programs, make bentonite a widely accepted seal material.

From the bottom clay component to the top earthen fill, different methods will be used to place clay materials in the shaft. Seal performance within the Salado Formation is far more important to regulatory compliance of the seal system than is performance of clay and earthen fill in the overlying formations. Therefore, more time and effort will be expended on placement of Salado clay components. Three potential construction methods could be used to place clay in the shaft, as discussed in Appendix G2-B: compacted blocks, vibratory roller, and dynamic compaction. Construction of Salado clay components specifies block assembly.

Required sealing performance of compacted clay elements varies with location. For example, Component 4 provides separation of water-bearing zones, while the lowest clay column (Component 12) limits fluid flow to the reconsolidating salt column. If liquid saturation in the clay column of 85% can be achieved, it would serve as a gas barrier. In addition, compacted clay seal components promote healing of the salt DRZ. To achieve low permeabilities, the dry density of the emplaced bentonite should be about 1.8 g/cm^3. A permeability distribution function for performance assessment and the logic for its selection are given in Appendix G2-A.

Verification of specified properties such as density, moisture content, permeability, or strength of compacted clay seals can be determined by direct measurement during construction. However, indirect methods are preferred because certain measurements, such as permeability, are likely to be time consuming and invasive. Methods used to verify the quality of emplaced seals will include quality of block production and field measurements of density.

5.2.3 Asphalt

Asphalt is used to prevent water migration down the shaft in two ways: as an asphalt column near the Rustler/Salado contact and as a "waterstop" sandwiched between concrete plugs at three locations within the Salado Formation. Asphalt components of the WIPP seal design add assurance that minimal transport of brine down the sealed shaft will occur.

Asphalt is a widely used construction material because of its many desirable engineering properties. Asphalt is a strong cement, readily adhesive, highly waterproof, and durable. Furthermore, it is a plastic substance that is readily mixed with mineral aggregates. A range of viscosity is achievable for asphalt mixtures. It is highly resistant to most acids, salts, and alkalis. These properties are well suited to the requirements of the WIPP shaft seal system.

Construction of the seal components containing asphalt can be accomplished using a slickline process where low-viscosity heated material is effectively pumped into the shaft. The technology to apply the asphalt in this manner is available as described in the construction procedures in Appendix G2-B.

The asphalt components are required to endure for about 100 years and limit brine flow down the shaft to the compacted salt component. Since asphalt will not be subjected to ultraviolet light or an oxidizing environment, it is expected to provide an effective seal for centuries. Air voids less than 2% ensure low permeability. The permeability of the massive asphalt column is expected to have an upper limit 1×10^{-18} m^2.

Sufficient construction practice and laboratory testing information is available to assure performance of the asphalt component. Laboratory validation tests to optimize viscosity may be desirable before final installation specifications are prepared. In general, verification tests would add quantitative documentation to expected performance values and have direct application to WIPP.

5.2.4 Compacted Salt Column

A reconsolidated column of natural WIPP salt will seal the shafts permanently. If salt reconsolidation is unimpeded by fluid pore pressures, the material will eventually achieve extremely low permeabilities approaching those of the native Salado Formation. Recent developments in support of the WIPP shaft seal system have produced confirming experimental results, constitutive material models, and construction methods that substantiate use of a salt column to create a low permeability seal component. Reuse of salt excavated in the process of creating the underground openings has been advocated since its initial proposal in the 1950s. Replacing the natural material in its original setting ensures physical, chemical, and mechanical compatibility with the host formation.

The function of the compacted and reconsolidated salt column is to limit transmission of fluids into or out of the repository for the statutory period of 10,000 years. The functional period starts within a hundred years and lasts essentially forever. After a period of consolidation, the salt column will almost completely retard gas or brine migration within the former shaft opening. A completely consolidated salt column will achieve flow properties indistinguishable from natural Salado salt.

The salt component is composed of crushed Salado salt with additional small amounts of water. The total water content of the crushed salt will be adjusted to 1.5 wt% before it is tamped into place. Field and laboratory tests have verified that natural salt can be compacted to significant fractional density ($\rho \geq 0.9$) with addition of these moderate amounts of water.

Dynamic compaction is the specified construction procedure to tamp crushed salt in the shaft. Deep dynamic compaction provides great energy to the crushed salt, is easy to apply, and has an effective depth of compactive influence greater than lift thickness. Dynamic compaction is

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relatively straightforward and requires a minimal work force in the shaft. Compaction itself will follow procedures developed in a large-scale compaction demonstration, as outlined in Appendix G2-B.

Numerical models of the shaft provide density of the compacted salt column as a function of depth and time. Many calculations comparing models for consolidation of crushed salt were performed to quantify performance of the salt column, as discussed in Appendix D of the Compliance Submittal Design Report (Sandia, 1996) and the references (Callahan et al., 1996; Brodsky et al., 1996). From the density-permeability relationship of reconsolidating crushed salt, permeability of the compacted salt seal component is calculated. In general, results show that the bottom of the salt column consolidates rapidly, achieving permeability of 1×10^{-19} m^2 in about 50 years. By 100 years, the middle of the salt column reaches similar permeability.

Results of the large-scale dynamic compaction demonstration suggest that deep dynamic compaction will produce a sufficiently dense starting material. As with other seal components, testing of the material in situ will be difficult and probably not optimal to ensure quality of the seal element. This is particularly apparent for the compacted salt component because the compactive effort produces a finely powdered layer on the top of each lift. It was demonstrated (Hansen and Ahrens, 1996) that the fine powder is very densely compacted upon tamping the superincumbent lifts. The best means to ensure that the crushed salt element is placed properly is to establish performance through verification of quality assurance/quality control procedures. If crushed salt is placed with a reasonable uniformity of water and compacted with sufficient energy, long-term performance can be assured.

5.2.5 Cementitious Grout

Cementitious grouting is specified for all concrete members. Grouting is also used in advance of liner removal to stabilize the ground and to limit water inflow during shaft seal construction. Cementitious grout is specified because of its proven performance, nontoxicity, and previous use at the WIPP.

The function of grout is to stabilize the surrounding rock before existing concrete liners are removed. Grout will fill fractures within adjacent lithologies, thereby adding strength and reducing permeability and, hence, water inflow during shaft seal construction. Grout around concrete members of the concrete asphalt waterstop will be employed in an attempt to tighten the interface and fill microcracks in the DRZ. Efficacy of grouting will be determined during construction.

An ultrafine cementitious grout has been specifically developed for use at the WIPP (Ahrens and Onofrei, 1996). This grout consists of Type 5 portland cement, pumice as a pozzolanic material, and superplasticizer. The average particle size is approximately 2 microns. The ultrafine grout is mixed in a colloidal grout mixer, with a water to components ratio (**W:C**) of 0.6:1.

Drilling and grouting sequences provided in Appendix G2-B follow standard procedures. Grout will be mixed on the surface and transported by slickline to the middle deck on the multi-deck stage (galloway). Grout pressures are specified below lithostatic to prevent hydrofracturing.

Performance of grout is not a consideration for compliance issues. Grouting of concrete elements is an added assurance to tighten interfaces. Grouting is used to facilitate construction by stabilizing any loose rock behind the concrete liner.

No verification of the effectiveness of grouting is currently specified. If injection around concrete plugs is possible, an evaluation of quantities and significance of grouting will be made during construction. Procedural specifications will include measurements of fineness and determination of rheology in keeping with processes established during the WIPP demonstration grouting (Ahrens et al., 1996).

5.2.6 Earthen Fill

A brief description of the earthen fill is provided in Appendix G2-A, and construction is summarized in Appendix G2-B. Compacted fill can be obtained from local borrow pits, or material excavated during shaft construction can be returned to the shaft. There are minimal design requirements for earthen fill and none that are related to WIPP regulatory performance.

5.3 Concluding Remarks

Materials specifications in Appendix G2-A provide descriptions of seal materials along with reasoning on their expected reliability in the WIPP setting. The specification follows a framework that states the function of the seal component, a description of the material, and a summary of construction techniques. The performance requirements for each material are detailed. Materials chosen for use in the shaft seal system have several common desirable attributes: low permeability, high density, compatibility, longevity, low cost, constructability, availability, and supporting documentation.

6. Construction Techniques

Construction of the shaft sealing system is feasible. The described procedures utilize currently available technology, equipment, and materials to satisfy shaft sealing system design guidance. Although alternative methods are possible, those described satisfy the design guidance requirements listed in Table G2-7 and detailed in the appendices. Construction feasibility is established by reference to comparable equipment and activities in the mining, petroleum, and food industries and test results obtained at the WIPP. Equipment and procedures for emplacement of sealing materials are described below.

6.1 Multi-Deck Stage

A multi-deck stage (Figures G2-6 and G2-7) consisting of three vertically connected decks will be the conveyance utilized during the shaft sealing operation. Detailed sketches of the multi-deck stage appear in Appendix G2-E. The stage facilitates installation and removal of utilities and provides a working platform for the various sealing operations. A polar crane attached to the lower deck provides the mechanism required for dynamic compaction and excavation of the shaft walls. Additionally, the header at the bottom of the slickline is supported by a reinforced steel shelf, which is securely bolted to the shaft wall during emplacement of sealing materials. The multi-deck stage can be securely locked in place in the shaft whenever desired (e.g., during dynamic compaction, excavation of the salt walls of the shaft, grouting, liner removal, etc.). The multi-deck stage is equipped with floodlights, remotely aimed closed-circuit television, fold-out floor extensions, a jib crane, and range-finding devices. Similar stages are commonly employed in shaft sinking operations.

The polar crane can be configured for dynamic compaction (Figure G2-6) or for excavation of salt (Figure G2-7); a man cage or bucket can be lowered through the stage to the working surface below. Controlled manually or by computer, the crane and its trolley utilize a geared track drive. The crane can swiftly position the tamper (required for dynamic compaction) in the drop positions required (Figure G2-8) or accommodate the undercutter required for excavation of the shaft walls. The crane incorporates a hoist on the trolley and an electromagnet, enabling it to position, hoist, and drop the tamper. A production rate of one drop every two minutes during dynamic compaction is possible.

6.2 Salado Mass Concrete (Shaft Station Monolith and Shaft Plugs)

Salado Mass Concrete, described in Appendix G2-A, will be mixed on surface at 20°C and transferred to emplacement depth through a slickline (i.e., a steel pipe fastened to the shaft wall and used for the transfer of sealing materials from surface to the fill horizon) minimizing air entrainment and ensuring negligible segregation. Existing sumps will be filled to the elevation of the floor of the repository horizon, and emplacement of the shaft station monolith is designed to eliminate voids at the top (back) of the workings.

When excavating salt for waterstops or plugs in the Salado Formation, an undercutter attached to the trolley of the polar crane will be forced into the shaft wall by a combination of geared trolley and undercutter drives. Full circumferential cuts will be accomplished utilizing the torque developed by the geared polar crane drive.

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The undercutter proposed is a modified version of those currently in use in salt and coal mines, where their performance is proven. Such modifications and applications have been judged feasible by the manufacturer.

The concrete-salt interface and DRZ around concrete plugs in the Salado Formation (and the one at the base of the Rustler Formation) will be grouted with ultrafine grout. Injection holes will be collared in the top of the plug and drilled downward at 45° below horizontal. The holes will be drilled in a "spin" pattern describing a downward opening cone designed to intercept both vertical and horizontal fractures (Figure G2-9). The holes will be stage grouted (i.e., primary holes will be drilled and grouted, one at a time). Secondary holes will then be drilled and grouted, one at a time, on either side of primaries that accepted grout.

6.3 Compacted Clay Columns (Salado and Rustler Formations)

Cubic blocks of sodium bentonite, 20.8 cm on the edge and weighing approximately 18 kg, will be precompacted on surface to a density between 1.8 and 2.0 gm/cm^3 and emplaced manually. The blocks will be transferred from surface on the man cage. Block surfaces will be moistened with a fine spray of potable water, and the blocks will be manually placed so that all surfaces are in contact. Peripheral blocks will be trimmed to fit irregularities in the shaft wall, and remaining voids will be filled with a thick mortar of sodium bentonite and potable water. Such blocks have been produced at the WIPP and used in the construction of 0.9-m-diameter seals, where they performed effectively (Knowles and Howard, 1996). Alternatives, which may be considered in future design evaluations, are discussed in Appendix G2-B.

6.4 Asphalt Waterstops and Asphaltic Mix Columns

Neat asphalt is selected for the asphalt waterstops, and an asphaltic mastic mix (**AMM**) consisting of neat asphalt, fine silica sand, and hydrated lime will be the sealing material for the columns. Both will be fluid at emplacement temperature and remotely emplaced. Neat asphalt (or AMM, prepared in a pug mill near the shaft collar) will be heated to 180°C and transferred to emplacement depth via an impedance-heated, insulated tremie line (steel pipe) suspended from slips (pipe holding device) at the collar of the shaft.

This method of line heating is common practice in the mining and petroleum industries. This method lowers the viscosity of the asphalt so that it can be pumped easily. Remote emplacement by tremie line eliminates safety hazards associated with the high temperature and gas produced by the hot asphalt. Fluidity ensures that the material will flow readily and completely fill the excavations and shaft. Slight vertical shrinkage will result from cooling (calculations in Appendix D of the Compliance Submittal Design Report (Sandia, 1996)), but the material will maintain contact with the shaft walls and the excavation for the waterstop. Vertical shrinkage will be counteracted by the emplacement of additional material.

6.5 Compacted WIPP Salt

Dynamic compaction of mine-run WIPP salt has been demonstrated (Ahrens and Hansen, 1995). The surface demonstration produced salt compacted to 90% of in-place rock salt density, with a statistically averaged permeability of 1.65×10^{-15} m^2. Additional laboratory consolidation of this material at 5 MPa confining pressure (simulating creep closure of the salt) resulted in increased compaction and lower permeability (Brodsky, 1994). Dynamic compaction was

selected because it is simple, robust, proven, has excellent depth of compaction, and is applicable to the vertical WIPP shafts.

The compactive effect expanded laterally and downward in the demonstration, and observation during excavation of the compacted salt revealed that the lateral compactive effect will fill irregularities in the shaft walls. Additionally, the depth of compaction, which was greater than that of the three lifts of salt compacted, resulted in the bottom lift being additionally compacted during compaction of the two overlying lifts. This cumulative effect will occur in the shafts.

Construction of the salt column will proceed in the following manner:

- Crushed and screened salt will be transferred to the fill elevation via slickline. Use of slicklines is common in the mining industry, where they are used to transfer backfill materials or concrete to depths far greater than those required at the WIPP. Potable water will be added via a fine spray during emplacement at the fill surface to adjust the moisture content to 1.5 ±0.3 wt%, accomplished by electronically coordinating the weight of the water with that of the salt exiting the hose.

- Dynamic compaction will then be used to compact the salt by dropping the tamper in specific, pre-selected positions such as those shown in Figure G2-8.

6.6 Grouting of Shaft Walls and Removal of Liners

The procedure listed below is a common mining practice which will be followed at each elevation where liner removal is specified. If a steel liner is present, it will be cut into manageable pieces and hoisted to the surface for disposal, prior to initiation of grouting.

Upward opening cones of diamond drill holes will be drilled into the shaft walls in a spin pattern (Figure G2-10) to a depth ensuring complete penetration of the Disturbed Rock Zone (**DRZ**) surrounding the shaft. For safety reasons, no major work will be done from the top deck; all sealing activities will be conducted from the bottom deck. The ends of the holes will be 3 m apart, and the fans will be 3 m apart vertically, covering the interval from 3 m below to 3 m above the interval of liner removal. Tests at the WIPP demonstrated that the ultrafine cementitious grout penetrated more than 2 m from the injection holes(Ahrens et al., 1996).

Injection holes will be drilled and grouted one at a time, as is the practice in stage grouting. Primary holes are grouted first, followed by the grouting of secondary holes on either side of primaries that accepted grout. Ultrafine grout will be injected below lithostatic pressure to avoid hydrofracturing the rock, proceeding from the bottom fan upward. Grout will be mixed on surface and transferred to depth via the slickline.

Radial, horizontal holes will then be drilled on a 0.3-m grid, covering the interval to be removed. These will be drilled to a depth sufficient to just penetrate the concrete liner. A chipping hammer will be used to break a hole through the liner at the bottom of the interval. This hole, approximately 0.3 m in diameter, will serve as "free face," to which the liner can be broken. Hydraulically-actuated steel wedges will then be used in the pre-drilled holes to break out the liner in manageable pieces, beginning adjacent to the hole and proceeding upward. Broken concrete will be allowed to fall to the fill surface, where it will be gathered and hoisted to the surface for disposal. Chemical seal rings will be removed as encountered.

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6.7 Earthen Fill

Local soil, screened to produce a maximum particle dimension of approximately 15 mm, will be the seal material. This material will be transferred to the fill surface via the slickline and emplaced in the same manner as the salt. After adjusting the moisture content of the earthen fill below the concrete plug in the Dewey Lake Redbeds to achieve maximum compaction, the fill will be dynamically compacted, achieving a permeability as low as that of the enclosing formation.

The portion of the earthen fill above the plug will be compacted with a vibratory-impact sheepsfoot roller, a vibratory sheepsfoot roller, or a walk-behind vibratory plate compactor, because of insufficient height for dynamic compaction.

6.8 Schedule

For discussion purposes, it has been assumed that the shafts will be sealed two at a time. This results in the four shafts being sealed in approximately six and a half years. The schedules presented in Appendix G2-B are based on this logic. Sealing the shafts sequentially would require approximately eleven and a half years.

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7. Structural Analyses of Shaft Seals

7.1 Introduction

The shaft seal system was designed in accordance with design guidance described in Section 3.2. To be successful, seal system components must exhibit desired structural behavior. The desired structural behavior can be as simple as providing sufficient strength to resist imposed loads. In other cases, structural behavior is critical to achieving desired hydrological properties. For example, permeability of compacted salt depends on the consolidation induced by shaft closure resulting from salt creep. In this example, results from structural analyses feed directly into fluid-flow calculations, which are described in Section 8, because structural behavior affects both time-dependent permeabilities of the compacted salt and pore pressures within the compacted salt. In other structural considerations, thermal effects are analyzed as they affect the constructability and schedule for the seal system. Thus a series of analyses, loosely termed structural analyses, were performed to accomplish three purposes:

1. to determine loads imposed on components and to assess both structural stability based on the strength of the component and mechanical interaction between components;

2. to estimate the influence of structural behavior of seal materials and surrounding rock on hydrological properties; and

3. to provide structural and thermal related information on construction issues.

For the most part, structural analyses rely on information and design details presented in the Design Description (Section 4), the Design Drawings (Appendix G2-E), and Material Specification (Section 5 and Appendix G2-A). Some analyses are generic, and calculation input and subsequent results are general in nature.

7.2 Analysis Methods

Finite-element modeling was the primary numerical modeling technique used to evaluate structural performance of the shaft seals and surrounding rock mass. Well documented finite-element computer programs, SPECTROM-32 and SPECTROM-41, were used in structural and thermal modeling, respectively. The computer program SALT_SUBSID was used in the subsidence modeling over the backfilled shaft-pillar area. Specific details of these computer programs as they relate to structural calculations are listed in Appendix D of the Compliance Submittal Design Report (Sandia, 1996), Section D2.

7.3 Models of Shaft Seals Features

Structural calculations require material models to characterize the behavior of (1) each seal material (concrete, crushed salt, compacted clay, and asphalt); (2) the intact rock lithologies in the near-surface, Rustler, and Salado formations; and (3) any DRZ within the surrounding rock. A general description of the material models used in characterizing each of these materials and features is given below. Details of the models and specific values of model parameters are given in Appendix D in the Compliance Submittal Design Report (Sandia, 1996), Section D3.

7.3.1 Seal Material Models

The SMC thermal properties required for the structural analyses (thermal conductivity, density, specific heat, and volumetric heat generation rate) were obtained from SMC test data. Concrete was assumed to behave as a viscoelastic material, based on experimental data, and the elastic modulus of SMC was modeled as age-dependent. Strength properties of SMC were specified in the design (see Appendix G2-A).

For crushed salt, the deformational model included a nonlinear elastic component and a creep consolidation component. The nonlinear elastic modulus was assumed to be density-dependent, based on laboratory test data performed on WIPP crushed salt. Creep consolidation behavior of crushed salt was based on three candidate models whose parameters were obtained from model fitting to hydrostatic and shear consolidation test data performed on WIPP crushed salt. Creep consolidation models include functional dependencies on density, mean stress, stress difference, temperature, grain size, and moisture content.

Compacted clay was assumed to behave according to a nonlinear elastic model in which shear stiffness is negligible, and asphalt was assumed to behave as a weak elastic material. Thermal properties of asphalt were taken from literature.

7.3.2 Intact Rock Lithologies

Salado salt was assumed to be argillaceous salt that is governed by the Multimechanism Deformation Coupled Fracture (**MDCF**) model, which is an extension of the Munson-Dawson (**M-D**) creep model. A temperature-dependent thermal conductivity was necessary.

Salado interbeds were assumed to behave elastically. Their material strength was assumed to be described by a Drucker-Prager yield function, consistent with values used in previous WIPP analyses.

Deformational behavior of the near-surface and Rustler Formation rock types was assumed to be time-invariant, and their strength was assumed to be described by a Coulomb criterion, consistent with literature values.

7.3.3 Disturbed Rock Zone Models

Two different models were used to evaluate the development and extent of the DRZ within intact salt. The first approach used ratios of time-dependent stress invariants to quantify the potential for damage or healing to occur. The second approach used the damage stress criterion according to the MDCF model for WIPP salt.

7.4 Structural Analyses of Shaft Seal Components

7.4.1 Salado Mass Concrete Seals

Five analyses related to structural performance of SMC seals were performed, including (1) a thermal analysis, (2) a structural analysis, (3) a thermal stress analysis, (4) a dynamic compaction analysis, and (5) an analysis of the effects of clay swelling pressure. This section presents these analyses and evaluates the results in terms of the performance of the SMC seal.

Details of these calculations are given in Appendix D in the Compliance Submittal Design Report (Sandia, 1996), Section D4.

7.4.1.1 Thermal Analysis of Concrete Seals

The objective of this calculation was to determine expected temperatures within (and surrounding) an SMC emplacement resulting from its heat of hydration. Results indicate that the concrete component temperature increases from ambient (27°C) to a maximum of 53°C at 0.02 year after emplacement. The maximum temperature in the surrounding salt is 38°C at approximately the same time. The thermal gradient within the concrete is approximately 1.5°C/m. Most of the higher temperatures are contained within the concrete. At a radial distance of 2 m into the surrounding salt, the temperature rise is less than 1°C. These conditions are favorable for proper performance of the SMC components. A 26°C temperature rise and a 1.5°C/m temperature gradient are not large enough to cause thermal cracking as the concrete cools (Andersen et al., 1992).

7.4.1.2 Structural Analysis of Concrete Seals

The objectives of this calculation were to determine (1) expected stresses within the concrete components caused by restrained creep of the surrounding salt and (2) expected stresses in the concrete component from weight of overlying seal material.

In the upper concrete-asphalt waterstop, radial stresses increase (compression is positive) from zero at time of emplacement (t = 0) to 2.5 MPa at t = 50 years. Similarly, radial stresses in the middle concrete component range from 3.5 to 4.5 MPa at 50 years after emplacement. In the lower concrete-asphalt waterstop, radial stresses range from 4.5 to 5.5 MPa at t = 50 years. All the calculated stresses are well below the unconfined compressive strength of the concrete (30 MPa).

The upper, middle, and lower concrete-asphalt waterstops are located at depths of 300, 420, and 610 m, respectively. When performing these calculations, it was assumed that each concrete component must support the weight of the overlying materials between it and the next concrete component above it. Using an average overburden density of 0.02 MPa/m, stresses induced by the overlying material are significantly less than the strength of the concrete. The structural integrity of concrete components will not be compromised by either induced radial stress or imposed vertical stress.

7.4.1.3 Thermal Stress Analysis of Concrete Seals

The objectives of this calculation were (1) to determine thermal stresses in concrete components from the heat of hydration and (2) to determine thermal impact on the creep of the surrounding salt.

Thermoelastic stresses in the concrete were calculated based on a maximum temperature increase of 26°C and assuming a fully confined condition. Results of this calculation indicate that short-term compressive thermal stresses in the concrete will be less than 9.2 MPa. The temperature rise in the surrounding salt is insignificant in terms of producing either detrimental or beneficial effects. Based on these results, the structural integrity of concrete components will not be compromised by thermoelastic stresses caused by heat of hydration.

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7.4.1.4 Effect of Dynamic Compaction on Concrete Seals

The objective of this calculation was to determine a required thickness of seal layers above concrete components to reduce the impact of dynamic compaction. Compaction depths for crushed salt and clay layers are 2.8 m and 2.2 m, respectively. Layers 3.7-m thick for crushed salt and 3-m thick for clay are to be emplaced before compaction begins, thus providing a layer about 30% thicker than the calculated compaction depths.

7.4.1.5 Effect of Clay Swelling Pressures on Concrete Seals

The objective of this calculation was to determine the increased stresses within concrete components as a result of clay swelling pressures. Test measurements on confined bentonite at an emplaced density of 1.8 g/cm^3 indicate that anticipated swelling pressures are on the order of 3.5 MPa. In order to fracture the salt surrounding the clay, the swelling pressures must exceed the lithostatic rock stress in the salt, which ranges from nominally 8.3 MPa at the upper clay seal to 14.4 MPa at the lower clay seal. The design strength of the concrete (31.0 MPa) is significantly greater than the swelling pressure of 3.5 MPa. Even in the unlikely event that the clay swelled to lithostatic pressures, the resulting state of stress in the concrete seal would lie well below any failure surface. Furthermore, the compressive tangential stress in the salt along the shaft wall, even after stress relaxation from creep, is always larger than lithostatic. Hence, radial fracturing from clay swelling pressure is not expected.

7.4.2 Crushed Salt Seals

Two analyses related to structural performance of crushed salt seals were performed, including (1) a structural analysis and (2) an analysis to determine effects of pore pressure on consolidation of crushed salt seals. This section presents the results of these analyses and evaluates the results in terms of performance of crushed salt seals. Details of these analyses are given in Appendix D in the Compliance Submittal Design Report (Sandia, 1996), Section D4.

7.4.2.1 Structural Analysis of Compacted Salt Seal

The objectives of this calculation were (1) to determine the fractional density of the crushed salt seal as a function of time and depth and, using these results, (2) to determine permeability of the crushed salt as a function of time and depth.

Results indicate that compacted salt will increase from its emplaced fractional density of 90% to a density of 95% approximately 40, 80, and 120 years after emplacement at the bottom, middle, and top of the shaft seal, respectively. Using the modified Sjaardema-Krieg creep consolidation model, the times required to fully reconsolidate the crushed salt to 100% fractional density are 70 years, 140 years, and 325 years at the bottom, middle, and top of the salt column, respectively. Based on these results, the desired fractional densities (hence, permeability) can be achieved over a substantial length of the compacted salt seal in the range of 50 to 100 years.

7.4.2.2 Pore Pressure Effects on Reconsolidation of Crushed Salt Seals

The objective of this calculation was to determine the effect of pore pressure on the reconsolidation of the crushed salt seal. Fractional densities of the crushed salt seal were calculated using the modified Sjaardema-Krieg consolidation model for a range of pore

pressures (0, 2, and 4 MPa). Results indicate that times required to consolidate the crushed salt increase as the pore pressure increases, as expected. For example, for a pore pressure of 2 MPa, the times required to achieve a fractional density of 96% are about 90 years, 205 years, and 560 years at the bottom, middle, and top of the crushed salt column, respectively. A pore pressure of 4 MPa would effectively prevent reconsolidation of the crushed salt within a reasonable period (<1,000 years). The results of this calculation were used in the fluid flow calculations, and the impact of these pore pressures on the permeability of the crushed salt seal is described in Section 8 and Appendix C of the Compliance Submittal Design Report (Sandia, 1996).

7.4.3 Compacted Clay Seals

One analysis was performed to determine the structural response of compacted clay seals. The objective of this calculation was to determine stresses in the upper Salado compacted clay component and the lower Salado compacted clay component as a result of creep of the surrounding salt. Details of this calculation are given in Appendix D in the Compliance Submittal Design Report (Sandia, 1996), Section D4. Results of this calculation indicate that after 50 years the compressive stresses in the upper Salado compacted clay component are about 0.7 MPa, not including the effects of swelling pressures. Similarly, after 50 years the stresses in the lower Salado compacted clay component are approximately 2.6 MPa. Based on these results, the compacted clay component will provide some restraint to the creep of salt and induce a back (radial) stress in the clay seal, which will promote healing of the DRZ in the surrounding intact salt (see discussion about DRZ in Section 7.5.1).

7.4.4 Asphalt Seals

Three analyses were performed related to structural performance of the asphalt seals, including (1) a thermal analysis, (2) a structural analysis, and (3) a shrinkage analysis. This section presents the results of these analyses and evaluates the results in terms of the performance of the asphalt seal. Details of these analyses are given in Appendix D of the Compliance Submittal Design Report (Sandia, 1996), Section D4.

7.4.4.1 Thermal Analysis

The objectives of this calculation were (1) to determine temperature histories within the asphalt seal and the surrounding salt and (2) to determine effects of the length of the waterstop.

Results indicate that the center of the asphalt column will cool from its emplaced temperature of 180°C to 83°C, 49°C, 31°C, and 26°C at times 0.1 year, 0.2 year, 0.5 year, and 1.0 year, respectively. Similarly, the asphalt/salt interface temperatures at corresponding times are 47°C, 38°C, 29°C, and 26°C. The time required for a waterstop to cool is significantly less than that required to cool the asphalt column. Based on these results, about 40 days are required for asphalt to cool to an acceptable working environment temperature. The thermal impact on enhanced creep rate of the surrounding salt is considered to be negligible.

7.4.4.2 Structural Analysis

The objective of this analysis was to calculate pressures in asphalt that result from restrained creep of the surrounding salt and to evaluate stresses induced on the concrete seal component by such pressurization.

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Results indicate that pressures in the waterstops after 100 years are 1.8 MPa, 2.5 MPa, and 3.2 MPa for the upper, middle, and lower waterstops, respectively. Based on these results, the structural integrity of concrete components will not be compromised by imposed pressures, and the rock surrounding the asphalt will not be fractured by the pressure. The pressure from asphalt is enough to initiate healing of the DRZ surrounding the waterstop.

7.4.4.3 Shrinkage Analysis

The objective of this analysis was to calculate shrinkage of the asphalt column as it cools from its emplaced temperature to an acceptable working environment temperature. Results of this analysis indicate that the 42-m asphalt column will shrink 0.9 m in height as the asphalt cools from its emplaced temperature of 180°C to 38°C.

7.5 Disturbed Rock Zone Considerations

7.5.1 General Discussion of DRZ

Microfracturing leading to a DRZ occurs within salt whenever excavations are made. Laboratory and field measurements show that a DRZ has enhanced permeability. The body of evidence strongly suggests that induced fracturing is reversible and healed when deviatoric stress states created by the opening are reduced. Rigid seal components in the shaft provide a restraint to salt creep closure, thereby inducing healing stress states in the salt. A more detailed discussion of the DRZ is included in Appendix D in the Compliance Submittal Design Report (Sandia, 1996).

7.5.2 Structural Analyses

Three analyses were performed to determine the behavior of the DRZ in the rock mass surrounding the shaft. The first analysis considered time-dependent DRZ development and subsequent healing of intact Salado salt surrounding each of the four seal materials. The second analysis considered time-dependent development of the DRZ within anhydrite and polyhalite interbeds within the Salado Formation. The last analysis considered time-independent DRZ development within the near-surface and Rustler formations. These analyses are discussed below and given in more detail in Appendix D of the Compliance Submittal Design Report (Sandia, 1996), Section D5. Results from these analyses were used as input conditions for the fluid flow analysis presented in Section 8 and Appendix C of the Compliance Submittal Design Report (Sandia, 1996).

7.5.2.1 Salado Salt

The objective of this calculation was to determine time-dependent extent of the DRZ in salt, assuming no pore pressure effects, for each of the four shaft seal materials (i.e., concrete, crushed salt, compacted clay, and asphalt. The seal materials below a depth of about 300 m provide sufficient rigidity to heal the DRZ within 100 years. Asphalt, modeled as a weak elastic material, will not create a stress state capable of healing the DRZ because it is located high in the Salado.

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7.5.2.2 Salado Anhydrite Beds

The objective of this calculation was to determine the extent of the DRZ within the Salado anhydrite and polyhalite interbeds as a result of creep of surrounding salt.

For all interbeds, the factor of safety against failure (shear or tensile fracturing) increases with depth into the rock surrounding the shaft wall. These results indicate that, with the exception of Marker Bed 117 (**MB117**), the factor of safety is greater than 1 (no DRZ will develop) for all interbeds. For MB117, the potential for fracturing is localized to within 1 m of the shaft wall.

7.5.2.3 Near-Surface and Rustler Formations

The objective of this calculation was to determine the extent of the DRZ surrounding the shafts in the near-surface and Rustler formations.

Rock types in near-surface and Rustler formations are anhydrite, dolomite, and mudstone. These rock types exhibit time-independent behavior. Results indicate that no DRZ will develop in anhydrite and dolomite (depths between 165 and 213 m). For mudstone layers, the radial extent of the DRZ increases with depth, reaching a maximum of 2.6 shaft radii at a depth of 223 m.

7.6 Other Analyses

This section discusses two structural analyses performed in support of design concerns, namely (1) the asphalt waterstops constructability and (2) benefits from shaft station backfilling. Analyses performed in support of these efforts are discussed below and given in more detail in Appendix D of the Compliance Submittal Design Report (Sandia, 1996), Section D6.

7.6.1 Asphalt Waterstops

The DRZ is a major contributor to fluid flows through a low permeability shaft seal system, regardless of the materials emplaced within the shaft. Therefore, to increase the confidence in the overall shaft seal, low permeability layers (termed radial waterstops) were included to intersect the DRZ surrounding the shaft. These waterstops are emplaced to alter the flow direction either inward toward the shaft seal or outward toward intact salt. Asphalt-filled waterstops will be effective soon after emplacement. The objectives of these structural calculations were to evaluate performance of the waterstops in terms of (1) intersecting the DRZ around the shaft, (2) inducing a new DRZ because of special excavation, and (3) promoting healing of the DRZ.

Results indicate that the DRZ from the shaft extends to a radial distance of less than one shaft radius (3.04 m). Waterstop excavation extends the DRZ radially to about 1.4 shaft radii (4.3 m). However, this extension is localized within the span of the concrete component and extends minimally past the waterstop edge. The DRZ extent reduced rapidly after the concrete and asphalt restrained creep of the surrounding salt. After 20 years, the spatial extent of the DRZ is localized near the asphalt-concrete interface, extending spatially into the salt at a distance of less than 2 m. Based on these results, construction of waterstops is possible without substantially increasing the DRZ. Furthermore, the waterstop extends well beyond the maximum extent of the DRZ surrounding the shaft and effectively blocks this flow path (within 2 years after emplacement), albeit over only a short length of the flow path.

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7.6.2 Shaft Pillar Backfilling

The objective of this calculation was to assess potential benefits from backfilling a portion of the shaft pillar to reduce subsurface subsidence and thereby decrease the potential for inducing fractures along the shaft wall. The calculated subsidence without backfilling is less than one foot, due to the relatively low extraction ratio at the WIPP. Based on the results of this analysis, backfilling portions of the shaft pillar would result in only 10% to 20% reduction in surface subsidence. This reduction in subsidence from backfilling is not considered enough to warrant backfilling the shaft pillar area. The shaft seals within the Salado are outside the angle-of-draw for any horizontal displacements caused by the subsidence over the waste panels. Moreover, horizontal strains caused by subsidence induced by closures within the shaft pillar are compressive in nature and insignificant in magnitude to induce fracturing along the shaft wall.

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8. Hydrologic Evaluation of the Shaft Seal System

8.1 Introduction

The design guidance in Section 3 presented the rationale for sealing the shaft seal system with low permeability materials, but it did not provide specific performance measures for the seal system. This section compares the hydrologic behavior of the system to several performance measures that are directly related to the ability of the seal system to limit liquid and gas flows through the seal system. The hydrologic evaluation is focused on the processes that could result in fluid flow through the shaft seal system and the ability of the seal system to limit any such flow. Transport of radiological or hazardous constituents will be limited if the carrier fluids are similarly limited.

The hydrologic performance models are fully described in Appendix C of the Compliance Submittal Design Report (Sandia, 1996). The analyses presented are deterministic. Quantitative values for those parameters that are considered uncertain and that may significantly impact the primary performance measures have been varied, and the results are presented in Appendix C the Compliance Submittal Design Report (Sandia, 1996). This section summarizes the seal system performance analyses and discusses results within the context of the design guidance of Section 3. The results demonstrate that (1) fluid flows will be limited within the shaft seal system and (2) uncertainty in the conceptual models and parameters for the seal system are mitigated by redundancy in component function and materials.

8.2 Performance Models

The physical processes that could impact seal system performance are presented in detail in Appendix C of the Compliance Submittal Design Report (Sandia, 1996). These processes have been incorporated into four performance models. These models evaluate (1) downward migration of groundwater from the Rustler Formation, (2) gas migration and consolidation of the crushed salt seal component, (3) upward migration of brines from the repository, and (4) flow between water-bearing zones in the Rustler Formation. The first three are analyzed using numerical models of the Air Intake Shaft (**AIS**) seal system and the finite-difference codes SWIFT II and TOUGH28W. These codes are extensively used and well documented within the scientific community. A complete description of the models is provided in Appendix C of the Compliance Submittal Design Report (Sandia, 1996). The fourth performance model uses a simple, analytical solution for fluid flow. Results from the analyses are summarized in the following sections and evaluated in terms of the design guidance presented in Section 3.

Material properties and conceptual models that may significantly impact seal system performance have been identified, and uncertainty in properties and models have been addressed through variation of model parameters. These parameters include (1) the effective permeability of the DRZ, (2) those describing salt column consolidation and the relationship between compacted salt density and permeability, and (3) repository gas pressure applied at the base of the shaft seal system.

8.3 Downward Migration of Rustler Groundwater

The shaft seal system is designed to limit groundwater flowing into and through the shaft sealing system (see Section 3). The principal source of groundwater to the seal system is the Culebra Member of the Rustler Formation. The Magenta Member of this formation is also considered a

groundwater source, albeit a less significant source than the Culebra. No significant sources of groundwater exist within the Salado Formation; however, brine seepage has been noted at a number of the marker beds. The modeling includes the marker beds, as discussed in Appendix C of the Compliance Submittal Design Report (Sandia, 1996). Downward migration of Rustler groundwater must be limited so that liquid saturation of the compacted salt column salt column does not impact the consolidation process and to ensure that significant quantities of brine do not reach the repository horizon. Because it is clear that limitation of liquid flow into the salt column necessarily limits liquid flow to the repository, the volumetric flux of liquid into and through the salt column were selected as performance measures for this model.

Consolidation of the compacted salt column salt column will be most rapid immediately following seal construction. Simulations were conducted for the 200-year period following closure to demonstrate that, during this initial period, downward migration of Rustler groundwater will be insufficient to impact the consolidation process. Lateral migration of brine through the marker beds is also quantified in the analysis and shown to be nondetrimental to the function of the salt column.

8.3.1 Analysis Method

Seal materials will not, in general, be fully saturated with liquid at the time of construction. The host rock surrounding the shafts will also be partially desaturated at the time of seal construction. The analysis presented in this section assumes a fully saturated system. The effects of partial saturation of the shaft seal system are favorable in terms of system performance, as will be discussed in Section 8.3.2.

Seal material and host rock properties used in the analyses are discussed in Appendix C of the Compliance Submittal Design Report (Sandia, 1996), Section C3. Appendix G2-A contains a detailed discussion of seal material properties. A simple perspective on the effects of material and host rock properties may be obtained from Darcy's Law. At steady-state, the flow rate in a fully saturated system depends directly on the system permeability. The seal system consists of the component material and host rock DRZ. Low permeability is specified for the engineered materials; thus the system component most likely to impact performance is the DRZ. Rock mechanics calculations presented in Appendix D of the Compliance Submittal Design Report (Sandia, 1996) predict that the DRZ in the Salado Formation will not be vertically continuous because of the intermittent layers of stiff anhydrites (marker beds). Asphalt waterstops are included in the design to minimize DRZ impacts. The effects of the marker beds and the asphalt waterstops on limiting downward migration are explicitly simulated through variation of the permeability of the layers of Salado DRZ.

Initial, upper, and lateral boundary conditions for the performance model are consistent with field measurements for the physical system. At the base of the shaft a constant atmospheric pressure is assumed.

8.3.2 Summary of Results

The initial pore volumes in the filled repository and the AIS salt column are approximately 460,000 m^3 and 250 m^3, respectively. The performance model predicts a maximum cumulative flow of less than 5 m^3 through the sealed shafts for the 200 years following closure. If the marker beds have a disturbed zone immediately surrounding the shaft, the maximum flow is less than 10 m^3 during the same period. Assuming the asphalt waterstops are not effective in

interrupting the vertical DRZ, the volumetric flow increases but is still less than 30 m^3 for the 200 years following closure. These volumes are less than 1/100 of 1% of the pore volume in the repository and less than 20% of the initial pore volume of the salt column.

Two additional features of the model predictions should also be considered. The first of these is that flow rates fall from less than 1 m^3 / year in the first five years to negligible values within 10 years of seal construction. Therefore most of the cumulative flow occurs within a few years following closure. The second feature is the model prediction that the system returns to nearly ambient undisturbed pressures within two years. The repressurization occurs quickly within the model due to the assumption of a fully saturated flow regime because of brine incompressibility. As will be discussed in Section 8.4, the pore pressure in the compacted salt column is a critical variable in the analysis. The pressure profiles predicted by the model are an artifact of the assumption of full liquid saturation and do not apply to the pore pressure analysis of the salt column.

The magnitude of brine flow that can reach the repository through a sealed shaft is minimal and will not impact repository performance. The flow that reaches the salt column must be assessed with regard to the probable impacts on the consolidation process. Although the volume of flow to the salt column is a small percentage of the available pore volume, the saturation state and fluid pore pressure of this component are the variables of significance. These issues cannot be addressed by a fully saturated model. Instead it is necessary to include these findings in a multi-phase model that includes the salt column. This is the topic of Section 8.4.

The results of the fully saturated model will over-predict the flow rates through the sealed shaft. This analysis does not take credit for the time required for the system to resaturate, nor does it take credit for the sorptive capabilities of the clay components. The principal source of groundwater to the system is the Rustler Formation. The upper clay component is located below the Rustler and above the salt column and will be emplaced at a liquid saturation state of approximately 80%. Bentonite clays exhibit strong hydrophilic characteristics, and it is expected that the upper clay component will have these same characteristics. As a result, it is possible that a significant amount of the minimal Rustler groundwater that reaches the clay column will be absorbed and retained by this seal component. Although this effect is not directly included in the present analysis, the installation of a partially saturated clay component provides assurance that the flow rates predicted by the model are maximum values.

8.4 Gas Migration and Consolidation of Compacted Salt Column

The seal system is designed to limit the flow of gas from the disposal system through the sealed shafts. Migration of gas could impact performance if this migration substantially increases the fluid pore pressure of the compacted salt column. The initial pore pressure of the salt column will be approximately atmospheric. The sealed system will interact with the adjacent desaturated host rock as well as the far-field formation. Natural pressurization will occur as the system returns to an equilibrium state. This pressurization, coupled with seepage of brine through the marker beds, will also result in increasing fluid pore pressure within the compacted salt column. The analysis presented in this section addresses the issue of fluid pore pressure in the compacted salt column resulting from the effects of gas generation at the repository horizon and natural repressurization from the surrounding formation. A brief discussion on the impedance to gas flow afforded by the lower compacted clay column is also presented.

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8.4.1 Analysis Method

A multi-phase flow model of the lower seal system was developed to evaluate the performance of components extending from the middle SMC component to the repository horizon. Rock mechanics calculations presented in Section 7 and Appendix D of the Compliance Submittal Design Report (Sandia, 1996) predict that the compacted salt column will consolidate for a period of approximately 400 years if the fluid-filled pores of the column do not produce a backstress. Within the physical setting of the compacted salt column, three processes have been identified which may result in a significant increase in pore pressure: groundwater flow from the Rustler Formation, gas migration from the repository, and natural fluid flow and repressurization from the Salado Formation. The first two processes were incorporated into the model as initial and boundary conditions, respectively. The third process was captured in all simulations through modeling of the lithologies surrounding the shaft. Simulations were conducted for 200 years following closure to evaluate any effects these processes might have on the salt column during this initial period.

As discussed in Section 8.3.1, the host rock DRZ is an important consideration in seal system performance. A vertically continuous DRZ could exist in both the Rustler and Salado Formations. Concrete-asphalt waterstops are included in the design to add assurance that a DRZ will not adversely impact seal performance. The significance of a continuous DRZ and waterstops will be evaluated based on results of the performance model.

A detailed description of the model grid, assumptions, and parameters is presented in Appendix C of the Compliance Submittal Design Report (Sandia, 1996).

8.4.2 Summary of Results

The consolidation process is a function of both time and depth. The resultant permeability of the compacted salt column will similarly vary. To simplify the evaluation, an effective permeability of the salt component was calculated. This permeability is calculated by analogy to electrical circuit theory. The permeability of each model layer is equated to a resistor in a series of resistors. The equivalent resistance (i.e., permeability) of a homogeneous column of identical length is derived in this manner. Figure G2-11 illustrates this process.

Results of the performance model simulations are summarized in Table G2-12. The effective permeabilities were calculated by the model assuming that, as the salt consolidated, permeability was reduced pursuant to the best-fit line through the experimental data (Appendix G2-A, Figure G2A-7). From Table G2-12 it is clear that, for all simulated conditions, the salt column consolidates to very low values in 200 years. Differences in the effective permeability because of increased repository gas pressure and a vertically continuous DRZ were negligible. The DRZ around concrete components is predicted to heal (Appendix D of the Compliance Submittal Design Report (Sandia, 1996)) within 25 years. If the asphalt waterstops do not function as intended, the DRZ in this region will still heal in 25 years, as compared to 2 years for effective waterstops. The effective permeability of the compacted salt column increases by about a factor of two for this condition. However, the resultant permeability is sufficiently low that the compacted salt columns will comprise permanent effective seals within the WIPP shafts.

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Table G2-12
Summary of Results from Performance Model

Repository Pressure	Rustler Flow (m^3)	Continuous DRZ (Yes/No)	Concrete-Asphalt Waterstop Healing Time (Years)	Effective Permeability at 200 Years (m^2)
7 MPa in 100 Years	0	No	2	3.3×10^{-20}
14 MPa in 200 Years	0	No	2	3.3×10^{-20}
7 MPa in 100 Years	2.7	Yes	2	3.4×10^{-20}
7 MPa in 100 Years	17.2	Yes	25	6.0×10^{-20}

The relationship between the fractional density (i.e., consolidation state) of the compacted salt column and permeability is uncertain, as discussed in Appendix G2-A. Lines drawn through the experimental data (Figure A-7) provide a means to quantify this uncertainty but do not capture the actual physical process of consolidation. As observed through microscopy, consolidation is dominated by pressure solution and redeposition, a mechanism of mass movement facilitated by the presence of moisture on grain boundaries (Hansen and Ahrens, 1996). As this process continues, the connected porosity and hence permeability of the composite mass will reduce at a rate that has not been characterized by the data collected in WIPP experiments. The results of the multi-phase performance model presented in Table G2-12 used a best-fit line through the data. Additional simulations were conducted using a line that represents a 95% certainty that the permeability is less than or equal to values taken from this line. Model simulations that used the 95% line are not considered representative of the consolidation process. However, these results provide an estimation of the significance that this uncertainty may have on the seal system performance.

Figure G2-12 depicts the effective permeability of the salt column as a function of time using the 95% line. The consolidation process, and hence permeability reduction, essentially stopped at 75 years for this simulation. Although the model predicts that the fractional density at the base of the salt column will reach approximately 97% of the density of intact halite, the permeability remains several orders of magnitude higher than that of the surrounding host rock. As a result, repressurization occurs rapidly throughout the vertical extent of the compacted salt column, and consolidation ceases. Laboratory experiments have shown that permeability to brine should decrease to levels of 10^{-18} to 10^{-20} m^2 at the fractional densities predicted by the performance model. The transport of brine within the consolidating salt will reduce the permeability even further (Brodsky et al., 1995). The predicted permeability of 10^{-16} m^2 is still sufficiently low that brine migration would be limited (DOE, 1995). However, the results of this analysis are more valuable in terms of demonstrating the coupled nature of the mechanical and hydrological behavior of consolidating crushed salt.

A final consideration within this performance model relates to the lower compacted clay column. This clay column is included in the design to provide a barrier to both gas and brine migration from the repository horizon. The ability of the clay to prevent gas migration will depend upon its liquid saturation state (Section 5 and Appendix G2-A). The lower clay component has an initial liquid saturation of about 80%, and portions of the column achieve brine saturations of nearly 100% during the 200 year simulation period. If the clay component performs as designed, gas migration through this component should be minimal. An examination of the model gas saturations indicates that, for all runs, gas flow occurs primarily through the DRZ prior to

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healing. These model predictions are consistent with field demonstrations that brine-saturated bentonite seals will prevent gas flow at differential pressures of up to 4 MPa (Knowles and Howard, 1996).

8.5 Upward Migration of Brine

The performance model discussed in Section 8.3 was modified to simulate undisturbed equilibrium pressures. As discussed in Appendix C of the Compliance Submittal Design Report (Sandia, 1996), the Salado Formation is overpressurized with respect to the measured heads in the Rustler, and upward migration of contaminated brines could occur through an inadequately sealed shaft. Sections 8.3 and 8.4 demonstrated that the compacted salt column will consolidate to a low permeability following repository closure. Appendix D of the Compliance Submittal Design Report (Sandia, 1996) and Section 7 show that the DRZ surrounding the long-term clay and crushed salt seal components will completely heal within the first several decades. As a result, upward migration at the base of the Salado salt is predicted to be approximately 1 m^3 over the regulatory period. At the Rustler/Salado contact, a total of approximately 20 m^3 migrates through the sealed AIS over the regulatory period. The only brine sources between these two depths are the marker beds. It can therefore be concluded that most of the brine flow reaching the Rustler/Salado contact originates in marker beds above the repository horizon. The seal system effectively limits the flow of brine and gas from the repository through the sealed shafts throughout the regulatory period.

8.6 Intra-Rustler Flow

The potential exists for vertical flow within water-bearing strata of the Rustler Formation. Flow rates were estimated using a closed form solution of the steady-state saturated flow equation (Darcy's Law). The significance of the calculated flow rates can be assessed in terms of the width of the hydraulic disturbance (i.e., plume half-width) generated in the recipient flow field. The plume half-width was calculated to be minimal for all expected conditions (Compliance Submittal Design Report (Sandia, 1996), Section C7). Intra-Rustler flow is therefore concluded to be of such a limited quantity that (1) it will not affect either the hydraulic or chemical regime in the Rustler and (2) it will not be detrimental to the seal system.

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9. Conclusions

The principal conclusion drawn from discussions in the previous sections and details provided in the appendices is that an effective, implementable design has been documented for the WIPP shaft sealing system. Specifically, the six elements of the Design Guidance, Table G2-12, are implemented in the design in the following manner:

1. The shaft sealing system shall limit the migration of radiological or other hazardous constituents from the repository horizon to the regulatory boundary during the 10,000-year regulatory period following closure.

   Based on the analysis presented in Section 8.5, it was determined that this shaft sealing system effectively limits the migration of radiological or other hazardous constituents from the repository horizon to the regulatory boundary during the 10,000-year regulatory period following closure.

2. The shaft sealing system shall limit groundwater flowing into and through the shaft sealing system.

   The combination of the seal components in the Salado Formation, the Rustler Formation, and above the Rustler combine to produce a robust system. Based on analysis presented in Section 8.3, it was concluded that the magnitude of brine flow that can reach the repository through the sealed shaft is minimal and will not impact repository performance.

3. The shaft sealing system shall limit chemical and mechanical incompatibility of seal materials with the seal environment.

   The sealing system components are constructed of materials possessing high durability and compatibility with the host rock. Engineered materials including salt-saturated concrete, bentonite, clays, and asphalt are expected to retain their design properties over the regulatory period.

4. The shaft sealing system shall limit the possibility for structural failure of individual components of the sealing system.

   Analysis of components has determined that: (a) the structural integrity of concrete components will not be compromised by induced radial stress, imposed vertical stress, temperature gradients, dynamic compaction of overlying materials, or swelling pressure associated with bentonite (Section 7.4.1); (b) the thermal impact of asphalt on the creep rate of the salt surrounding the asphalt waterstops is negligible (Section 7.4.4); and (c) the pressure from the asphalt element of the concrete-asphalt waterstops is sufficient to initiate healing of the surrounding DRZ within two years of emplacement (Section 7.6.1). The potential for structural failure of sealing components is minimized by the favorable compressive stress state that will exist in the sealed WIPP shafts.

5. The shaft sealing system shall limit subsidence of the ground surface in the vicinity of the shafts and the possibility of accidental entry after sealing.

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The use of high density sealing materials that completely fill the shafts eliminates the potential for shaft wall collapse, eliminates the possibility of accidental entry after closure, and assures that local surface depressions will not occur at shaft locations.

6. The shaft sealing system shall limit the need to develop new technologies or materials for construction of the shaft sealing system.

   The shaft sealing system utilizes existing construction technologies (identified in Section 6) and materials (identified in Section 5).

The design guidance can be summarized as focusing on two principal questions: Can you build it, and will it work? The use or adaptation of existing technologies for the placement of the seal components combined with the use of available, common materials assure that the design can be constructed. Performance of the sealing system has been demonstrated in the hydrologic analyses that show very limited flows of gas or brine, in structural analyses that assure acceptable stress and deformation conditions, and in the use of low permeability materials that will function well in the environment in which they are placed. Confidence in these conclusions is bolstered by the basic design approach of using multiple components to perform each intended sealing function and by using extensive lengths within the shafts to effect a sealing system. Additional confidence is added by the results of field and lab tests in the WIPP environment that support the data base for the seal materials.

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FIGURES

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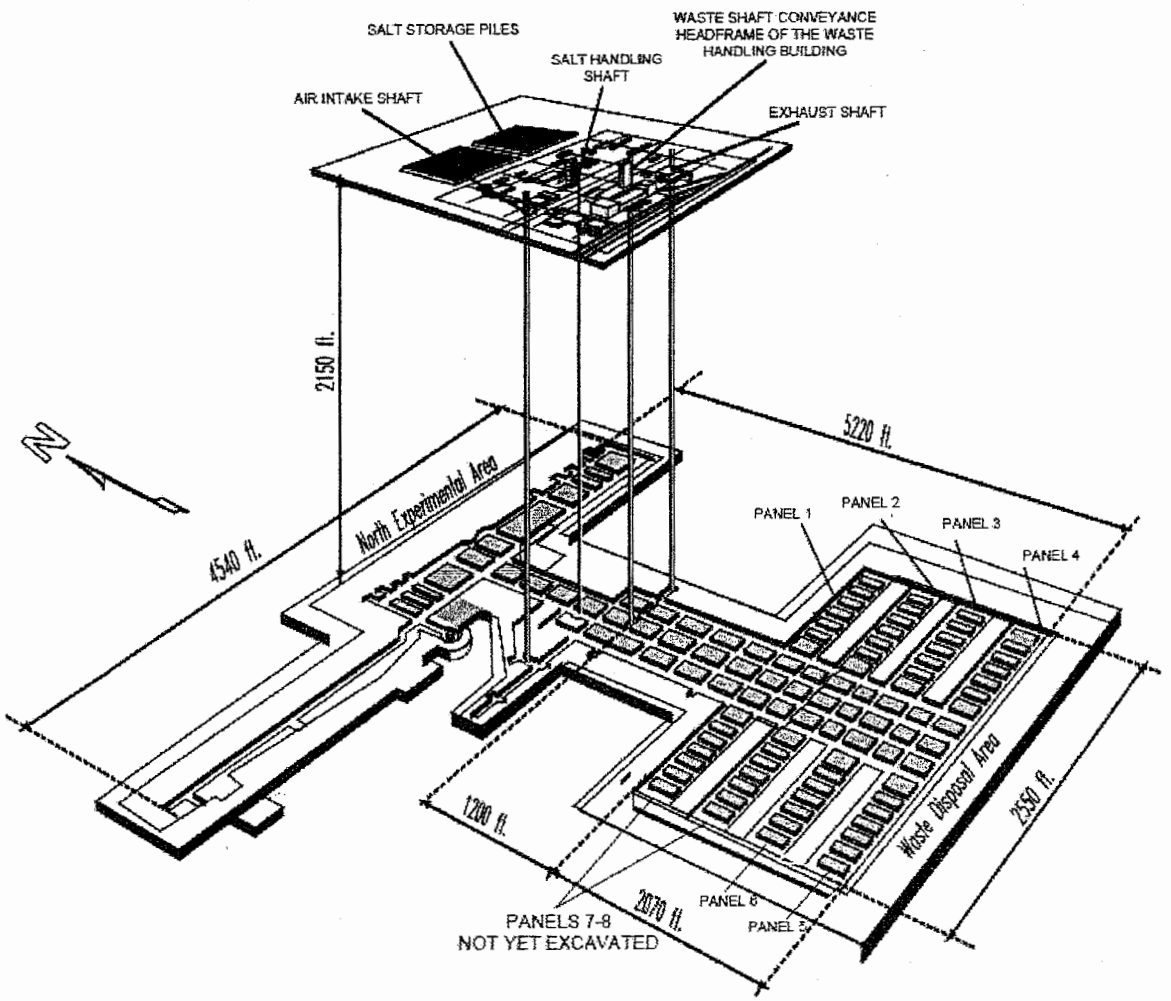

Figure G2-1
View of the WIPP Underground Facility

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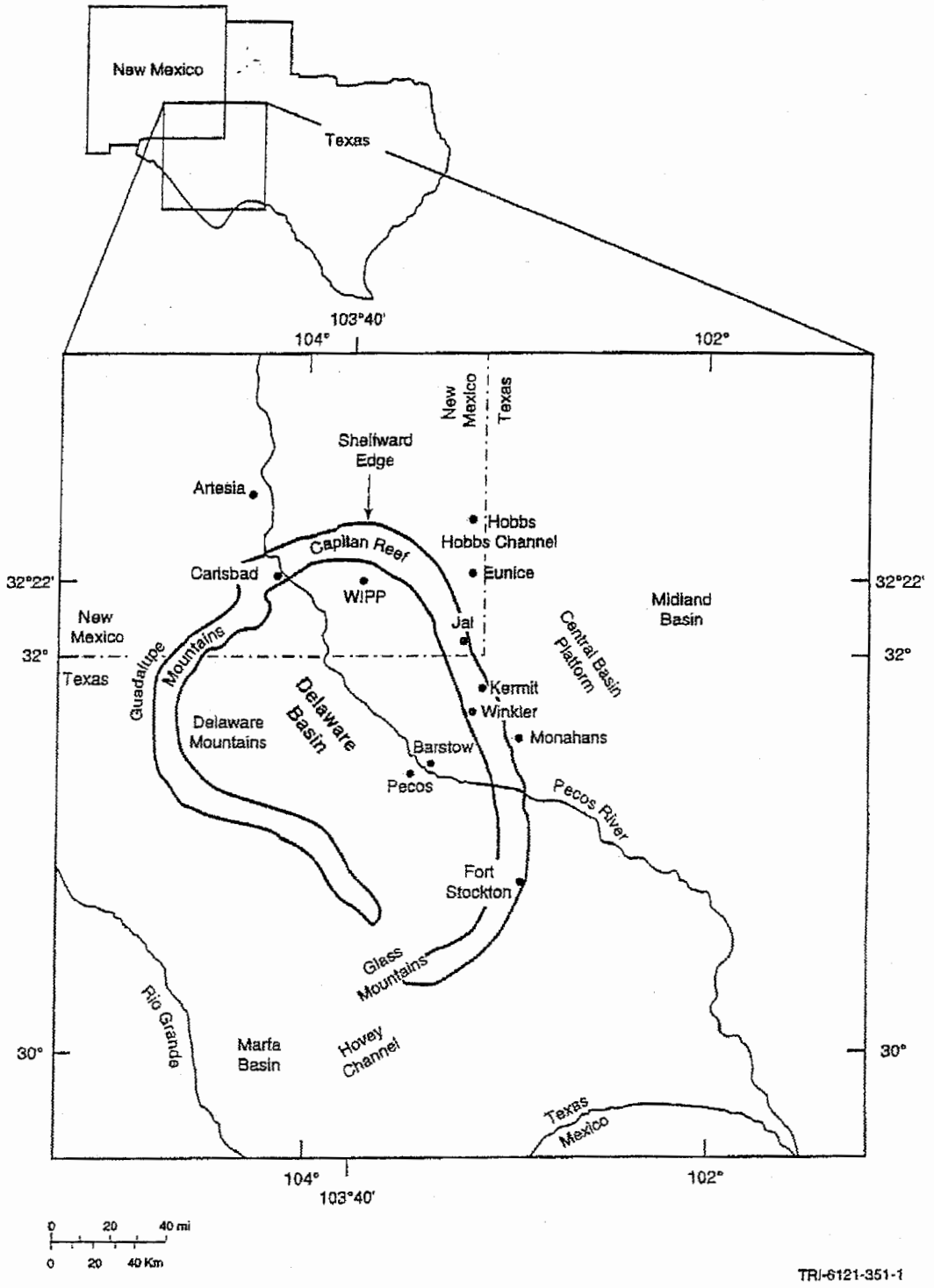

Figure G2-2
Location of the WIPP in the Delaware Basin

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Erathem	System	Series	Lithostratigraphic Unit	Age Estimate (yr)
Cenozoic	Quaternary	Holocene	Windblown sand	
		Pleistocene	Mescalero caliche	~500,000
			Gatuña Formation	~600,000
	Tertiary	Pliocene	Ogallala Formation	5.5 million
		Miocene		24 million
		Oligocene	Absent in southeastern New Mexico	
		Eocene		
		Paleocene		66 million
Mesozoic	Cretaceous	Upper	Absent in southeastern New Mexico	
		Lower	Detritus preserved	144 million
	Jurassic		Absent in southeastern New Mexico	208 million
	Triassic	Upper	Dockum Group	
		Lower	Absent in southeastern New Mexico	245 million
Paleozoic	Permian	Ochoan	Dewey Lake Redbeds Rustler Formation Salado Formation Castile Formation	
	Upper	Guadalupian	Capitan Limestone and Bell Canyon Formation	
	Lower	Leonardian	Bone Springs	
		Wolfcampian	Wolfcamp (informal)	286 million

Modified from Bachman, 1987

Figure G2-3
Chart Showing Major Stratigraphic Divisions, Southeastern New Mexico

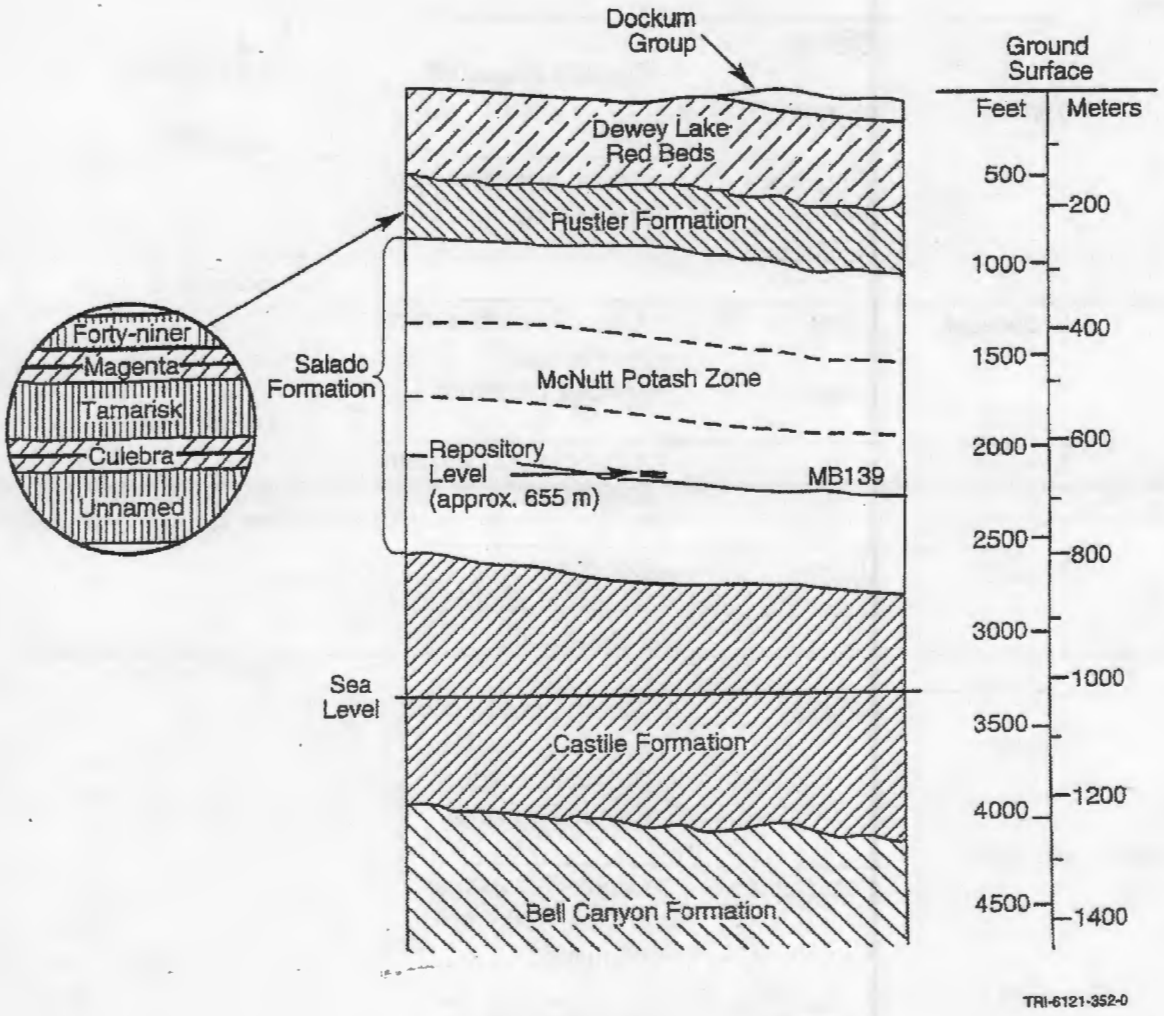

Figure G2-4
Generalized Stratigraphy of the WIPP Site Showing Repository Level

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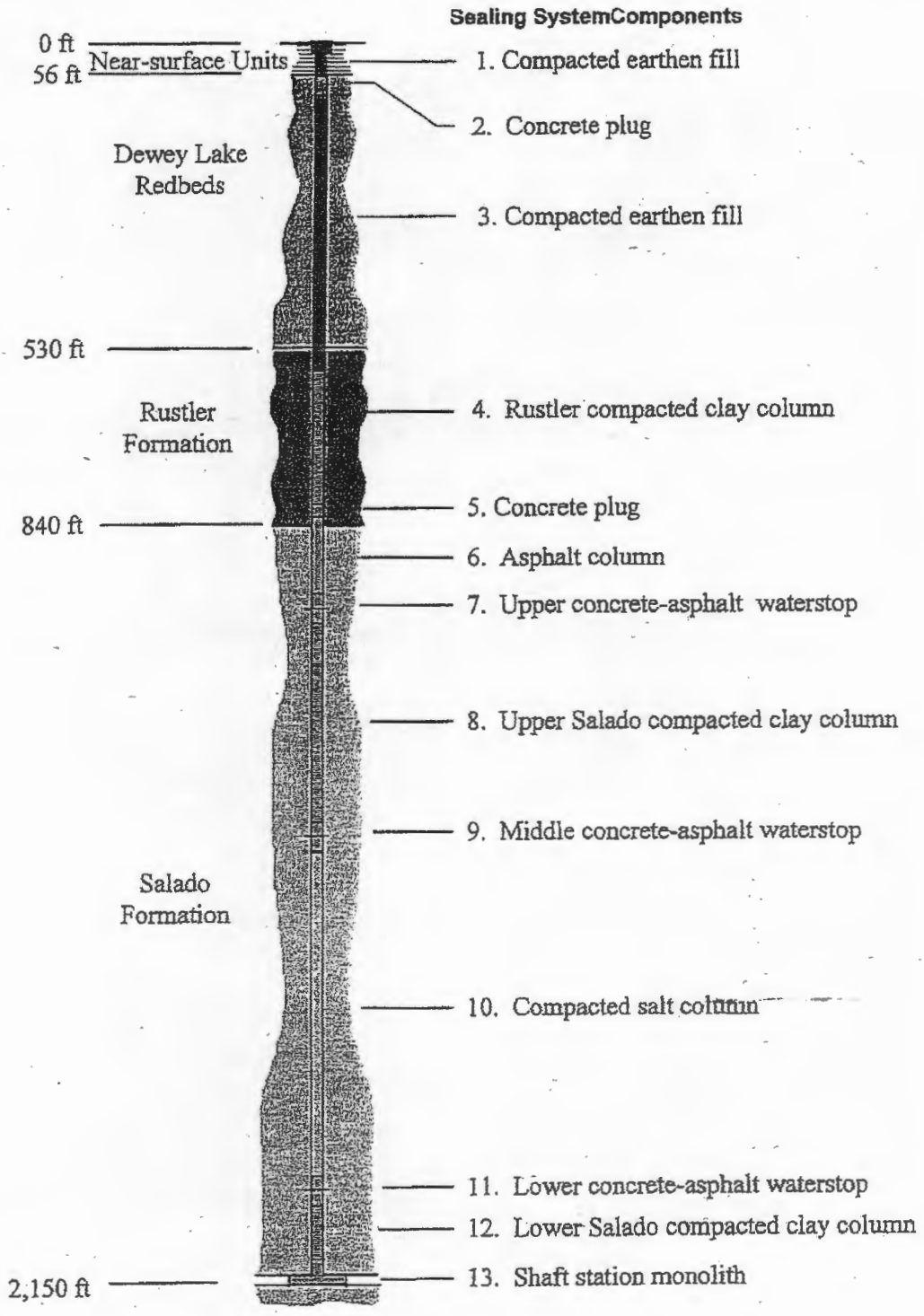

Figure G2-5
Arrangement of the Air Intake Shaft Sealing System

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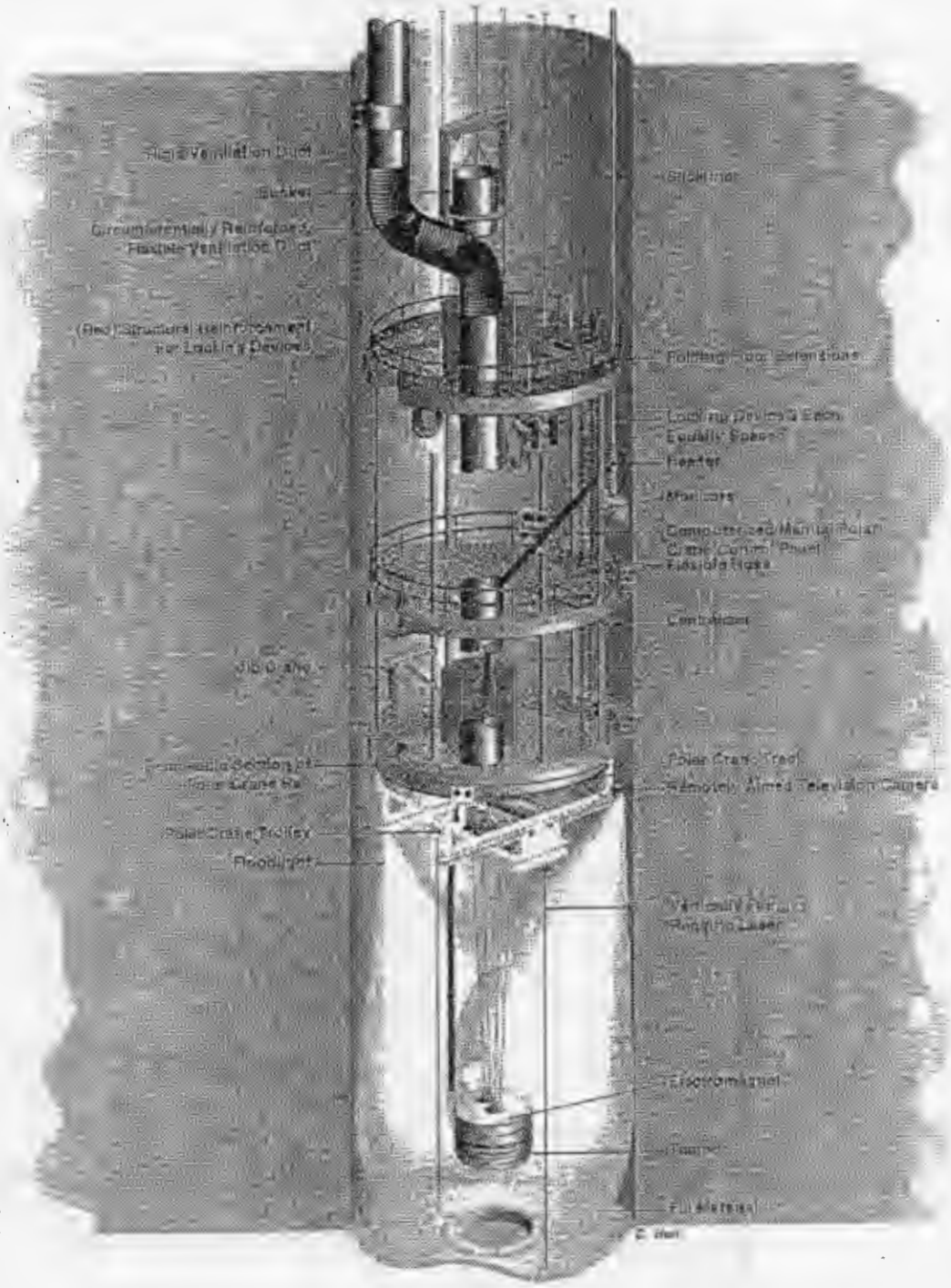


Figure G2-6
Multi-deck Stage Illustrating Dynamic Compaction

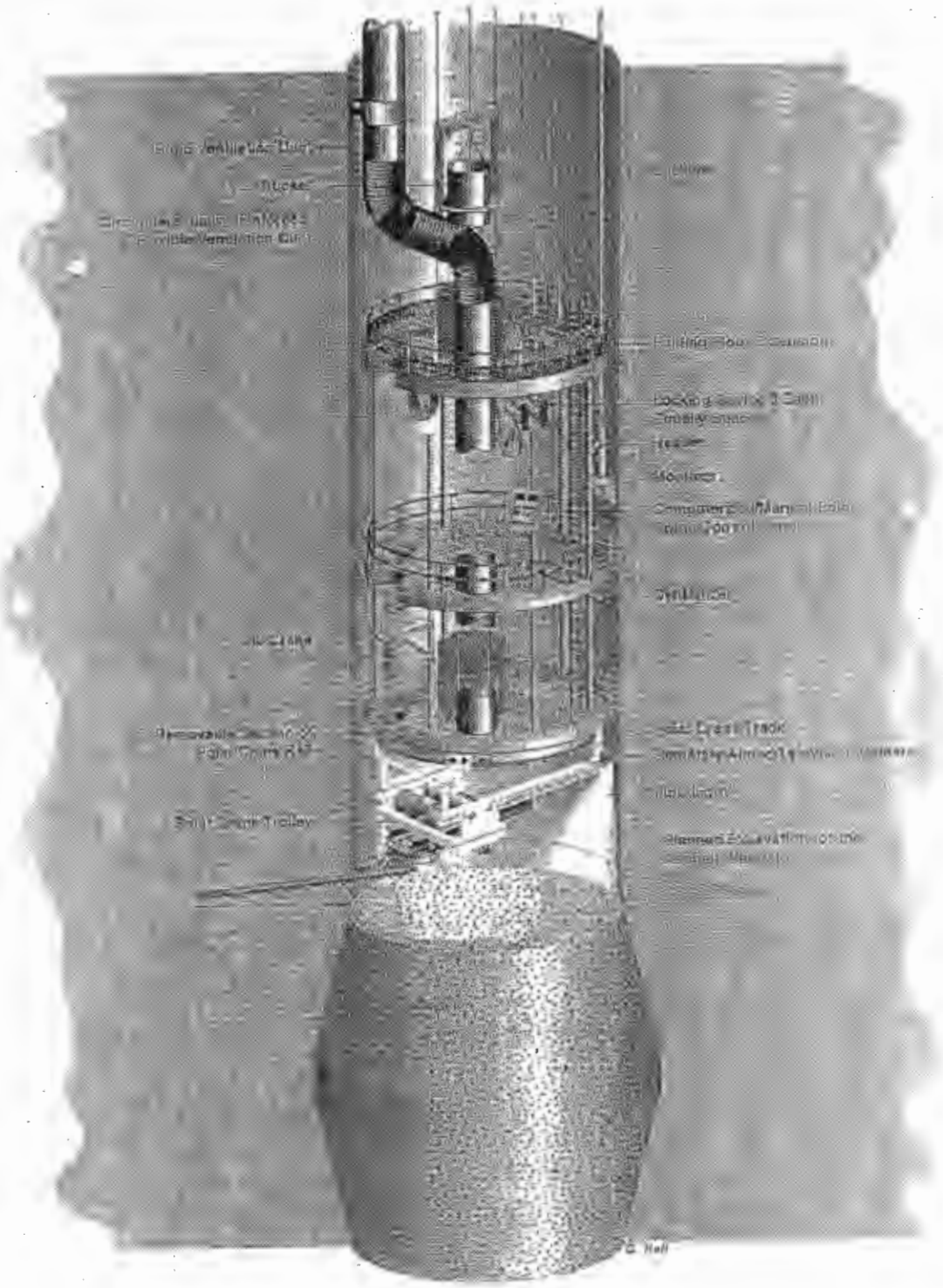
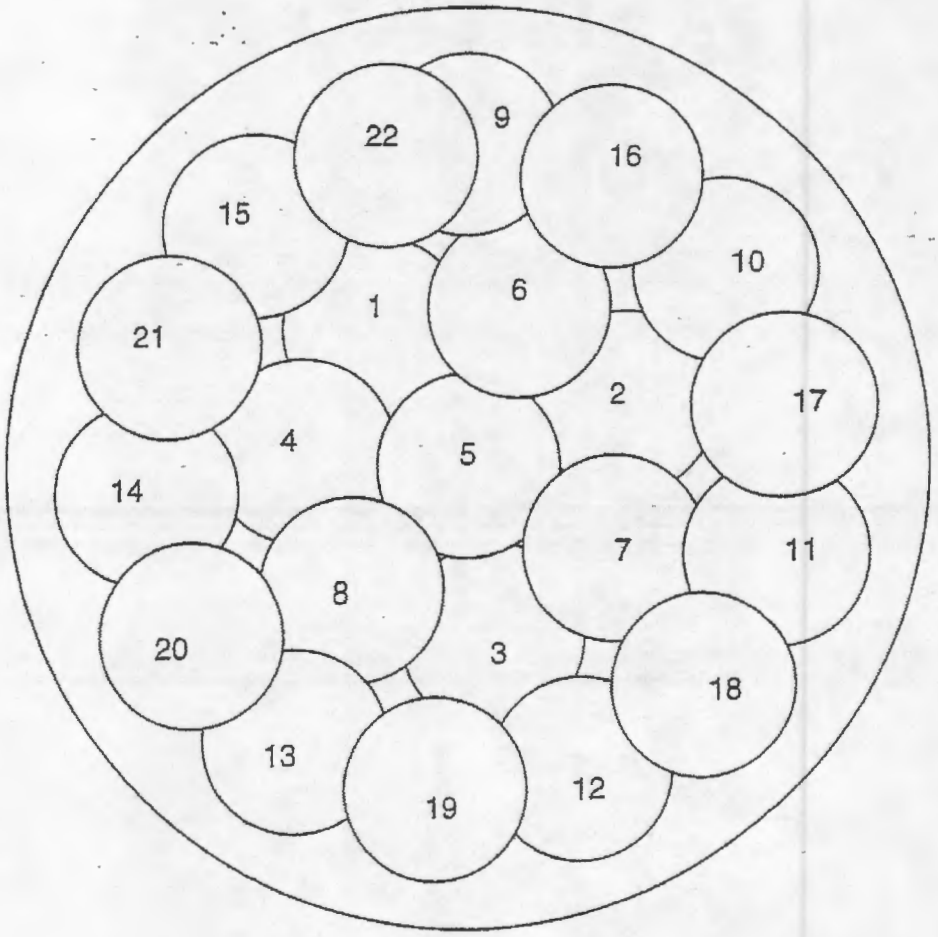


Figure G2-7
Multi-deck Stage Illustrating Excavation for Asphalt Waterstop



Scale: 1" = 4'

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Figure G2-8
Drop Pattern for 6-m-Diameter Shaft Using a 1.2-m-Diameter Tamper

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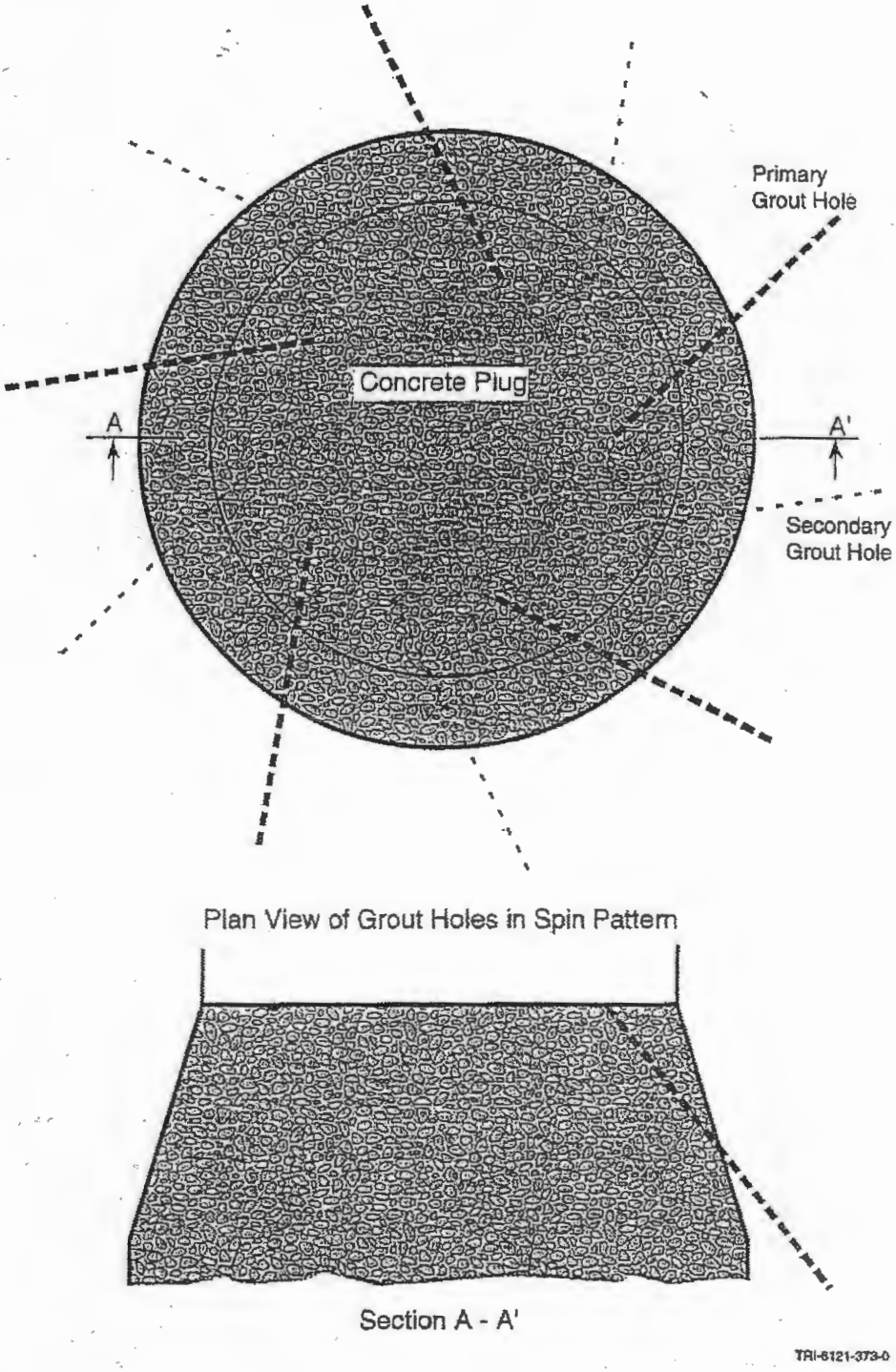
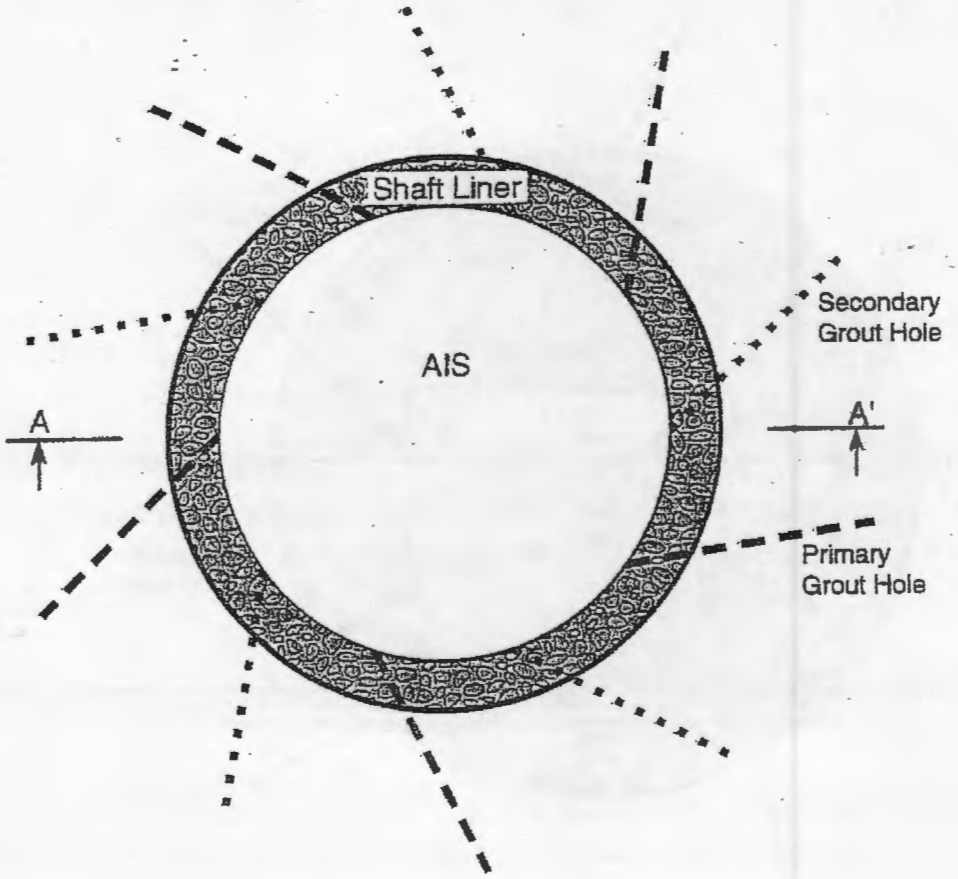


Figure G2-9
Plan and Section Views of Downward Spin Pattern of Grout Holes



Plan View of Grout Holes in Spin Pattern

Section A - A'

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Figure G2-10
Plan and Section Views of Upward Spin Pattern of Grout Holes

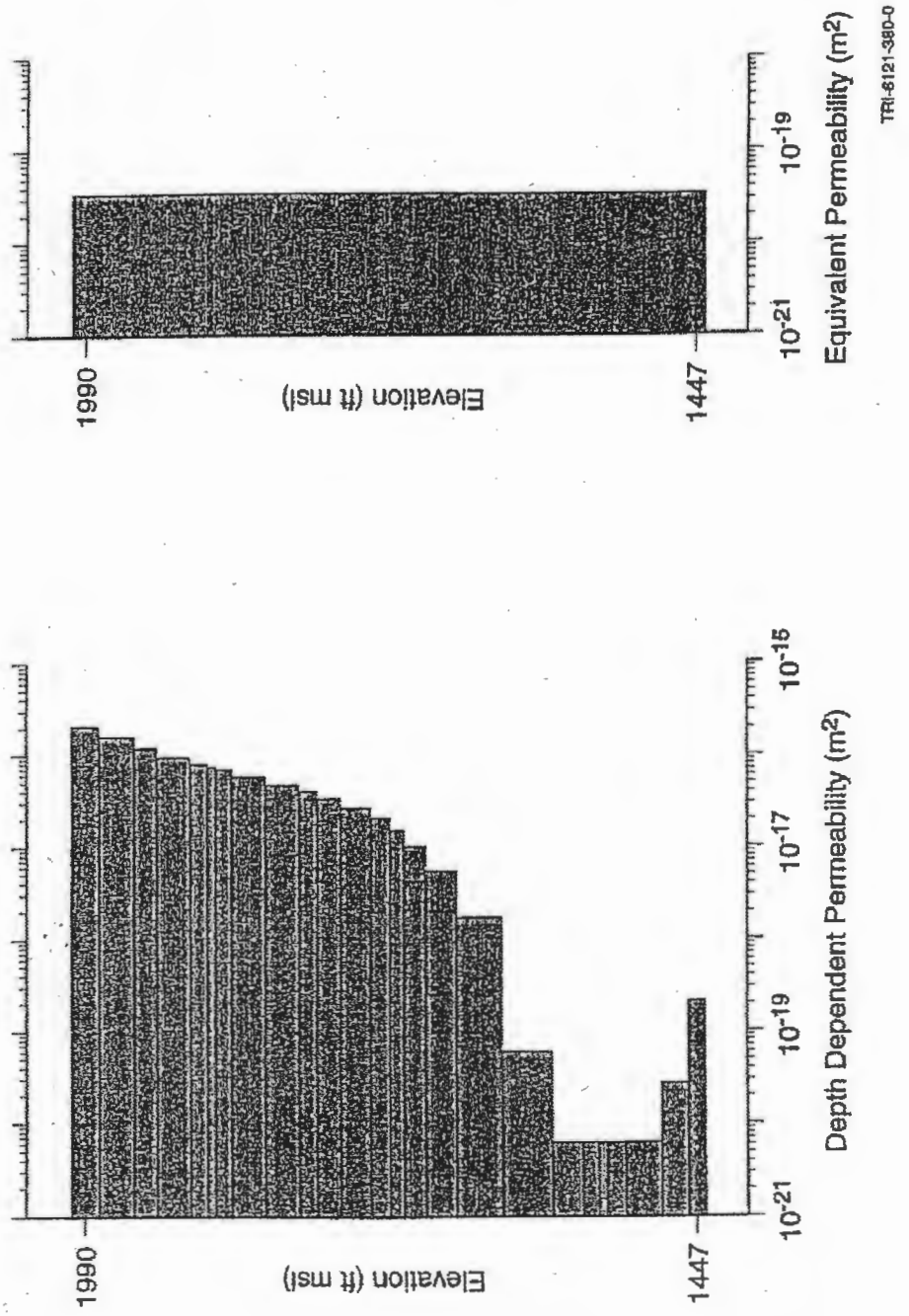

Figure G2-11
Example of Calculation of an Effective Salt Column Permeability from the Depth-Dependent Permeability at a Point in Time

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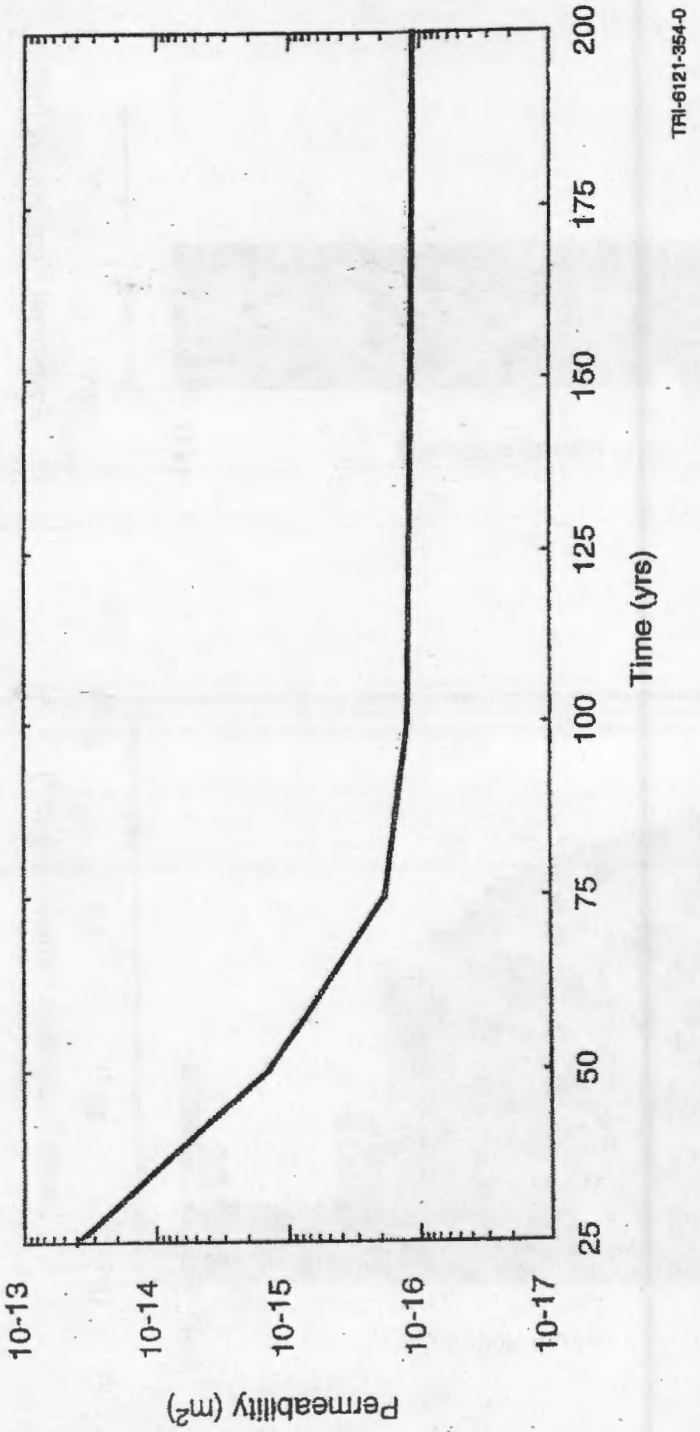

Figure G2-12
Effective Permeability of the Compacted Salt Column using the 95% Certainty Line

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ATTACHMENT G2
APPENDIX A

MATERIAL SPECIFICATION

SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

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ATTACHMENT G2
APPENDIX A

MATERIAL SPECIFICATION

SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

Appendix A Abstract

This appendix specifies material characteristics for shaft seal system components designed for the Waste Isolation Pilot Plant. The shaft seal system will not be constructed for decades; however, if it were to be constructed in the near term, materials specified here could be placed in the shaft and meet performance specifications. A material specification is necessary today to establish a frame of reference for design and analysis activities and to provide a basis for seal material parameters. This document was used by three integrated working groups: (1) the architect/engineer for development of construction methods and supporting infrastructure, (2) fluid flow and structural analysis personnel for evaluation of seal system adequacy, and (3) technical staff to develop probability distribution functions for use in performance assessment. The architect/engineers provide design drawings, construction methods and schedules as appendices to the final shaft seal system design report, called the *Compliance Submittal Design Report* (Permit Attachment G2). Similarly, analyses of structural aspects of the design and fluid flow calculations comprise other appendices to the final design report (not included in this Permit Attachment). These products together are produced to demonstrate the adequacy of the shaft seal system to independent reviewers, regulators, and stakeholders. It is recognized that actual placement of shaft seals is many years in the future, so design, planned construction method, and components will almost certainly change between now and the time that detailed construction specifications are prepared for the bidding process. Specifications provided here are likely to guide future work between now and the time of construction, perhaps benefiting from optimization studies, technological advancements, or experimental demonstrations.

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A1. INTRODUCTION

This appendix provides a body of technical information for each of the WIPP shaft seal system materials identified in the text of the *Compliance Submittal Design Report* (Permit Attachment G2). This material specification characterizes each seal material, establishes why it will function adequately, states briefly how each component will be placed, and quantifies expected characteristics, particularly permeability, pertinent to a WIPP-specific shaft seal design. Each material is first described from an engineering viewpoint, then appropriate properties are summarized in tables and figures which emphasize permeability parameter distribution functions used in performance calculations. Materials are discussed beyond limits normally found in conventional construction specifications. Descriptive elements focus on stringent shaft seal system requirements that are vital to regulatory compliance demonstration. Information normally contained in an engineering *performance specification* is included because more than one construction method, or even a completely different material, may function adequately. Content that would eventually be included contractually in *specifications for materials* or *specifications for workmanship* are not included in detail. The goal of these specifications is to substantiate why materials used in this seal system design will limit fluid flow and thereby adequately limit releases of hazardous constituents from the WIPP site at the point of compliance defined in Permit Part 5 and limit releases of radionuclides at the regulatory boundary.

Figure G2A-1 is a schematic drawing of the proposed WIPP shaft sealing system. Design detail and other characteristics of the geologic, hydrologic and chemical setting are provided in the main body of Permit Attachment G2, other appendices, and references. The four shafts will be entirely filled with dense materials possessing low permeability and other desirable engineering and economic attributes. Seal materials include concrete, clay, asphalt, and compacted salt. Other construction and fill materials include cementitious grout and earthen fill. The level of detail included for each material, and the emphasis of detail, vary among the materials. Concrete, clay, and asphalt are common construction materials used extensively in hydrologic applications. Their descriptions will be rather complete, and performance expectations will be drawn from the literature and site-specific references. Portland cement concrete is the most common structural material being proposed for the WIPP shaft seal system and its use has a long history. Considerable specific detail is provided for concrete because it is salt-saturated. Clay is used extensively in the seal system. Clay is often specified in industry as a construction material, and bentonitic clay has been widely specified as a low permeability liner for hazardous waste sites. Therefore, a considerable body of information is available for clay materials, particularly bentonite. Asphalt is a widely used paving and waterproofing material, so its specification here reflects industry practice. It has been used to seal shaft linings as a filler between the concrete and the surrounding rock, but has not been used as a full shaft seal component. Compaction and natural reconsolidation of crushed salt are uniquely applied here. Therefore, the crushed salt specification provides additional information on its constitutive behavior and sealing performance. Cementitious grout is also specified in some detail because it has been developed and tested for WIPP-specific applications and similar international waste programs. Earthen fill will be given only cursory specifications here because it has little impact on the shaft seal performance and placement to nominal standards is easily attained.

Discussion of each material is divided into sections, which are described in the annotated bullets below:

Functions

A general summary of functions of specific seal components is presented. Each seal component must function within a natural setting, so design considerations embrace naturally occurring characteristics of the surrounding rock.

Material Characteristics

Constitution of the seal material is described and key physical, chemical, mechanical, hydrological, and thermal features are discussed.

Construction

A brief mention is made regarding construction, which is more thoroughly treated in Appendix B of the *Compliance Submittal Design Report* (Permit Attachment G2, Appendix B). Construction, as discussed in this section, is primarily concerned with proper placement of materials. A viable construction procedure that will attain placement specifications is identified, but such a specification does not preclude other potential methods from use when the seal system is eventually constructed.

Performance Requirements

Regulations to which the WIPP must comply do not provide quantitative specifications applicable to seal design. Performance of the WIPP repository is judged against performance standards for miscellaneous units specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601) for releases of hazardous constituents at the point of compliance defined in Permit Part 5. Performance is also judged against potential releases of radionuclides at the regulatory boundary, which is a probabilistic calculation. To this end, probability distribution functions for permeabilities (referred to as PDFs) of each material have been derived for performance assessment of the WIPP system and are included within this subsection on performance requirements.

Verification Methods

It must be assured that seal materials placed in the shaft meet specifications. Both design and selection of materials reflect this principal concern. Assurance is provided by quality control procedures, quality assurance protocol, real-time testing, demonstrations of technology before construction, and personnel training. Materials and construction procedures are kept relatively simple, which creates robustness within the overall system. In addition, elements of the seal system often are extensive in length, and construction will require years to complete. If atypical placement of materials is detected, corrections can be implemented without impacting performance. These specifications limit in situ testing of seal material as it is constructed although, if it is later determined to be desirable, certain in situ tests can be amended in construction specifications. Invasive testing has the potential to compromise the material, add cost, and create logistic and safety problems. Conventional specifications are made for property testing and quality control.

References

These specifications draw on a wealth of information available for each material. Reference to literature values, existing data, anecdotal information, similar applications, laboratory and field testing, and other applicable supportive documentation is made.

A1.1 Sealing Strategy

The shaft seal system design is an integral part of compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264) and 40 CFR §191. The EPA has also promulgated 40 CFR §194, entitled "Criteria for the Certification and Re-certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191," to which this design and these specifications are responsive. Other seal design requirements, such as State of New Mexico regulations, apply to stratigraphy above the Salado.

Compliance of the site with 20.4.1.500 NMAC (incorporating 40 CFR §264) and 40 CFR §191 will be determined in part by the ability of the seal system to limit migration of hazardous constituents to the point of compliance defined in Permit Part 5, and migration of radionuclides to the regulatory boundary. Both natural and engineered barriers may combine to form the isolation system, with the shaft seal system forming an engineered barrier in a natural setting. Seal system materials possess high durability and compatibility with the host rock. All materials used in the shaft seal system are expected to maintain their integrity for very long periods. The system contains functional redundancy and uses differing materials to reduce uncertainty in performance. Some sealing components are used to retard fluid flow soon after placement, while other components are designed to function well beyond the regulatory period. International programs engaged in research and demonstration of sealant technology provide significant information on longevity of materials similar to those proposed for this shaft seal system (Gray, 1993). When this information is applied to the setting and context of the WIPP, there is strong evidence that the materials specified will maintain their positive attributes for defensibly long periods.

A1.2 Longevity

Longevity of materials is considered within the site geologic and hydrologic setting as summarized in the main body of this report (Permit Attachment G2) and described in the Seal System Design Report (DOE, 1995). A major environmental advantage of the WIPP locality is an overall lack of groundwater to seal against. In terms of sealing the WIPP site, the stratigraphy can be conveniently divided into the Salado Formation and the superincumbent formations comprising primarily the Rustler Formation and the Dewey Lake Redbeds. The Salado Formation, composed mainly of evaporite sequences dominated by halite, is nearly impermeable. Transmissivity of engineering importance in the Salado Formation is lateral along anhydrite interbeds, basal clays, and fractured zones near underground openings. Neither the Dewey Lake Redbeds nor the Rustler Formation contains regionally productive sources of water, although seepage near the surface in the Exhaust Shaft has been observed. Permeability of materials placed in the Salado below the contact with the Rustler, and their effects on the surrounding disturbed rock zone, are the primary engineering properties of concern. Even though very little regional water is present in the geologic setting, the seal system reflects great concern for groundwater's potential influence on materials comprising the shaft seal system.

Shaft seal materials have been selected in part because of their exceptional durability. However, it is recognized that brine chemistry *could* impact engineered materials if conditions permitted. Highly concentrated saline solutions can, under severe circumstances, affect performance of cementitious materials and clay. Concrete has been shown to degrade under certain conditions, and clays can be more transmissive to brine than to potable water. Asphalt and compacted salt are essentially chemically inert to brine. Although stable in naturally occurring seeps such as those in the Santa Barbara Channel (California), asphalt can degrade when subjected to ultraviolet light or through microbial activity. Brine would not chemically change the compacted salt column, but mechanical effects of pore pressure are of concern to reconsolidation. Mechanical influences of brine on the reconsolidating salt column are discussed in Sections 7 and 8 of the main report (Permit Attachment G2), which summarize Appendices D and C, respectively (Appendices C and D are not included in the Permit, but are contained in *Waste Isolation Pilot Plant Shaft Sealing System Compliance Submittal Design Report ("Compliance Submittal Design Report")* (Sandia, 1996)).

Because of limited volumes of brine, low hydraulic gradients, and low permeability materials, the geochemical setting will have little influence on shaft seal materials. Each material is durable, though the potential exists for degradation or alteration under extreme conditions. For example, the three major components of portland cement concrete, portlandite ($Ca(OH)_2$,) calcium-aluminate-hydrate (CAH) and calcium-silicate-hydrate (CSH), are not thermodynamically compatible with WIPP brines. If large quantities of high ionic strength brine were available and transport of mass was possible, degradation of cementitious phases would certainly occur. Such a localized phenomenon was observed on a construction joint in the liner of the Waste Handling Shaft at the WIPP site. Within the shaft seal system, however, the hydrologic setting does not support such a scenario. Locally brine will undoubtedly contact the surface of mass placements of concrete. A low hydrologic gradient will limit mass transport, although degradation of paste constituents is expected where brine contacts concrete.

Among longevity concerns, degradation of concrete is the most recognized. At this stage of the design, it is established that only small volumes of brine ever reach the concrete elements (see Section 8). Further analysis concerned with borehole plugging using cementitious materials shows that at least 100 pore volumes of brine in an open system would be needed to begin degradation processes. In a closed system, such as the hydrologic setting in the WIPP shafts, phase transformations create a degradation product of increased volume. Net volume increase owing to phase transformation in the absence of mass transport would decrease rather than increase permeability of concrete seal elements.

Mechanical and chemical stability of clays, in this case the emphasis is on bentonitic clay, is particularly favorable in the WIPP geochemical and hydrological environment. A compendium of recent work associated with the Stripa project in Sweden (Gray, 1993) provides field-scale testing results, supportive laboratory experimental data, and thermodynamic modeling that lead to a conclusion that negligible transformation of the bentonite structure will occur over the regulatory period of the WIPP. In fact, very little brine penetration into clay components is expected, based on intermediate-scale experiments at WIPP. Any wetting of bentonite will result in development of swelling pressure, a favorable situation that would accelerate return to a uniform stress state within the clay component.

Natural bentonite is a stable material that generally will not change significantly over a period of ten thousand years. Bentonitic clays have been widely used in field and laboratory experiments concerned with radioactive waste disposal. As noted by Gray (1993), three internal

mechanisms, illitization, silicification and charge change, could affect sealing properties of bentonite. Illitization and silicification are thermally driven processes and, following discussion by Gray (1993), are not possible in the environment or time-frame of concern at the WIPP. The naturally occurring Wyoming bentonite which is the specified material for the WIPP shaft seal is well over a million years old. It is, therefore, highly unlikely that metamorphism of bentonite enters as a design concern.

Asphalt has existed for thousands of years as natural seeps. Longevity studies specific to DOE's Hanford site have utilized asphalt artifacts buried in ancient ceremonies to assess long-term stability (Wing and Gee, 1994). Asphalt used as a seal component deep in the shaft will inhabit a benign environment, devoid of ultraviolet light or an oxidizing atmosphere. Additional assurance against possible microbial degradation in asphalt elements is mitigated with addition of lime. For these reasons, it is thought that design characteristics of asphalt components will endure well beyond the regulatory period.

Materials being used to form the shaft seals are the same as those being suggested in the scientific and engineering literature as appropriate for sealing deep geologic repositories for radioactive wastes. This fact was noted during independent technical review. Durability or longevity of seal components is a primary concern for any long-term isolation system. Issues of possible degradation have been studied throughout the international community and within waste isolation programs in the USA. Specific degradation studies are not detailed in this document because longevity is one of the over-riding attributes of the materials selected and degradation is not perceived to be likely. However, it is acknowledged here that microbial degradation, seal material interaction, mineral transformation, such as silicification of bentonite, and effects of a thermal pulse from asphalt or hydrating concrete remain areas of continued study.

A2. MATERIAL SPECIFICATIONS

The WIPP shaft seal system plays an important role in meeting regulatory requirements such as 20.4.1.500 NMAC (incorporating 40 CFR §§264.111 and 264.601) and 40 CFR 191. A combination of available, durable materials which can be emplaced with low permeability is proposed as the seal system. Components include mass concrete, asphalt waterstops sandwiched between concrete plugs, a column of asphalt, long columns of compacted clay, and a column of compacted crushed WIPP salt. The design is based on common materials and construction technologies that could be implemented using today's technology. In choosing materials, emphasis was given to permeability characteristics and mechanical properties. The function, constitution, construction, performance, and verification of each material are given in the following sections.

A2.1 Mass Concrete

Concrete has exceptionally low permeability and is widely used for hydraulic applications such as water storage tanks, water and sewer systems, and massive dams. Salt-saturated concrete has been used successfully as a seal material in potash and salt mining applications. Upon hydration, unfractured concrete is nearly impermeable, having a permeability less than 10^{-20} m^2. In addition, concrete is a primary structural material used for compression members in countless applications. Use of concrete as a shaft seal component takes advantage of its many attributes and the extensive documentation of its use.

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This specification for mass concrete will discuss a special design mixture of a salt-saturated concrete called Salado Mass Concrete or SMC (Wakeley et al., 1995). Performance of SMC and similar salt-saturated mixtures is established and will be completely adequate for concrete applications within the WIPP shafts. Because concrete is such a widely used material, it has been written into specifications many times. Therefore, the specification for SMC contains recognized standard practices, established test methods, quality controls, and other details that are not available at a similar level for other seal materials. Use of salt-saturated concrete, especially SMC, is backed by extensive laboratory and field studies that establish performance characteristics far exceeding requirements of the WIPP shaft seal system.

A2.1.1 Functions

The function of the concrete is to provide a durable component with small void volume, adequate structural compressive strength, and low permeability. Concrete components appear within the shaft seal system at the very bottom, the very top, and several locations in between where they provide a massive plug that fills the opening and a tight interface between the plug and host rock. In addition, concrete is a rigid material that will support overlying seal components while promoting natural healing processes within the salt disturbed rock zone (the DRZ is discussed further in Appendix D of the Compliance Submittal Design Report (Sandia, 1996)).

Concrete is one of the redundant components that protects the reconsolidating salt column. Since the salt column will achieve low permeabilities in fewer than 100 years (see Section 2.4.4 of this specification), concrete would no longer be needed after that time. For purposes of performance assessment calculations, a change in concrete permeability to degraded values is "allowed" to occur. However, concrete within the Salado Formation is likely to endure throughout the regulatory period with sustained engineering properties.

All concrete sealing elements, with the exception of a possible concrete cap, are unreinforced. In conventional civil engineering design, reinforcement is used to resist tensile stresses since concrete is weak in tension and reinforcement bar (rebar) balances tensile stresses in the steel with compressive stresses in concrete. However, concrete has exceptional compressive strength, and all the states of stress within the shaft will be dominated by compressive stress. Mass concrete, by definition, is related to any volume of concrete where heat of hydration is a design concern. SMC is tailored to minimize heat of hydration and overall differential temperature. An analysis of hydration heat distribution is included in Appendix D of the Compliance Submittal Design Report (Sandia, 1996). Boundary conditions are favorable for reducing any possible thermally induced tensile cracking during the hydration process.

A2.1.2 Material Characteristics

Salt-saturated concrete contains sufficient salt as an aggregate to saturate hydration water with respect to NaCl. Salt-saturated concrete is required for all uses within the Salado Formation because fresh water concrete would dissolve part of the host rock. Dissolution would cause a poor bond and perhaps a more porous interface, at least initially.

Dry materials for SMC include cementitious materials, fine and coarse aggregates, and sodium chloride. Concrete mixture proportions of materials for one cubic yard of concrete appear in Table A-1.

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Table A-1
Concrete Mixture Proportions

Material	lb/yd^3
Portland cement	278
Class F fly ash	207
Expansive cement	134
Fine aggregate	1292
Coarse aggregate	1592
Sodium chloride	88
Water	225

kg/m^3 = (lb/yd^3) * (0.59). Water: Cement Ratio is weight of water divided by all cementitious materials.

Table A-2 is a summary of standard specifications for concrete materials. Further discussion of each specification is presented in subsequent text, where additional specifications pertinent to particular concrete components are also given.

Table A-2
Standard Specifications for Concrete Materials

Material	Applicable Standard Tests and Specifications	Comments
Class H oilwell cement	American Petroleum Institute Specification 10	Chemical composition determined according to ASTM C 114
Class F fly ash	ASTM C 618, Standard Specification for Fly Ash	Composition and properties determined according to ASTM C 311
Expansive cement	Similar to ASTM C 845	Composition determined according to ASTM C 114
Salt	ASTM E 534, Chemical Analysis of Sodium Chloride	Batched as dry ingredient, not as an admixture
Coarse and fine aggregates	ASTM C 33, Standard Specification for Concrete Aggregates; ASTM C 294 and C 295 also applied	Moisture content determined by ASTM C 566

Portland cement shall conform to American Petroleum Institute (API) Specification 10 Class G or Class H. Additional requirements for the cement are that the fineness as determined according to ASTM C 204 shall not exceed 300 m^2/kg, and the cement must meet the requirement in ASTM C 150 for moderate heat of hydration.

Fly Ash shall conform to ASTM C 618, Class F, with the additional requirement that the percentage of Ca cannot exceed 10 %.

Expansive cement for shrinkage-compensation shall have properties so that, when used with portland cement, the resulting blend is shrinkage compensating by the mechanism described in ASTM C 845 for Type K cement. Additional requirements for chemical composition of the shrinkage compensating cement appear in Table A-3.

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Table A-3
Chemical Composition of Expansive Cement

Chemical composition	Weight %
Magnesium oxide, max	1.0
Calcium oxide, min	38.0
Sulfur trioxide, max	28.0
Aluminum trioxide (AL_2O_3), min	7.0
Silicon dioxide, min	7.0
Insoluble residue, max	1.0
Loss on ignition, max	12.0

Sodium Chloride shall be of a technical grade consisting of a minimum of 99.0 % sodium chloride as determined according to ASTM E 534, and shall have a maximum particle size of 600 µm.

Aggregate proportions are reported here on saturated surface-dry basis. Specific gravity of coarse and fine aggregates used in these proportions were 2.55 and 2.58, respectively. Absorptions used in calculations were 2.25 (coarse) and 0.63 (fine) % by mass. Concrete mixture proportions will be adjusted to accommodate variations in the materials selected, especially differences in specific gravity and absorptions of aggregates. Fine aggregate shall consist of natural silica sand. Coarse aggregate shall consist of gravel. The quantity of flat and elongated particles in the separate size groups of coarse aggregates, as determined by ASTM D 4791, using a value of 3 for width-thickness ratio and length-width ratio, shall not exceed 25 % in any size group. Moisture in the fine and coarse aggregate shall not exceed 0.1 % when determined in accordance with ASTM C 566. Aggregates shall meet the requirements listed in Table A-4.

A2.1.3 Construction

Construction techniques include surface preparation of mass concrete and slickline (a drop pipe from the surface) placement at depth within the shaft. A batching and mixing operation on the surface will produce a wet mixture having initial temperatures not exceeding 20°C. Placement uses a tremie line, where the fresh concrete exits the slickline below the surface level of the concrete being placed. This procedure will minimize entrained air. Placement requires no vibration and, except for the large concrete monolith at the base of each shaft, no form work. No special curing is required for the concrete because its natural environment ensures retention of humidity and excellent hydration conditions. It is desired that each concrete pour be continuous, with the complete volume of each component placed without construction joints. However, no perceivable reduction in performance is anticipated if, for any reason, concrete placement is interrupted. A free face or cold joint could allow lateral flow but would remain perpendicular to flow down the shaft. Further discussion of concrete construction is presented in Permit Attachment G2, Appendix B.

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Table A-4
Requirements for Salado Mass Concrete Aggregates

Property	Fine Aggregate	Coarse Aggregate
Specific Gravity (ASTM C 127, ASTM C 128)	2.65, max	2.80, max
Absorption (ASTM C 127, ASTM C 128)	1.5 percent, max	3.5 percent, max
Clay Lumps and Friable Particles (ASTM C 142)	3.0 percent, max	3.0 percent, max
Material Finer than 75-µm (No. 200) Sieve (ASTM C 117)	3.0 percent, max	1.0 percent, max
Organic Impurities (ASTM C 40)	No. 3, max	N/A
L.A. Abrasion (ASTM C 131, ASTM C 535)	N/A	50 percent, max
Petrographic Examination (ASTM C 295)	Carbonate mineral aggregates shall not be used	Carbonate rock aggregates shall not be used
Coal and Lignite, less than 2.00 specific gravity (ASTM C 123)	0.5 percent, max	0.5 percent, max

A2.1.4 Performance Requirements

Specifications of concrete properties include characteristics in the green state as well as the hardened state. Properties of hydrated concrete include conventional mechanical properties and projections of permeabilities over hundreds of years, a topic discussed at the end of this section. Table A-5 summarizes target properties for SMC. Attainment of these characteristics has been demonstrated (Wakeley et al., 1995). SMC has a strength of about 40 MPa at 28 days and continues to gain strength after that time, as is typical of hydrating cementitious materials. Concrete strength is naturally much greater than required for shaft seal elements because the state of stress within the shafts is compressional with little shear stress developing. In addition, compressive strength of SMC increases as confining pressure increases (Pfeifle et al., 1996). Volume stability of the SMC is also excellent, which assures a good bond with the salt.

Thermal and constitutive models for the SMC are described in Appendix D of the Compliance Submittal Design Report (Sandia, 1996). Thermal properties are fit to laboratory data and used to calculate heat distribution during hydration. An isothermal creep law and an increasing modulus are used to represent the concrete in structural calculations. The resistance established by concrete to inward creep of the Salado Formation accelerates healing of microcracks in the salt. The state of stress impinging on concrete elements within the Salado Formation will approach a lithostatic condition.

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Table A-5
Target Properties for Salado Mass Concrete

Property	Comment
Initial slump 10 ± 1.0 in. Slump at 2 hr 8 ± 1.5 in.	ASTM C 143, high slump needed for pumping and placement
Initial temperature ≤ 20°C	ASTM C 1064, using ice as part of mixing water
Air content ≤ 2.0%	ASTM C 231 (Type B meter), tight microstructure and higher strength
Self-leveling	Restrictions on underground placement may preclude vibration
No separately batched admixtures	Simple and reproducible operations
Adiabatic temperature rise ≤ 16°C at 28 days	To reduce thermally induced cracking
30 MPa (4500 psi) compressive strength	ASTM C 39, at 180 days after placement
Volume stability	ASTM C 157, length change between +0.05 and -0.02% through 180 days

Permeability of SMC is very low, consistent with most concretes. Owing to a favorable state of stress and isothermal conditions, the SMC will remain intact. Because little brine is available to alter concrete elements, minimal degradation is possible. Resistance to phase changes of salt-saturated concretes and mortars within the WIPP setting has been excellent. These favorable attributes combine to assure concrete elements within the Salado will remain structurally sound and possess very low permeability for exceedingly long periods.

Permeabilities of SMC and other salt-saturated concretes have been measured in Small-Scale Seal Performance Tests (SSSPT) and Plug Test Matrix (PTM) at the WIPP for a decade and are corroborated by laboratory measurements (e.g., Knowles and Howard, 1996; Pfeifle et al., 1996). From these tests, values and ranges of concrete permeability have been developed. For performance assessments calculations, permeability of SMC seal components is treated as a random variable defined by a log triangular distribution with a best estimator of 1.78×10^{-19} m^2 and lower and upper limits of 2.0×10^{-21} and 1.0×10^{-17} m^2, respectively.

The probability distribution function is shown in Figure G2A-2. Further, it is recognized that concrete function is required for only a relatively short-term period as salt reconsolidates. Concrete is expected to function adequately beyond its design life. For calculational expediency, a higher, very conservative permeability of 1.0×10^{-14} is assigned to concrete after 400 years. This abrupt change in permeability does not imply degradation, but rather reflects system redundancy and the fact that concrete is no longer relied on as a seal component.

A2.1.5 Verification Methods

The concrete supplier shall perform the inspection and tests described below (Tables A-6 and A-7) and, based on the results of these inspections and tests, shall take appropriate action. The laboratory performing verification tests shall be on-site and shall conform with ASTM C 1077. Individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Laboratory Testing Technicians, Grade I. The Buyer will inspect the laboratory, equipment, and test

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procedures for conformance with ASTM C 1077 prior to start of dry materials batching operations and prior to restarting operations.

A2.1.5.1 Fine Aggregate

(A) Grading. Dry materials will be sampled while the batch plant is operating; there shall be a sieve analysis and fineness modulus determination in accordance with ASTM C 136.

(B) Fineness Modulus Control Chart. Results for fineness modulus shall be grouped in sets of three consecutive tests, and the average and range of each group shall be plotted on a control chart. The upper and lower control limits for average shall be drawn 0.10 units above and below the target fineness modulus, and the upper control limit for range shall be 0.20 units above the target fineness modulus.

Table A-6
Test Methods Used for Measuring Concrete Properties During and After Mixing

Property	Test Method	Title
Slump	ASTM C 143	Slump of Portland Cement Concrete
Unit weight	ASTM C 138	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
Air content	ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
Mixture temperature	ASTM C 1064	Temperature of Freshly Mixed Concrete

Table A-7
Test Methods Used for Measuring Properties of Hardened Concrete

Property	Test Method	Title
Compressive strength	ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens
Modulus of elasticity	ASTM C 469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
Volume stability	ASTM C 157	Length Change of Hardened Cement Mortar and Concrete

(C) Corrective Action for Fine Aggregate Grading. When the amount passing any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure for any sieve, the fact shall be immediately reported to the Buyer. Whenever a point on the fineness modulus control chart, either for average or range, is beyond one of the control limits, the frequency of testing shall be doubled. If two consecutive points are beyond the control limits, the process shall be stopped and stock discarded if necessary.

(D) Moisture Content Testing. There shall be at least two tests for moisture content in accordance with ASTM C 566 during each 8-hour period of dry materials batch plant operation.

(E) Moisture Content Corrective Action. Whenever the moisture content of fine aggregate exceeds 0.1 % by weight, the fine aggregate shall be immediately resampled and retested. If there is another failure the batching shall be stopped.

A2.1.5.2 Coarse Aggregate

(A) Grading. Coarse aggregate shall be analyzed in accordance with ASTM C 136.

(B) Corrective Action for Grading. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Buyer. Where two consecutive averages of five tests are outside specification limits, the dry materials batch plant operation shall be stopped, and immediate steps shall be taken to correct the grading.

(C) Moisture Content Testing. There shall be at least two tests for moisture content in accordance with ASTM C 566 during each 8-hour period of dry materials batch plant operation.

(D) Moisture Content Corrective Action. Whenever the moisture content of coarse aggregate exceed 0.1 % by weight, the coarse aggregate shall be immediately resampled and retested. If there is another failure, batching shall be stopped.

A2.1.5.3 Batch-Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, and granular sodium chloride shall be continuously controlled. The aggregate batch weights shall be adjusted as necessary to compensate for their nonsaturated surface-dry condition.

A2.1.5.4 Concrete Products

Concrete products will be tested during preparation and after curing as summarized in Tables A-6 and A-7 for preparation and hydrated concrete, respectively.

A2.2 Compacted Clay

Compacted clays are commonly proposed as primary sealing materials for nuclear waste repositories and have been extensively investigated (e.g., Gray, 1993). Compacted clay as a shaft sealing component provides a barrier to brine and possibly to gas flow into or out of the repository and supports the shaft with a high density material to minimize subsidence. In the event that brine does contact the compacted clay columns, bentonitic clay can generate a beneficial swelling pressure. Swelling would increase internal supporting pressure on the shaft wall and accelerate healing of any disturbed rock zone. Wetted, swelling clay will seal fractures as it expands into available space and will ensure tightness between the clay seal component and the shaft walls.

A2.2.1 Functions

In general, clay is used to prevent fluid flow either down or up the shaft. In addition, clay will stabilize the shaft opening and provide a backstress within the Salado Formation that will enhance healing of microfractures in the disturbed rock. Bentonitic clays are specified for Components 4, 8, and 12. In addition to limiting brine migration down the shafts, a primary function of a compacted clay seal through the Rustler Formation (Component 4) is to provide separation of water bearing units. The primary function of the upper Salado clay column (Component 8) is to limit groundwater flow down the shaft, thereby adding assurance that the

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reconsolidating salt column is protected. The lower Salado compacted clay column (Component 12) will act as a barrier to brine and possibly to gas flow (see construction alternatives in Appendix B) soon after placement and remain a barrier throughout the regulatory period.

A2.2.2 Material Characteristics

The Rustler and Salado compacted clay columns will be constructed of a commercial well-sealing grade sodium bentonite blocks compacted to between 1.8 and 2.0 g/cm^3. An extensive experimental data base exists for the permeability of sodium bentonites under a variety of conditions. Many other properties of sodium bentonite, such as strength, stiffness, and chemical stability also have been thoroughly investigated. Advantages of clays for sealing purposes include low permeability, demonstrated longevity in many types of natural environments, deformability, sorptive capacity, and demonstrated successful utilization in practice for a variety of sealing purposes.

A variety of clays could be considered for WIPP sealing purposes. For WIPP, as for most if not all nuclear waste repository projects, bentonite has been and continues to be a prime candidate as the clay sealing material. Bentonite clay is chosen here because of its overwhelming positive sealing characteristics. Bentonite is a highly plastic swelling clay material (e.g., Mitchell, 1993), consisting predominantly of smectite minerals (e.g., IAEA, 1990). Montmorillonite, the predominant smectite mineral in most bentonites, has the typical plate-like structure characteristic of most clay minerals.

The composition of a typical commercially available sodium bentonite (e.g. Volclay, granular sodium bentonite) contains over 90% montmorillonite and small portions of feldspar, biotite, selenite, etc. A typical sodium bentonite has the chemical composition summarized in Table A-8 (American Colloid Company, 1995). This chemical composition is close to that reported for MX-80 which was used successfully in the Stripa experiments (Gray, 1993). Sodium bentonite has a tri-layer expanding mineral structure of approximately (Al $Fe_{1.67}$ $Mg_{0.33}$) Si_4O_{10} (OH_2) $Na^+Ca^{++}{}_{0.33}$. Specific gravity of the sodium bentonite is about 2.5. The dry bulk density of granular bentonite is about 1.04 g/cm^3.

Densely compacted bentonite (of the order of 1.75 g/cm^3), when confined, can generate a swelling pressure up to 20 MPa when permeated by water (IAEA, 1990). The magnitude of the swelling pressure generated depends on the chemistry of the permeating water. Laboratory and field measurements suggest that the bentonite specified for shaft seal materials in the Salado may achieve swell pressures of 3 to 4 MPa, and likely substantially less. Swelling pressure in the bentonite column is not expected to be appreciable because little contact with brine fluids is conceivable. Further considerations of potential swelling of bentonite within the Rustler Formation may be appropriate, however.

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Table A-8
Representative Bentonite Composition.

Chemical Compound	Weight %
SiO_2	63.0
Al_2O_3	21.1
Fe_2O_3	3.0
FeO	0.4
MgO	2.7
Na_2O	2.6
CaO	0.7
H_2O	5.6
Trace Elements	0.7

Mixtures of bentonite and water can range in rheological characteristics from a virtually Newtonian fluid to a stiff solid, depending on water content. Bentonite can form stiff seals at low moisture content, and can penetrate fractures and cracks when it has a higher water content. Under the latter conditions it can fill void space in the seal itself and disturbed rock zones. Bentonite with dry density of 1.75 g/cm^3 has a cohesion of 5-50 kPa, and a friction angle of 5 to 15° (IAEA, 1990). At density greater than 1.6-1.7 g/cm^3, swelling pressure of bentonite is less affected by the salinity of groundwater providing better chemical and physical stabilities.

A2.2.3 Construction

Seal performance within the Salado Formation is far more important to regulatory compliance than is performance of earthen fill in the overlying formations. Three potential construction methods might be used to place clay in the shaft, as discussed in Appendix B. Construction of bentonite clay components specifies block assembly procedures demonstrated successfully at the WIPP site (Knowles and Howard, 1996) and in a considerable body of work by Roland Pusch (see summary in Gray, 1993). To achieve low permeabilities, dry density of the bentonite blocks should be about 2.0 g/cm^3, although a range of densities is discussed in Section 2.2.4. A high density of clay components is also desirable to carry the weight of overlying seal material effectively and to minimize subsidence.

Placement of clay in the shaft is one area of construction that might be made more cost and time effective through optimization studies. An option to construct clay columns using dynamic compaction will likely prove to be efficient, so it is specified for earthen fill in the Dewey Lake Redbeds (as discussed later) and may prove to be an acceptable placement method for other components. Dynamic compaction would use equipment developed for placement of crushed salt. The Canadian nuclear waste program has conducted extensive testing, both in situ and in large scale laboratory compaction of clay-based barrier materials with dynamic hydraulically powered impact hammers (e.g., Kjartanson et al, 1992). The Swedish program similarly has investigated field compaction of bentonite-based tunnel backfill by means of plate vibrators (e.g., Nilsson, 1985). Both studies demonstrated the feasibility of in situ compaction of bentonite-based materials to a high density. Near surface, conventional compaction methods

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will be used because insufficient space remains for dynamic compaction using the multi-deck work stage.

A2.2.4 Performance Requirements

The proven characteristics of bentonite assure attainment of very low permeability seals. It is recognized that the local environment contributes to the behavior of compacted clay components. Long-term material stability is a highly desired sealing attribute. Clay components located in brine environments will have to resist cation exchange and material structure alteration. Clay is geochemically mature, reducing likelihood of alteration and imbibition of brine is limited to isolated areas. Compacted clay is designed to withstand possible pressure gradients and to resist erosion and channeling that could conceivably lead to groundwater flow through the seal. Compacted clay seal components support the shaft walls and promote healing of the salt DRZ. Volume expansion or swelling would accelerate healing in the salt. A barrier to gas flow could be constructed if moisture content of approximately 85% of saturation could be achieved.

Permeability of bentonite is inversely correlated to dry density. Figure G2A-3 plots bentonite permeability as a function of reported sample density for sodium bentonite samples. The permeability ranges from approximately 1×10^{-21} to 1×10^{-17} m^2. In all cases, the data in Figure G2A-3 are representative of low ionic strength permeant waters. Data provided in this figure are limited to sodium bentonite and bentonite/sand mixtures with clay content greater than or equal to 50 %. Cheung et al. (1987) report that in bentonite/sand mixtures, sand acts as an inert fraction which does not alter the permeability of the mixture from that of a 100 % bentonite sample at the same equivalent dry density. Also included in Figure G2A-3 are the three point estimates of permeability at dry densities of 1.4, 1.8, and 2.1 g/cm^3 provided by Jaak Daemen of the University of Nevada, Reno, who is actively engaged in WIPP-specific bentonite testing.

A series of in situ tests (SSSPTs) that evaluated compacted bentonite as a sealing material at the WIPP site corroborate data shown in Figure G2A-3. Test Series D tested two 100 % bentonite seals in vertical boreholes within the Salado Formation at the repository horizon. The diameter of each seal was 0.91 m, and the length of each seal was 0.91 m. Cores of the two bentonite seals had initial dry densities of 1.8 and 2.0 g/cm^3. Pressure differentials of 0.72 and 0.32 MPa were maintained across the bentonite seals with a brine reservoir on the upstream (bottom) of the seals for several years.

Over the course of the seal test, no visible brine was observed at the downstream end of the seals. Upon decommissioning the SSSPT, brine penetration was found to be only 15 cm. Determination of the absolute permeability of the bentonite seal was not precise; however, a bounding calculation of 1×10^{-19} m^2 was made by Knowles and Howard (1996).

Beginning with a specified dry density of 1.8 to 2.0 g/cm^3 and Figure G2A-3, a distribution function for clay permeability was developed and is provided in Figure G2A-4. Parameter distribution reflects some conservative assumptions pertaining to WIPP seal applications. The following provide rationale behind the distribution presented in Figure G2A-4.

1. A practical minimum for the distribution can be specified at 1×10^{-21} m^2.

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2. If effective dry density of the bentonite emplaced in the seals only varies from 1.8 to 2.0 g/cm^3, then a maximum expected permeability can be extrapolated from Figure G2A-3 as 1×10^{-19} m^2.

3. Uncertainty exists in being able to place massive columns of bentonite to design specifications. To address this uncertainty in a conservative manner, it is assumed that the compacted clay be placed at a dry density as low as 1.6 g/cm^3. At 1.6 g/cm^3, the maximum permeability for the clay would be approximately 5×10^{-19} m^2. Therefore, neglecting salinity effects, a range of permeability from 1×10^{-21} to 5×10^{-19} m^2 with a best estimate of less than 1×10^{-19} m^2 could be reasonably defined (assuming a best estimate emplacement density of 1.8 g/cm^3). It could be argued, based on Figure G2A-3, that a best estimate could be as low as 2×10^{-20}m^2.

Salinity increases bentonite permeability; however, these effects are greatly reduced at the densities specified for the shaft seal. At seawater salinity, Pusch et al. (1989) report the effects on permeability could be as much as a factor of 5 (one-half order of magnitude). To account for salinity effects in a conservative manner, the maximum permeability is increased from 5×10^{-19} to 5×10^{-18} m^2. The best estimate permeability is increased by one-half order of magnitude to 5×10^{-19} m^2. The lower limit is held at 1×10^{-21} m^2. Because salinity effects are greatest at lower densities, the maximum is adjusted one full order of magnitude while the best estimate (assumed to reside at a density of 1.8 g/cm^3) is adjusted one-half of an order.

The four arguments presented above give rise to the permeability cumulative frequency distribution plotted in Figure G2A-4, which summarizes the performance specification for bentonite columns.

A2.2.5 Verification Methods

Verification of specified properties such as density, moisture content or strength of compacted clay seals can be determined by direct access during construction. However, indirect methods are preferred because certain measurements, such as permeability, are likely to be time consuming and invasive. Methods used to verify the quality of emplaced seals will include quality of block production and field measurements of density. As a minimum, standard quality control procedures recommended for compaction operations will be implemented including visual observation, in situ density measurements, and moisture content measurements. Visual observation accompanied by detailed record keeping will assure design procedures are being followed. In situ testing will confirm design objectives are accomplished in the field.

Density measurements of compacted clay shall follow standard procedures such as ASTM D 1556, D 2167, and D 2922. The moisture content of clay blocks shall be calculated based on the water added during mixing and can be confirmed by following ASTM Standard procedures D 2216 and D 3017. It is probable that verification procedures will require modifications to be applicable within the shaft. As a minimum, laboratory testing to certify the above referenced quality control measures will be performed to assure that the field measurements provide reliable results.

A2.3 Asphalt Components

Asphalt is used to prevent water migration down the shaft in two ways: an asphalt column bridging the Rustler/Salado contact and a "waterstop" sandwiched between concrete plugs at

three locations within the Salado Formation, two above the salt column and one below the salt column. An asphalt mastic mix (AMM) that contains aggregate is specified for the column while the specification for the waterstop layer is pure asphalt.

Asphalt is a widely used construction material with many desirable properties. Asphalt is a strong cement, is readily adhesive, highly waterproof, and durable. Furthermore, it is a plastic substance that provides controlled flexibility to mixtures of mineral aggregates with which it is usually combined. It is highly resistant to most acids, salts, and alkalis. A number of asphalts and asphalt mixes are available that cover a wide range of viscoelastic properties which allows the properties of the mixture to be designed for a wide range of requirements for each application. These properties are well suited to the requirements of the WIPP shaft seal system.

A2.3.1 Functions

The generic purpose of asphalt seal components above the salt column is to eliminate water migration downward. The asphalt waterstops above the salt column are designed to intersect the DRZ and limit fluid flow. Asphalt is not the lone component preventing flow of brine downward; it functions in tandem with concrete and a compacted clay column. Waterstop Component # 11 located below the salt column would naturally limit upward flow of brine or gas. Concrete abutting the asphalt waterstops provides a rigid element that creates a backstress upon the inward creeping salt, promoting healing within the DRZ. Asphalt is included in the WIPP shaft seal system to reduce uncertainty of system performance by providing redundancy of function while using an alternative material type. The combination of shaft seal components restricts fluid flow up or down to allow time for the salt column to reconsolidate and form a natural fluid-tight seal.

The physical and thermal attributes of asphalt combine to reduce fluid flow processes. The placement fluidity permits asphalt to flow into uneven interstices or fractures along the shaft wall. Asphalt will self-level into a nearly voidless mass. As it cools, the asphalt will eventually cease flowing. The elevated temperature and thermal mass of the asphalt will enhance creep deformation of the salt and promote healing of the DRZ surrounding the shaft. Asphalt adheres tightly to most materials, eliminating flow along the interface between the seal material and the surrounding rock.

A2.3.2 Material Characteristics

The asphalt column specified for the WIPP seal system is an AMM commonly used for hydraulic structures. The AMM is a mixture of asphalt, sand, and hydrated lime. The asphalt content of AMM is higher than those used in typical hot mix asphalt concrete (pavements). High asphalt contents (10-20% by weight) and fine, well-graded aggregate (sand and mineral fillers) are used to obtain a near voidless mix. A low void content ensures a material with extremely low water permeability because there are a minimum number of connected pathways for brine migration.

A number of different asphaltic construction materials, including hot mix asphalt concrete (HMAC), neat asphalt, and AMMs, were evaluated for use in the WIPP seal design. HMAC was eliminated because of construction difficulty that might have led to questionable performance. An AMM is selected as a preferred alternative for the asphalt columns because it has economic and performance advantages over the other asphaltic options. Aggregate and mineral fines in the AMM increase rigidity and strength of the asphalt seal component, thereby enhancing the potential to heal the DRZ and reducing shrinkage relative to neat asphalt.

Viscosity of the AMM is an important physical property affecting construction and performance. The AMM is designed to have low enough viscosity to be pumpable at application temperatures and able to flow readily into voids. High viscosity of the AMM at operating temperatures prevents long-term flow, although none is expected. Hydrated lime is included in the mix design to increase the stability of the material, decrease moisture susceptibility, and act as an anti-microbial agent. Table A-9 details the mix design specifications for the AMM.

The asphalt used in the waterstop is AR-4000, a graded asphalt of intermediate viscosity. The waterstop uses pure, or neat, asphalt because it is a relatively small volume when compared to the column.

A2.3.3 Construction

Construction of asphalt seal components can be accomplished using a slickline process where the molten material is effectively pumped into the shaft. The AMM will be mixed at ground level in a pug mill at approximately 180°C. At this temperature the material is readily pourable. The AMM will be slicklined and placed using a heated and insulated tremie line. The AMM will easily flow into irregularities in the surface of the shaft or open fractures until the AMM cools. After cooling, flow into surface irregularities in the shaft and DRZ will slow considerably because of the sand and mineral filler components in the AMM and the temperature dependence of the viscosity of the asphalt. AMM requires no compaction in construction. Neat asphalt will be placed in a similar fashion.

The technology to pump AMM is available as described in the construction procedures in Appendix B. One potential problem with this method of construction is ensuring that the slickline remains heated throughout the construction phase. Impedance heating (a current construction technique) can be used to ensure the pipe remains at temperatures sufficient to promote flow. The lower section (say 10 m) of the pipe may not need to be heated, and it may not be desirable to heat it as it is routinely immersed in the molten asphalt during construction to minimize air entrainment. Construction using large volumes of hot asphalt would be facilitated by placement in sections. After several meters of asphalt are placed, the slickline would be retracted by two lengths of pipe and pumping resumed. Once installed, the asphalt components will cool; the column will require several months to approach ambient conditions. Calculations of cooling times and plots of isotherms for the asphalt column are given in Appendix D of the Compliance Submittal Design Report (Sandia, 1996). It should be noted that a thermal pulse into the surrounding rock salt could produce positive rock mechanics conditions. Fractures will heal much faster owing to thermally activated dislocation motion and diffusion. Salt itself will creep inward at a much greater rate as well.

Table A-9
Asphalt Component Specifications

AMM Composition:	20 wt% asphalt (AR-4000 graded asphalt) 70 wt% aggregate (silicate sand) 10 wt% hydrated lime	
Aggregate (% passing by weight)		
US Sieve Size		Specification Limits
2.36 mm	(No. 8)	100
1.18 mm	(No. 16)	90
600	(No. 30)	55-75
300	(No. 50)	35-50
150	(No. 100)	15-30
75	(No. 200)	5-15
Mineral Filler: Hydrated Lime Chemical Composition:		
Total active lime content (% by weight)		min. 90.0%
Unhydrated lime weight (% by weight CaO)		max. 5.0%
Free water (% by weight H_2O)		max. 4.0%
Residue Analysis:		
Residue retained on No. 6 sieve		max. 0.1%
Residue retained on No. 30 sieve		max. 3.0%

A2.3.4 Performance Requirements

Asphalt components are required to endure for about 100 years as an interim seal while the compacted salt component reconsolidates to create a very low permeability seal component. Since asphalt will not be subjected to ultraviolet light or an oxidizing environment, it is expected to provide an effective brine seal for several centuries. Air voids should be less than 2% to ensure low permeability. Asphalt mixtures do not become measurably permeable to water until voids approach 8% (Brown, 1990).

At Hanford, experiments are ongoing on the development of a passive surface barrier designed to isolate wastes (in this case to prevent downward flux of water and upward flux of gases) for 1000 years with no maintenance. The surface barrier uses asphalt as one of many horizontal components because low-air-void, high-asphalt-content materials are noted for low permeability and improved mechanically stable compositions. The design objective of this asphalt concrete was to limit infiltration to 1.6×10^{-9} cm/s (1.6×10^{-11} m/s, or for fresh water, an intrinsic permeability of 1.6×10^{-18} m^2). The asphalt component of the barrier is composed of a 15 cm layer of asphaltic concrete overlain with a 5-mm layer of fluid-applied asphalt. The reported hydraulic conductivity of the asphalt concrete is estimated to be 1×10^{-9} m/s (equivalent to an intrinsic permeability of approximately 1×10^{-16} m^2 assuming fresh water). Myers and Duranceau (1994) report that the hydraulic conductivity of fluid-applied asphalt is estimated to be 1.0×10^{-11} to 1.0×10^{-10} cm/s (equivalent to an intrinsic permeability of approximately 1.0×10^{-20} to 1.0×10^{-19} m^2 assuming fresh water).

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Consideration of published values results in a lowest practical permeability of 1×10^{-21} m^2. The upper limit of the asphalt seal permeability is assumed to be 1×10^{-18} m^2. Intrinsic permeability of the asphalt column is defined as a log triangular distributed parameter, with a best estimate value of 1×10^{-20} m^2 , a minimum value of 1×10^{-21} m^2, and a maximum value of 1×10^{-18} m^2, as shown in Figure G2A-5. It is recognized that the halite DRZ in the uppermost portion of the Salado Formation is not likely to heal because creep of salt is relatively slow.

These values are used in performance assessment of regulatory compliance analyses and in fluid flow calculations (Appendix C of the Compliance Submittal Design Report (Sandia, 1996)) pertaining to seal system functional evaluation. Other calculations pertaining to rock mechanics and structural considerations of asphalt elements are discussed in Appendix D of the Compliance Submittal Design Report (Sandia, 1996).

A2.3.5 Verification Methods

Viscosity of the AMM must be low enough for easy delivery through a heated slickline. Sufficient text book information is available to assure performance of the asphalt component; however, laboratory validation tests may be desirable before installation. There are no plans to test asphalt components after they are placed. With that in mind, some general tests identified below would add quantitative documentation to expected performance values and have direct application to WIPP. The types and objectives of the verification tests are:

Mix Design. A standard mix design which evaluates a combination of asphalt and aggregate mixtures would quantify density, air voids, viscosity, and permeability. Although the specified mixture will function adequately, studies could optimize the mix design.

Viscoelastic Properties at Service Temperatures. Viscoelastic properties over the range of expected service temperatures would refine the rheological model.

Accelerated Aging Analysis. Asphalt longevity issues could be further addressed by using the approach detailed in PNL-Report 9336 (Freeman and Romine, 1994).

Brine Susceptibility Analysis. The presumed inert nature of the asphalt mix can be demonstrated through exposure to groundwater brine solutions found in the Salado Formation. Potential for degradation will be characterized by monitoring the presence of asphalt degradation products in WIPP brine or brine simulant as a function of time. Effects on hydraulic conductivity can be measured during these experiments.

A2.4 Compacted Salt Column

A reconstituted salt column has been proposed as a primary means to isolate for several decades those repositories containing hazardous materials situated in evaporite sequences. Reuse of salt excavated in the process of creating the underground openings has been advocated since the initial proposal by the NAS in the 1950s. Replacing the natural material to its original setting ensures physical, chemical, and mechanical compatibility with the host formation. Recent developments in support of the WIPP shaft seal system have produced confirming experimental results, constitutive material laws, and construction methods that substantiate use of a salt column for a low permeability, perfectly compatible seal component.

Numerical models of the shaft and seal system have been used to provide information on the mechanical processes that affect potential pathways and overall performance of the seal system. Several of these types of analyses are developed in Appendix D of the Compliance Submittal Design Report (Sandia, 1996). Simulations of the excavated shaft and the compacted salt seal element behavior after placement show that as time passes, the host salt creeps inward, the compacted salt is loaded by the host formation and consolidates, and a back pressure is developed along the shaft wall. The back pressure imparted to the host formation by the compacted salt promotes healing of any microcracks in the host rock. As compacted salt consolidates, density and stiffness increase and permeability decreases.

A2.4.1 Functions

The function of the compacted and reconsolidated salt column is to limit transmission of fluids into or out of the repository for the statutory period of 10,000 years. The functional period starts within a hundred years and lasts essentially forever. After a period of consolidation, the salt column will almost completely retard gas or brine migration within the former shaft opening. A completely consolidated salt column will achieve flow properties indistinguishable from natural Salado salt.

A2.4.2 Material Characteristics

The salt component comprises crushed Salado salt with addition of small amounts of water. No admixtures other than water are needed to meet design specifications. Natural Salado salt (also called WIPP salt) is typical of most salts in the Permian Basin: it has an overall composition approaching 90-95 % halite with minor clays, carbonate, anhydrite, and other halite minerals. Secondary minerals and other impurities are of little consequence to construction or performance of the compacted salt column as long as the halite content is approximately 90 %.

The total water content of the crushed salt should be approximately 1.5 wt% as it is tamped into place. Field and laboratory testing verified that natural salt can be compacted to significant density ($\rho \geq 0.9$) with addition of these modest amounts of water. In situ WIPP salt contains approximately 0.5 wt% water. After it is mined, transported, and stored, some of the connate water is lost to evaporation and dehydration. Water content of the bulk material that would be used for compaction in the shaft is normally quite small, on the order of 0.25 wt%, as measured during compaction demonstrations (Hansen and Ahrens, 1996). Measurements of water content of the salt will be necessary periodically during construction to calibrate the proper amount of water to be added to the salt as it is placed.

Water added to the salt will be sprayed in a fine mist onto the crushed salt as it is cast in each lift. Methods similar to those used in the large-scale compaction demonstration will be developed such that the spray visibly wets the salt grain surfaces. General uniformity of spray is desired. The water has no special chemical requirements for purity. It can be of high quality (drinkable) but need not be potable. Brackish water would suffice because water of any quality would become brackish upon application to the salt.

The mined salt will be crushed and screened to a nominal maximum diameter of 5 mm. Gradation of particles smaller than 5 mm is not of concern because the crushing process will create relatively few fines compared to the act of dynamic compaction. Based on preliminary large-scale demonstrations, excellent compaction was achieved without optimization of particle sizes. It is evident from results of the large compaction demonstration coupled with laboratory

studies that initial density can be increased and permeability decreased beyond existing favorable results. Further demonstrations of techniques, including crushing and addition of water may be undertaken in ensuing years between compliance certification and beginning of seal placement.

A2.4.3 Construction

Dynamic compaction is the specified procedure to tamp crushed salt in the shaft. Other techniques of compaction have potential, but their application has not been demonstrated. Deep dynamic compaction provides the greatest energy input to the crushed salt, is easy to apply, and has an effective depth of compactive influence far greater than lift thickness. Dynamic compaction is relatively straightforward and requires a minimal work force. If the number of drops remains constant, diameter and weight of the tamper increases in proportion to the diameter of the shaft. The weight of the tamper is a factor in design of the infrastructure supporting the hoisting apparatus. Larger, heavier tampers require equally stout staging. The construction method outlined in Appendix B balances these opposing criteria. Compaction itself will follow the successful procedure developed in the large-scale compaction demonstration (Hansen and Ahrens, 1996).

Transport of crushed salt to the working level can be accomplished by dropping it down a slickline. As noted, additional water will be sprayed onto the crushed salt at the bottom of the shaft as it is placed. Lift heights of approximately 2 m are specified, though greater depths could be compacted effectively using dynamic compaction. Uneven piles of salt can be hand leveled.

A2.4.4 Performance Requirements

Compacted crushed salt is a unique seal material because it consolidates naturally as the host formation creeps inward. As the crushed salt consolidates, void space diminishes, density increases, and permeability decreases. Thus, sealing effectiveness of the compacted salt column will improve with time. Laboratory testing over the last decade has shown that pulverized salt specimens can be compressed to high densities and low permeabilities (Brodsky et al., 1996). In addition, consolidated crushed salt uniquely guarantees chemical and mechanical compatibility with the host salt formation. Therefore, crushed salt will provide a seal that will function essentially forever once the consolidation process is completed. Primary performance results of these analyses include plots of fractional density as a function of depth and time for the crushed salt column and permeability distribution functions that will be used for performance assessment calculations. These performance results are summarized near the end of this section, following a limited background discussion.

To predict performance, a constitutive model for crushed salt is required. To this end, a technical evaluation of potential crushed salt constitutive models was completed (Callahan et al., 1996). Ten potential crushed salt constitutive models were identified in a literature search to describe the phenomenological and micromechanical processes governing consolidation of crushed salt. Three of the ten potential models were selected for rigorous comparisons to a specially developed, although somewhat limited, database. The database contained data from hydrostatic and shear consolidation laboratory experiments. The experiments provide deformation (strain) data as a function of time under constant stress conditions. Based on volumetric strain measurements from experiments, change in crushed salt density and porosity are known. In some experiments, permeability was also measured, which provides a relationship between density and permeability of crushed salt. Models were fit to the

experimental database to determine material parameter values and the model that best represents experimental data.

Modeling has been used to predict consolidating salt density as a function of time and position in the shaft. Position or depth of the calculation is important because creep rates of intact salt and crushed salt are strong functions of stress difference. Analyses made use of a "pineapple" slice structural model at the top (430 m), middle (515 m), and bottom (600 m) of the compacted salt column. Initial fractional density of the compacted crushed salt was 0.90 (1944 kg m^{-3}). The structural model, constitutive material models, boundary conditions, etc. are described in Appendix D of the Compliance Submittal Design Report (Sandia, 1996). Modeling results coupled with laboratory-determined relationships between density and permeability were used to develop distribution functions for permeability of the compacted crushed salt column for centuries after seal emplacement.

Analyses used reference engineering values for parameters in the constitutive models (e.g., the creep model for intact salt and consolidation models for crushed salt). Some uncertainty associated with model parameters exists in these constitutive models. Consolidating salt density was quantified by predicting density at specific times using parameter variations. Many of these types of calculations comparing three models for consolidation of crushed salt were performed to quantify performance of the salt column, and the reader is referred to Appendix D of the Compliance Submittal Design Report (Sandia, 1996) for more detail.

Predictions of fractional density as a function of time and depth are shown in Figure G2A-6. Performance calculations of the seal system require quantification of the resultant salt permeability. The permeability can be derived from the experimental data presented in Figure G2A-7. This plot depicts probabilistic lines through the experimental data. From these lines, distribution functions can be derived. Permeability of the compacted salt column is treated as a transient random variable defined by a log triangular distribution. Distribution functions were provided for 0, 50, 100, 200, and 400 years after seal emplacement, assuming that fluids in the salt column pores spaces would not produce a backstress. The resultant cumulative frequency distribution for seal permeability at the seal mid-height is shown in Figure G2A-8. This method predicts permeabilities ranging from 1×10^{-23} m^2 to 1×10^{-16} m^2. Because crushed salt consolidation will be affected by both mechanical and hydrological processes, detailed calculations were performed. These calculations are presented in Appendices C and D.

Numerical models of the shaft provide density of the compacted salt column as a function of depth and time. From the density-permeability relationship, permeability of the compacted salt seal component can be calculated. Similarly, the extent of the disturbed rock zone around the shaft is provided by numerical models. From field measurements of the halite DRZ, permeability of the DRZ is known as a function of depth and time. These spatial and temporal permeability values provide information required to assess the potential for brine and gas movement in and around the consolidating salt column.

A2.4.5 Verification Methods

Results of the large-scale dynamic compaction demonstration suggest that deep dynamic compaction will produce a dense starting material, and laboratory work and modeling show that compacted salt will reconsolidate within several decades to an essentially impermeable mass. As with other seal components, testing of the material in situ will be difficult and probably not the best way to ensure quality of the seal element. This is particularly apparent for the compacted

salt component because the compactive effort produces a finely powdered layer on the top of each lift. It turns out that the fine powder compacts into a very dense material when the next lift is compacted. The best way to ensure that the crushed salt element functions properly is to establish performance through QA/QC procedures. If crushed salt is placed with a reasonable uniformity of water and is compacted with sufficient energy, long-term performance can be assured.

Periodic measurements of the water content of loose salt as it is placed in lifts will be used for verification and quality control. Thickness of lifts will be controlled. Energy imparted to each lift will be documented by logging drop patterns and drop height. If deemed necessary, visual inspection of the tamped salt can be made by human access. The powder layer can be shoveled aside and hardness of underlying material can be qualitatively determined or tested. Overall geometric measurements made from the original surface of each lift could be used to approximate compacted density.

A2.5 Cementitious Grout

Cementitious grouting is specified for all concrete members in response to external review suggestions. Grouting is also used in advance of liner removal to stabilize the ground. Cementitious grout is specified because of its proven performance, nontoxicity, and previous use at the WIPP.

A2.5.1 Functions

The function of grout is to stabilize the surrounding rock before existing concrete liners are removed. Grout will fill fractures within adjacent lithologies, thereby adding strength and reducing permeability. Grout around concrete members of the concrete asphalt waterstop will be employed in an attempt to tighten the interface and fill microcracks in the DRZ. Efficacy of grouting will be determined during construction. In addition, reduction of local permeability will further limit groundwater influx into the shaft during construction. Concrete plugs are planned for specific elevations in the lined portion of each shaft. The formation behind the concrete liner will be grouted from approximately 3 m below to 3 m above the plug positions to ensure stability of any loose rock.

A2.5.2 Material Characteristics

The grout developed for use in the shaft seal system has the following characteristics:

- no water separation upon hydration,
- low permeability paste,
- fine particle size,
- low hydrational heat,
- no measurable agglomeration subsequent to mixing,
- two hours of injectability subsequent to mixing,
- short set time,
- high compressive strength, and
- competitive cost.

A cementitious grout developed by Ahrens and coworkers (Ahrens et al., 1996) is specified for application in the shaft seal design. This grout consists of portland cement, pumice as a pozollanic material, and superplasticizer in the proportions listed in Table A-10. The ultrafine grout is mixed in a colloidal grout mixer, with a water to components ratio (W:C) of 0.6:1. Grout has been produced with 90 % of the particles smaller than 5 microns and an average particle size of 2 microns. The extremely small particle size enables the grout to penetrate fractures with apertures as small as 6 microns.

Table A-10
Ultrafine Grout Mix Specification

Component	Weight Percent (wt%)
Type 5 portland cement	45
Pumice	55
Superplasticizer	1.5

A2.5.3 Construction

Grout holes will be drilled in a spin pattern that extends from 3 m below to 3 m above that portion of the lining to be removed. The drilling and grouting sequence will be defined in the workmanship specifications prior to construction. Grout will be mixed on surface and transferred to the work deck via the slick line. Maximum injection pressure will be lithostatic, less 50 psig. It is estimated that four holes can be drilled and grouted per shift.

A2.5.4 Performance Requirements

Performance of grout is not a consideration for compliance issues. Grouting is used to facilitate construction by stabilizing any loose rock behind the concrete liner. If the country rock is fractured, grouting will reduce the permeability of the DRZ significantly. Application at the WIPP demonstrated permeability reduction in an anhydrite marker bed of two to three orders of magnitude (Ahrens et al., 1996). Reduction of local permeability adds to longevity of the grout itself and reduces the possibility of brine contacting seal elements. Because grout does not influence compliance issues, a model for it is not used and has not been developed. General performance achievements are:

- filled fractures as small as 6 microns,
- no water separation upon hydration,
- no evidence of halite dissolution,
- no measurable agglomeration subsequent to mixing,
- one hour of injectability,
- initial Vicat needle set in 2.5 hours,
- compressive strength 40 MPa at 28 days, and
- competitive cost.

A2.5.5 Verification Methods

No verification of the effectiveness of grouting is currently specified. If injection around concrete plugs is possible, an evaluation of quantities and significance of grouting will be made during

construction. Procedural specifications will include measurements of fineness and determination of rheology in keeping with processes established during the WIPP demonstration grouting (Ahrens et al., 1996).

A2.6 Earthen Fill

Compacted earthen fill comprise approximately 150 m of shaft fill in the Dewey Lake Redbeds and near surface stratigraphy.

A2.6.1 Functions

There are minimal performance requirements imposed for Components 1 and 3 and none that affect regulatory compliance of the site. Specifications for Components 1 and 3 are general: fill the shaft with relatively dense material to reduce subsidence.

A2.6.2 Material Characteristics

Fill can utilize material that was excavated during shaft sinking and stored at the WIPP site, or a borrow pit may be excavated to secure fill material. The bulk fill material may include bentonite additive, if deemed appropriate.

A2.6.3 Construction

Dynamic compaction is specified for the clay column in the Dewey Lake Formation because of its perceived expediency. Vibratory compaction will be used near surface when there is no longer space for the three stage construction deck.

A2.6.4 Performance Requirements

Care will be taken to compact the earthen fill with an energy of twice Modified Proctor energy, which has been shown to produce a dense, uniform fill.

A2.6.6 Verification

Materials placed will be documented, with density measurements as appropriate.

A3. CONCLUDING REMARKS

Material specifications in this appendix provide descriptions of seal materials along with reasoning about why they are expected to function well in the WIPP setting. The specification follows a framework that states the function of the seal component, a description of the material, and a summary of construction techniques that could be implemented without resorting to extensive development efforts. Discussion of performance requirements for each material is the most detailed section because design of the seal system requires analysis of performance to ascertain compliance with regulations. Successful design of the shaft seal system is demonstrated by an evaluation of how well the design performs, rather than by comparison with a predetermined quantity.

Materials chosen for use in the shaft seal system have several common desirable attributes: low permeability, availability, high density, longevity, low cost, constructability, and supporting

documentation. Functional redundancy using different materials provides an economically and technologically feasible shaft seal system that limits fluid transport.

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FIGURES

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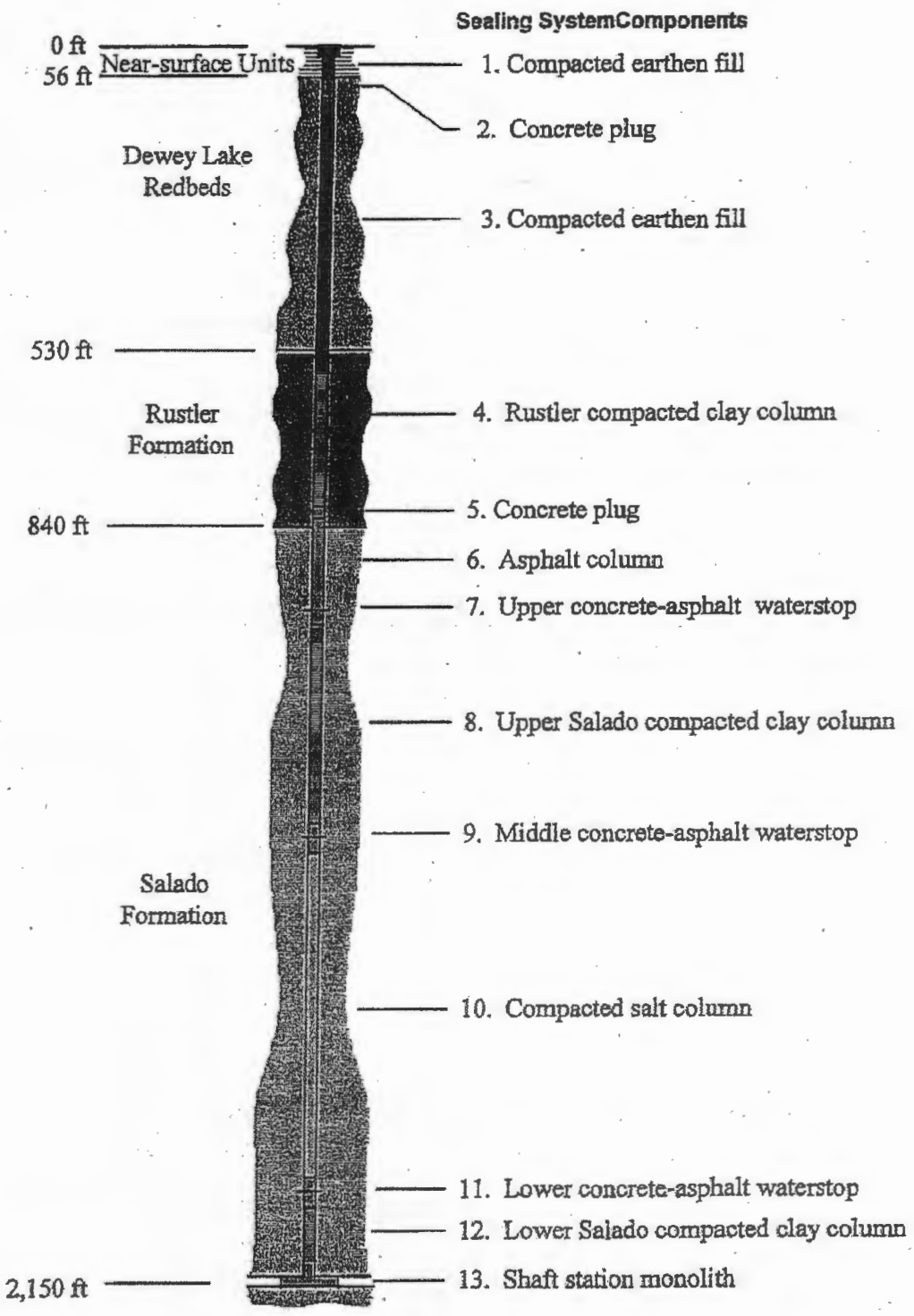

Figure G2A-1
Schematic of the WIPP Shaft Seal Design

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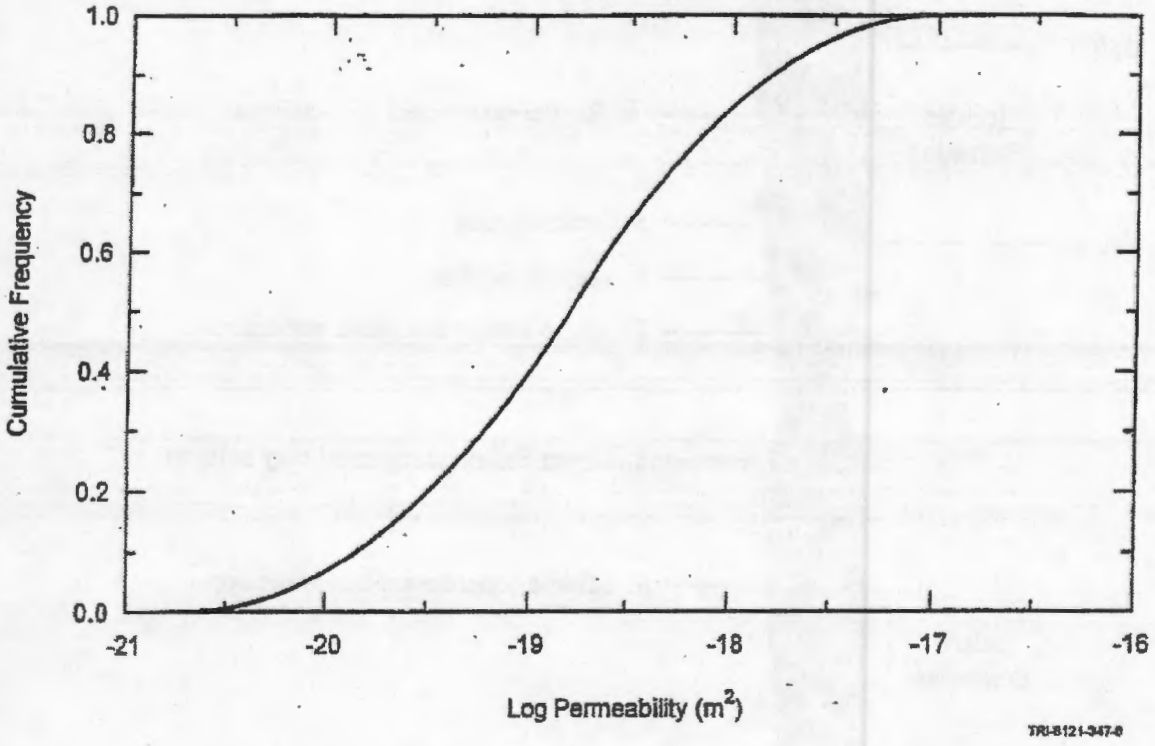

Figure G2A-2
Cumulative Distribution Function for SMC

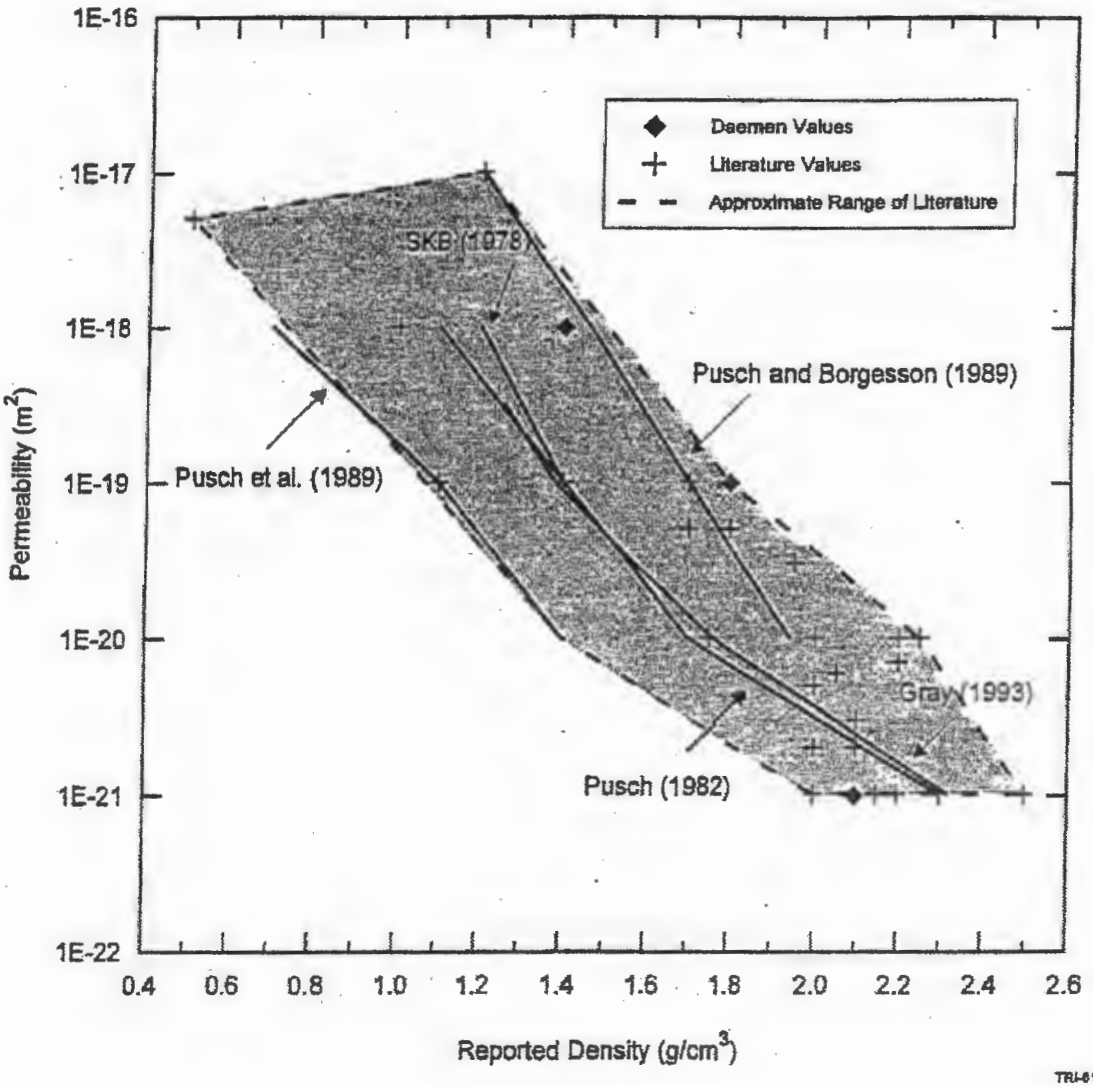

Figure G2A-3
Sodium Bentonite Permeability Versus Density

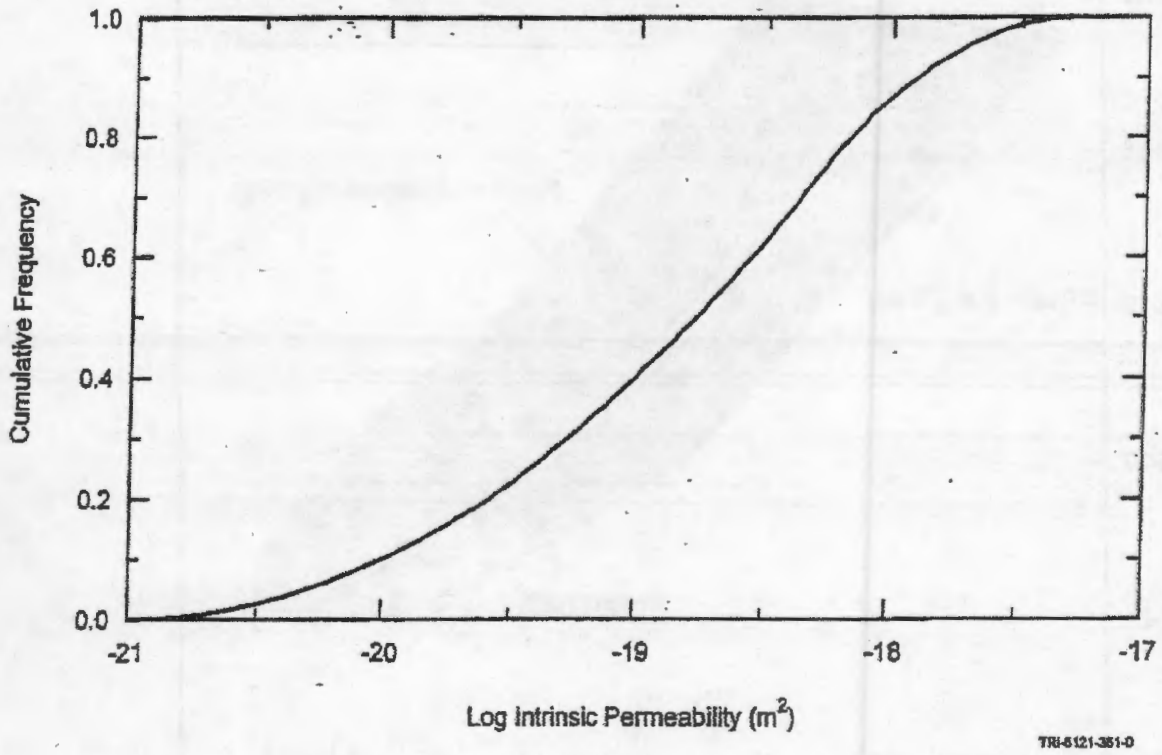

Figure G2A-4
Cumulative Frequency Distribution for Compacted Bentonite

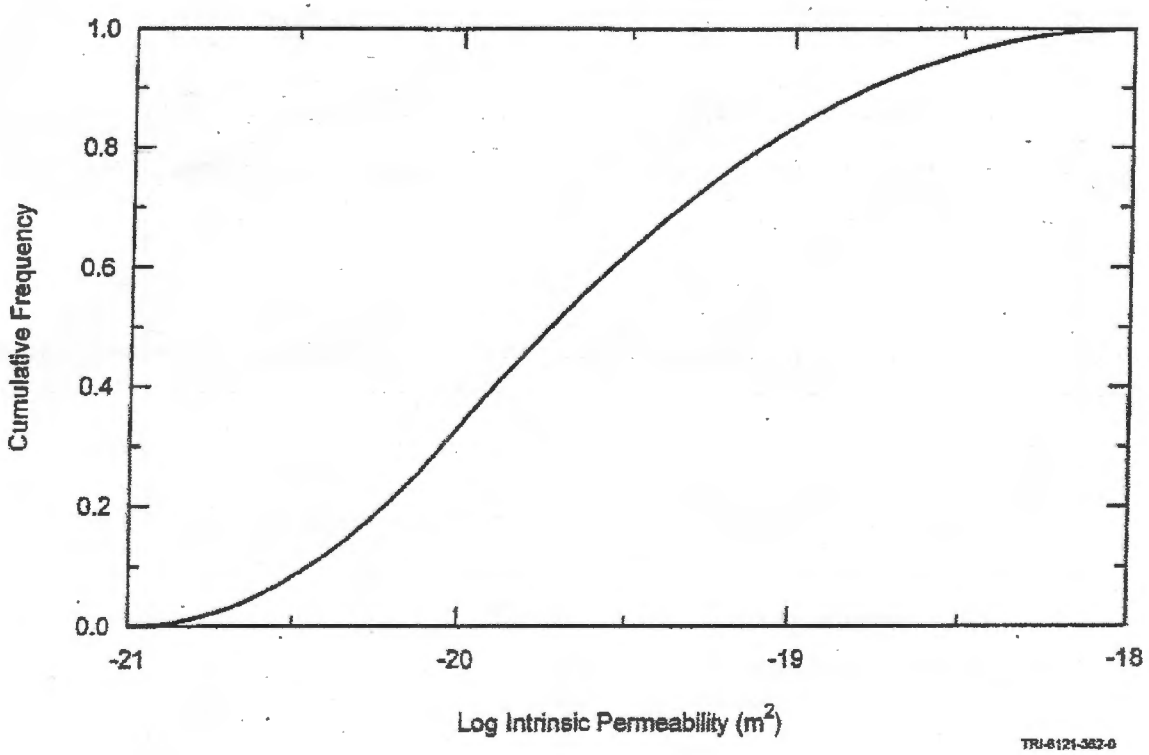

Figure G2A-5
Asphalt Permeability Cumulative Frequency Distribution Function

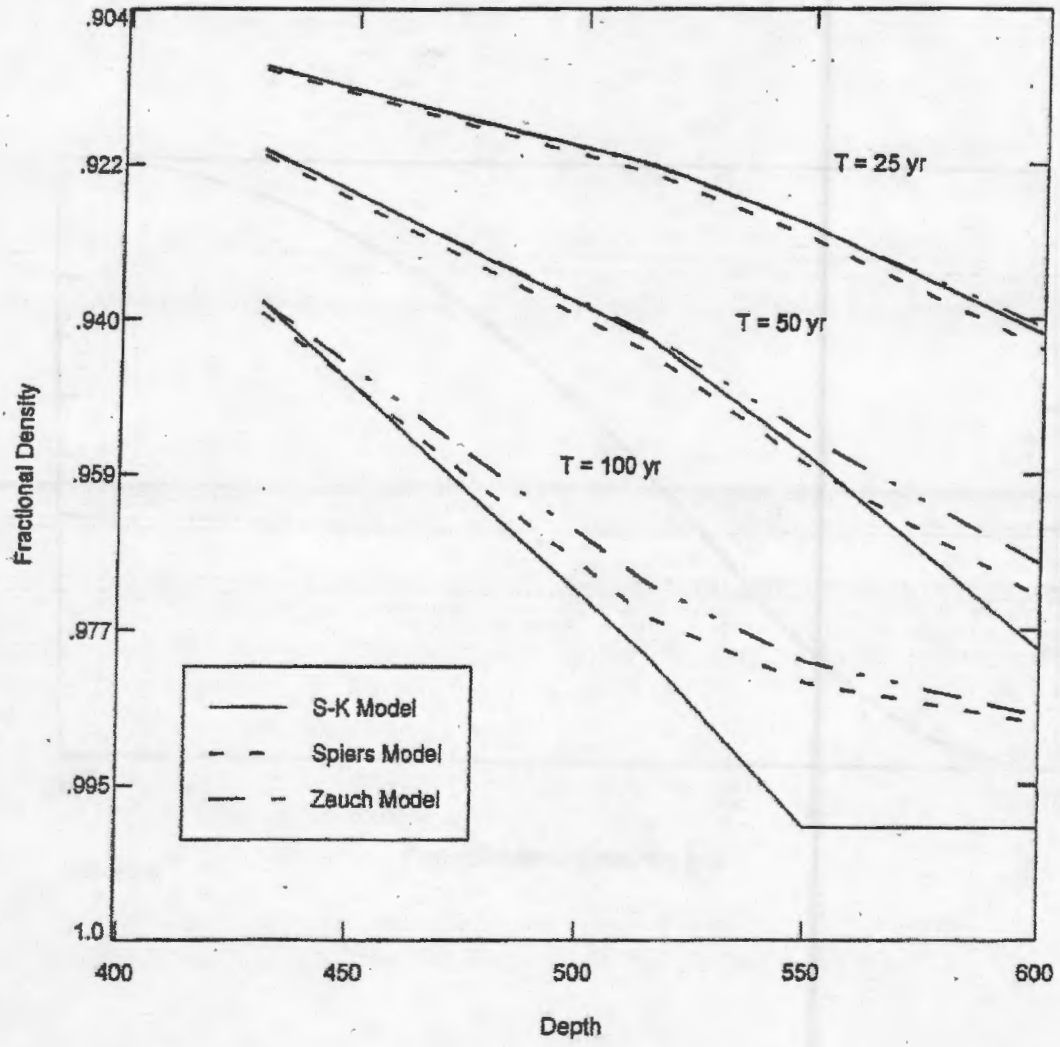

Figure G2A-6
Fractional Density of the Consolidating Salt Column

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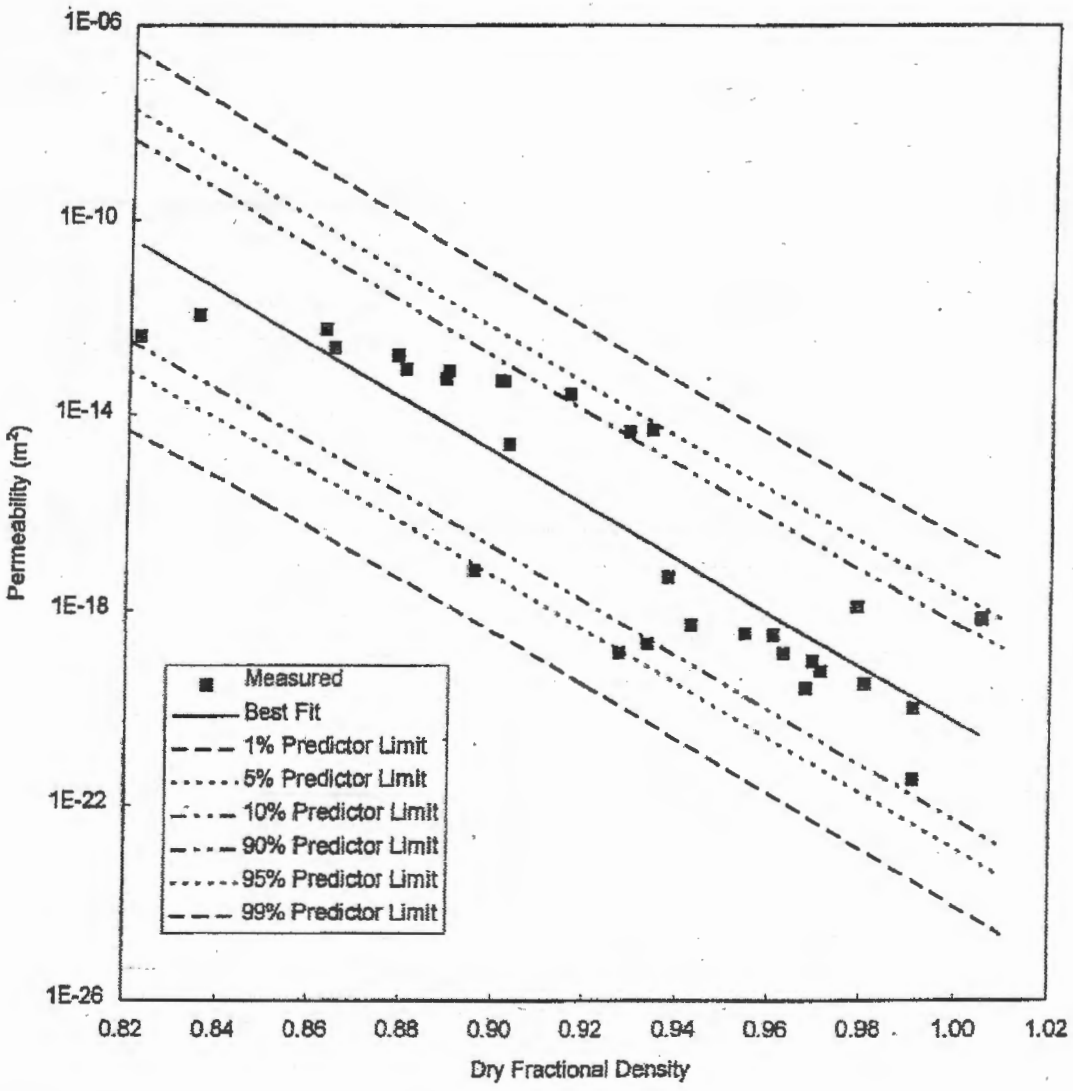

Figure G2A-7
Permeability of Consolidated Crushed Salt as a Function of Fractional Density

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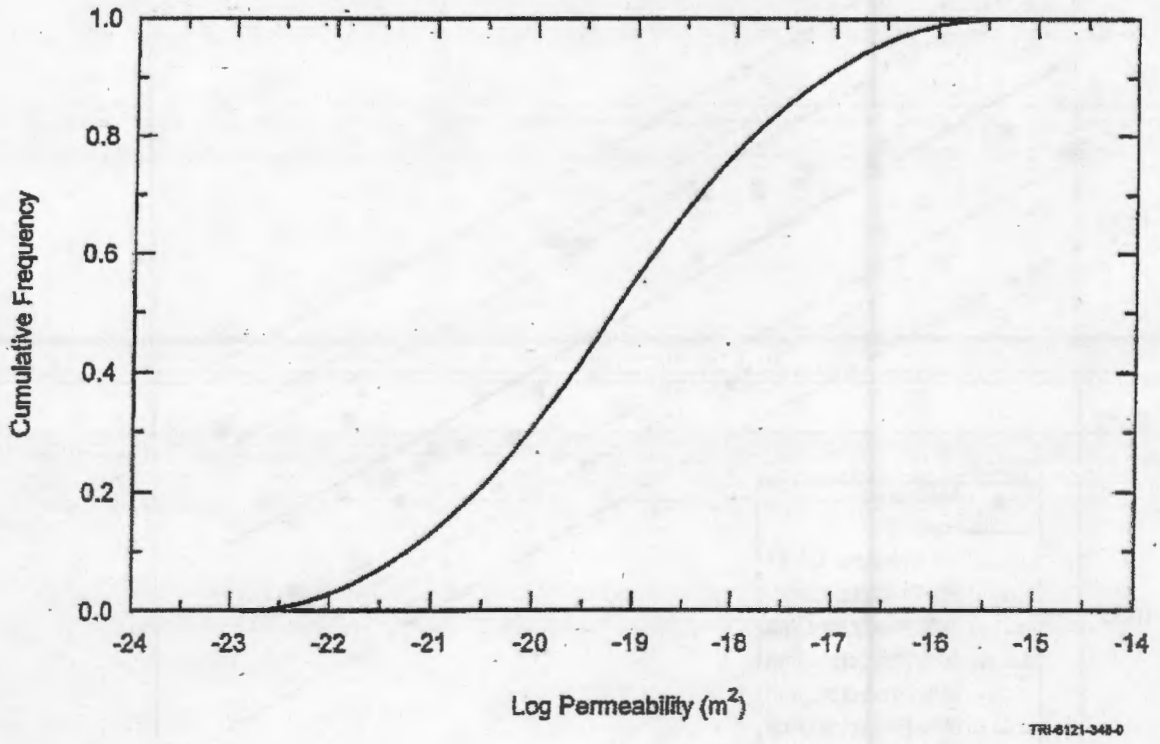

Figure G2A-8
Compacted Salt Column Permeability Cumulative Frequency Distribution Function at Seal Midpoint 100 Years Following Closure

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ATTACHMENT G2
APPENDIX B

SHAFT SEALING CONSTRUCTION PROCEDURES

SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

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ATTACHMENT G2
APPENDIX B

SHAFT SEALING CONSTRUCTION PROCEDURES

SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

Appendix B Abstract

This appendix describes equipment and procedures used to construct the shaft seals as specified in Permit Attachment G2. Existing or reasonably modified construction equipment is specified, standard mining practices are applied, and a general schedule is provided at the end of this appendix. This appendix describes the following activities:

- pre-sealing activities for the sub-surface and surface,
- construction and operation of a multi-deck stage,
- installation of special concrete (sumps, shaft station monoliths, and concrete plugs),
- installation of compacted clay columns,
- emplacement and dynamic compaction of WIPP salt,
- installation of neat asphalt and asphaltic mastic mix,
- grouting of concrete plugs and the country rock behind existing shaft liners,
- removal of portions of the existing shaft liners, and
- emplacement of compacted earthen fill.

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B1. Introduction

This appendix describes construction specifications for placement of shaft seal materials. Flexibility is incorporated in construction specifications to facilitate placement of several different material types. Engineering materials used to seal the full length of the shaft include earthen fill, compacted clay, tamped crushed salt, asphalt, concrete, and a combination of concrete and asphalt in concrete-asphalt waterstops. Appendix A of Permit Attachment G2 provides details of the materials. A full-length shaft seal of this type has never before been constructed; however, application of available technology and equipment, standard construction practices, and common materials provides confidence that the system can be placed to satisfy the design requirements.

A primary feature of the construction specification is development of a work platform from which seal materials are placed. Although the proposed multi-deck stage (galloway) proposed here is engineered specifically for shaft sealing operations, it is similar to stages used for construction of shafts. Inherently flexible, the multi-deck stage facilitates several construction methods required for the various materials specified for the shaft seal system. It provides an assembly of a slickline and header for transport of flowable materials from the surface to the placement horizon. A crane device is attached to the base of the stage to facilitate compaction, and an avenue through the stage provides a means to transport bulk material. It is understood that procedures specified here may change during the tens of years preceding construction as a result of equipment development, additional testing, or design changes. Further, it is acknowledged that the construction methods specified are not the only methods that could place the seal materials successfully.

A few assumptions are made for purposes of evaluating construction activities. These assumptions are not binding, but are included to assist discussion of general operational scenarios. For example, four multi-deck stages are specified, one for each shaft. This specification is based on shaft-sinking experience, which indicates that because of the wear encountered, it is advisable to replace rather than rebuild stages. However, much of the equipment on the multi-deck stage is reused. For scheduling purposes, it is assumed that sealing operations are conducted in two of the four shafts simultaneously. The Air Intake and Exhaust Shafts are sealed first, and the Waste and Salt Handling Shafts are sealed last. With this approach, shaft sealing will require about six and a half years, excluding related work undertaken by the WIPP Management and Operating Contractor (**MOC**). Sealing the shafts sequentially would require approximately eleven and a half years. To facilitate discussion of scheduling and responsibilities, it is assumed that sealing operations will be conducted by a contractor other than the MOC.

Years from now, when actual construction begins, it is probable that alternatives may be favored. Therefore, construction procedures note alternative methods in recognition that changes are likely and that the construction strategy is sufficiently robust to accommodate alternatives. This appendix contains both general and very specific information. It begins with a discussion of general mobilization in Section 2. Details of the multi-deck construction stage are provided in Section 3. Section 4 contains descriptions of the construction activities. Information presented here is supplemented by several engineering drawings and sketches contained in Permit Attachment G2, Appendix E. The topical information and the level of provided detail substantiate the theory that reliable shaft seal construction is possible using available technology and materials.

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B2. Project Mobilization

The duty descriptions that follow are for discussion purposes. The discussions do not presuppose contractual arrangements, but simply identify tasks necessary for shaft seal construction.

B2.1 Subsurface

Prior to initiation of sealing activities, the MOC will remove installations and equipment on the repository level. A determination of items removed will be made before construction begins. Such removal would include, but is not limited to, gates and fences at the shaft; equipment such as winches, ventilation fans, pipelines; and communication and power cables. Additionally, the following items will be removed from the shafts:

- cables, counterweights, and sheaves;
- existing waterlines; and
- electrical cables not required for sealing operations.

The following equipment will be stored near the shaft on the repository level by the Sealing Contractor prior to initiation of sealing activities:

- a concrete header, hopper, and pump;
- a concrete pump line to distribute concrete; and
- an auxiliary mine fan and sufficient flexible ventilation tubing to reach work areas required for installation of the shaft station concrete monolith.

The subsurface will be prepared adequately for placement of the shaft station monolith. Determination of other preparatory requirements may be necessary at the time of construction.

B2.2 Surface

The MOC will remove surface facilities such as headframes, hoists, and buildings to provide clear space for the Sealing Contractor. Utilities required for sealing activities (e.g., air compressors, water, electrical power and communication lines) will be preserved. The Sealing Contractor will establish a site office and facilities required to support the construction crews, including a change house, lamp room, warehouse, maintenance shop, and security provisions. Locations will be selected and foundations constructed for headframes, multi-deck stage winches, man/equipment hoist, and exhaust fan. A drawing in Permit Attachment G2, Appendix E (Sketch E-4) depicts a typical headframe and associated surface facilities. The hoist and winches will be enclosed in suitable buildings; utilities and ventilation ducting will be extended to the shaft collar. The large ventilation fan located near the collar is designed to exhaust air through the rigid ventilation duct, resulting in the movement of fresh air down the shaft. Air flow will be sufficient to support eight workers to the depth of the repository level. The following facilities will be procured and positioned near the shaft collar:

- a concrete batch plant capable of weighing, batching, and mixing the concrete to design specifications;

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- a crushing and screening plant to process WIPP salt and local soil;
- an insulated and heated pug mill, asphalt pump, asphalt storage tank, and other auxiliary equipment; and
- pads, silos, and structures to protect sealing materials from the weather.

The Sealing Contractor will construct a temporary structural steel bulkhead over the shaft at the surface. The bulkhead will be sufficiently strong to support the weight of the multi-deck stage, which will be constructed on it. When the multi-deck stage is completed, the headframe will be erected. The headframe (depicted in Permit Attachment G2, Appendix E, Sketch E-3) will be built around the multi-deck stage, and a mobile crane will be required during fabrication. When the headframe is completed, cables for hoisting and lowering the multi-deck stage will be installed. Cables will run from the three winches, over the sheaves in the headframe, down and under the sheaves on the multi-deck stage, and up to anchors in the headframe. The headframe will be sufficiently high to permit the multi-deck stage to be hoisted until the lowest component is 3.05 m (10 ft) above surface. This will facilitate slinging equipment below the multi-deck stage and lowering it to the work surface, as well as activities required at the collar during asphalt emplacement.

The multi-deck stage will be lowered to clear the collar, allowing the installation of compressed-air-activated steel shaft collar doors, which will serve as a safety device, permitting safe access to the man cage and bucket, while preventing objects from falling down the shaft. Following installation of these doors, workers will utilize the multi-deck stage to traverse the shaft from the collar to the repository horizon, inspecting it for safety hazards and making any necessary repairs. After this inspection, the multi-deck stage will return to the surface.

B2.3 Installation of Utilities

In preparation for placement of shaft seal materials, requisite utilities will be outfitted for operations. The multi-deck stage will descend from the collar to the repository horizon. As added assurance against unwanted water, a gathering system similar to the one currently in place at the bottom of the concrete liner will be installed and moved upward as seal emplacement proceeds. Water collected will be hoisted to the surface for disposal. Additionally, any significant inflow will be located and minimized by grouting. After installation of the water gathering system, the following utilities will be installed from surface to the repository horizon by securely fastening them to the shaft wall:

- 5.1-cm steel waterline with automatic shut-off valves every 60 m;
- 10.2-cm steel compressed-air line;
- power, signal, and communications cables;
- 15.2 cm steel slickline and header; and
- a rigid, cylindrical, ventilation duct, which would range from 107 cm in diameter in the three largest shafts to 91 cm in diameter in the Salt Handling Shaft.

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B3. Multi-Deck Stage

The multi-deck stage (galloway) provides a work platform from which all sealing operations except placement of asphalt are conducted. The concept of using a multi-deck stage is derived from similar equipment commonly employed during shaft sinking operations. Plan and section views of conceptual multi-deck stages are shown in Permit Attachment G2, Appendix E, Sketches E-1 and E-2. The construction decks specified here are modified from typical shaft sinking configurations in two important ways to facilitate construction. Conceptual illustrations of these two modifications are displayed in Figures G2B-1 and G2B-2. Figure G2B-1 illustrates the multi-deck performing dynamic compaction of salt. Figure G2B-2 illustrates the multi-deck stage configured for excavation of the kerf required for the asphalt waterstop in Salado salt.

A device called a polar crane mounted below the lower deck can be configured for either dynamic compaction or salt excavation. The crane can rotate 360° horizontally by actuating its geared track drive. Its maximum rotational speed will be approximately two revolutions per minute. The crane can be controlled manually or by computer (computerized control will swiftly position the tamper in the numerous drop positions required for dynamic compaction). When excavation for the concrete-asphalt waterstops is required, the tamper, electromagnet, and cable used for dynamic compaction will be removed, and a custom salt undercutter will be mounted on the polar crane trolley. Geared drives on the crane, trolley, and undercutter will supply the force required for excavation. In addition to the special features noted above and shown in Figures G2B-1 and G2B-2, the multi-deck stage has the following equipment and capabilities:

- Maximum hoisting/lowering speed is approximately 4.6 m (15 ft) per minute.
- A cable, electromagnet, and tamper will be attached to the polar crane during dynamic compaction. The cylindrical tamper consists of A-36 carbon steel plates bolted together with high-tensile-strength steel bolts. It is hoisted and dropped by the polar crane using the electromagnet. The tamper will be mechanically secured to the polar crane before personnel are allowed under it.
- Range-finding lasers will facilitate the accurate positioning of the multi-deck stage above the work surface and allow the operator to determine when the surface is sufficiently level. The distance indicated by each laser will be displayed on a monitor at the crane control station.
- Flood lights and remotely controlled closed-circuit television equipment will enable the crane operator to view operations below the multi-deck stage on a monitor.
- Fold-out floor extensions that accommodate the variance in shaft diameter between the unlined and lined portions of the shaft will be provided for safety.
- A cutout in each deck, combined with a removable section of the polar crane track, will permit stage movement without removal of the rigid ventilation duct (which is fastened to the shaft wall).

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The multi-deck stage is equipped with many of the features found on conventional shaft sinking stages, such as:

- three independent hoisting/lowering cables,
- man and material conveyances capable of passing through the multi-deck stage and accessing the working surface below,
- a jib crane that can be used to service the working surface below,
- removable safety screens and railings, and
- centering devices.

Three sets of double locking devices are provided to secure the multi-deck stage to the shaft wall. A suitable factor of safety for these locking devices is judged to be 4. The area of the grips securing the deck is calculated from static principles:

$$FS = \mu(Co)(A)/W \qquad \text{(B-1)}$$

where:

FS = factor of safety
μ = steel/salt friction coefficient = 0.15 (see Table 20.1 in McClintock and Aragon, 1966; and Van Sambeek, 1988)
Co = compressive strength of WIPP salt, which varies from 172 kg/cm^2 to 262 kg/cm^2 (Van Sambeek, 1988)
W = total vertical weight
A = total gripper pad surface area.

Manipulating the equation to solve for required area, applying a factor of safety of 4, selecting the heaviest work stage (753,832 kg) and the minimum compressive strength value for salt (assuming that the locking pressure equals the minimum compressive strength of salt), the following gripper surface area (A) is:

A = 4(753,832 kg)/0.15(172 kg/cm^2) = 11,416.5 cm^2, and each of the six gripper pads would be 1902.8 cm^2.

As designed, each gripper pad area is 2167.2 cm^2, resulting in a factor of safety (FS) of 4.56. Additionally, although tension in the hoisting cables is relaxed while the multi-deck stage is in the locked configuration, the cables are still available to hold the work-deck, should the locking devices fail.

B4. Placement of Sealing Materials

Construction activities include placement of materials in three basic ways: (1) by slickline (e.g., concrete and asphalt), (2) by compaction (e.g., salt and earthen fill), and (3) by physical placement (e.g., clay blocks). Materials will be placed at various elevations using identical procedures. Because placement procedures generally are identical regardless of elevation, they

will be described only once. Where differences occur, they will be identified and described. In general, placement of shaft seal elements is described from bottom to top.

B4.1 Concrete

Concrete is used as a seal material for several different components, such as the existing sumps in the Salt Handling Shaft and the Waste Shaft, the shaft station monoliths, concrete plugs, and concrete-asphalt waterstops. Existing sumps are shown in Permit Attachment G2, Appendix E, Drawings SNL-007, Sheets 6 and 21. Shaft station monoliths are shown in Drawings SNL-007, Sheets 6, 11, 16, and 21. Concrete plugs are depicted on Drawings SNL-007, Sheets 4, 5, 9, 10, 14, 15, 19, and 20. Lower, middle, and upper concrete-asphalt waterstops are shown in Drawing SNL-007, Sheet 22. Construction material for all concrete members will be Salado Mass Concrete (SMC).

As specified, all SMC will be mixed on surface to produce a product possessing the characteristics defined in Permit Attachment G2, Appendix A. Concrete will be transferred to its placement location within the shaft via slickline and header. The slickline (shown in Figure G2B-1) is a steel pipe fastened to the shaft wall. Vertical drops as great as 656 m to the repository horizon are required. Such concrete transport and construction are common in mining applications. For example, a large copper mine in Arizona is placing concrete at a depth of 797 m using this procedure. A header attached to the bottom of the slickline is designed to absorb kinetic energy generated by the falling material. The header, a steel pipe slightly larger in diameter than the slickline and made of thicker steel, diverts the flow 45°, absorbing most of the impact. Because the drop generates considerable force, the header will be securely supported by a reinforced steel shelf bolted to the shaft wall. A flexible hose, in sections approximately 3 m long and joined by quick-connect fittings, will be attached to the header.

B4.1.1 Shaft Station Monolith

Construction of the shaft station monoliths is preceded by filling two existing sumps with SMC. Initially, sufficient hose will be used to convey the concrete to the bottom of the sump. The discharge will remain below the concrete surface during placement to minimize air entrainment. Sections of hose will be withdrawn and removed as the SMC rises to the floor of the repository horizon in a continuous pour. Subsequent to filling the sump, arrangements will be made to place the concrete monolith.

A small mine fan will be located above the rigid suction-duct inlet to ensure a fresh air base. Masonry block forms will be constructed at the extremities of the shaft station monolith in the drifts leading from the station. Temporary forms, partially filling the opening, will be erected at the shafts to facilitate the placement of the outermost concrete. These temporary forms will permit access necessary to ensure adequate concrete placement. SMC will be transported via the slickline to the header, which will discharge into a hopper feeding the concrete pump, and the pump will be attached to the pumpcrete line. The pumpcrete line, suspended in cable slings near the back of the drifts, will be extended to the outer forms. A flexible hose, attached to the end of the pumpcrete line, will be used by workers to direct emplacement. The pumpcrete line will be withdrawn as emplacement proceeds toward the shaft.

When the concrete has reached the top of the temporary forms, they will be extended to seal the openings completely, and two 5-cm-diameter polyvinyl chloride (PVC) pipes will be incorporated in the upper portion of each form. Both pipes will be situated in a vertical plane

oriented on the long axis of the heading and inclined away from the station at approximately 70° to the horizontal. The upper end of the top pipe will extend to just below the back, and the upper end of the lower pipe will be located just below that of the top pipe. SMC will be injected through the lower pipe until return is obtained from the upper pipe, ensuring that the heading has been filled to the back. The header will then be moved to a position in the shaft above the designed elevation at the top of the shaft station monolith and supported by a bracket bolted to the shaft wall. After the outer concrete has achieved stability, the temporary interior forms may be removed. Equipment no longer required will be slung below the multi-deck stage and hoisted to surface for storage and later use. The station and shaft will be filled to design elevation with concrete via the slickline, header, and flexible hose. The slickline is cleaned with spherical, neoprene swabs ("pigs") that are pumped through the slickline, header, and hose.

B4.1.2 Concrete-Asphalt Waterstops

Lower, middle, and upper concrete-asphalt waterstops in a given shaft are identical and consist of two SMC sections separated by an asphalt waterstop. Before the bottom member of the lower concrete component is placed, the multi-deck stage will be raised into the headframe; the polar crane will be mounted below the lower deck; and the salt undercutter will be mounted on the crane trolley. The multi-deck stage will then return to the elevation of the concrete component. Two undercutter bars will be used to make the necessary excavations for upper, middle, and lower asphalt-concrete waterstops and the concrete plug above the Salado Formation. Notches for the plugs will be excavated using a short, rigid cutter bar (length less than half the radius). The kerf for the asphalt waterstop will be excavated using a long cutter bar that can excavate the walls to a depth of one shaft radius. These operations will be conducted as required as seal placement proceeds upward.

The lower concrete member (and all subsequent concrete entities) will be placed via the slickline, header, and flexible hose, using the procedure outlined for the shaft station monolith. Construction of vertical shaft seals provides the ideal situation for minimizing interface permeability between the rock and seal materials. Concrete will flow under its own weight to provide intimate contact. A tight cohesive interface was demonstrated for concrete in the small-scale seal performance tests (SSSPTs). The SSSPT concrete plugs were nearly impermeable without grouting. However, interface grouting is usually performed in similar construction, and it will be done here in the appropriate locations.

B4.1.3 Concrete Plugs

An SMC plug, keyed into the shaft wall, is situated a few meters above the upper Salado contact in the Rustler Formation. A final SMC plug is located a few meters below surface in the Dewey Lake Redbeds. This plug is emplaced within the existing shaft liner using the same construction technique employed for the concrete-asphalt waterstops.

B4.2 Clay

B4.2.1 Salado and Rustler Compacted Clay Column

Blocks of sodium bentonite clay, precompacted to a density of 1.8 to 2.0 g/cm^3, will be the sealing material. This density has been achieved at the WIPP using a compaction pressure of 492.2 kg/cm^2 in a machine designed to produce adobe blocks (Knowles and Howard, 1996). Blocks are envisioned as cubes, 20.8 cm on the edge, weighing approximately 18 kg, a

reasonable weight for workers to handle. The bentonite blocks will be compacted at the WIPP in a new custom block-compacting machine and will be stored in controlled humidity to prevent desiccation cracking. Blocks will be transported from surface in the man cage, which will be sized to fit through the circular "bucket hole" in the multi-deck stage. The conveyance will be stacked with blocks to a height of approximately 1.8 m.

Installation will consist of manually stacking individual blocks so that all interfaces are in contact. Block surfaces will be moistened with a spray of potable water as the blocks are placed to initiate a minor amount of swelling, which will ensure a tight fit and a decrease in permeability. Peripheral blocks will be trimmed to fit irregularities in the shaft wall and placed as close to the wall as possible. Trimmed material will be manually removed with a vacuum. Dry bentonite will be manually tamped into remaining voids in each layer of blocks. This procedure will be repeated throughout the clay column. The multi-deck stage will, in all cases, be raised and utilities removed to the surface as emplacement of sealing materials proceeds upward.

Dynamic compaction construction is an alternative method of clay emplacement that could be considered in the detailed design. Dynamic compaction materials being considered are:

- sodium bentonite/fine silica sand, and
- highly compressed bentonite pellets.

Boonsinsuk et al. (1991) developed and tested a dynamic (drop hammer) method for a relatively large diameter (0.5-m) hole, simulated with a steel cylinder, that gave very good results on 1 : 1 dry mass mixtures of sodium bentonite and sand, at a moisture content of 17% to 19%. The alternatives have the advantages of simplifying emplacement.

B4.3 Asphalt

Asphalt, produced as a distillate of petroleum, is selected as the seal material because of its longevity, extremely low permeability, history of successful use as a shaft lining material, and its ability to heal if deformed. Shielded from ultraviolet radiation and mixed with hydrated lime to inhibit microbial degradation, the longevity of the asphalt will be great. Emplaced by tremie line at the temperature specified, the material will be fluid and self-leveling, ensuring complete contact with the salt.

Construction of an asphalt column using heated asphalt will introduce heat to the surrounding salt. The thermal shock and heat dissipation through the salt has not been studied in detail. Performance of the asphalt column may be enhanced by the introduction of the heat that results from acceleration of creep and healing of microfractures. If, upon further study, the thermomechanical effects are deemed undesirable or if an alternative construction method is preferred at a later date, asphalt can readily be placed as blocks. Asphalt can "cold flow" to fill gaps, or the seams between blocks can be filled with low-viscosity material.

B4.3.1 Concrete-Asphalt Waterstops

Electrically insulated, steel grated flooring will be constructed over the shaft at the surface. A second, similar flooring will be built in the shaft 3 m below the first. These floors will be used only during the emplacement of asphalt and asphaltic mastic mix (AMM) and will be removed at all other times. A 12.7-cm ID/14-cm OD, 4130 steel pipe (tremie line) in 3-m lengths will be electrically equipped for impedance heating, then insulated and suspended in the shaft from

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slips (pipe holding devices) situated on the upper floor. The tremie line cross-sectional area is smallest at the shoulder of the top thread, where tensional yield is 50,000 kg; the line weight is 20.8 kg/m. Heavier weights are routinely suspended in this manner in the petroleum and mining industries.

Neat, AR-4000-graded petroleum-based asphalt cement will be the sealing material for asphalt waterstops. Neat asphalt from the refinery will be delivered to the WIPP at approximately 80°C in conventional, insulated refinery trucks and pumped into a heated and insulated storage tank located near the shaft. The multi-deck stage will be hoisted into the headframe and mechanically secured for safety. Asphalt, heated to 180°C ±5°, will be pumped down the shaft to the fill elevation through the heated tremie line. Viscosity of the neat asphalt for the waterstops will be sufficiently low to allow limited penetration of the DRZ. Installation of asphalt in each of the concrete-waterstops is identical.

As the pipe is lowered, workers on the lower deck will attach the wiring required for heating circuits and apply insulation. Workers on the top deck will install flanged and electrically insulated couplings as required (the opening in the slip bowl will be large enough to permit the passage of these couplings). Properly equipping and lowering the pipe should progress at the rate of one section every 10 minutes. The lower asphalt waterstop requires approximately 607 m of pipe for a casing weight of 12,700 kg. Additionally, electrical wire and insulation will weigh about 7250 kg for a total equipped tremie line weight of 20,000 kg. Therefore, the safety factor for the tremie line is 50,000 kg/20,000 kg, or 2.5.

To minimize air entrainment, the lower end of the tremie line will be immersed as much as 1 m during hot asphalt emplacement. Therefore, the lower 3 m of casing will be left bare (to simplify cleaning when emplacement has been completed).

Initially the tremie line will be lowered until it contacts the concrete plug (immediately underlying the excavation for the waterstop) and then raised approximately 0.3 m. Asphalt emplacement will proceed as follows:

- The impedance heating system will be energized, heating the tremie line to 180°C ±5°, and the asphalt in the storage tank will be heated to approximately 180°C ±5°.
- Heated, neat asphalt will be pumped down the tremie line at a rate approximating 13 L/min. This low rate will ensure that the asphalt flows across the plug from the insertion point, completely filling the excavation and shaft to the design elevation.
- The tremie line will be raised 3 m and cleaned by pumping a neoprene swab through it with air pressure. Impedance heating will be stopped, and the line will be allowed to cool. When cool, the line will be hoisted, stripped, cleaned, disassembled, and stored for future use.

Sealing operations will be suspended until the air temperature at the top of the asphalt has fallen to approximately 50°C for the comfort of the workers when they resume activity at the fill horizon. Temperature will be determined by lowering a remotely read thermometer to an elevation approximately 3 m above the asphalt at the center of the shaft. The temperature of the asphalt at the center of the shaft will be 50°C in about a month, but active ventilation should permit work to resume in about two weeks (see calculations in Appendix D of *Waste Isolation*

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Pilot Plant Shaft Sealing System Compliance Submittal Design Report ("Compliance Submittal Design Report") (Sandia, 1996)).

When sufficient cooling has occurred, workers will descend in the multi-deck stage and cover the hot asphalt with an insulating and structural material such as fiber-reinforced shotcrete, as illustrated in Figure G2B-3. To accomplish this, they will spray cementitious shotcrete containing fibrillated polypropylene fibers (for added tensional strength), attaining a minimum thickness of approximately 0.6 m.

B4.3.2 Asphaltic Mastic Mix Column

Asphaltic mastic mix (AMM) for the column will be prepared on surface in a pug mill. Viscosity of the AMM can be tailored to provide desired properties such as limited migration into large fractures.

- AMM will be prepared by mixing the ingredients in the pug mill, which has been heated to 180°C ±5°. The mix will be pumped from the pug mill through the tremie line to the emplacement depth. AMM is self-leveling at this temperature, and its hydrostatic head will ensure intimate contact with the shaft walls.

- Pumping rate will be approximately 200 L/min for efficiency, because of the larger volume (approximately 1,224,700 L in the Air Intake Shaft). To facilitate efficient emplacement and avoid air entrainment, the tremie line will not be shortened until the mix has filled 6 vertical meters of the shaft. Back pressure (approximately 0.84 kg/cm^2) resulting from 6 m of AMM above the discharge point will be easily overcome from surface by the hydraulic head.

After 6 vertical meters of AMM have been placed:

- Impedance heating current will be turned off and locked out (the hot line will drain completely).

- To prevent excessive back pressure resulting from AMM above the insertion point, the line will be disconnected from the pump and hoisted hot. Two sections will be stripped, removed, cleaned with a "pig," and stacked near the shaft.

- Electrical feed will be adjusted (because of the decreased resistance of the shortened line).

- The tremie line will be reconnected to the pump.

- The impedance heating system will be energized.

- When the temperature of the line has stabilized at 180°C ±5°, pumping will resume.

This procedure will be followed until the entire column, including the volume computed to counteract 0.9 m of vertical shrinkage (calculations in Appendix D of the Compliance Submittal Design Report (Sandia, 1996)), has been placed. The line will be disconnected from the pump and cleaned by pumping "pigs" through it with air pressure. It will then be hoisted, stripped, removed in 3-m sections, and stacked on surface for reuse.

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Sealing operations will be suspended following removal of the tremie line, and ventilation will be continuous to speed cooling. The column will shrink vertically but maintain contact with the shaft walls as it cools. When the air temperature at 3 m above the asphalt has cooled sufficiently, workers will descend on the multi-deck stage and cover the hot asphalt with fibercrete as described for the concrete-asphalt waterstop (Permit Attachment G2, Appendix B, Section B4.3.1) and illustrated in Figure G2B-3.

Note: Near the top of the Salado Formation, portions of the concrete liner key, chemical seal rings, and concrete and steel shaft liners will be removed. Liner removal will occur before emplacement of AMM. For safety, exposed rock will be secured with horizontal, radial rock bolts and cyclone steel mesh. A range-finding device, fastened to the shaft wall approximately 3 m above the proposed top of the asphaltic column, will indicate when the hot AMM reaches the desired elevation. A remotely read thermometer, affixed to the shaft wall approximately 2 m above the proposed top of the column, will show when the air temperature has fallen sufficiently to resume operations. The intake of the rigid ventilation duct will be positioned approximately 3 m above the proposed top of the column, and ventilation will be continuous throughout emplacement and cooling of the asphaltic column. After the multi-deck stage has been hoisted into the headframe and mechanically secured for safety, emplacement of AMM will proceed.

B4.4 Compacted Salt Column

Crushed, mine-run salt, dynamically compacted against intact Salado salt, is the major long-term shaft seal element. As-mined WIPP salt will be crushed and screened to a maximum particle dimension of 5 mm. The salt will be transferred from surface to the fill elevation via the slickline and header. A flexible hose attached to the header will be used to emplace the salt, and a calculated weight of water will be added. After the salt has been nominally leveled, it will be dynamically compacted. Dynamic compaction consists of compacting material by dropping a tamper on it and delivering a specified amount of energy. The application of three times Modified Procter Energy (MPE) to each lift (one MPE equals 2,700,000 Joules/m^3) will result in compacting the salt to 90% of the density of in-place rock salt.

Approximately 170 vertical meters of salt will be dynamically compacted. Dynamic compaction was validated in a large-scale demonstration at Sandia National Laboratories during 1995. As-mined WIPP salt was dynamically compacted to 90% density of in-place rock salt in a cylindrical steel chamber simulating the Salt Handling Shaft (Ahrens and Hansen, 1995). Depth of compaction is greater than that achieved by most other methods, allowing the emplacement of thicker lifts. For example, dropping the 4.69 metric ton tamper 18 m (as specified below) results in a compaction depth of approximately 4.6 m, allowing emplacement of lifts 1.5-m high. Most other compaction methods are limited to lifts of 0.3 m or less. Lift thickness will be increased and drop height decreased for the initial lift above the concrete plug at the base of the salt column to ensure that the concrete is not damaged. Drop height for the second and third lifts will be decreased as well. Although the tamper impact is thereby reduced, three MPE will be delivered to the entire salt column.

If lifts are 1.5-m thick, the third lift below the surface will receive additional densification during compaction of overlying lifts, and this phenomenon will proceed up the shaft. Construction will begin by hoisting the multi-deck stage to the surface and attaching the cable, electromagnet, and tamper to the hoist on the polar crane. The multi-deck assembly will be lowered to the placement elevation, and moisture content of the crushed and screened salt will be calibrated. Then the salt will be conveyed at a measured rate via a weighbelt conveyor to a vibrator-

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equipped hopper overlying the 15.2-cm ID slickline. The salt will pass down the slickline and exit a flexible hose connected to the header. A worker will direct the discharge so that the upper surface of the lift is nominally level and suitable for dynamic compaction. A second worker will add potable water, in the form of a fine spray, to the salt as it exits the hose. Water volume will be electronically controlled and coordinated with the weight of the salt to achieve the desired moisture content.

The initial lift above the SMC will be 4.6 m, and drop height will be 6 m. This increased lift thickness and reduced drop height are specified to protect the underlying SMC plug from damage and/or displacement from tamper impact. Compaction depth for a drop height of 6 m is approximately 3.7 m. Ultimately, the tamper will be dropped six times in each position, resulting in a total of 132 drops per lift in the larger shafts. The drop pattern is shown in Figure G2B-4. A salt lift 1.5 m high will then be placed and leveled. Following compaction of the initial lift, the multi-deck stage will be positioned so the base of the hoisted tamper is 10 m above the surface of the salt.

The multi-deck stage will then be secured to the shaft walls by activating hydraulically powered locking devices. Hydraulic pressure will be maintained on these units when they are in the locked position; in addition, a mechanical pawl and ratchet on each pair will prevent loosening. The safety factor for the locking devices has been calculated to be approximately 4.5. After locking, tension in the hoisting cables will be relaxed, and centering rams will be activated to level the decks. Prior to positioning the stage, tension will be applied to the hoisting cables; the centering rams will be retracted; and the locking devices will be disengaged.

The work deck will be hoisted until the base of the retracted tamper is 23 m above the surface of the salt, where it will be locked into position and leveled as described above. This procedure, repeated throughout the salt column, allows emplacement and compaction of three lifts (1.5-m thick) per multi-deck stage move. Depth of compaction for a drop height of 18 m is approximately 4.6 m. Therefore the third lift below the fill surface will receive a total of 9 MPE (274,560 m kg/m^3), matching the energy applied in the successful, large-scale demonstration.

The compactive effect expands laterally as it proceeds downward from the base of the tamper and will effectively compact the salt into irregularities in the shaft wall, as demonstrated in the large-scale demonstration. Although other techniques could be used, dynamic compaction was selected because it is simple, can be used in the WIPP shafts, and has been demonstrated (Hansen and Ahrens, 1996).

The tamper will be dropped from the hoisted position by turning off the power to the electromagnet. Immediately upon release, the crane operator will "chase" the tamper by lowering the electromagnet at twice hoisting speed; the magnet will engage the tamper, allowing it to be hoisted for the subsequent drop. Initially, the tamper will be dropped in positions that avoid impact craters caused by preceding drops. The surface will then be leveled manually and the tamper dropped in positions omitted during the previous drop series.

Experience gained during the large-scale salt compaction demonstration indicated that a considerable volume of dust is generated during the emplacement of the salt, but not during dynamic compaction. However, because the intake of the rigid vent duct is below the multi-deck stage, workers below the stage will wear respirators during emplacement. They will be the only workers affected by dust during dynamic compaction.

The Air Intake Shaft will require 22 drop positions (Figure G2B-4). Application of one MPE requires six drops in each position, for a total of 132 drops per lift. Three MPE, a total of 396 drops per lift, will be applied to all salt. After each compaction cycle, the salt surface will be leveled manually and the tamper will be dropped in positions omitted in the preceding drop series. Two lifts, each 1.8 m high, will then be sequentially placed, leveled, and compacted with two MPE, using a 6-m drop height.

Dynamic compaction ensures a tight interface. Salt compacted during the large-scale dynamic compaction demonstration adhered so tenaciously to the smooth interior walls of the steel compaction chamber that grinders with stiff wire wheels were required for its removal.

B4.5 Grout

Ultrafine sulfate-resistant cementitious grout (Ahrens et al., 1996) is selected as the sealing material. Specifically developed for use at the WIPP, and successfully demonstrated in an in situ test, the hardened grout has a permeability of 1×10^{-21} m^2. It has the ability to penetrate fractures smaller than 6 microns and is being used for the following purposes:

- to seal many of the microfractures in the DRZ and ensure a tight interface between SMC and the enclosing rock, and
- to solidify fractured rock behind existing concrete shaft liners, prior to removal of the liner (for worker safety).

The interface between concrete plugs in the Salado Formation (and one in the Rustler Formation, a short distance above the Salado) will be grouted. A 45° downward-opening cone of reverse circulation diamond drill holes will be collared in the top of the plugs, drilled in a spin pattern (see Figure G2B-5), and stage grouted with ultrafine cementitious grout at 3.5 kg/cm^2 below lithostatic pressure. Stage grouting consists of:

- drilling and grouting primary holes, one at a time;
- drilling and grouting secondary holes, one at a time, on either side of the primary holes that accepted grout; and
- (if necessary) drilling and grouting tertiary holes on either side of secondary holes that accepted grout.

Note: For safety, all liner removal tasks will be accomplished from the bottom deck. In areas where the steel liner is removed, it will be cut into manageable pieces with a cutting torch and hoisted to the surface for disposal. Mechanical methods will be employed to clean and roughen the existing concrete shaft liner before placing the Dewey Lake SMC plug in the shafts.

The work sequence will start 3 m below the lower elevation of liner removal. A 45° upward-opening cone of grout injection holes, drilled in a "spin" pattern (Figure G2B-6), will be drilled to a depth subtending one shaft radius on a horizontal plane. These holes will be stage grouted as described in Section 4.5. Noncoring, reverse circulation, diamond drill equipment will be used to avoid plugging fractures with fine-grained diamond drill cuttings. Ultrafine cementitious grout will be mixed on the surface, transferred via the slickline to the upper deck of the multi-deck stage, and injected at 3.5 kg/cm^2 gage below lithostatic pressure to avoid hydrofracturing the rock.

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Grout will be transferred in batches, and after each transfer, a "pig" will be pumped through the slickline and header to clean them. Grouting will proceed upward from the lowest fan to the highest. Recent studies conducted in the Air Intake Shaft (Dale and Hurtado, 1996) show that this hole depth exceeds that required for complete penetration of the Disturbed Rock Zone (DRZ). Maximum horizontal spacing at the ends of the holes will be 3 m.

The multi-deck stage will then be raised 3 m and a second fan, identical to the first, will be drilled and grouted. This procedure will continue, with grout fans 3 m apart vertically, until the highest fan, located 3 m above the highest point of liner removal, has been drilled and grouted. Ultrafine cementitious grout was observed to penetrate more than 2 m in the underground grouting experiment conducted at the WIPP in Room L-3 (Ahrens and Onofrei, 1996).

When grouting is completed, the multi-deck stage will be lowered to the bottom of the liner removal section and a hole will be made through the concrete liner. This hole, approximately 30 cm in diameter, will serve as "free-face" to which the liner will be broken. Similar establishment and utilization of free face is a common practice in hard rock mining (e.g., the central drill hole in a series drilled into the rock to be blasted is left empty and used as free-face to which explosives in adjacent holes break the rock). Radial, horizontal percussion holes will be drilled on a 30-cm grid (or less, if required), covering the liner to be removed. Hydraulic wedges, activated in these holes, will then break out the liner, starting adjacent to the free face and progressing away from it, from the bottom up. Broken fragments of the concrete liner will fall to the fill surface below.

A mucking "claw," suspended from the trolley of the polar crane, will collect the broken concrete and place it in the bucket for removal to the surface. As many as three buckets can be used to speed this work.

B4.6 Compacted Earthen Fill

Local soil, screened to a maximum particle dimension of 13 mm, will be placed and compacted to inhibit the migration of surficial water into the shaft cross section. Such movement is further decreased by a 12-m high SMC plug at the top of the Dewey Lake Redbeds.

B4.6.1 Lower Section

Emplacement of the compacted earthen fill will proceed as follows:

- Moisture content of the screened soil will be determined.
- The soil will then be transferred via the slickline, header, and flexible hose from surface to the fill elevation. The moisture content optimal for compaction will be achieved using the same procedure as described for compacted salt (Permit Attachment G2, Appendix B, Section B4.4). The soil will be emplaced in lifts 1.2 m high (depth of compaction is approximately 3.7 m) and dynamically compacted using a drop height of 18.3 m.
- The fill will be dynamically compacted until its hydraulic conductivity to water is nominally equivalent to that of the surrounding formation.

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This procedure will continue until the lower section has been emplaced and compacted. Care will be exercised at the top of the column to ensure that all soil receives sufficient compaction.

B4.6.2 Upper Section

The upper section contains insufficient room to employ dynamic compaction. Therefore the screened soil, emplaced as described above, will be compacted by vibratory-impact sheepsfoot roller, vibratory sheepsfoot roller, or a walk-behind vibratory-plate compactor. Because of the limited compaction depth of this equipment, lifts will be 0.3 m high. The top of the fill will be coordinated with the MOC to accommodate plans for decommissioning surface facilities and placing markers.

B4.7 Schedule

Preliminary construction schedules are included on the following pages. The first schedule is a concise outline of the total construction schedule. It is followed by individual schedules for each shaft. The first schedule in each shaft series is a truncated schedule showing the major milestones. The truncated schedules are followed by detailed construction schedules for each shaft. These schedules indicate that it will take approximately six and a half years to complete the shaft sealing operations, assuming two shafts are simultaneously sealed.

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SEALING SCHEDULE - ALL SHAFTS

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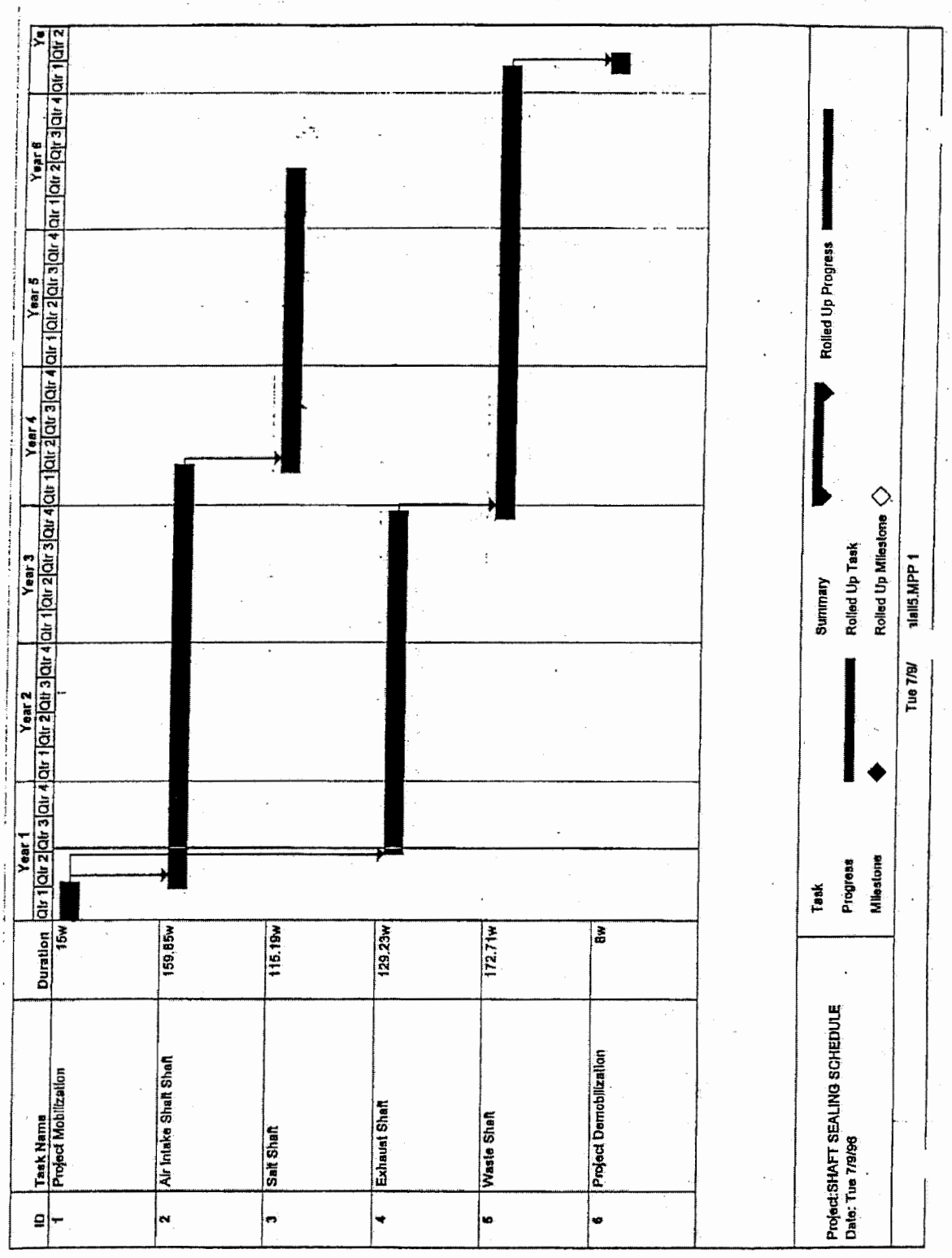
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Duration
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
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Qtr 2
Qtr 3
Qtr 4
1 Project Mobilization 15w
2 Air Intake Shaft Shaft 159.85w
3 Salt Shaft 115.19w
4 Exhaust Shaft 129.23w
5 Waste Shaft 172.71w
6 Project Demobilization 8w
Project:SHAFT SEALING SCHEDULE
Date: Tue 7/9/96
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Tue 7/9/
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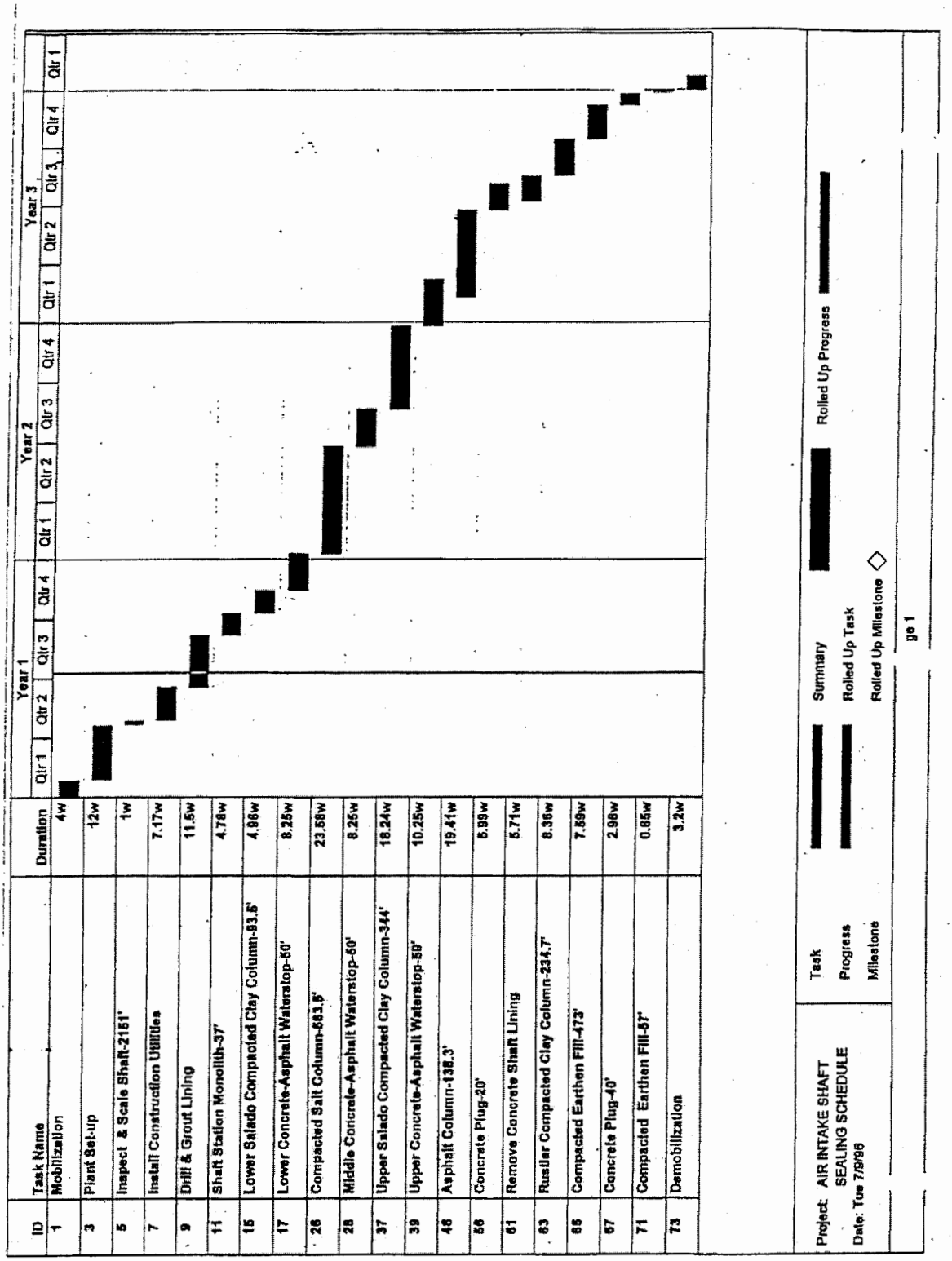
SEALING SCHEDULE - AIR INTAKE SHAFT


Year 1
Year 2
Year 3
Qtr 1
Qtr 2
Qtr 3
Qtr 4
ID
Task Name
Duration
1 Mobilization 4w
3 Plant Set-up 12w
5 Inspect & Scale Shaft-2161' 1w
7 Install Construction Utilities 7.17w
9 Drill & Grout Lining 11.5w
11 Shaft Station Monolith-37' 4.78w
15 Lower Salado Compacted Clay Column-93.5' 4.86w
17 Lower Concrete-Asphalt Waterstop-50' 8.25w
26 Compacted Salt Column-683.5' 23.58w
28 Middle Concrete-Asphalt Waterstop-50' 8.25w
37 Upper Salado Compacted Clay Column-344' 18.24w
39 Upper Concrete-Asphalt Waterstop-50' 10.25w
48 Asphalt Column-138.3' 19.41w
58 Concrete Plug-20' 6.99w
61 Remove Concrete Shaft Lining 5.71w
63 Rustler Compacted Clay Column-234.7' 8.36w
65 Compacted Earthen Fill-473' 7.59w
67 Concrete Plug-40' 2.96w
71 Compacted Earthen Fill-57' 0.85w
73 Demobilization 3.2w
Project: AIR INTAKE SHAFT SEALING SCHEDULE
Date: Tue 7/9/96
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Rolled Up Milestone
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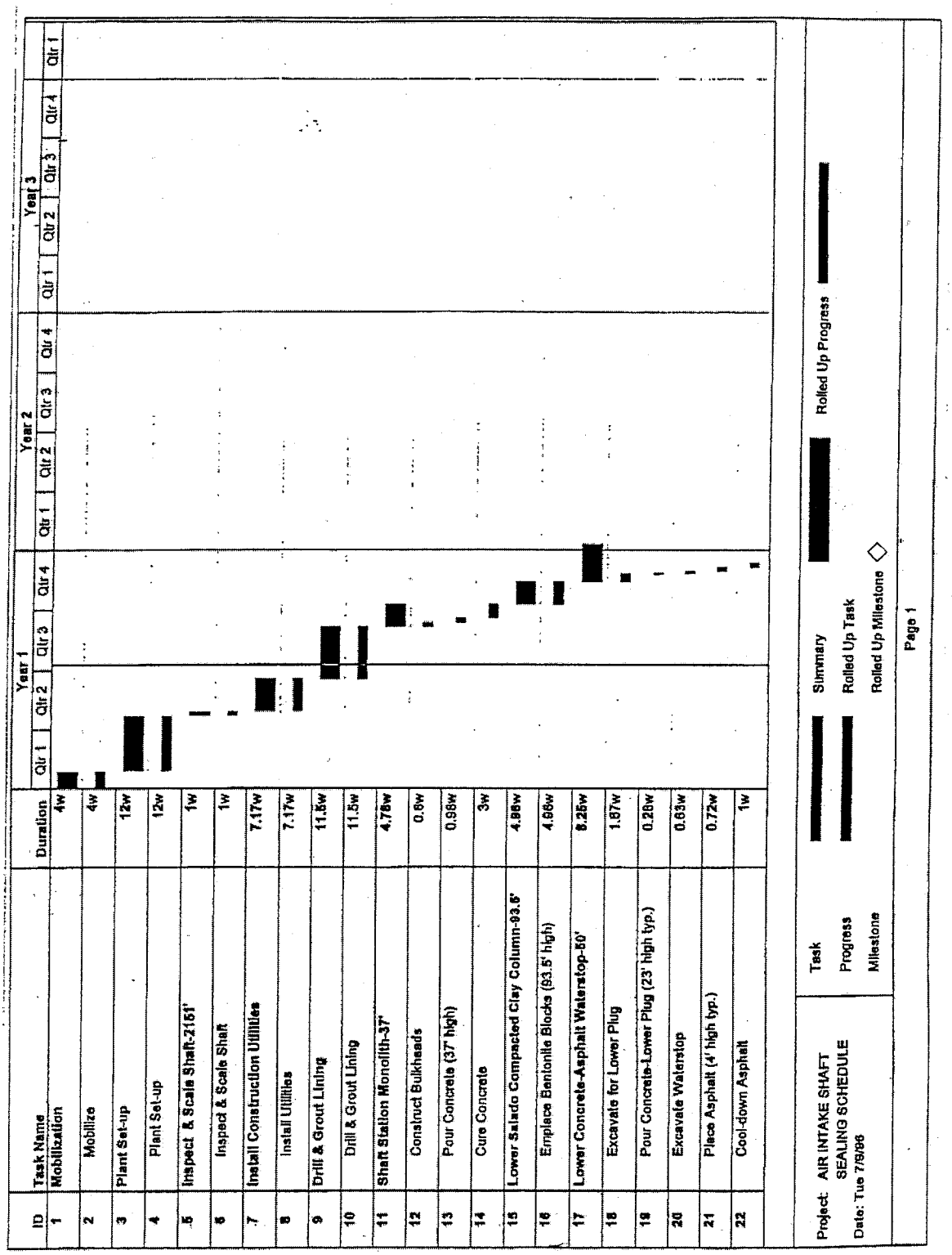
Year 1
Year 2
Year 3
Qtr 1
Qtr 2
Qtr 3
Qtr 4
ID
Task Name
Duration
1 Mobilization 4w
2 Mobilize 4w
3 Plant Set-up 12w
4 Plant Set-up 12w
5 Inspect & Scale Shaft-2151' 1w
6 Inspect & Scale Shaft 1w
7 Install Construction Utilities 7.17w
8 Install Utilities 7.17w
9 Drill & Grout Lining 11.5w
10 Drill & Grout Lining 11.5w
11 Shaft Station Monolith-37' 4.76w
12 Construct Bulkheads 0.6w
13 Pour Concrete (37' high) 0.98w
14 Cure Concrete 3w
15 Lower Salado Compacted Clay Column-93.5' 4.98w
16 Emplace Bentonite Blocks (93.5' high) 4.86w
17 Lower Concrete-Asphalt Waterstop-50' 8.25w
18 Excavate for Lower Plug 1.87w
19 Pour Concrete-Lower Plug (23' high typ.) 0.28w
20 Excavate Waterstop 0.63w
21 Place Asphalt (4' high typ.) 0.72w
22 Cool-down Asphalt 1w
Project: AIR INTAKE SHAFT SEALING SCHEDULE
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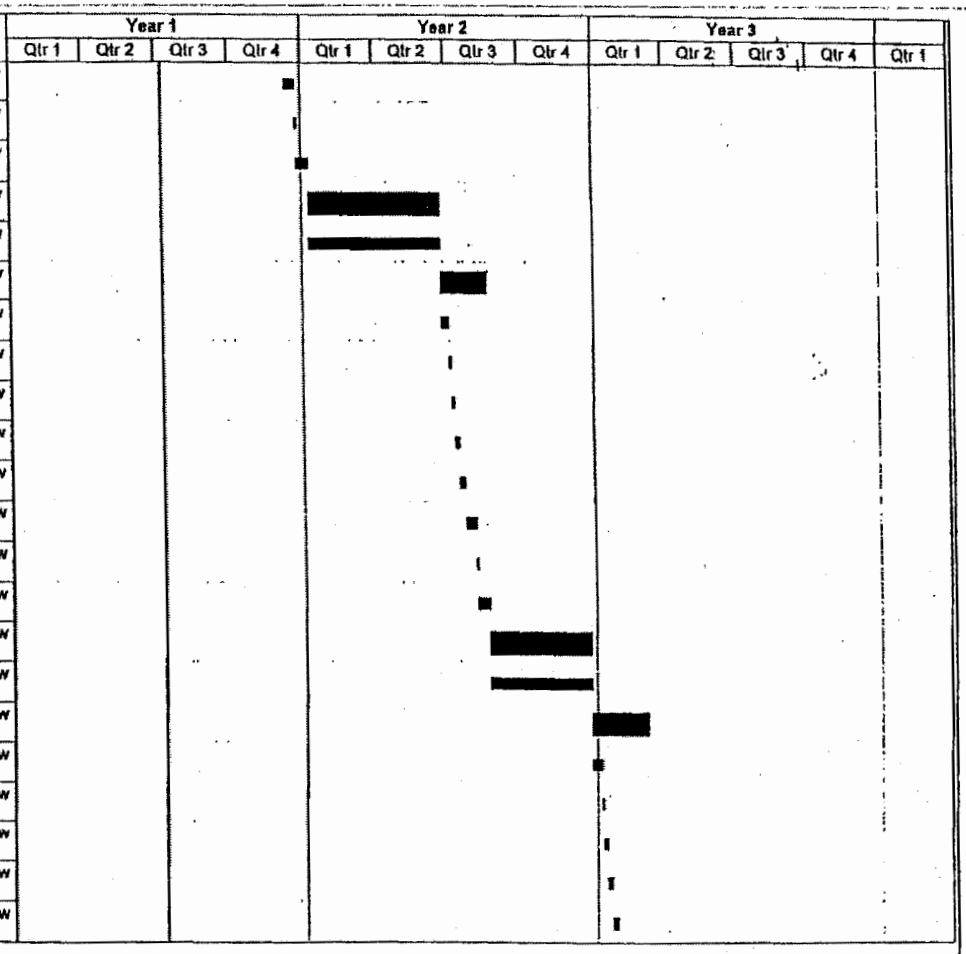
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Page 1

ID	Task Name	Duration
23	Excavate for Upper Plug	1.67w
24	Pour Concrete-Upper Plug (23' high typ.)	0.28w
25	Cure Concrete	2w
26	Compacted Salt Column-563.5'	23.58w
27	Emplace & Compact Crushed/Screened Salt	23.58w
28	Middle Concrete-Asphalt Waterstop-50'	8.25w
29	Excavate for Lower Plug	1.67w
30	Pour Concrete-Lower Plug	0.28w
31	Excavate Waterstop	0.63w
32	Place Asphalt	0.72w
33	Cool-down Asphalt	1w
34	Excavate for Upper Plug	1.67w
35	Pour Concrete-Upper Plug	0.28w
36	Cure Concrete	2w
37	Upper Salado Compacted Clay Column-344'	16.24w
38	Emplace Bentonite Blocks	16.24w
39	Upper Concrete-Asphalt Waterstop-50'	10.25w
40	Excavate for Lower Plug	1.67w
41	Pour Concrete-Lower Plug	0.28w
42	Excavate Waterstop	0.63w
43	Place Asphalt	0.72w
44	Cool-down Asphalt	1w



Project: AIR INTAKE SHAFT SEALING SCHEDULE
Date: Tue 7/9/96

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone ◇
Rolled Up Progress

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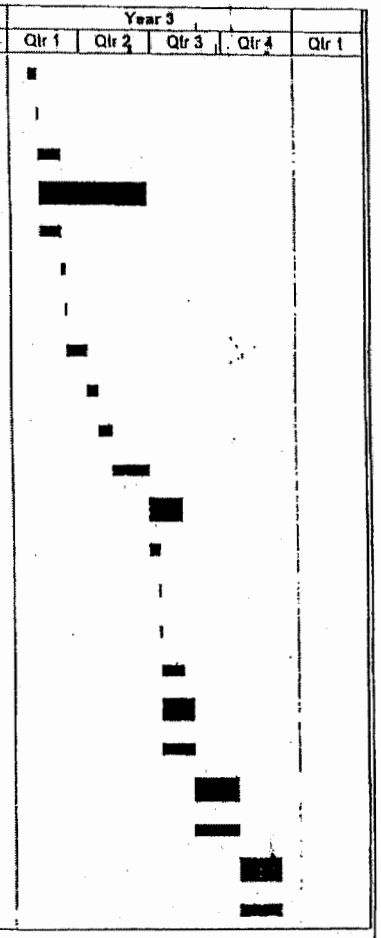
ID	Task Name	Duration
45	Excavate for Upper Plug	1.67w
46	Pour Concrete-Upper Plug	0.28w
47	Cure Concrete	4w
48	Asphalt Column-136.3'	19.41w
49	Remove Lining in Key	3.76w
50	Remove Chemical Seal Rings	0.8w
51	Mobilize to Emplace Asphalt	0.3w
52	Asphalt in Salt Section	3.62w
53	Asphalt in Lower Lined Section	1.93w
54	Complete Asphalt Emplacement	2.77w
55	Cool-down Asphalt	6.43w
56	Concrete Plug-20'	5.99w
57	Remove Concrete Lining & Rock	1.65w
58	Remove Liner Plate	0.13w
59	Pour Concrete(20' high)	0.21w
60	Cure Concrete	4w
61	Remove Concrete Shaft Lining	5.71w
62	Remove 66' of lining--4 zones	5.71w
63	Rustler Compacted Clay Column-234.7'	8.36w
64	Emplace & Compact Bentonite(234.7' high)	8.36w
65	Compacted Earthen Fill-473'	7.59w
66	Emplace & Compact Earthen Fill(473' high)	7.59w



Project: AIR INTAKE SHAFT SEALING SCHEDULE
Date: Tue 7/9/96

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone ◇
Rolled Up Progress

Page 3

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ID	Task Name	Duration	Year 1				Year 2				Year 3				
			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1
67	Concrete Plug-40'	2.96w													
68	Clean Existing Surface	0.6w													
69	Pour Concrete(40' high)	0.36w													
70	Cure Concrete	2w													
71	Compacted Earthen Fill-57'	0.65w													
72	Emplace & Compact Earthen Fill (57' high)	0.65w													
73	Demobilization	3.2w													
74	Demob	3.2w													

Project: AIR INTAKE SHAFT SEALING SCHEDULE
Date: Tue 7/9/96

Task — Summary — Rolled Up Progress
Progress — Rolled Up Task
Milestone — Rolled Up Milestone ◇

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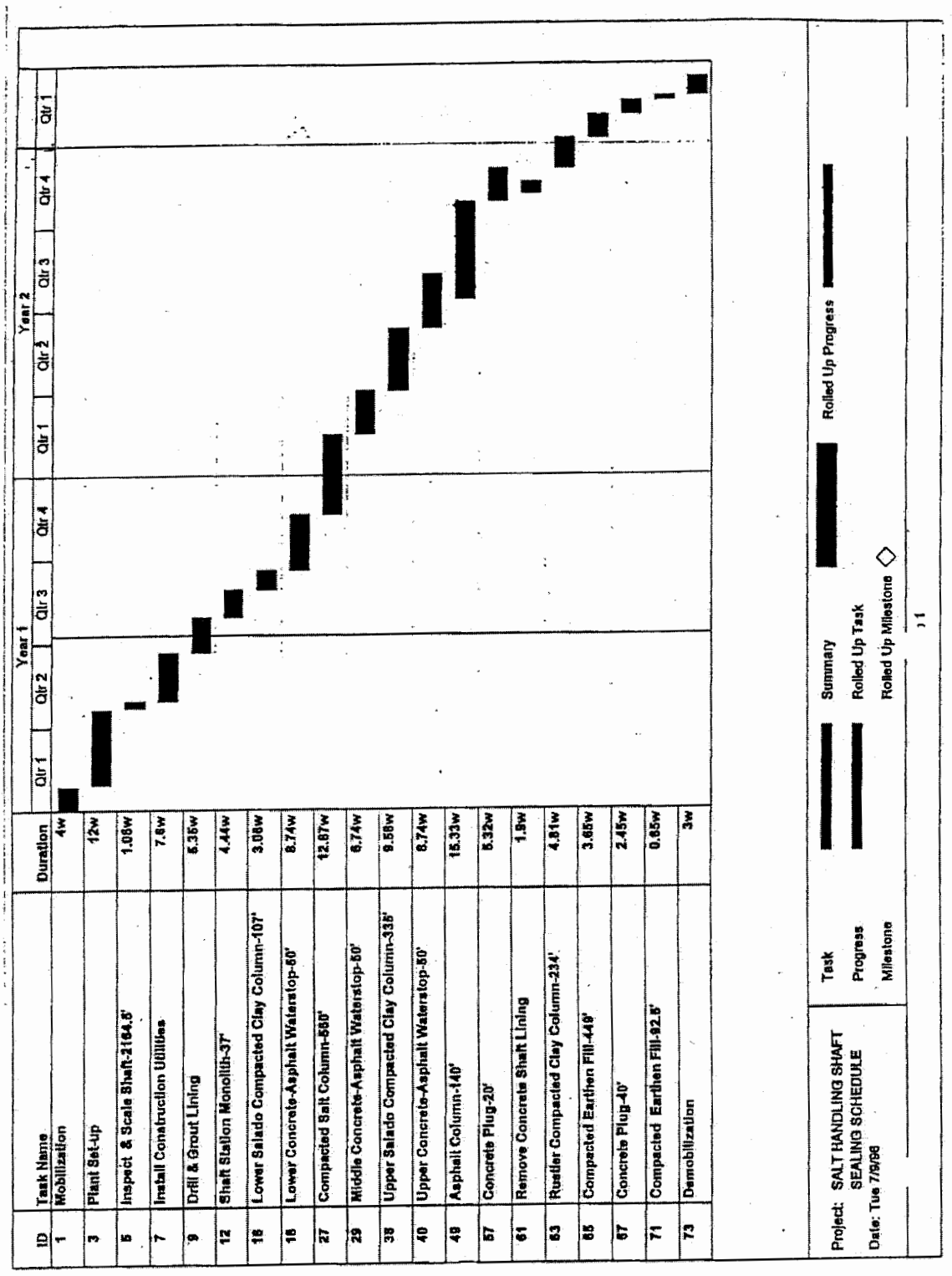
91205

SEALING SCHEDULE - SALT HANDLING SHAFT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Year 2
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Qtr 1
1 Mobilization 4w
3 Plant Set-up 12w
5 Inspect & Scale Shaft-2164.6' 1.08w
7 Install Construction Utilities 7.8w
9 Drill & Grout Lining 5.35w
12 Shaft Station Monolith-37' 4.44w
18 Lower Salado Compacted Clay Column-107' 3.08w
16 Lower Concrete-Asphalt Waterstop-50' 8.74w
27 Compacted Salt Column-550' 12.67w
29 Middle Concrete-Asphalt Waterstop-50' 8.74w
38 Upper Salado Compacted Clay Column-338' 9.58w
40 Upper Concrete-Asphalt Waterstop-50' 8.74w
49 Asphalt Column-148' 15.33w
57 Concrete Plug-20' 5.32w
61 Remove Concrete Shaft Lining 1.8w
63 Rustler Compacted Clay Column-234' 4.81w
65 Compacted Earthen Fill-448' 3.65w
67 Concrete Plug-40' 2.45w
71 Compacted Earthen Fill-92.5' 0.85w
73 Demobilization 3w
Project: SALT HANDLING SHAFT SEALING SCHEDULE
Date: Tue 7/9/96
Task
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Rolled Up Milestone
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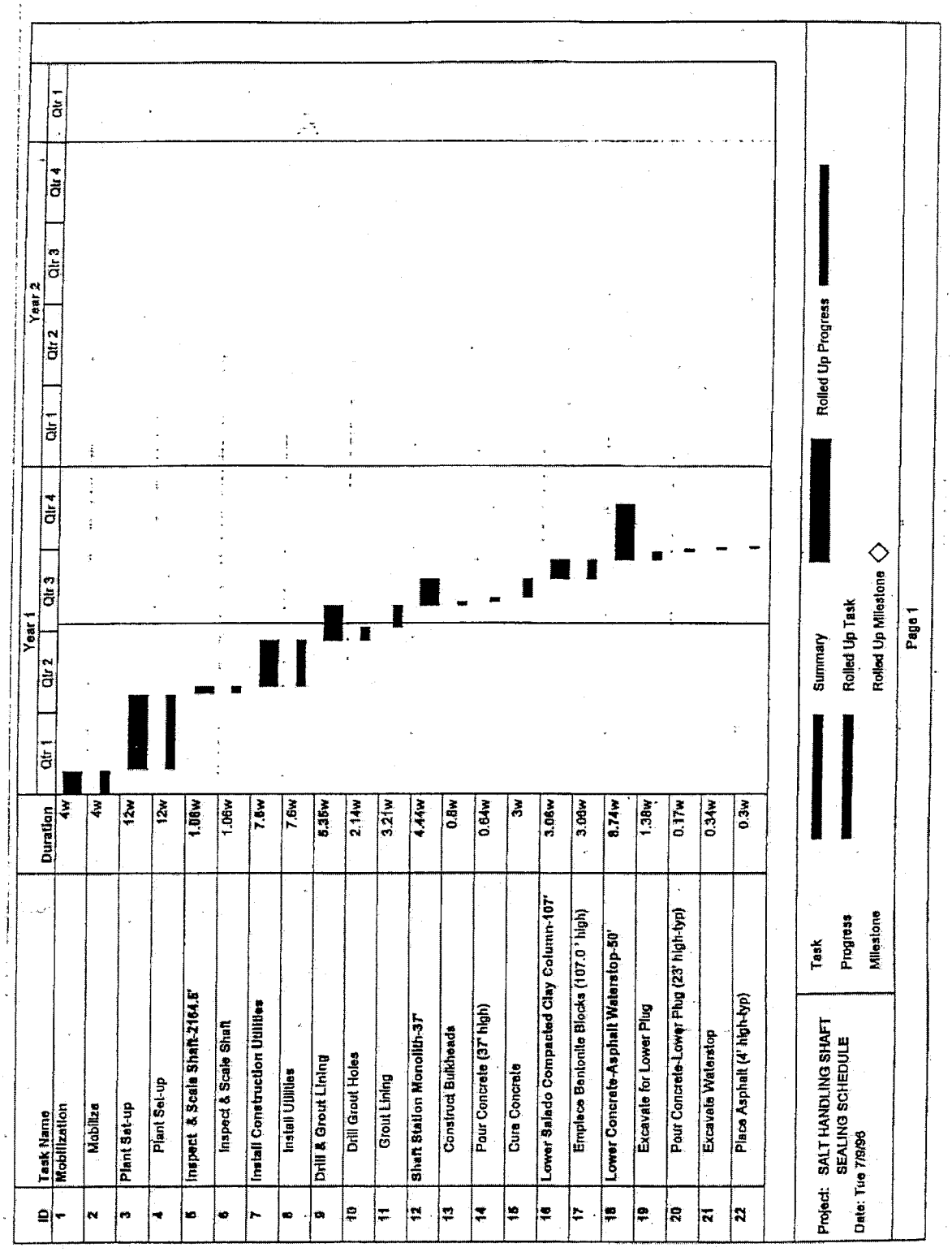
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Year 1
Year 2
Qtr 1
Qtr 2
Qtr 3
Qtr 4
1 Mobilization 4w
2 Mobiliza 4w
3 Plant Set-up 12w
4 Plant Set-up 12w
5 Inspect & Scale Shaft-2164.5' 1.06w
6 Inspect & Scale Shaft 1.06w
7 Install Construction Utilities 7.6w
8 Install Utilities 7.6w
9 Drill & Grout Lining 5.35w
10 Drill Grout Holes 2.14w
11 Grout Lining 3.21w
12 Shaft Station Monolith-37' 4.44w
13 Construct Bulkheads 0.8w
14 Pour Concrete (37' high) 0.64w
15 Cure Concrete 3w
16 Lower Salado Compacted Clay Column-107' 3.06w
17 Emplace Bentonite Blocks (107.0 ' high) 3.06w
18 Lower Concrete-Asphalt Waterstop-50' 8.74w
19 Excavate for Lower Plug 1.38w
20 Pour Concrete-Lower Plug (23' high-typ) 0.17w
21 Excavate Waterstop 0.34w
22 Place Asphalt (4' high-typ) 0.3w
Project: SALT HANDLING SHAFT SEALING SCHEDULE
Date: Tue 7/9/96
Task
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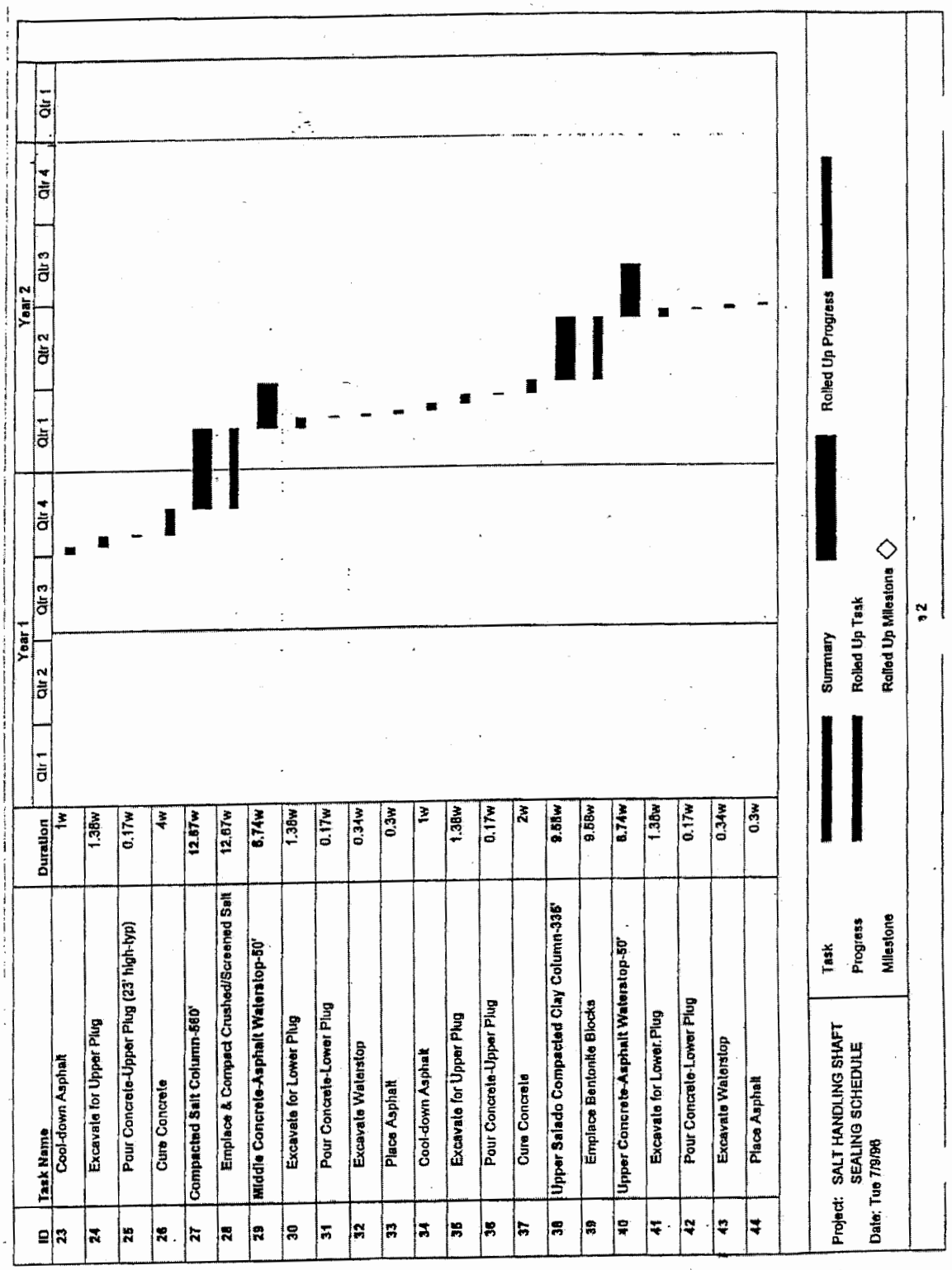

ID	Task Name	Duration
23	Cool-down Asphalt	1w
24	Excavate for Upper Plug	1.38w
25	Pour Concrete-Upper Plug (23' high-typ)	0.17w
26	Cure Concrete	4w
27	Compacted Salt Column-560'	12.87w
28	Emplace & Compact Crushed/Screened Salt	12.87w
29	Middle Concrete-Asphalt Waterstop-50'	8.74w
30	Excavate for Lower Plug	1.38w
31	Pour Concrete-Lower Plug	0.17w
32	Excavate Waterstop	0.34w
33	Place Asphalt	0.3w
34	Cool-down Asphalt	1w
35	Excavate for Upper Plug	1.38w
36	Pour Concrete-Upper Plug	0.17w
37	Cure Concrete	2w
38	Upper Salado Compacted Clay Column-335'	9.58w
39	Emplace Bentonite Blocks	9.58w
40	Upper Concrete-Asphalt Waterstop-50'	8.74w
41	Excavate for Lower Plug	1.38w
42	Pour Concrete-Lower Plug	0.17w
43	Excavate Waterstop	0.34w
44	Place Asphalt	0.3w

ID	Task Name	Duration
45	Cool-down Asphalt	1w
46	Excavate for Upper Plug	1.38w
47	Pour Concrete-Upper Plug	0.17w
48	Cure Concrete	4w
49	Asphalt Column-140'	15.33w
50	Remove Lining in Key	2.02w
51	Remove Chemical Seal Rings	0.4w
52	Mobilize to emplace asphalt	2w
53	Asphalt in Salt Section	2.73w
54	Asphalt in Lower Lined Section	0.25w
55	Complete Asphalt Emplacement	1.5w
56	Cool-down Asphalt	8.43w
57	Concrete Plug-20'	5.32w
58	Remove Concrete Lining & Rock	1.11w
59	Pour Concrete (20' high)	0.21w
60	Cure Concrete	4w
61	Remove Concrete Shaft Lining	1.9w
62	Remove 72' of lining--4 zones	1.9w
63	Rustler Compacted Clay Column-234'	4.81w
64	Emplace & Compact Bentonite (234' high)	4.81w
65	Compacted Earthen Fill-449'	3.65w
66	Emplace & Compact Earthen Fill (449' high)	3.65w

Project: SALT HANDLING SHAFT SEALING SCHEDULE
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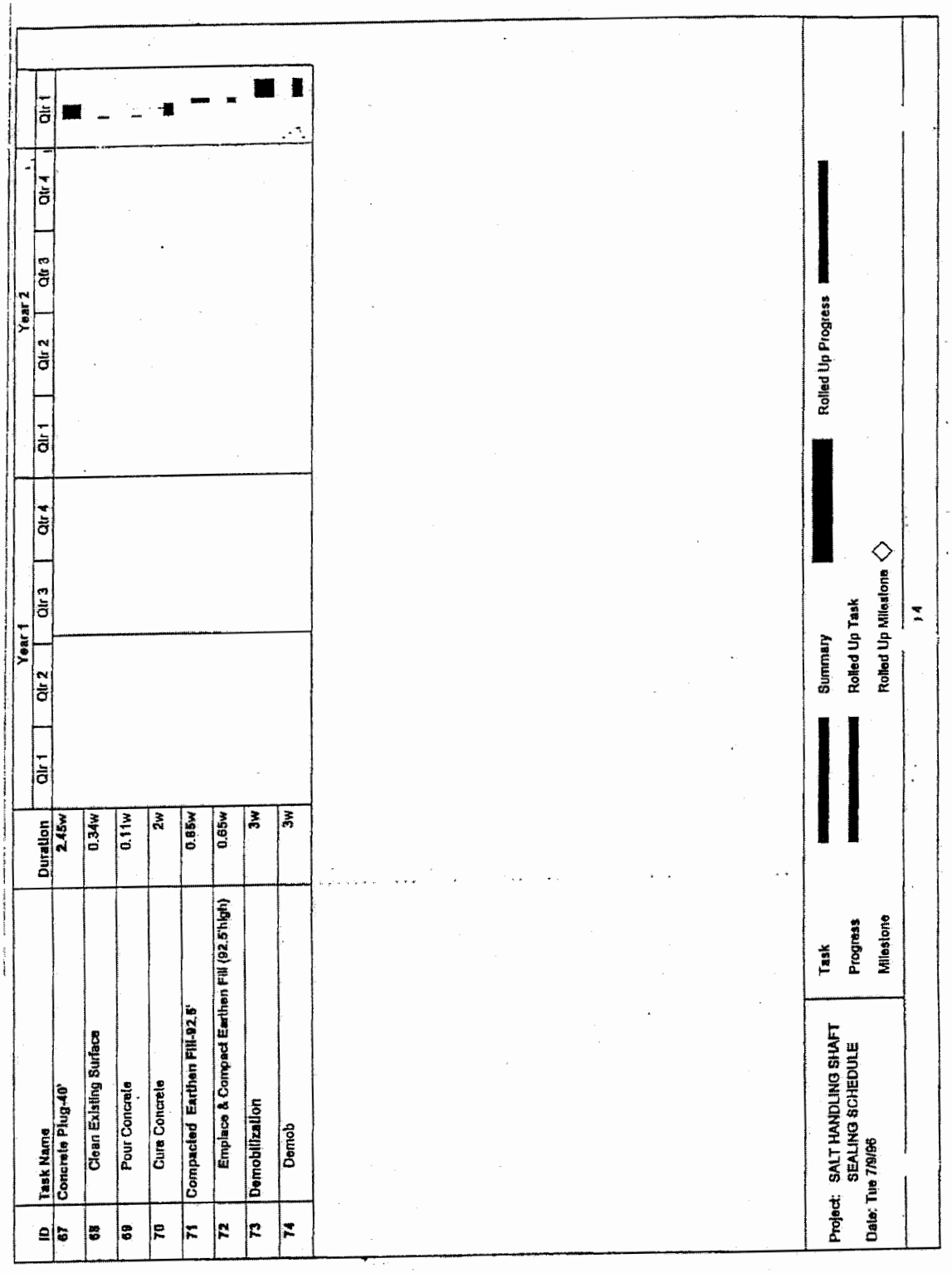
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Task Name
Duration
Year 1
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Year 2
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Qtr 1
67 Concrete Plug-40' 2.45w
68 Clean Existing Surface 0.34w
69 Pour Concrete 0.11w
70 Cure Concrete 2w
71 Compacted Earthen Fill-92.5' 0.85w
72 Emplace & Compact Earthen Fill (92.5'high) 0.65w
73 Demobilization 3w
74 Demob 3w
Project: SALT HANDLING SHAFT SEALING SCHEDULE
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Progress
Milestone
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1

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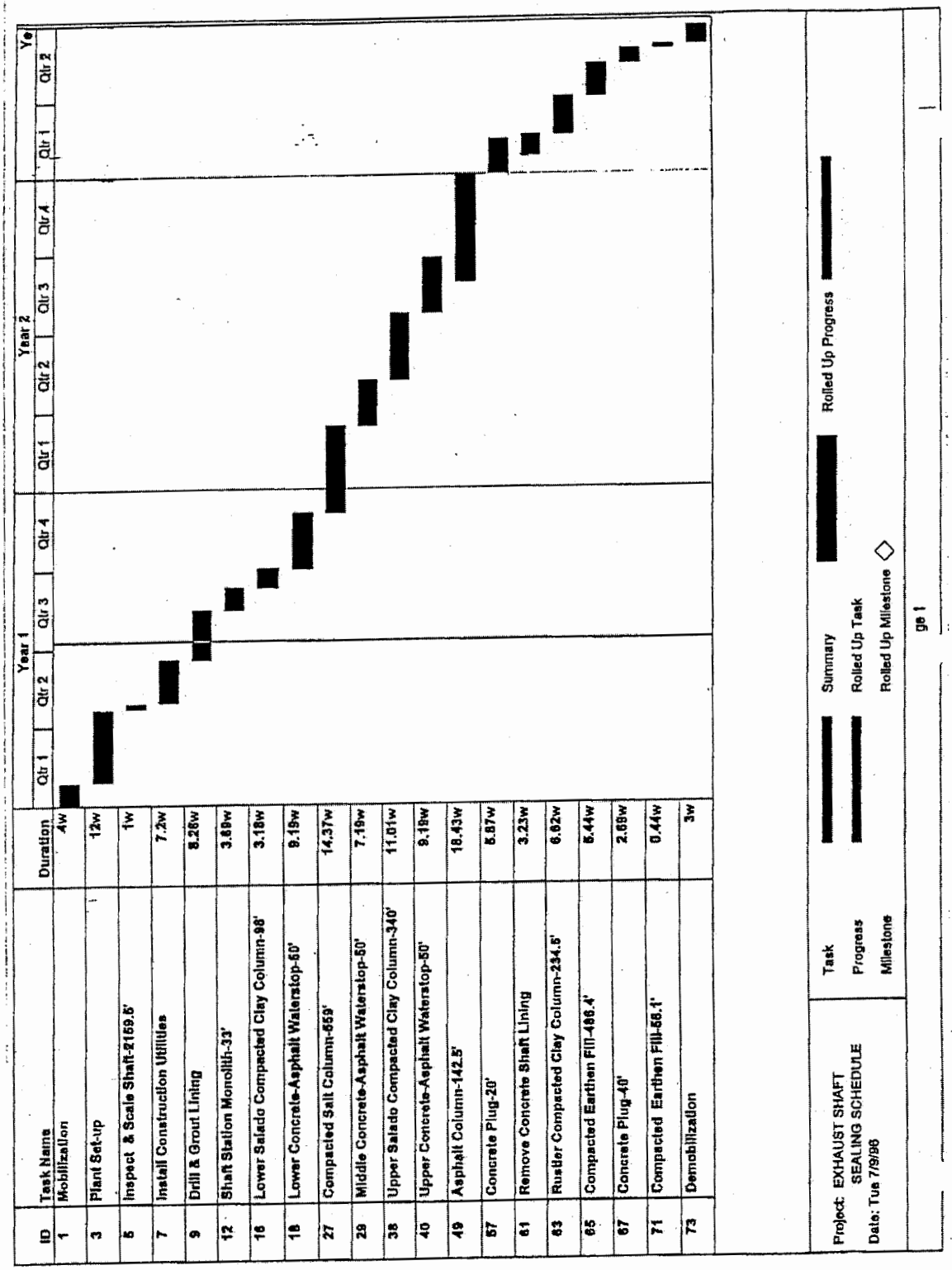
SEALING SCHEDULE - EXHAUST SHAFT



ID	Task Name	Duration
1	Mobilization	4w
3	Plant Set-up	12w
5	Inspect & Scale Shaft-2159.5'	1w
7	Install Construction Utilities	7.2w
9	Drill & Grout Lining	8.28w
12	Shaft Station Monolith-33'	3.69w
16	Lower Salado Compacted Clay Column-98'	3.18w
18	Lower Concrete-Asphalt Waterstop-50'	8.19w
27	Compacted Salt Column-859'	14.37w
29	Middle Concrete-Asphalt Waterstop-50'	7.19w
38	Upper Salado Compacted Clay Column-340'	11.01w
40	Upper Concrete-Asphalt Waterstop-50'	9.18w
49	Asphalt Column-142.5'	18.43w
57	Concrete Plug-20'	8.87w
61	Remove Concrete Shaft Lining	3.23w
63	Rustler Compacted Clay Column-234.5'	6.82w
65	Compacted Earthen Fill-486.4'	8.44w
67	Concrete Plug-40'	2.69w
71	Compacted Earthen Fill-56.1'	8.44w
73	Demobilization	3w

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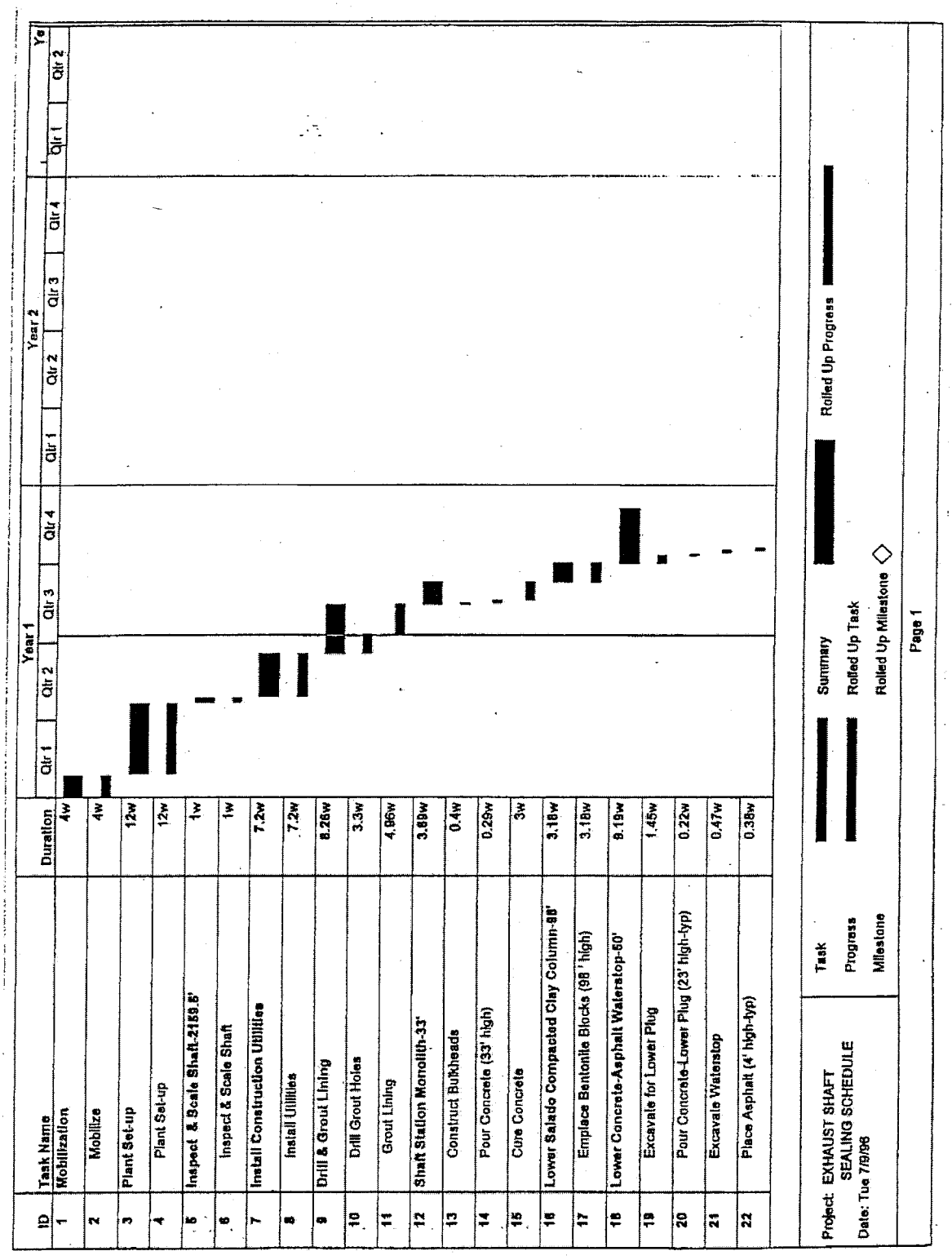
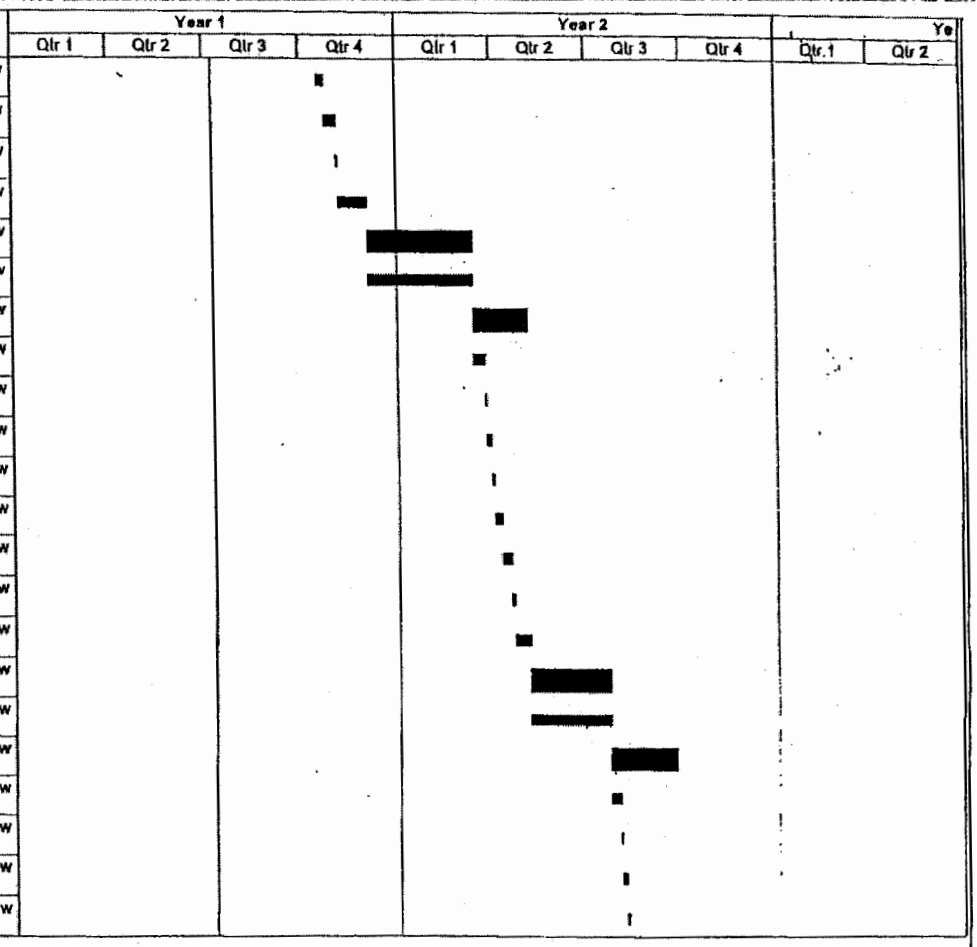


ID	Task Name	Duration
1	Mobilization	4w
2	Mobilize	4w
3	Plant Set-up	12w
4	Plant Set-up	12w
5	Inspect & Scale Shaft-2159.6'	1w
6	Inspect & Scale Shaft	1w
7	Install Construction Utilities	7.2w
8	Install Utilities	7.2w
9	Drill & Grout Lining	8.26w
10	Drill Grout Holes	3.3w
11	Grout Lining	4.96w
12	Shaft Station Monolith-33'	3.89w
13	Construct Bulkheads	0.4w
14	Pour Concrete (33' high)	0.29w
15	Cure Concrete	3w
16	Lower Salado Compacted Clay Column-98'	3.18w
17	Emplace Bentonite Blocks (98' high)	3.18w
18	Lower Concrete-Asphalt Waterstop-50'	8.19w
19	Excavate for Lower Plug	1.45w
20	Pour Concrete-Lower Plug (23' high-typ)	0.22w
21	Excavate Waterstop	0.47w
22	Place Asphalt (4' high-typ)	0.38w

ID	Task Name	Duration
23	Cool-down Asphalt	1w
24	Excavate for Upper Plug	1.45w
25	Pour Concrete-Upper Plug (23' high-typ)	0.22w
26	Cure Concrete	4w
27	Compacted Salt Column-859'	14.37w
28	Emplace & Compact Crushed/Screened Salt	14.37w
29	Middle Concrete-Asphalt Waterstop-50'	7.19w
30	Excavate for Lower Plug	1.45w
31	Pour Concrete-Lower Plug	0.22w
32	Excavate Waterstop	0.47w
33	Place Asphalt	0.38w
34	Cool-down Asphalt	1w
35	Excavate for Upper Plug	1.45w
36	Pour Concrete-Upper Plug	0.22w
37	Cure Concrete	2w
38	Upper Salado Compacted Clay Column-340'	11.01w
39	Emplace Bentonite Blocks(340' high)	11.01w
40	Upper Concrete-Asphalt Waterstop-50'	9.19w
41	Excavate for Lower Plug	1.45w
42	Pour Concrete-Lower Plug	0.22w
43	Excavate Waterstop	0.47w
44	Place Asphalt	0.38w



Project: EXHAUST SHAFT SEALING SCHEDULE
Date: Tue 7/9/96

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Summary
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ID	Task Name	Duration
45	Cool-down Asphalt	1w
46	Excavate for Upper Plug	1.45w
47	Pour Concrete-Upper Plug	0.22w
48	Cure Concrete	4w
49	Asphalt Column-142.5'	18.43w
50	Remove Lining in Key	3.16w
51	Remove Chemical Seal Rings	0.5w
52	Mobilize to Emplace Asphalt	2w
53	Asphalt in Salt Section	2.64w
54	Asphalt in Lower Lined Section	1.44w
55	Complete Asphalt Emplacement	2.27w
56	Cool-down Asphalt	6.43w
57	Concrete Plug-20'	5.67w
58	Remove Concrete Lining & Rock	1.7w
59	Pour Concrete (20' high)	0.17w
60	Cure Concrete	4w
61	Remove Concrete Shaft Lining	3.23w
62	Remove 84' of lining--4 zones	3.23w
63	Rustler Compacted Clay Column-234.5'	6.62w
64	Emplace & Compact Bentonite(234.5' high)	6.62w
65	Compacted Earthen Fill-486.4'	5.44w
66	Emplace & Compact Earthen Fill(486.4' high	5.44w

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ID	Task Name	Duration	Year 1				Year 2				Ye	
			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2
67	Concrete Plug-40'	2.68w										
68	Clean Existing Surface	0.47w										
69	Pour Concrete	0.22w										
70	Cure Concrete	2w										
71	Compacted Earthen Fill-56.1'	0.44w										
72	Emplace & Compact Earthen Fill (56.1'high)	0.44w										
73	Demobilization	3w										
74	Demob	3w										

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SEALING SCHEDULE - WASTE SHAFT

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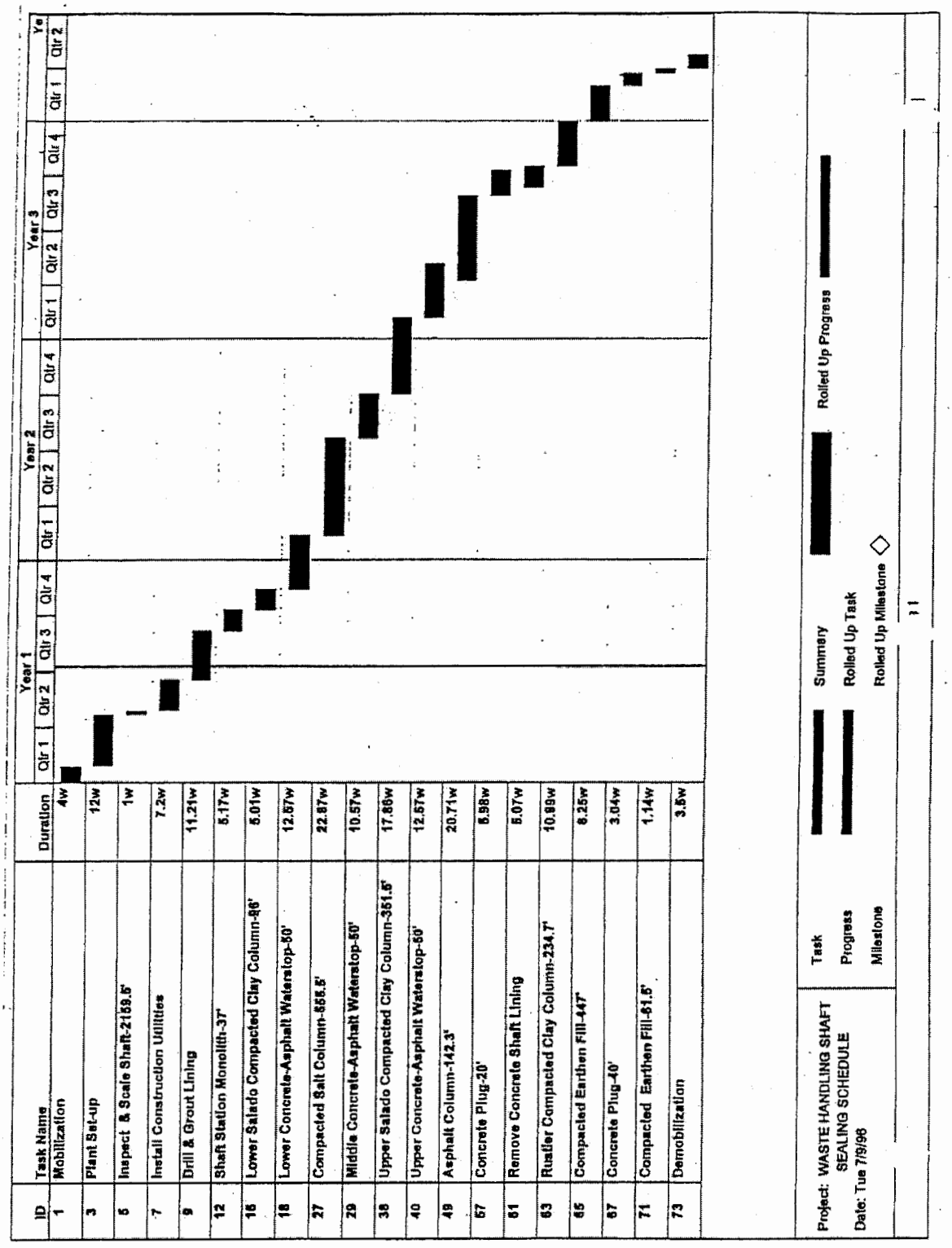
ID
Task Name
Duration
Year 1
Year 2
Year 3
Qtr 1
Qtr 2
Qtr 3
Qtr 4
1 Mobilization 4w
3 Plant Set-up 12w
5 Inspect & Scale Shaft-2159.5' 1w
7 Install Construction Utilities 7.2w
9 Drill & Grout Lining 11.21w
12 Shaft Station Monolith-37' 5.17w
16 Lower Salado Compacted Clay Column-86' 5.01w
18 Lower Concrete-Asphalt Waterstop-50' 12.57w
27 Compacted Salt Column-555.5' 22.57w
29 Middle Concrete-Asphalt Waterstop-50' 10.57w
38 Upper Salado Compacted Clay Column-351.5' 17.86w
40 Upper Concrete-Asphalt Waterstop-50' 12.57w
49 Asphalt Column-142.3' 20.71w
67 Concrete Plug-20' 5.98w
61 Remove Concrete Shaft Lining 5.07w
63 Ruatler Compacted Clay Column-234.7' 10.99w
65 Compacted Earthen Fill-447' 8.25w
67 Concrete Plug-40' 3.04w
71 Compacted Earthen Fill-81.5' 1.14w
73 Demobilization 3.5w
Project: WASTE HANDLING SHAFT SEALING SCHEDULE
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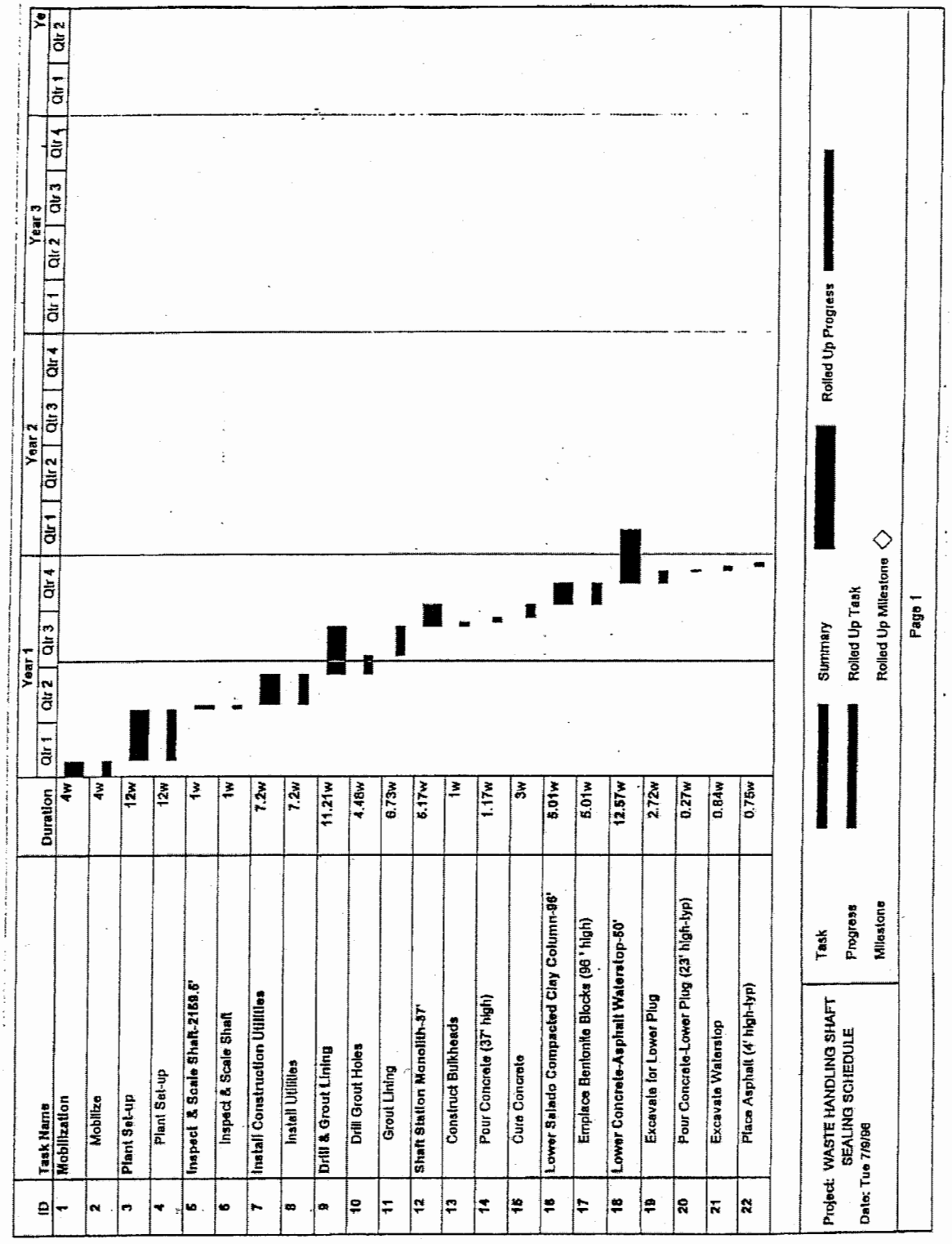
Rolled Up Progress


ID
Task Name
Duration
Year 1
Year 2
Year 3
Qtr 1
Qtr 2
Qtr 3
Qtr 4
1 Mobilization 4w
2 Mobilize 4w
3 Plant Set-up 12w
4 Plant Set-up 12w
5 Inspect & Scale Shaft-2159.6' 1w
6 Inspect & Scale Shaft 1w
7 Install Construction Utilities 7.2w
8 Install Utilities 7.2w
9 Drill & Grout Lining 11.21w
10 Drill Grout Holes 4.46w
11 Grout Lining 6.73w
12 Shaft Station Monolith-37' 5.17w
13 Construct Bulkheads 1w
14 Pour Concrete (37' high) 1.17w
15 Cure Concrete 3w
16 Lower Salado Compacted Clay Column-96' 5.01w
17 Emplace Bentonite Blocks (96 ' high) 5.01w
18 Lower Concrete-Asphalt Waterstop-50' 12.57w
19 Excavate for Lower Plug 2.72w
20 Pour Concrete-Lower Plug (23' high-typ) 0.27w
21 Excavate Waterstop 0.84w
22 Place Asphalt (4' high-typ) 0.75w
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Task
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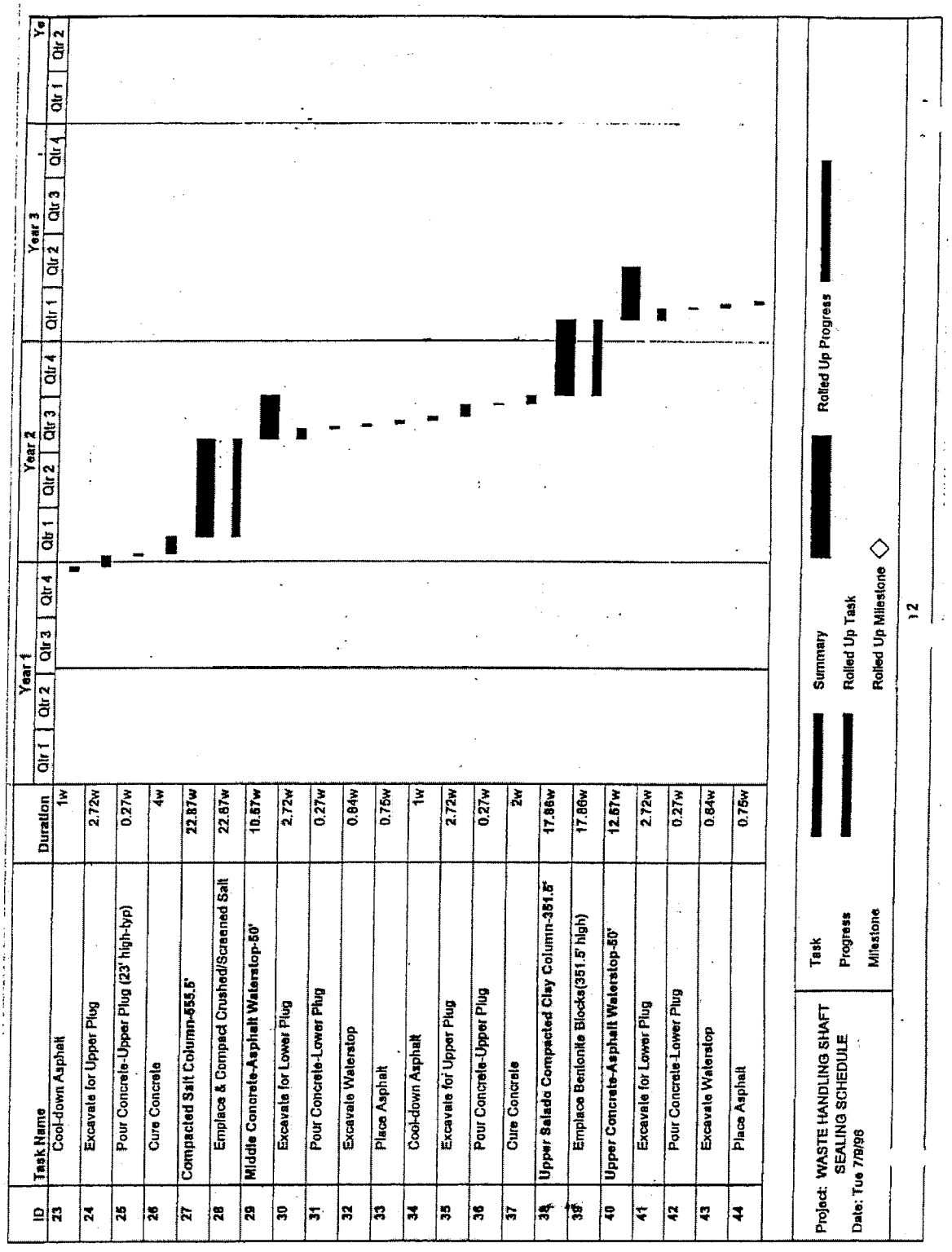
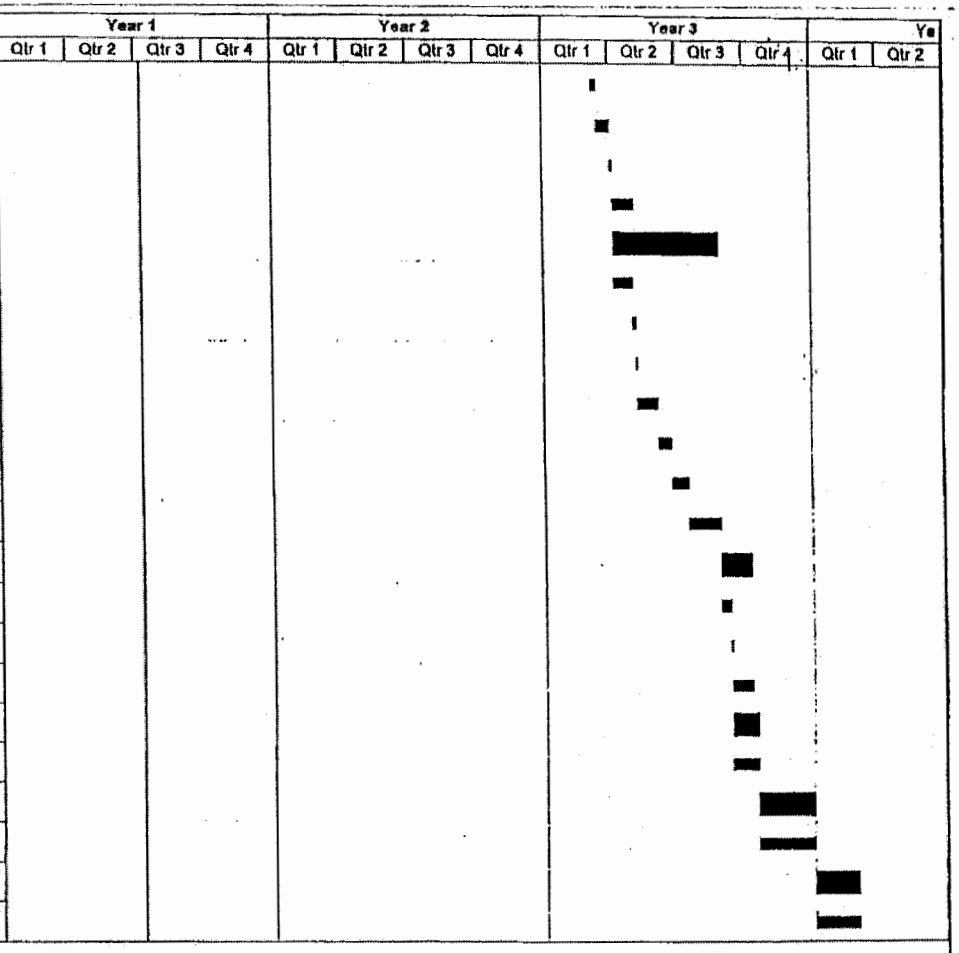


ID	Task Name	Duration
23	Cool-down Asphalt	1w
24	Excavate for Upper Plug	2.72w
25	Pour Concrete-Upper Plug (23' high-typ)	0.27w
26	Cure Concrete	4w
27	Compacted Salt Column-655.5'	22.87w
28	Emplace & Compact Crushed/Screened Salt	22.87w
29	Middle Concrete-Asphalt Waterstop-50'	10.67w
30	Excavate for Lower Plug	2.72w
31	Pour Concrete-Lower Plug	0.27w
32	Excavate Waterstop	0.84w
33	Place Asphalt	0.75w
34	Cool-down Asphalt	1w
35	Excavate for Upper Plug	2.72w
36	Pour Concrete-Upper Plug	0.27w
37	Cure Concrete	2w
38	Upper Salado Compacted Clay Column-351.5'	17.86w
39	Emplace Bentonite Blocks(351.5' high)	17.86w
40	Upper Concrete-Asphalt Waterstop-50'	12.67w
41	Excavate for Lower Plug	2.72w
42	Pour Concrete-Lower Plug	0.27w
43	Excavate Waterstop	0.84w
44	Place Asphalt	0.75w

64225

ID	Task Name	Duration
45	Cool-down Asphalt	1w
46	Excavate for Upper Plug	2.72w
47	Pour Concrete-Upper Plug	0.27w
48	Cure Concrete	4w
49	**Asphalt Column-142.3'**	20.71w
50	Remove Lining in Key	3.8w
51	Remove Chemical Seal Rings	0.6w
52	Mobilize to emplace asphalt	0.3w
53	Asphalt in Salt Section	4.01w
54	Asphalt in Lower Lined Section	2.33w
55	Complete Asphalt Emplacement	3.24w
56	Cool-down Asphalt	6.43w
57	**Concrete Plug-20'**	5.98w
58	Remove Concrete Lining & Rock	1.73w
59	Pour Concrete (20' high)	0.25w
60	Cure Concrete	4w
61	**Remove Concrete Shaft Lining**	5.07w
62	Remove 64' of lining--4 zones	5.07w
63	**Rustler Compacted Clay Column-234.7'**	10.99w
64	Emplace & Compact Bentonite (234.7' high)	10.99w
65	**Compacted Earthen Fill-447'**	6.25w
66	Emplace & Compact Earthen Fill (447' high)	6.25w



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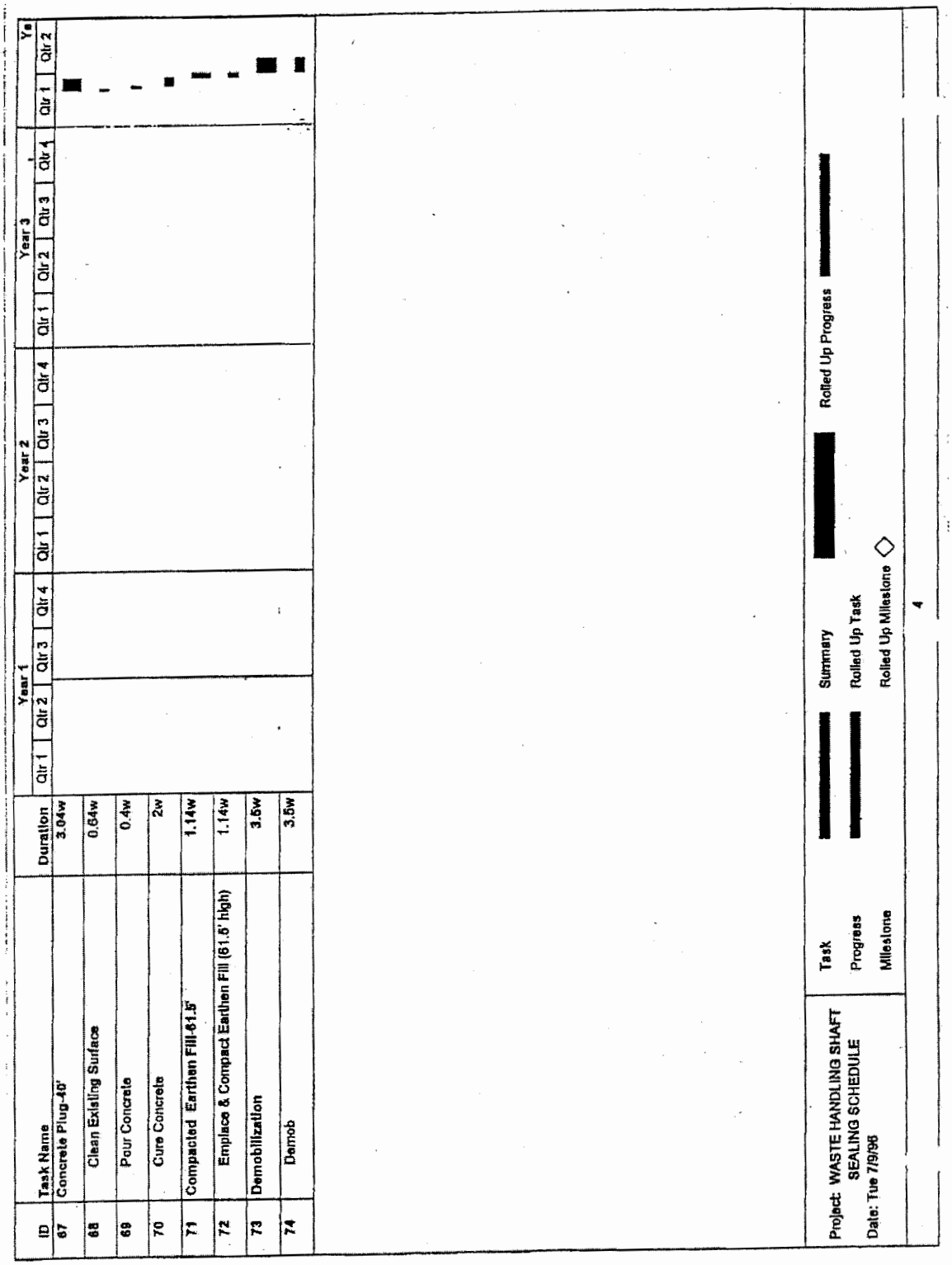
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Year 3
Qtr 1
Qtr 2
Qtr 3
Qtr 4
67 Concrete Plug-40' 3.04w
68 Clean Existing Surface 0.64w
69 Pour Concrete 0.4w
70 Cure Concrete 2w
71 Compacted Earthen Fill-61.5' 1.14w
72 Emplace & Compact Earthen Fill (61.5' high) 1.14w
73 Demobilization 3.5w
74 Demob 3.5w
Project: WASTE HANDLING SHAFT SEALING SCHEDULE
Date: Tue 7/9/96
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
4

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B5. References

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FIGURES

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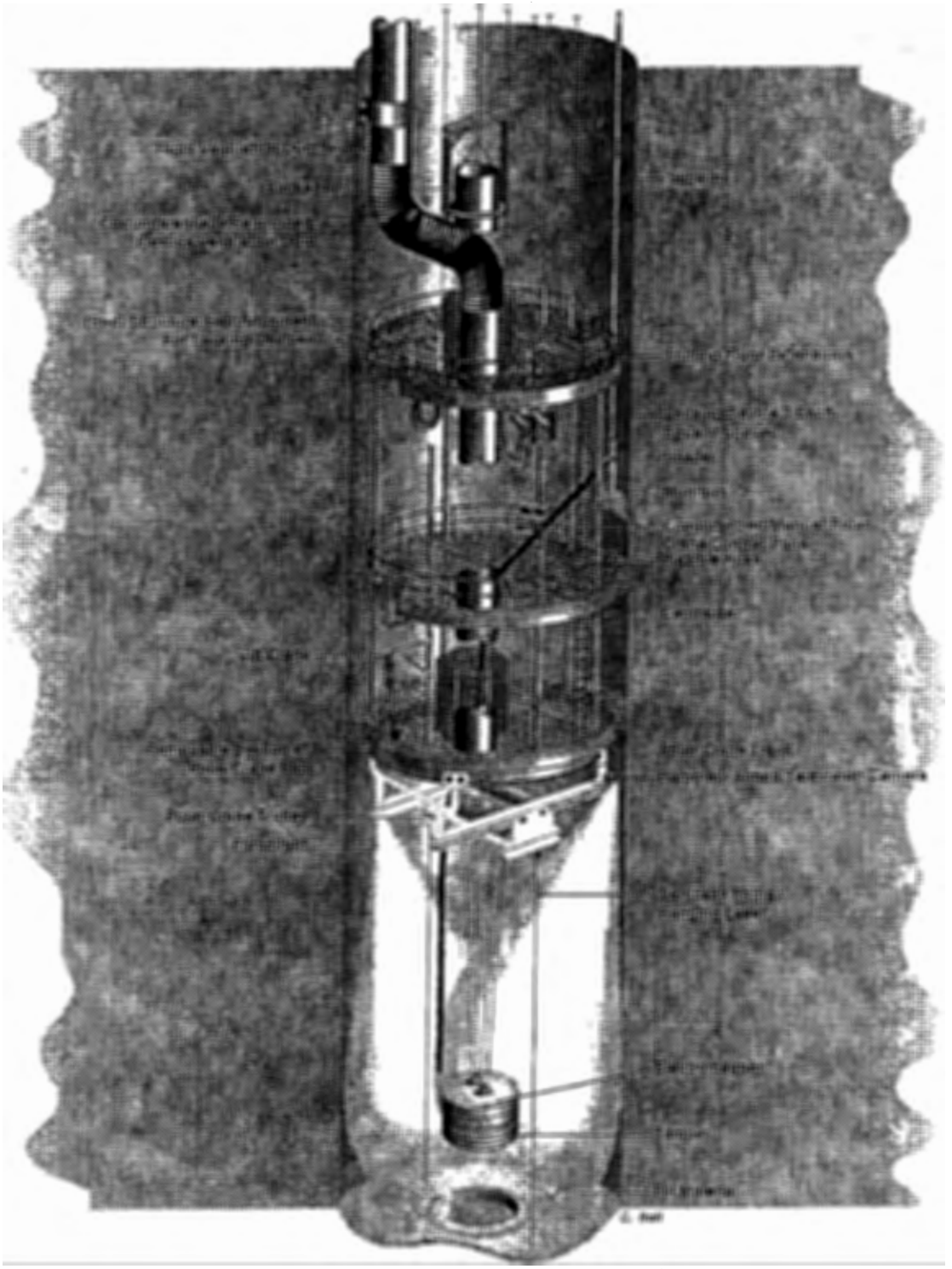

Figure G2B-1
Multi-Deck Stage Illustrating Dynamic Compaction

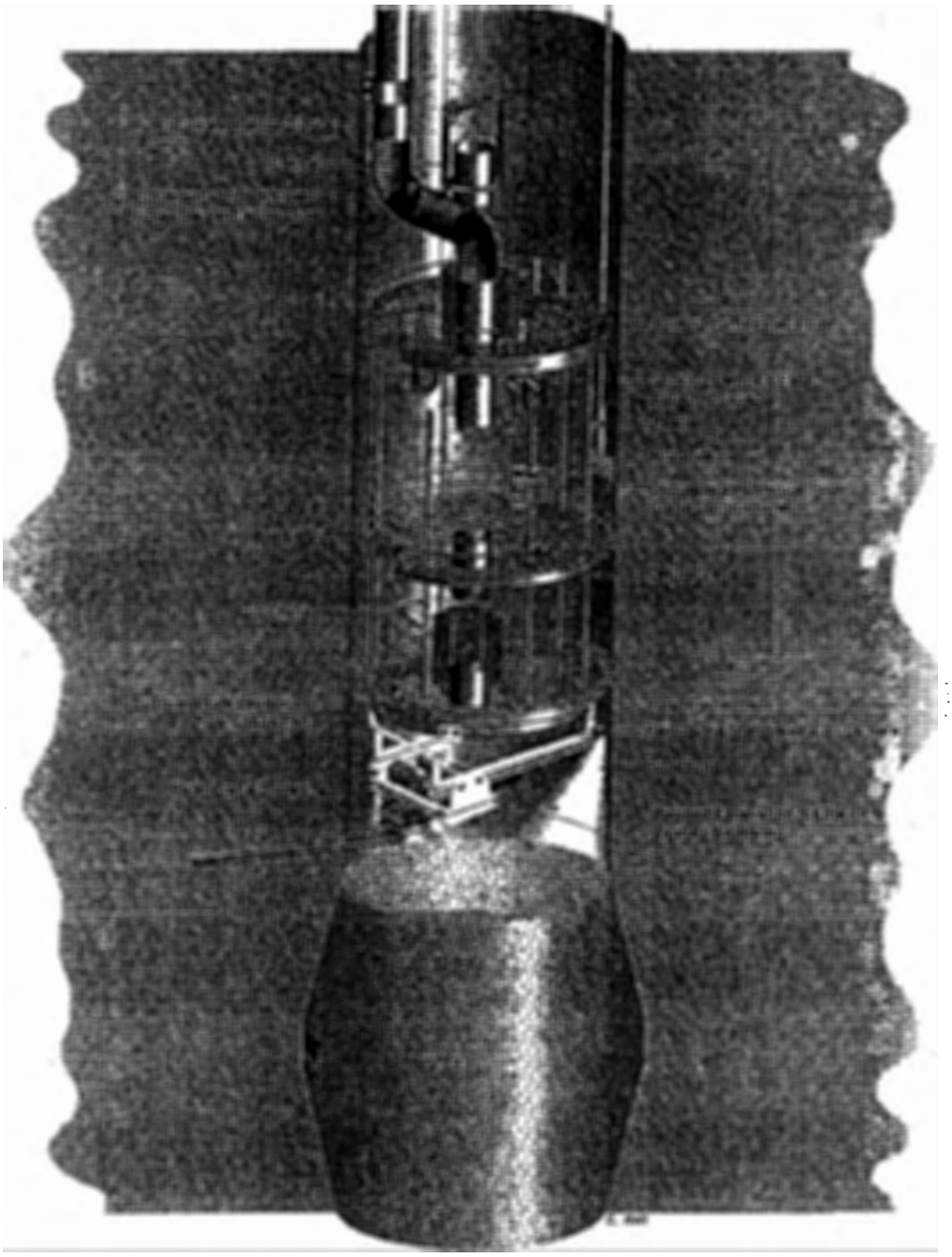

Figure G2B-2
Multi-Deck Stage Illustrating Excavation for Asphalt Waterstop

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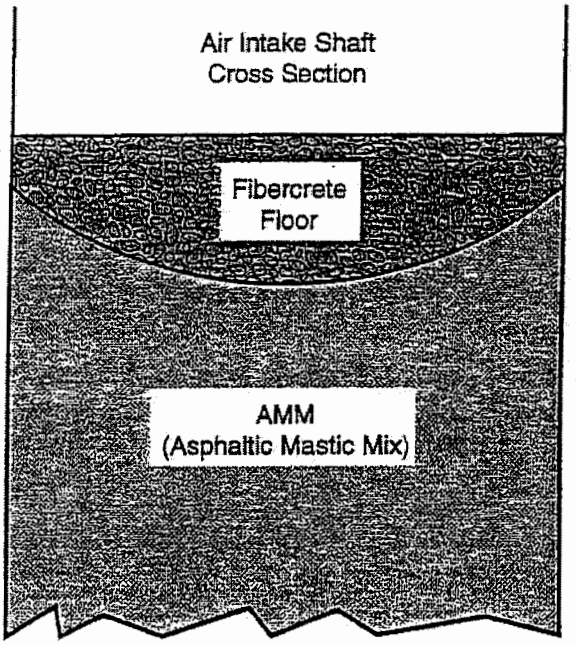

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Figure G2B-3
Typical Fibercrete at Top of Asphalt

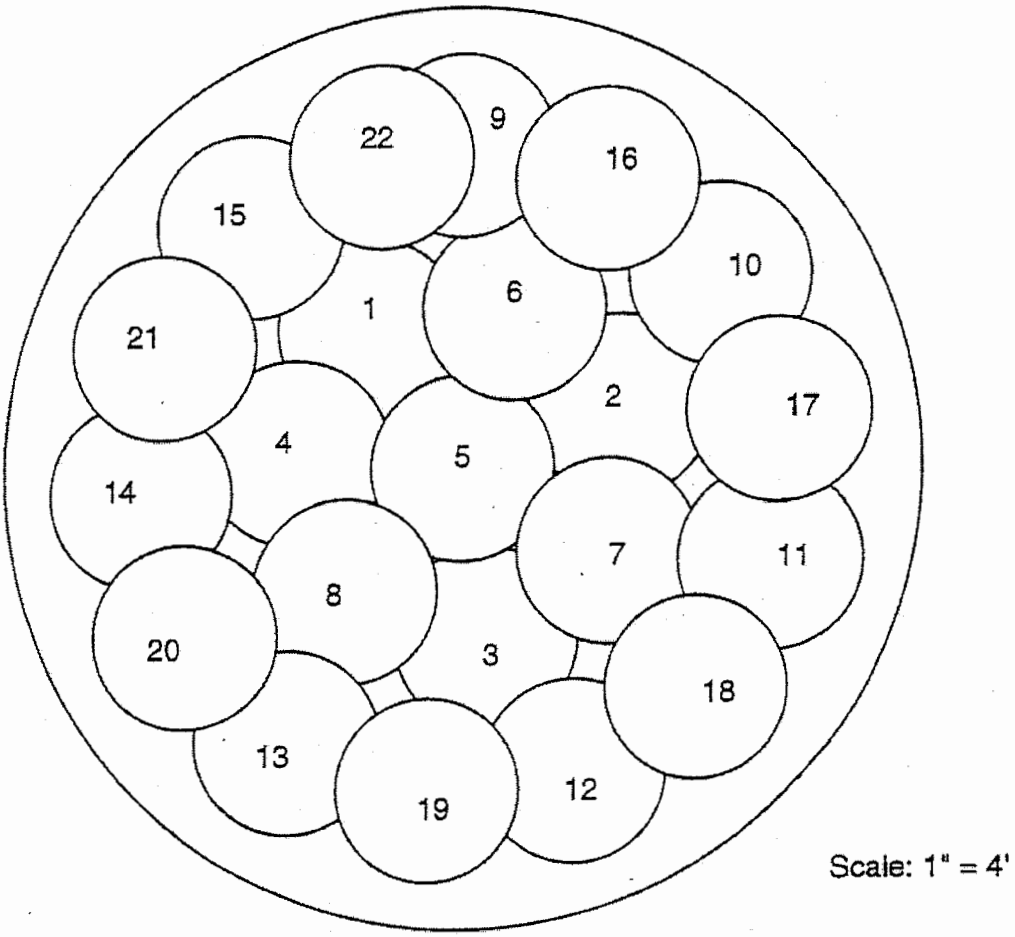


Figure G2B-4
Drop Pattern for 6-m-Diameter Shaft Using a 1.2-m-Diameter Tamper

04235

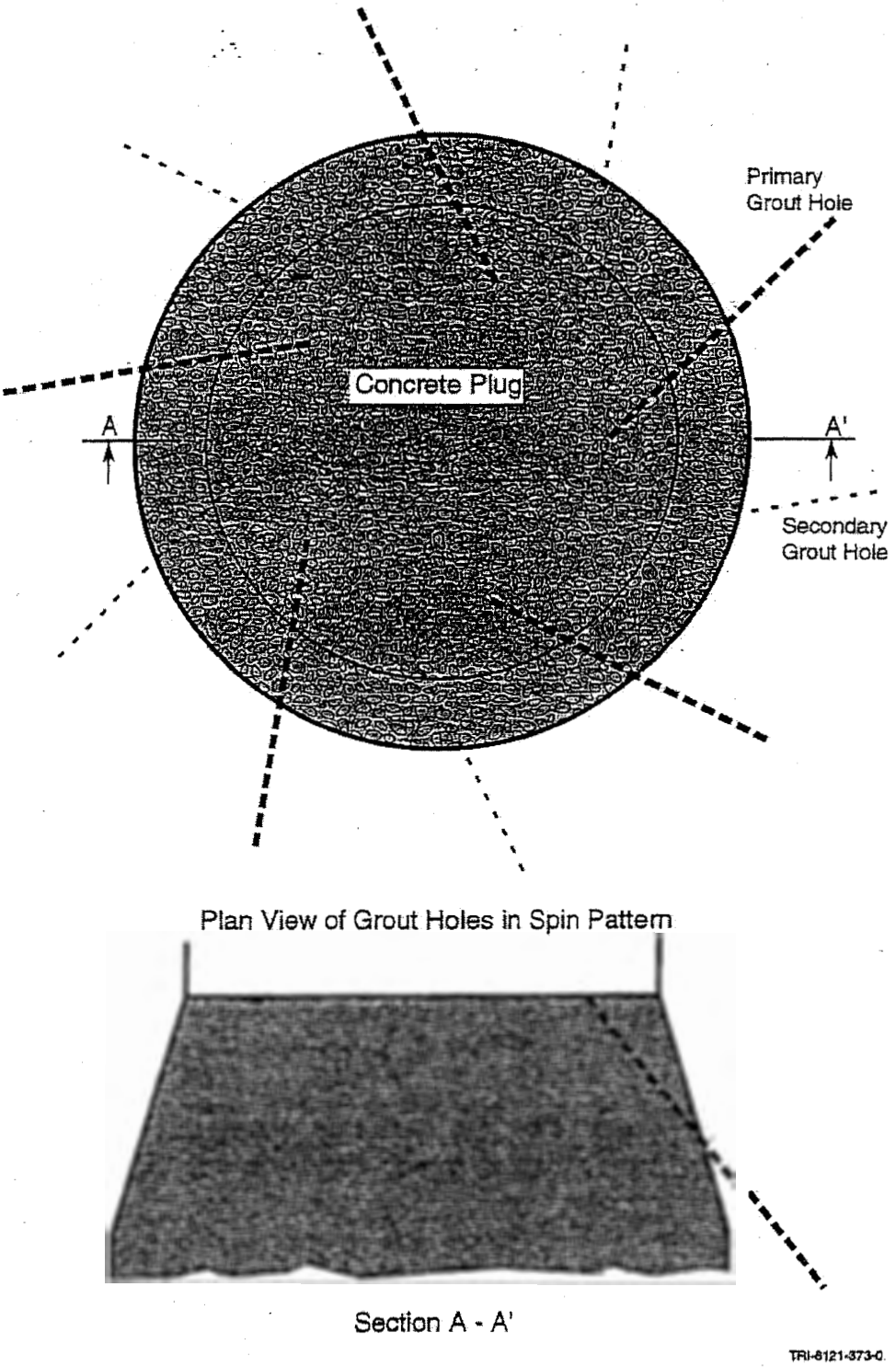
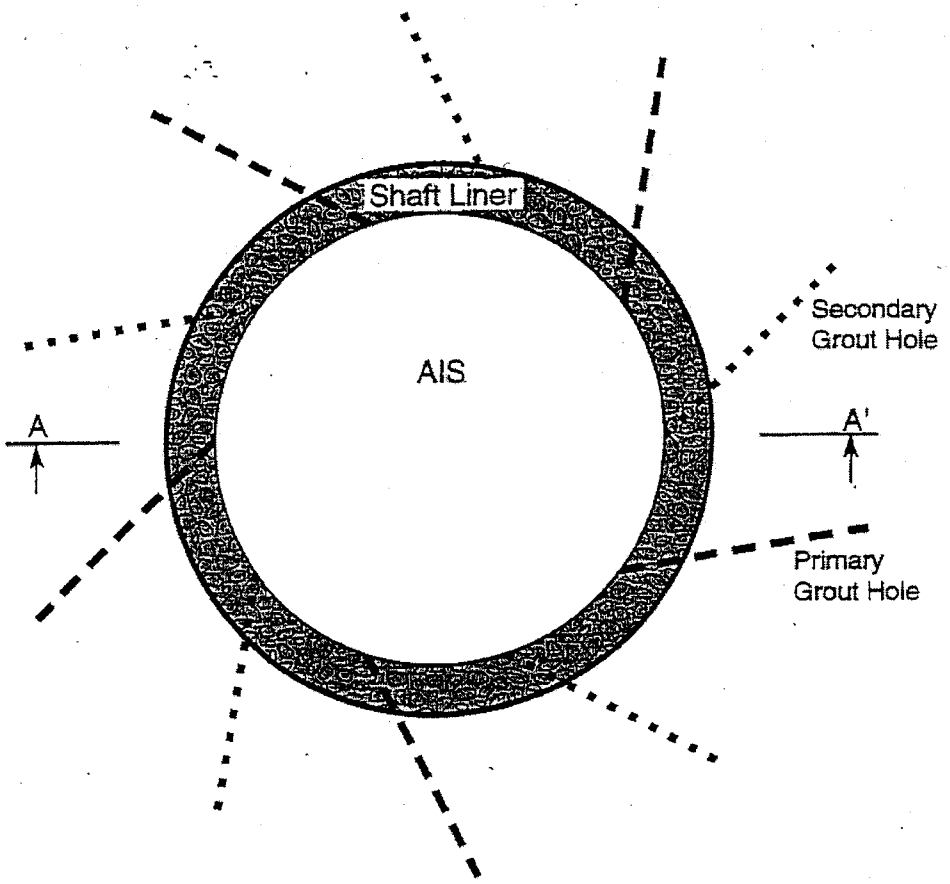
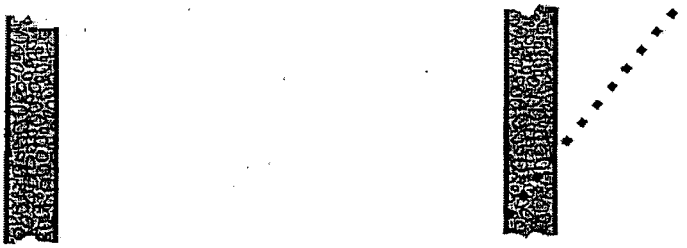


Figure G2B-5
Plan and Section Views of Downward Spin Pattern of Grout Holes



Plan View of Grout Holes in Spin Pattern



Section A - A'

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Figure G2B-6
Plan and Section Views of Upward Spin Pattern of Grout Holes

: QH237

ATTACHMENT G2
APPENDIX E

DESIGN DRAWINGS

SHAFT SEALING SYSTEM
COMPLIANCE SUBMITTAL DESIGN REPORT

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SAND96-1326/2
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Printed August 1996

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Category UC-721

Waste Isolation Pilot Plant
Shaft Sealing System
Compliance Submittal Design Report

Volume 2 of 2:
Appendix E

Repository Isolation Systems Department
Sandia National Laboratories
Albuquerque, NM 87185

ABSTRACT

This is the second volume of a two-volume report describing a shaft sealing system design for the Waste Isolation Pilot Plant. This appendix contains detailed drawings of the shaft sealing system and its components.

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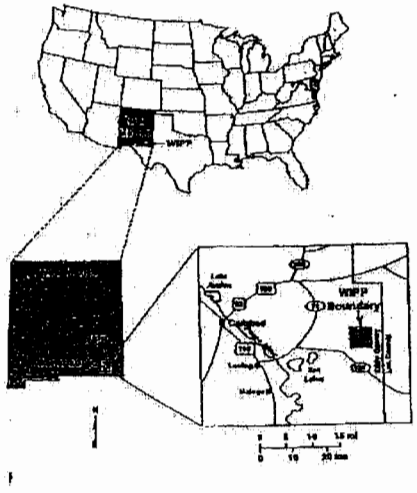
WASTE ISOLATION PILOT PLANT

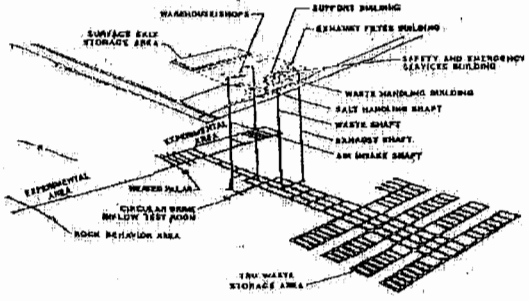
CARLSBAD, NM

SHAFT SEALING SYSTEM DESIGN

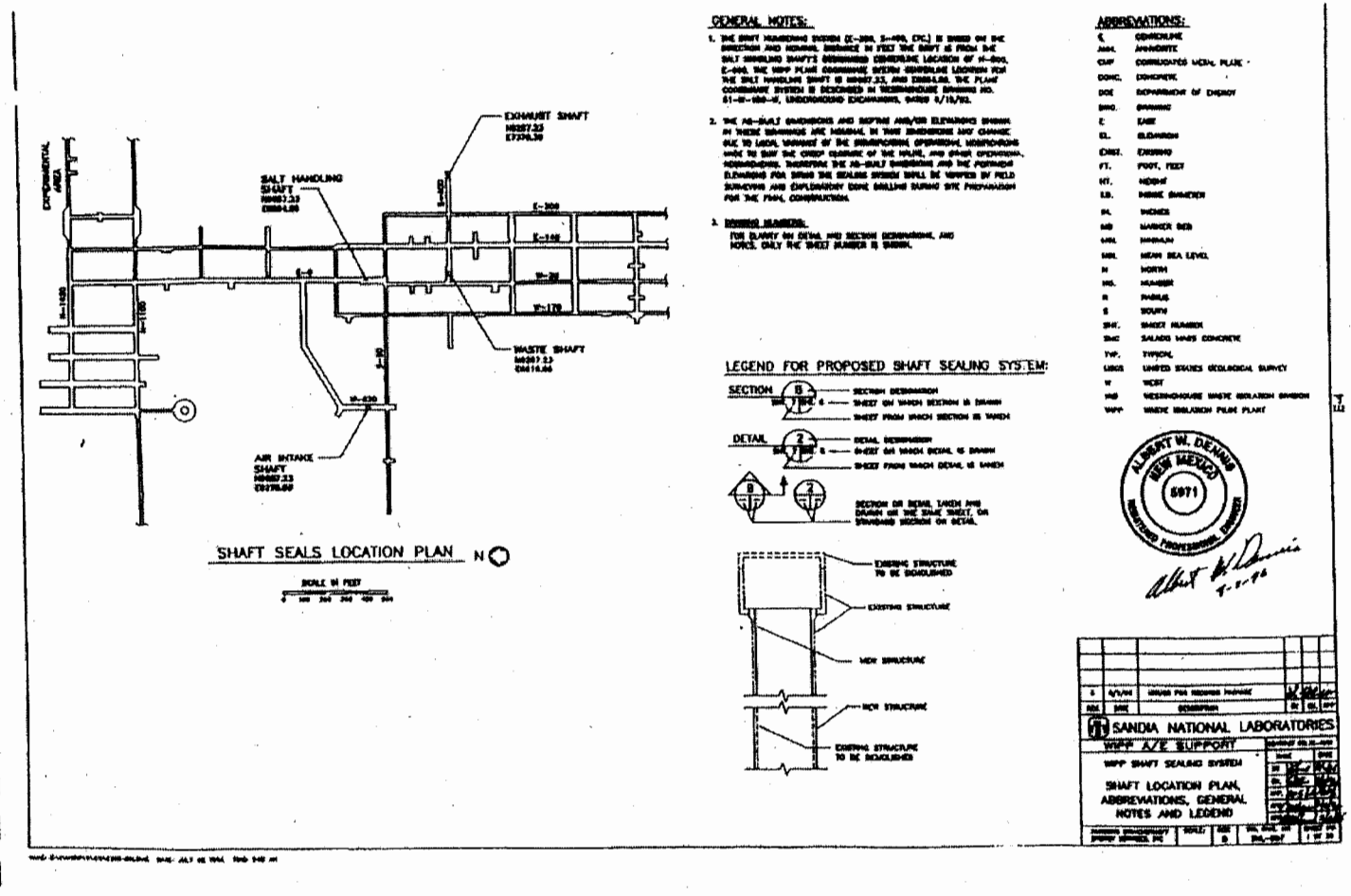
DESIGN DRAWINGS



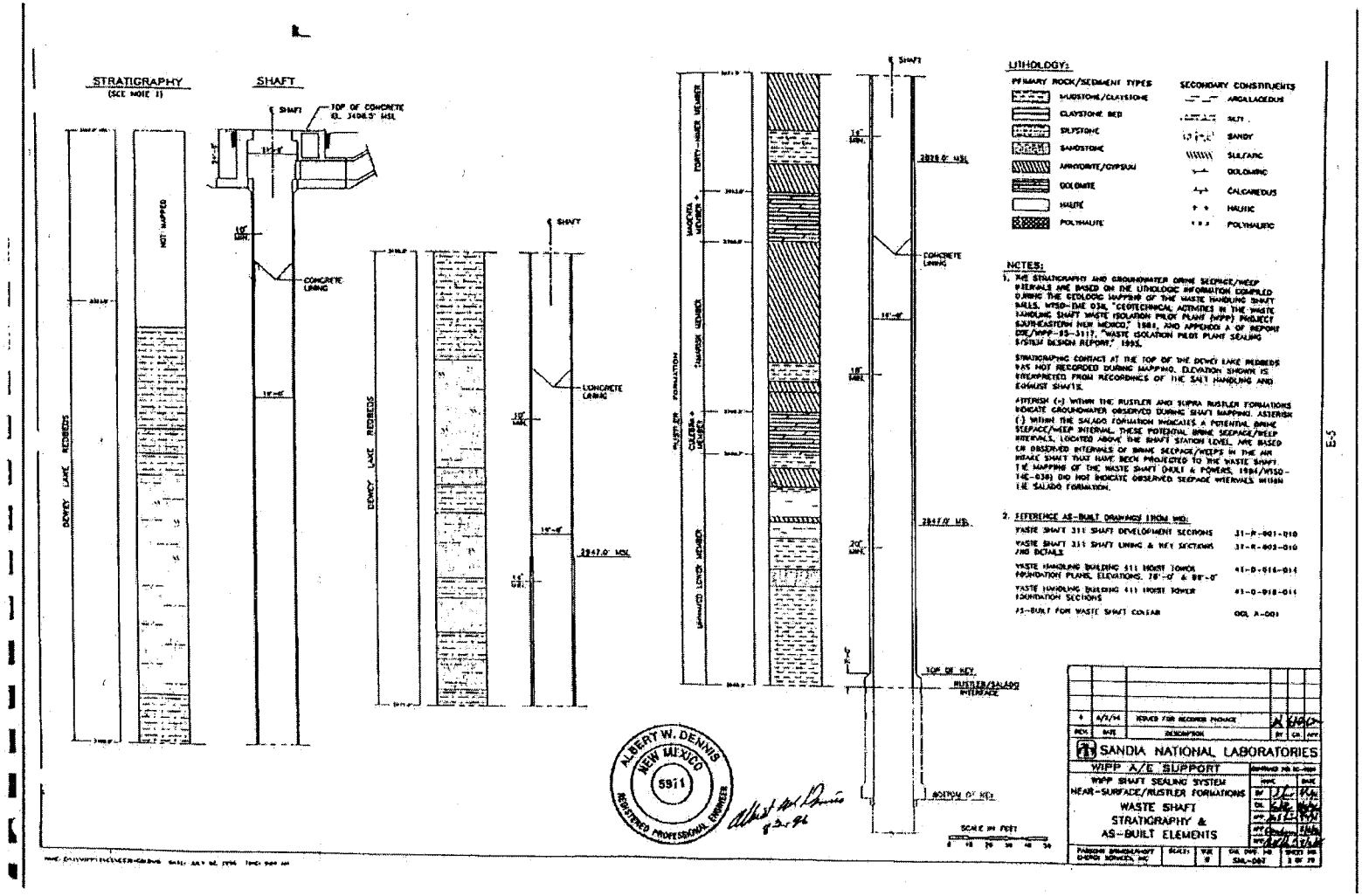
WIPP LAYOUT



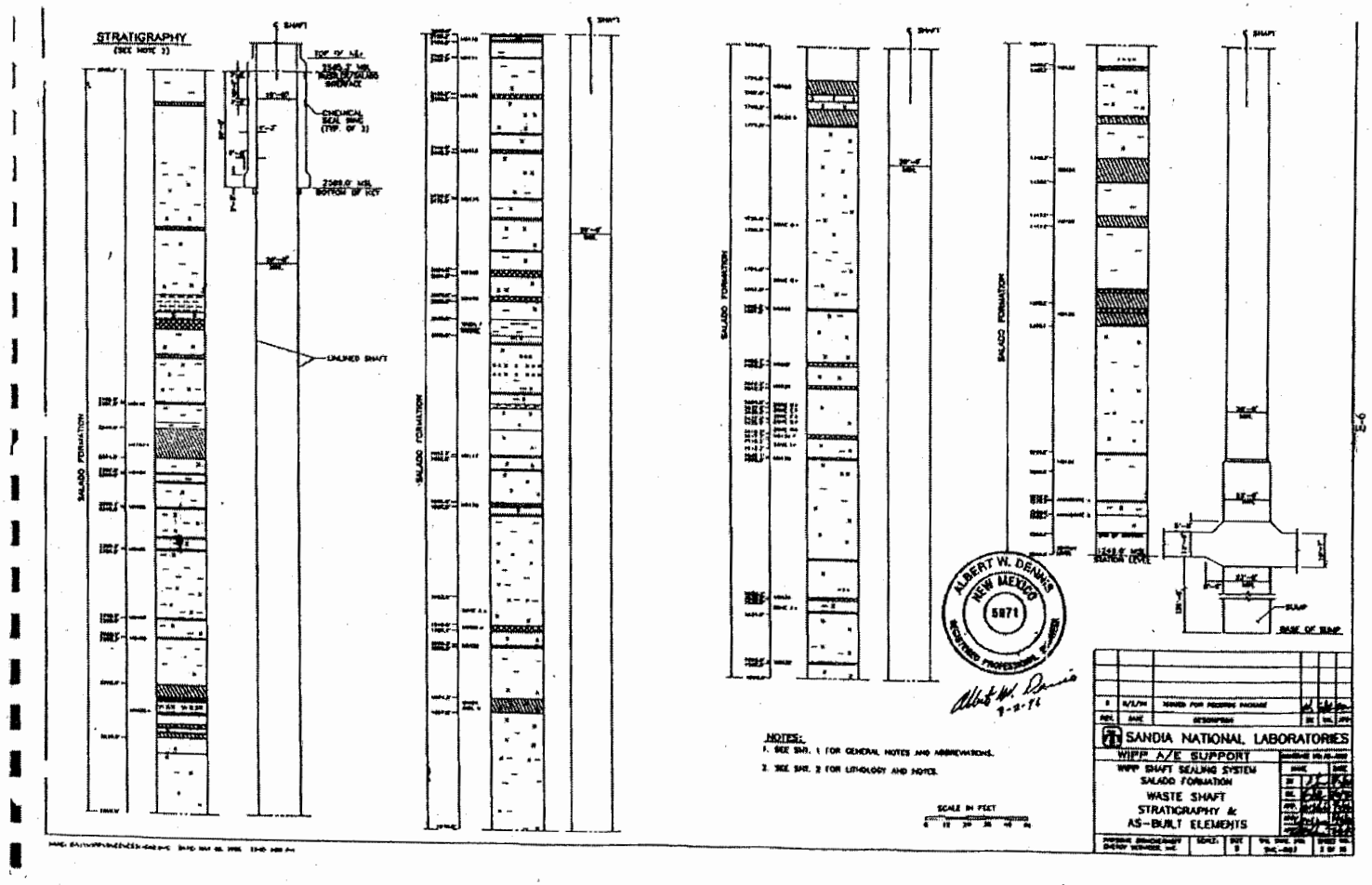
DRAWING NUMBER	TITLE
SNL-007 1 OF 28	WIPP SHAFT SEALING SYSTEM SHAFT LOCATION PLAN, ABBREVIATIONS, GENERAL NOTES AND LEGEND
SNL-007 2 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS WASTE SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 3 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION WASTE SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 4 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS WASTE SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 5 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION HALITE SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 6 OF 28	WIPP SHAFT SEALING SYSTEM WASTE SHAFT SHAFT STATION MONOLITH
SNL-007 7 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS AIR INTAKE SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 8 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION AIR INTAKE SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 9 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS AIR INTAKE SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 10 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION AIR INTAKE SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 11 OF 28	WIPP SHAFT SEALING SYSTEM AIR INTAKE SHAFT SHAFT STATION MONOLITH
SNL-007 12 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS EXHAUST SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 13 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION EXHAUST SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 14 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS EXHAUST SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 15 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION EXHAUST SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 16 OF 28	WIPP SHAFT SEALING SYSTEM EXHAUST SHAFT SHAFT STATION MONOLITH
SNL-007 17 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS SALT HANDLING SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 18 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION SALT HANDLING SHAFT STRATIGRAPHY & AS-BUILT ELEMENTS
SNL-007 19 OF 28	WIPP SHAFT SEALING SYSTEM NEAR-SURFACE/RUSTLER FORMATIONS SALT HANDLING SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 20 OF 28	WIPP SHAFT SEALING SYSTEM SALADO FORMATION SALT HANDLING SHAFT STRATIGRAPHY & SEALING SUBSYSTEM PROFILE
SNL-007 21 OF 28	WIPP SHAFT SEALING SYSTEM SALT HANDLING SHAFT SHAFT STATION MONOLITH
SNL-007 22 OF 28	WIPP SHAFT SEALING SYSTEM CONCRETE-ASPHALT WATERSTOP IN SALADO FORMATION
SNL-007 23 OF 28	WIPP SHAFT SEALING SYSTEM ASPHALT COLLAR
SNL-007 24 OF 28	WIPP SHAFT SEALING SYSTEM UPPER AND LOWER SALADO COMPACTED CLAY COLUMNS
SNL-007 25 OF 28	WIPP SHAFT SEALING SYSTEM COMPACTED SALT COLUMN
SNL-007 26 OF 28	WIPP SHAFT SEALING SYSTEM CONCRETE PLUG
SNL-007 27 OF 28	WIPP SHAFT SEALING SYSTEM RUSTLER COMPACTED CLAY COLUMN
SNL-007 28 OF 28	WIPP SHAFT SEALING SYSTEM COMPACTED MARINER FILL AND CONCRETE PLUG



1 Shaft Location Plan, Abbreviations, General Notes and Legend Sheet 1 of 28

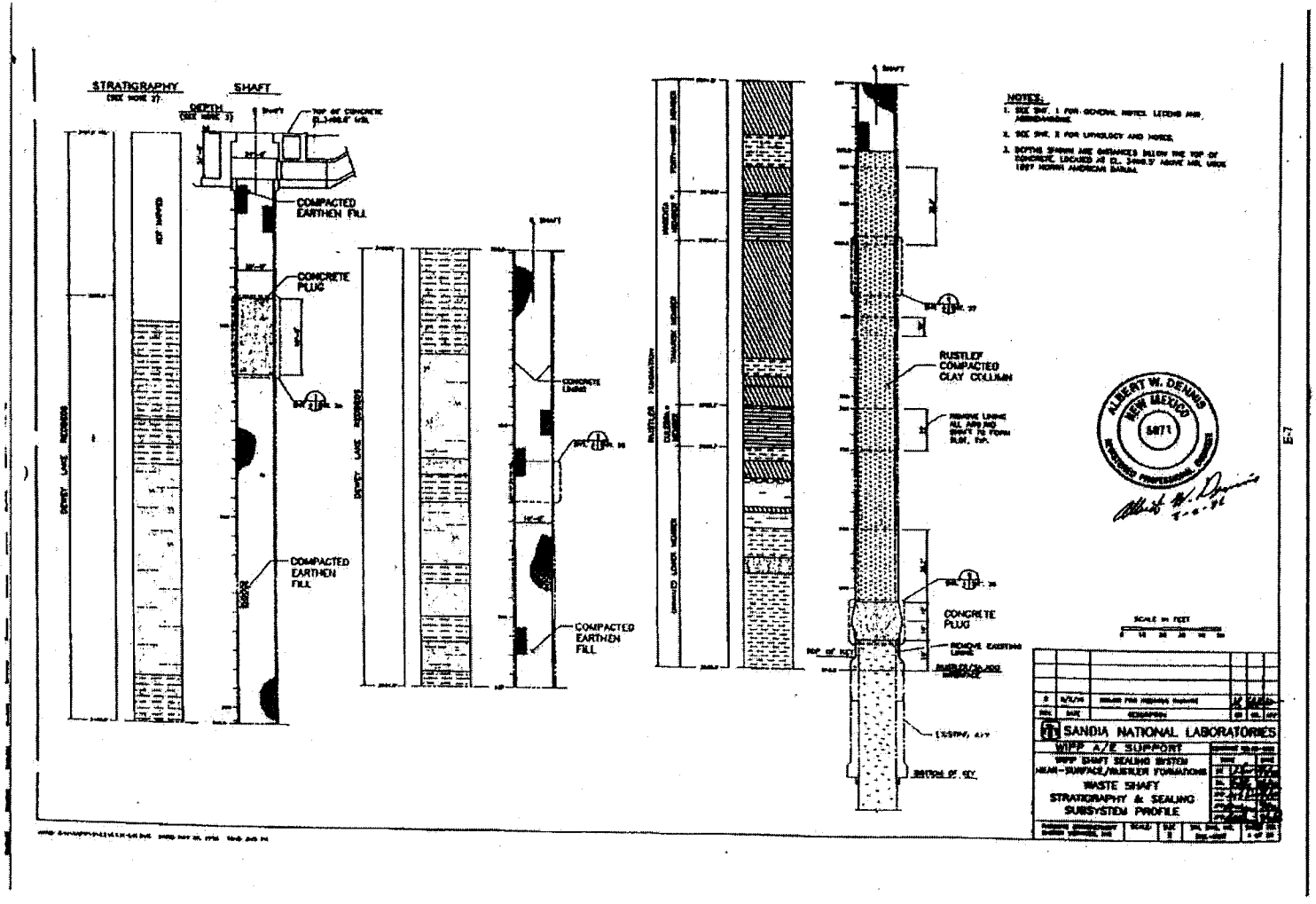


1 Near-Surface/Rustler Formations Waste Shaft Stratigraphy and AS-Built Elements Sheet 2 of 28



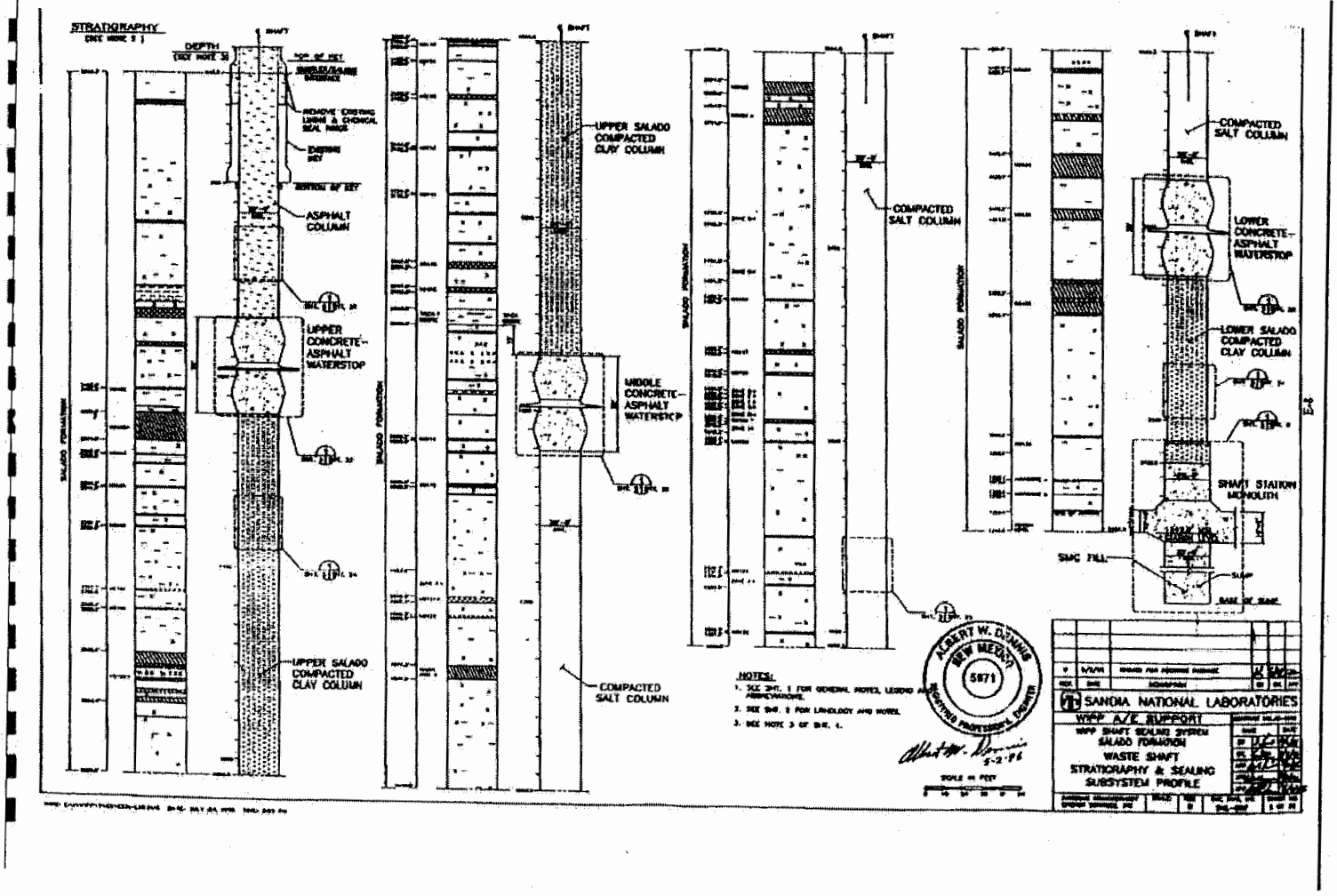
Salado Formation Waste Shaft Stratigraphy and AS-Built Elements

Sheet 3 of 28



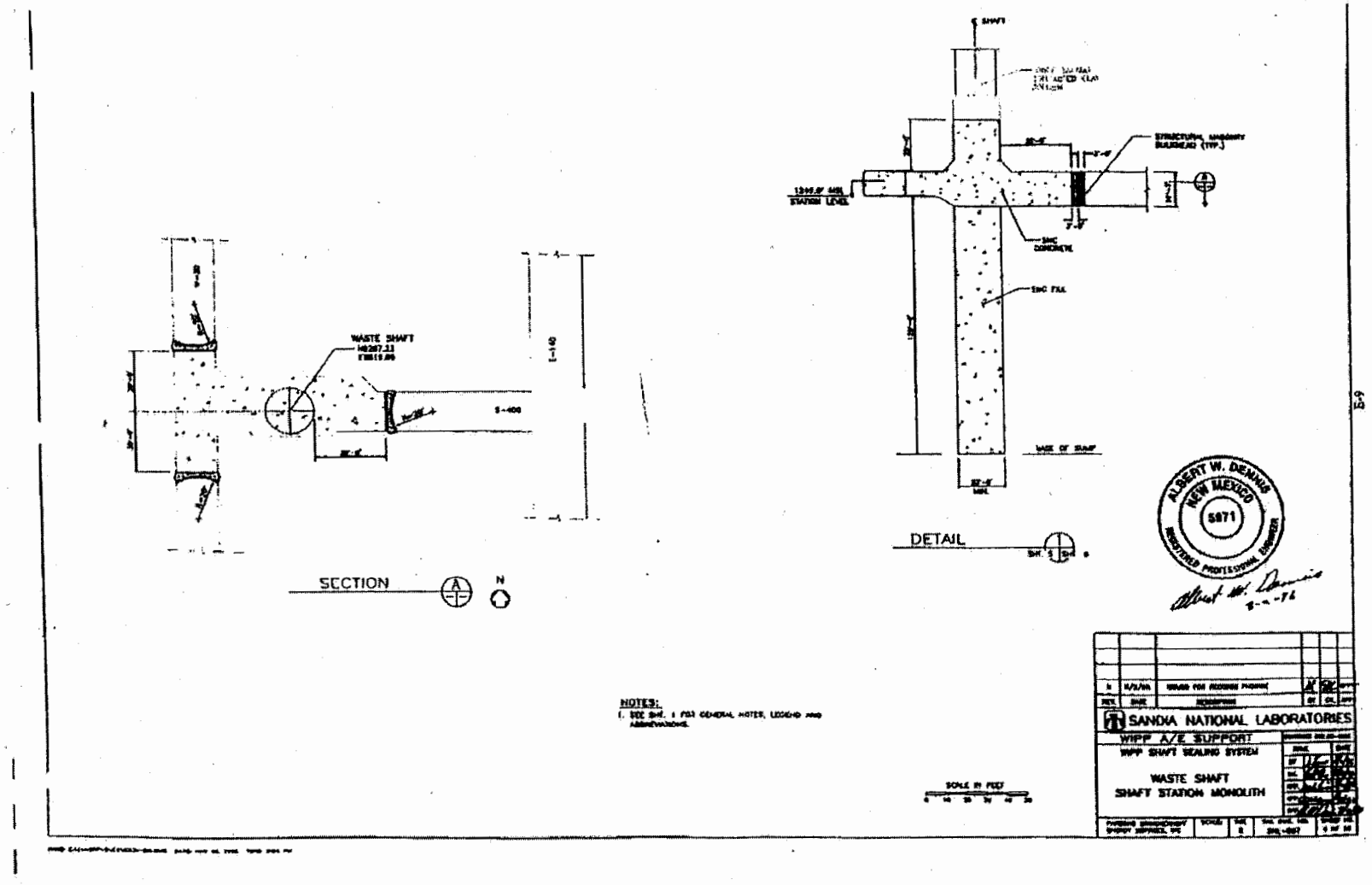
Near-Surface/Rustler Formations Waste Shaft Stratigraphy and Sealing Subsystem Profile

Sheet 4 of 28



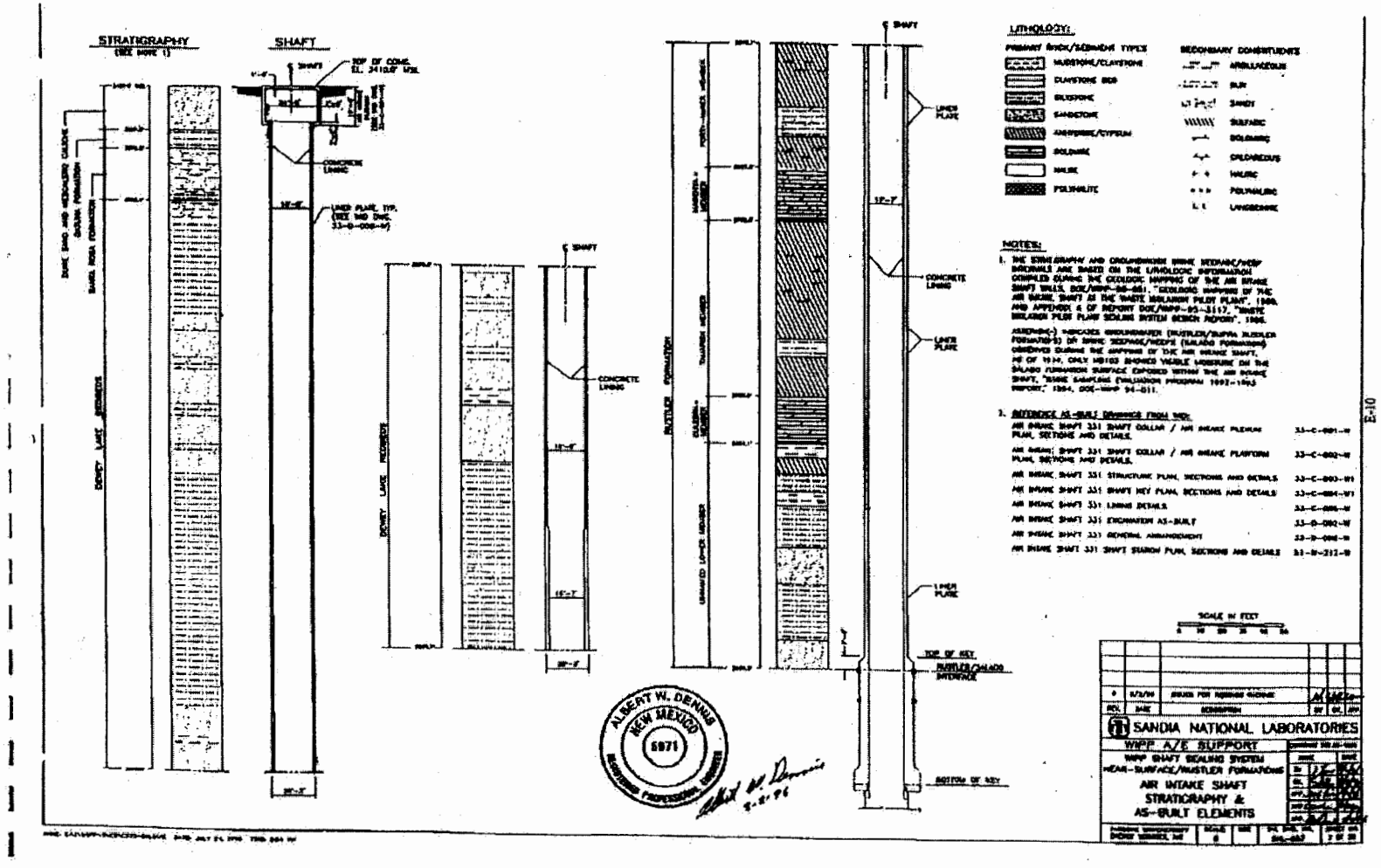
Salado Formation Waste Shaft Stratigraphy and Sealing Subsystem Profile

Sheet 5 of 28



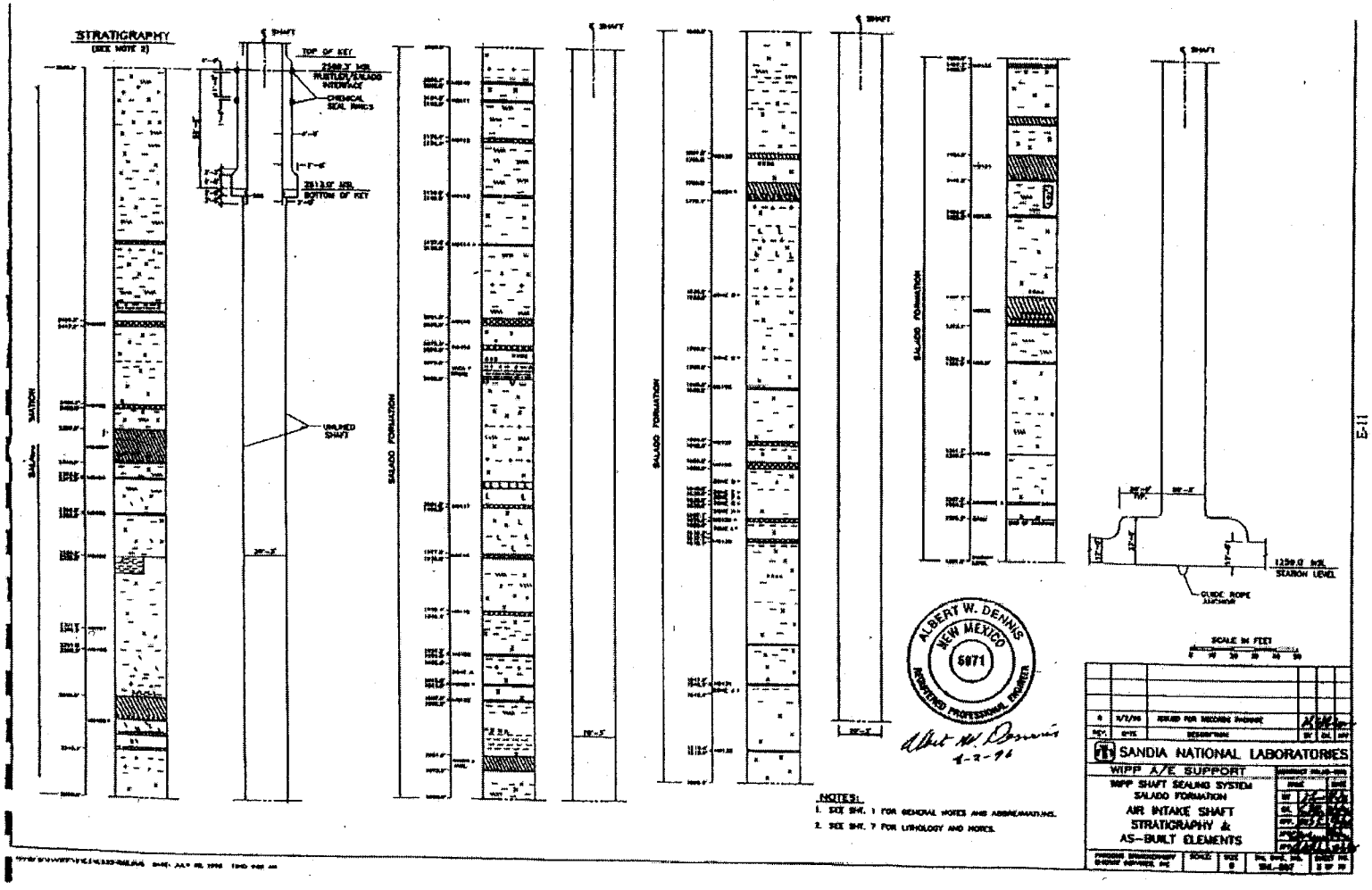
Waste Shaft Station Monolith

Sheet 6 of 28



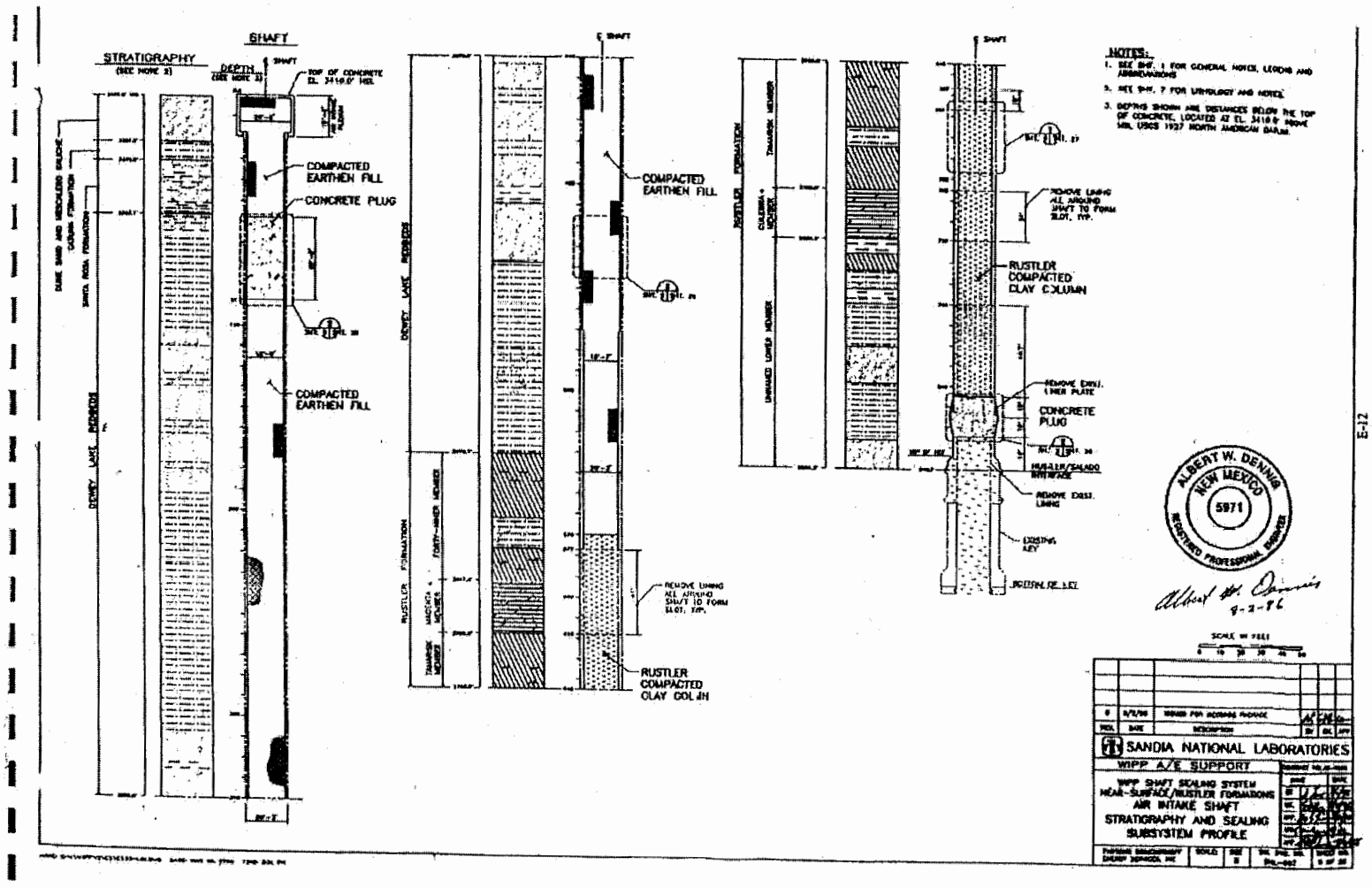
Near-Surface / Rustler Formations Air Intake Shaft Stratigraphy and AS-Built Elements

Sheet 7 of 28

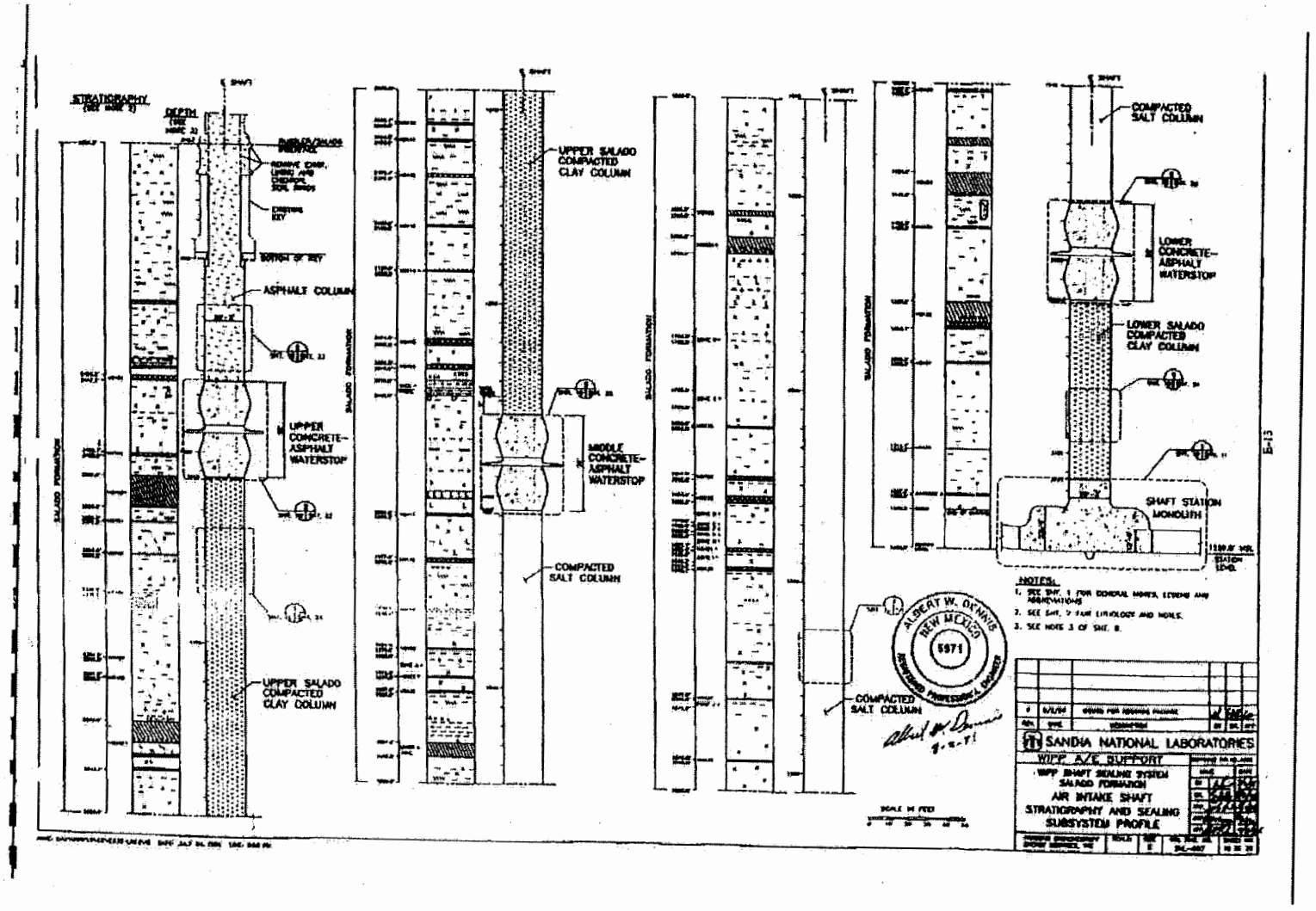


Salado Formation Air Intake Shaft Stratigraphy and AS-Built Elements

Sheet 8 of 28

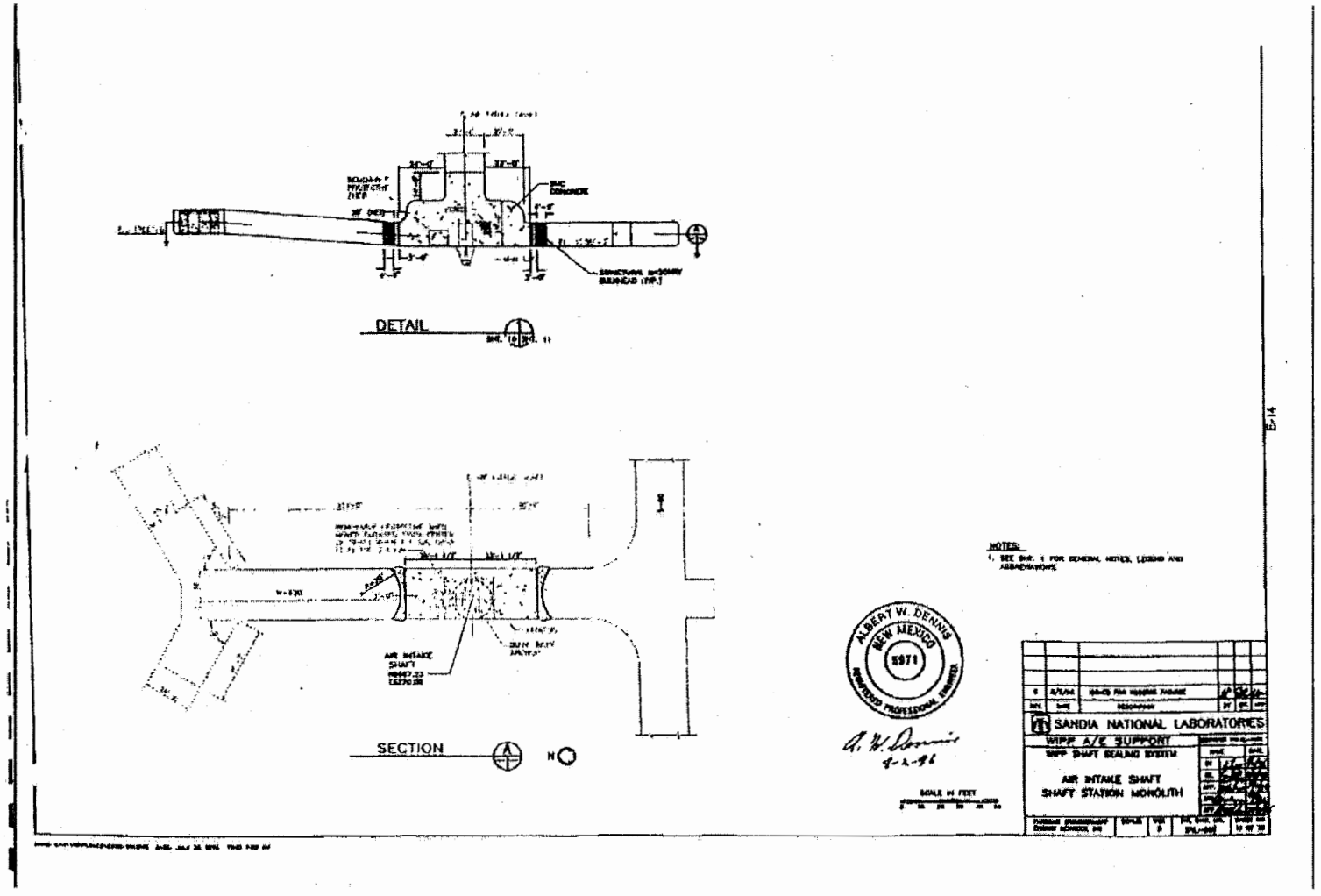


Near-Surface / Rustler Formations Air Intake Shaft Stratigraphy and Sealing Subsytem Profile



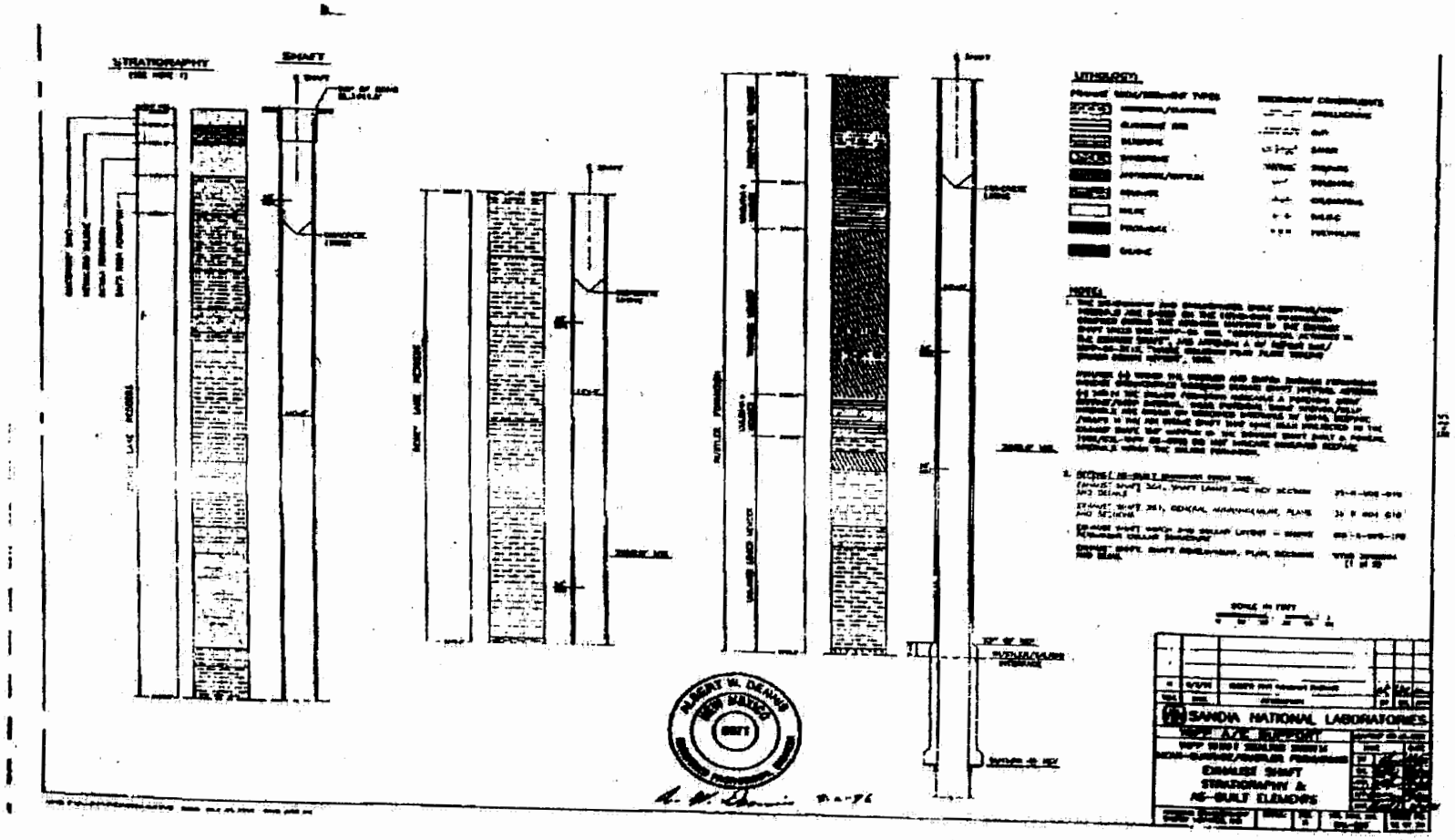
Salado Formation Air Intake Shaft Stratigraphy and Sealing Subsytem Profile

Sheet 10 of 28

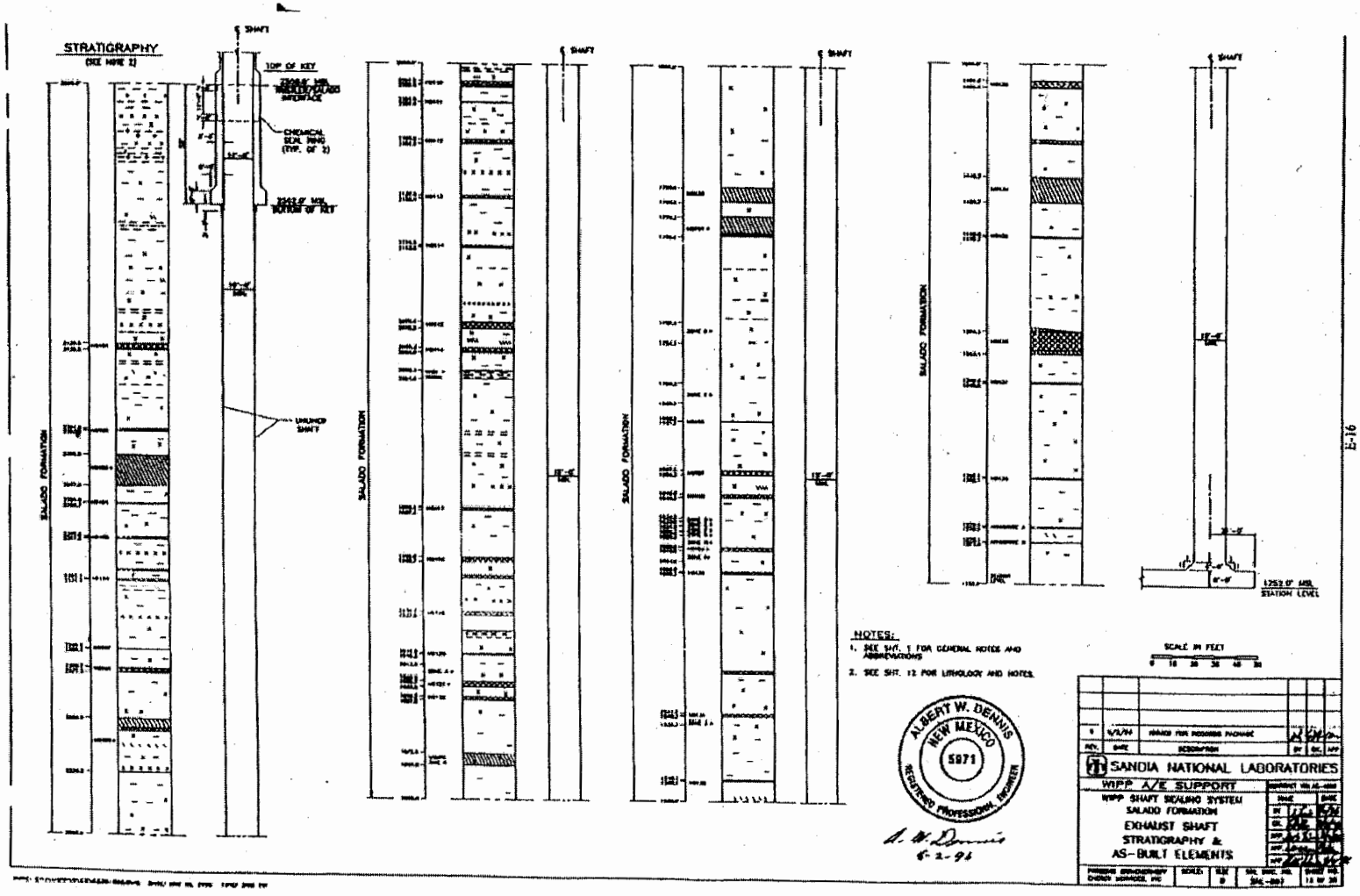


Air Intake Shaft Station Monolith

Sheet 11 of 28

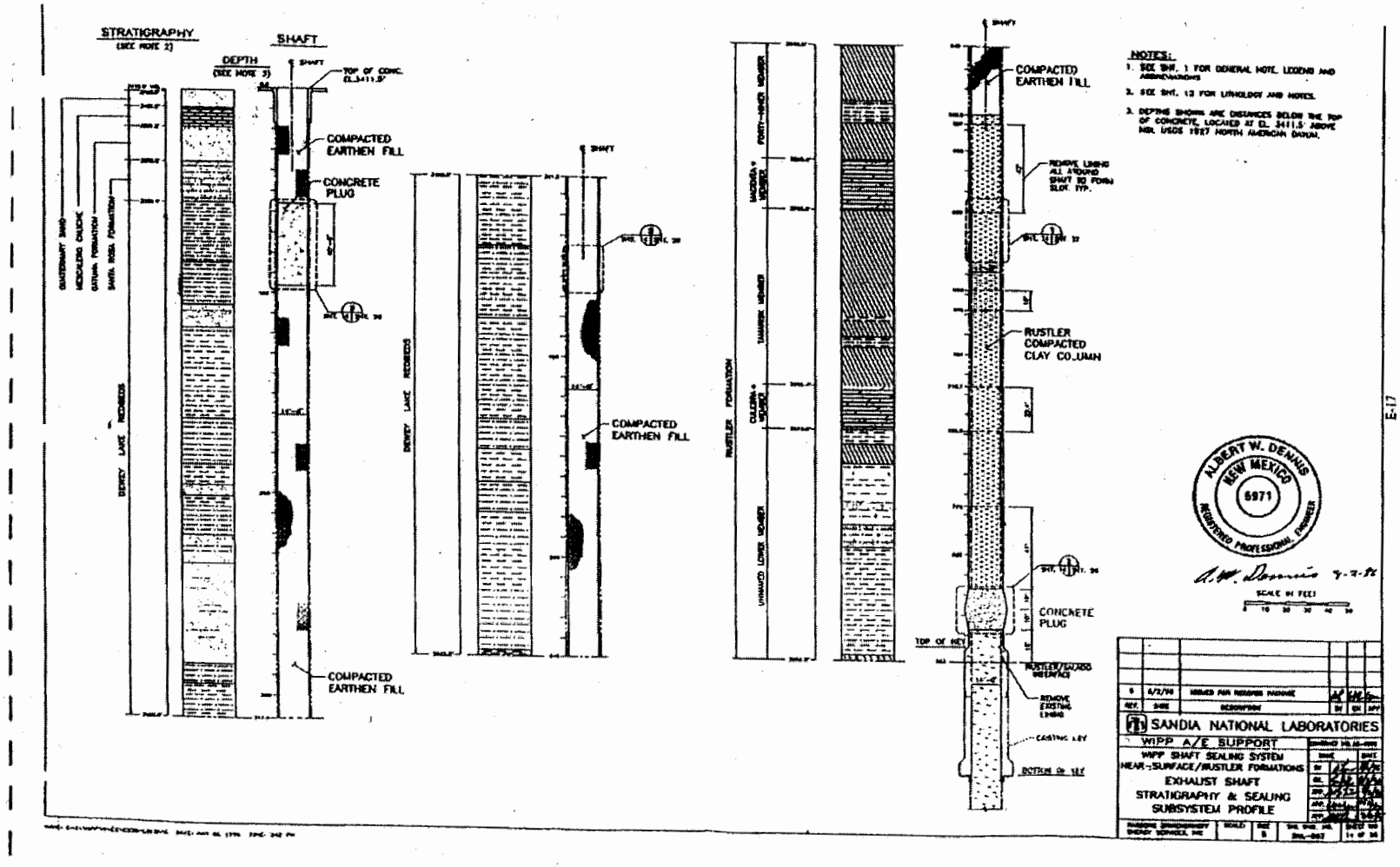


1 Near-Surface / Rustler Formations Exhaust Shaft Stratigraphy and AS-Built Elements Sheet 12 of 28



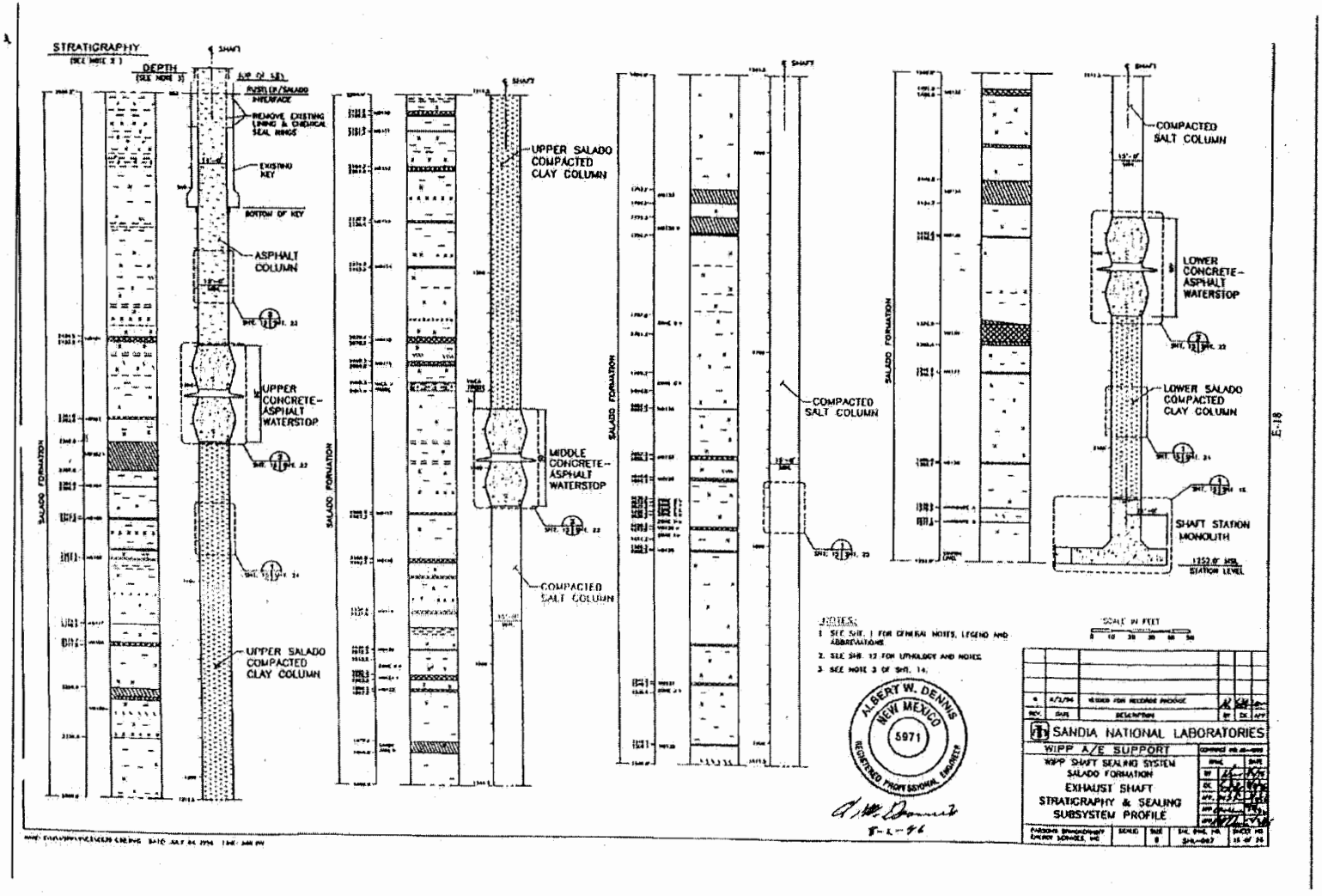
Salado Formation Exhaust Shaft Stratigraphy and AS-Built Elements

Sheet 13 of 28



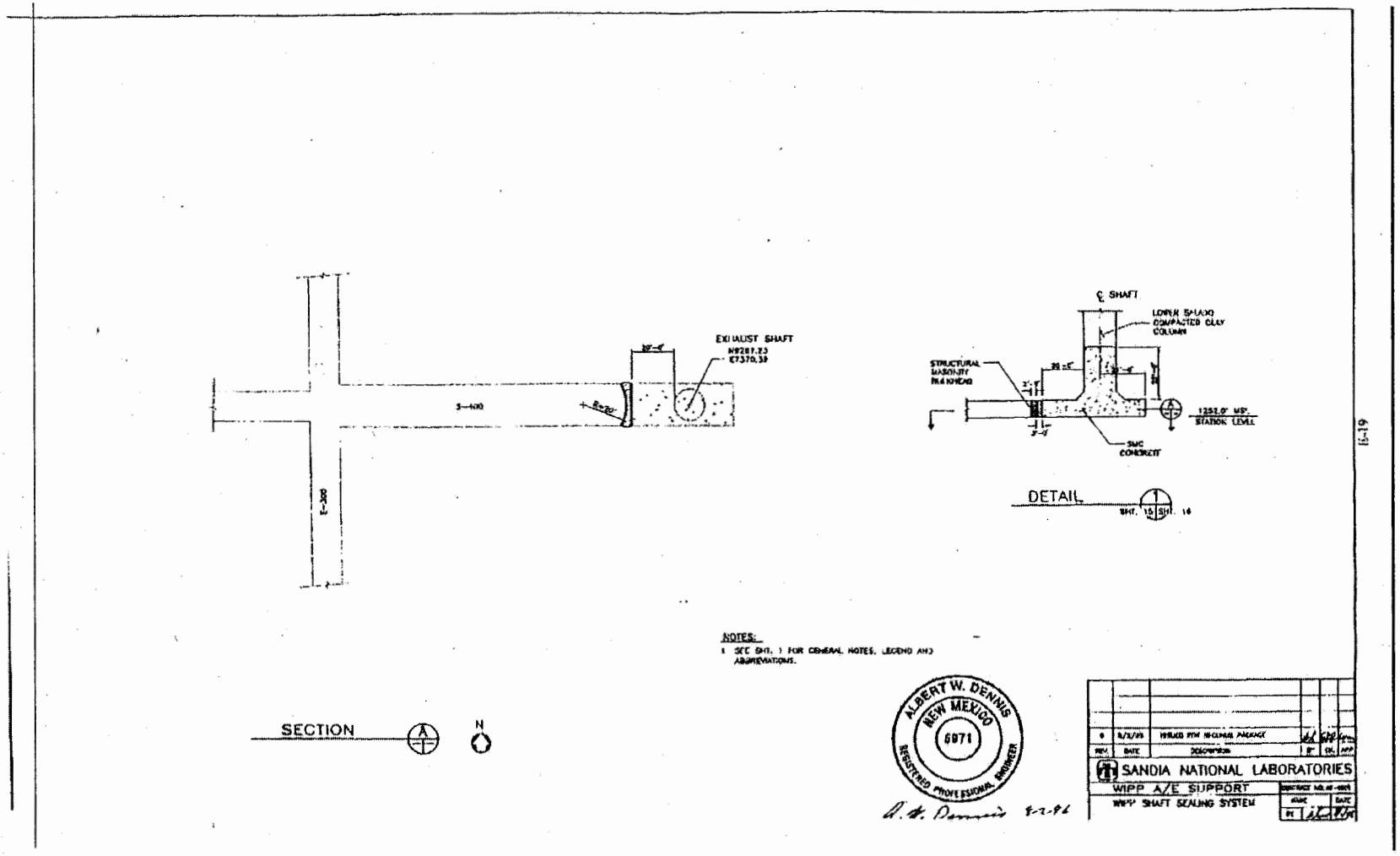
Near-Surface / Rustler Formations Exhaust Shaft Stratigraphy and Sealing Subsystem Profile

Sheet 14 of 28



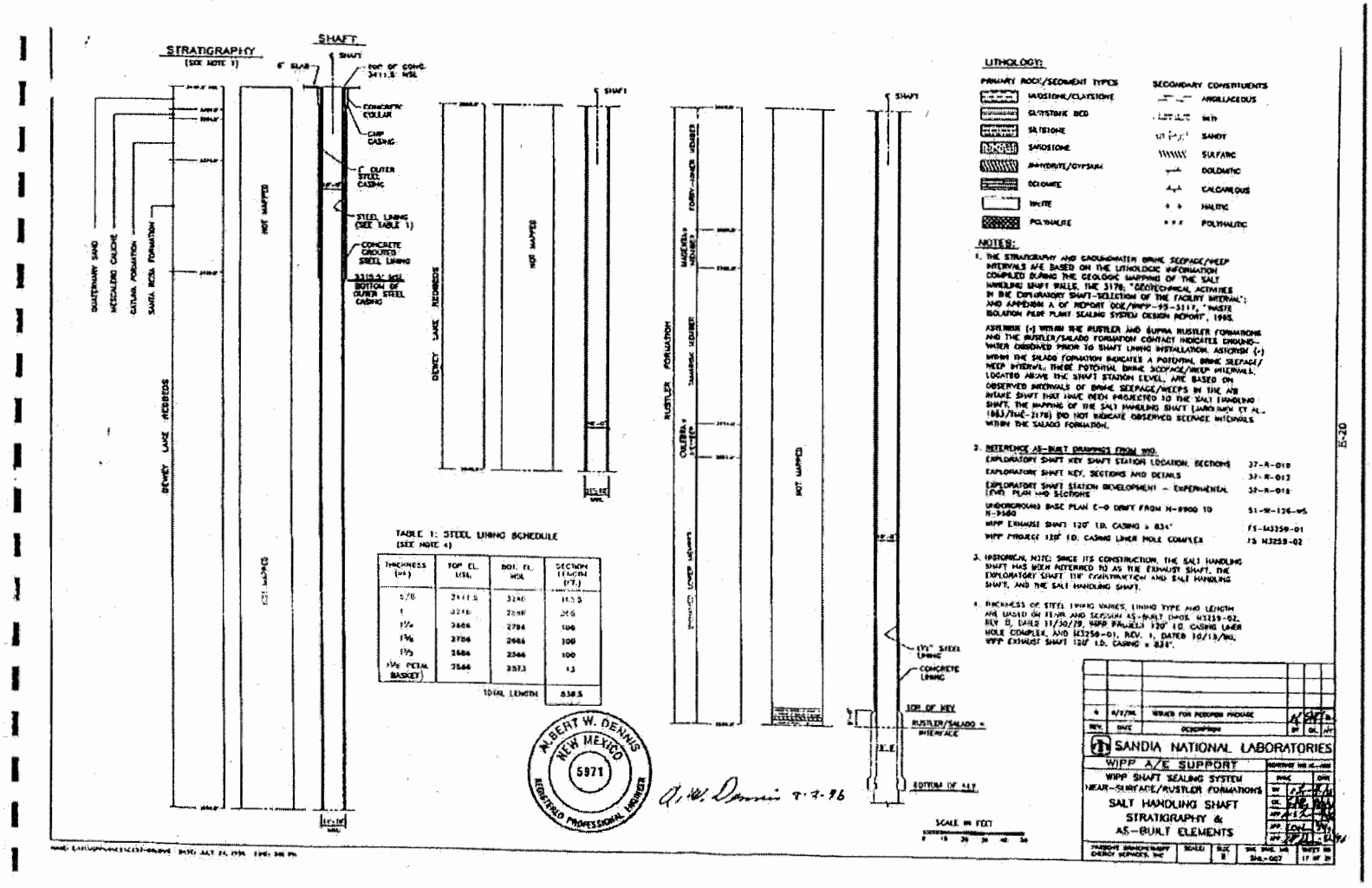
Salado Formation Exhaust Shaft Stratigraphy and Sealing Subsystem Profile

Sheet 15 of 28

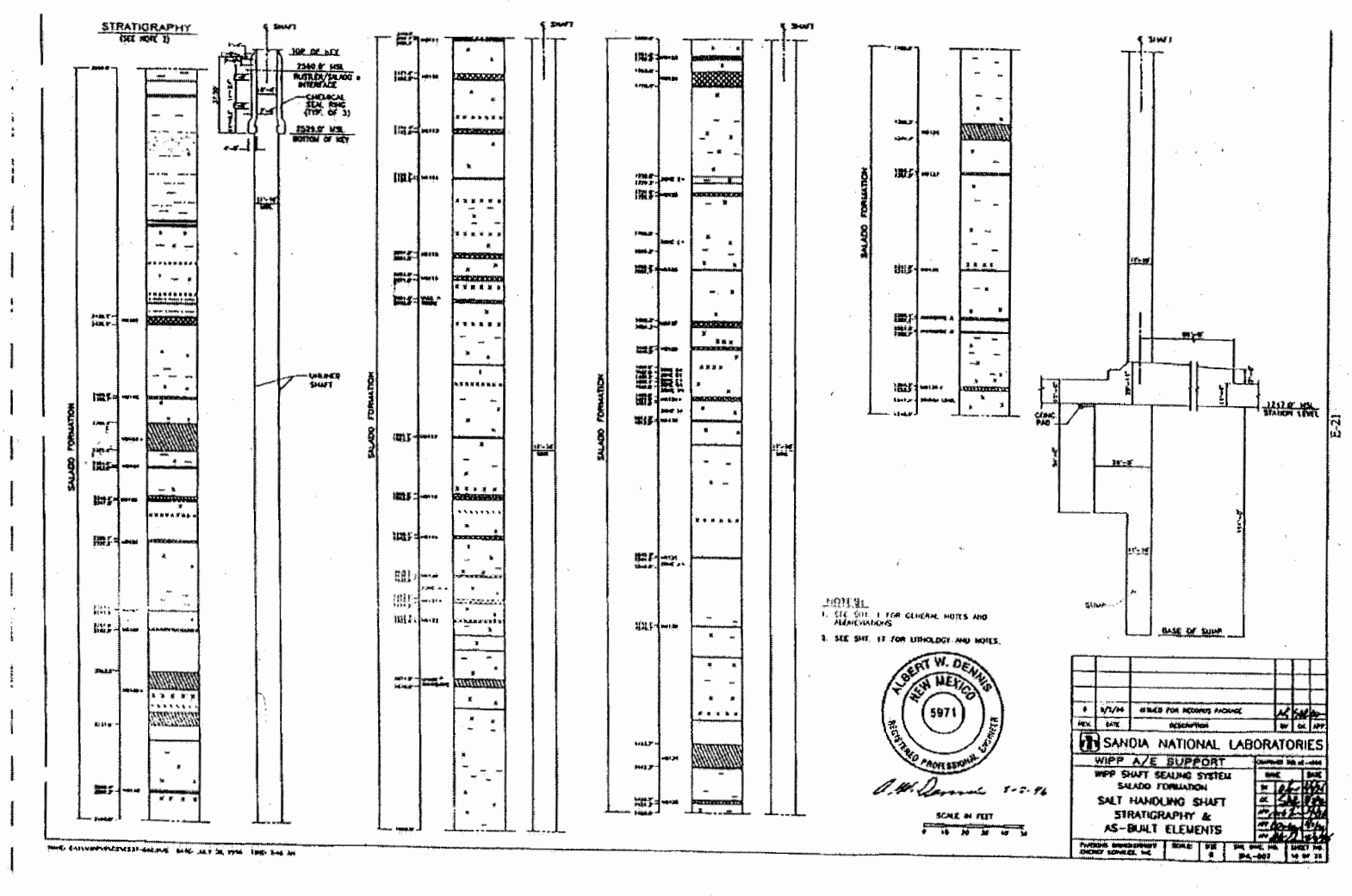


Exhaust Shaft Station Monolith

Sheet 16 of 28

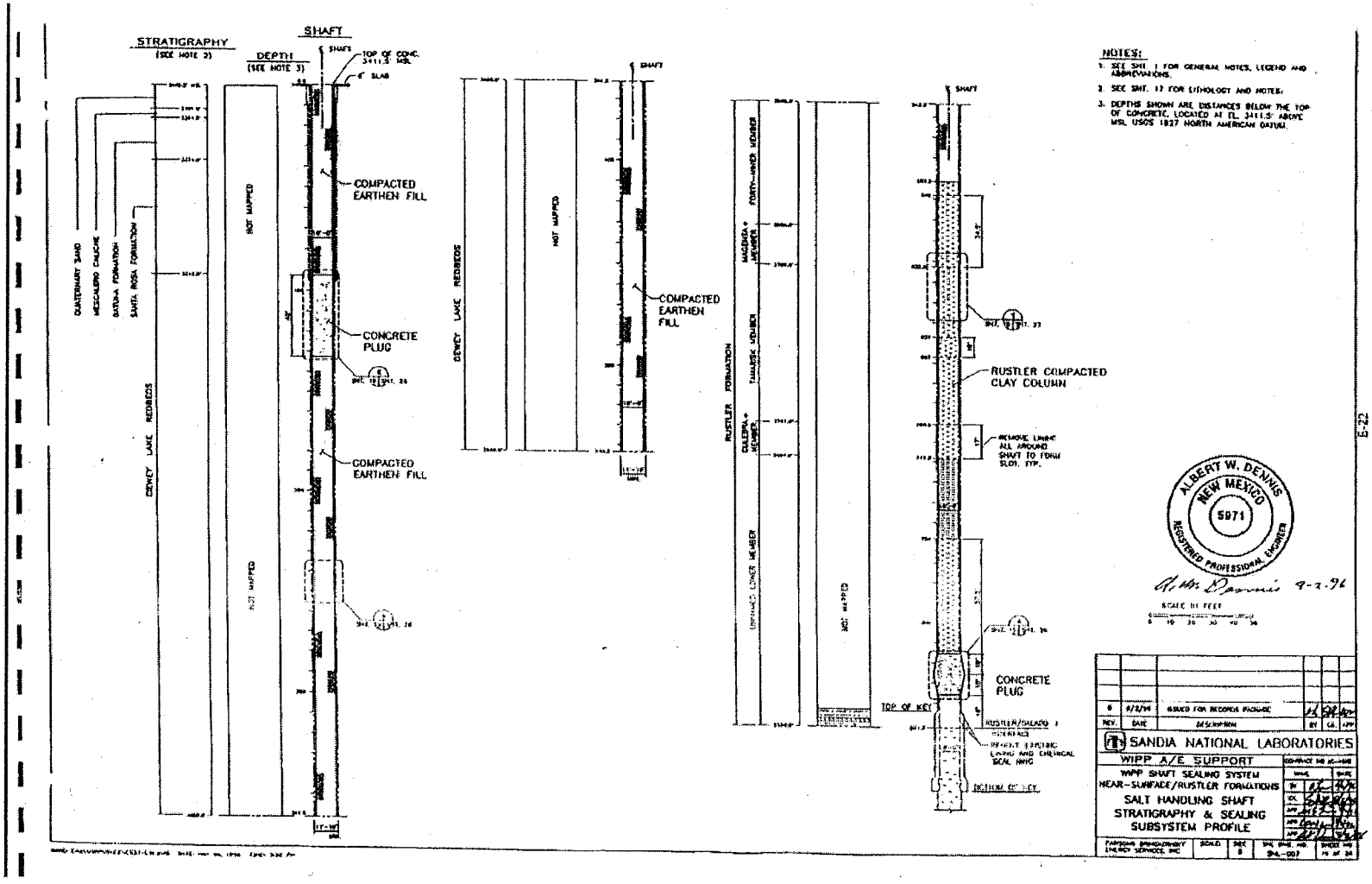


Near-Surface / Rustler Formations Salt Handling Shaft Stratigraphy and AS-Built Elements Sheet 17of 28

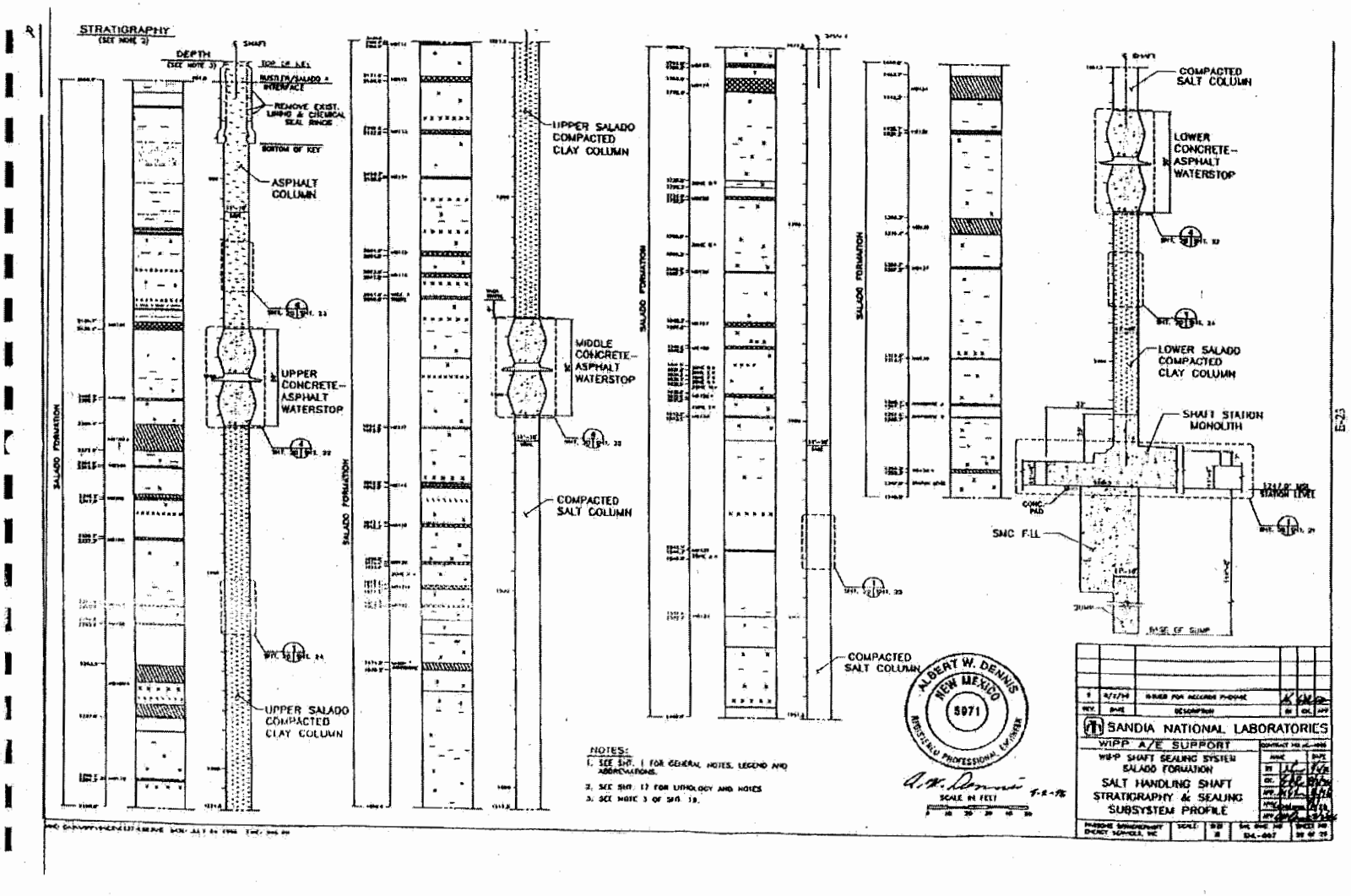


Salado Formation Salt Handling Shaft Stratigraphy and AS-Built Elements

Sheet 18 of 28

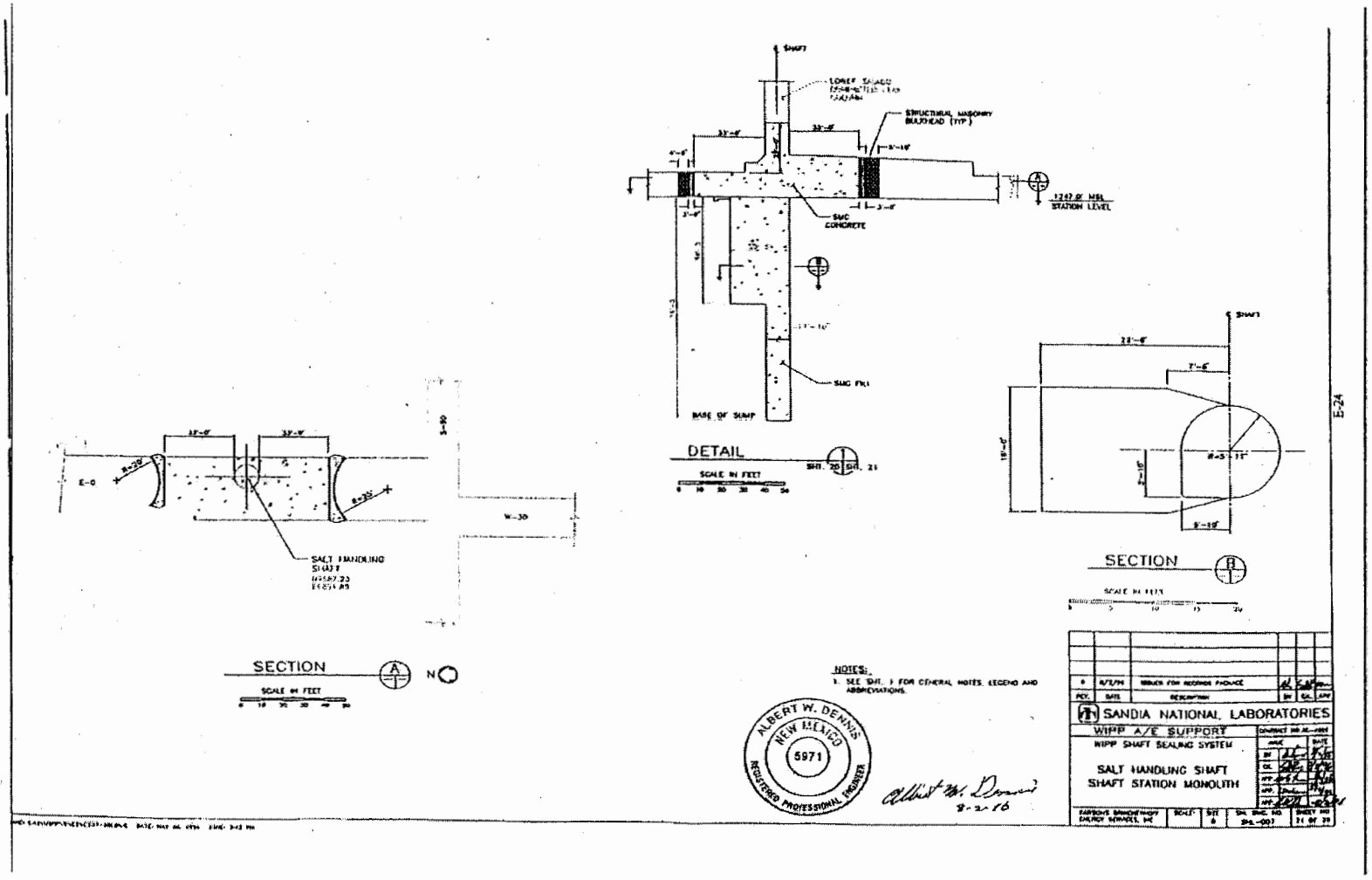


Near-Surface / Rustler Formations Salt Handling Shaft Stratigraphy and Sealing Subsystem Profile Sheet 19 of 28



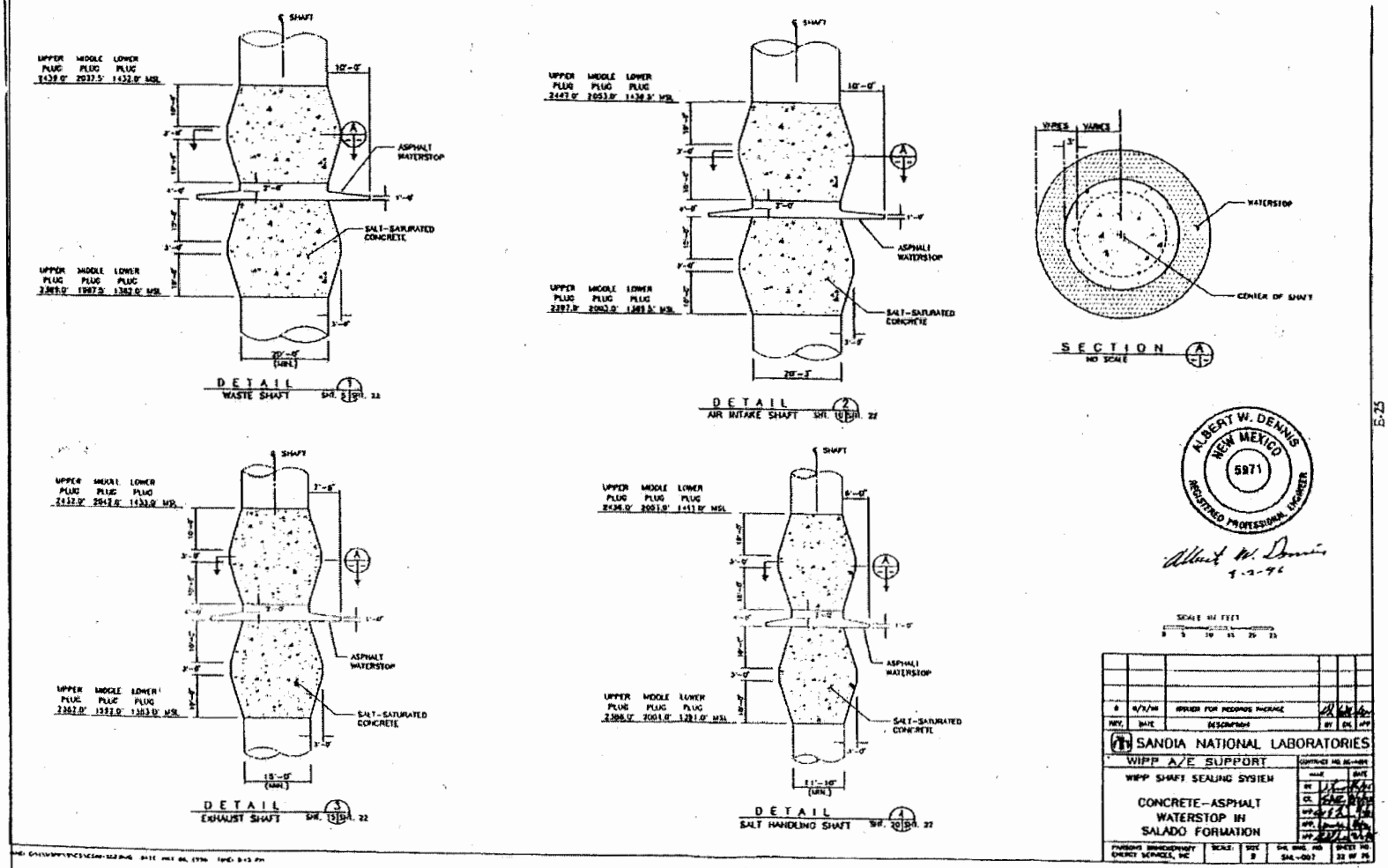
Salado Formation Salt Handling Shaft Stratigraphy and Sealing Subsystem Profile

Sheet 20 of 28



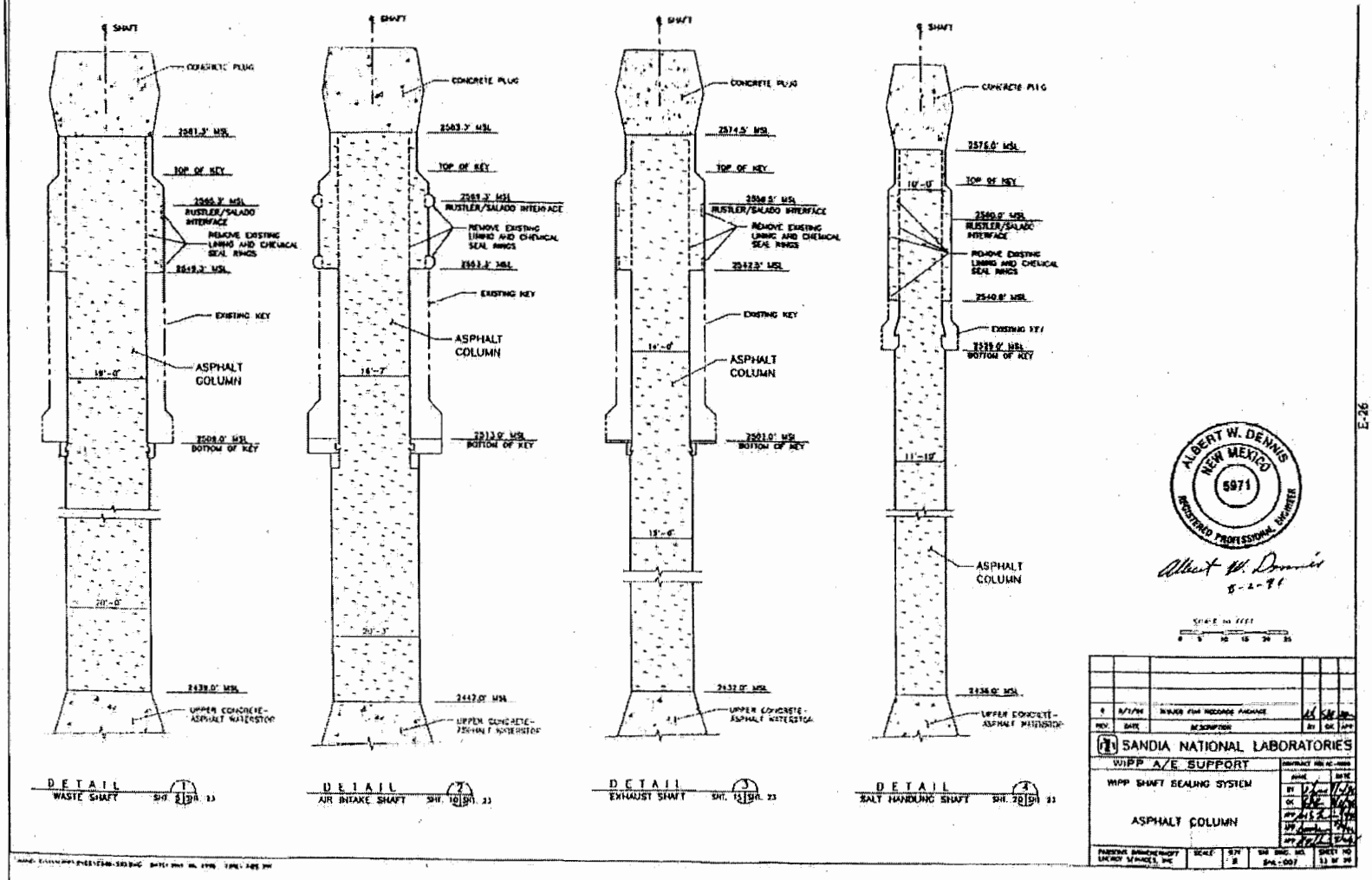
Salt Handling Shaft Shaft Station Monolith

Sheet 21 of 28



Concrete-Asphalt Water Stop in Salado Formation

Sheet 22 of 28



Asphalt Column

Sheet 23 of 28

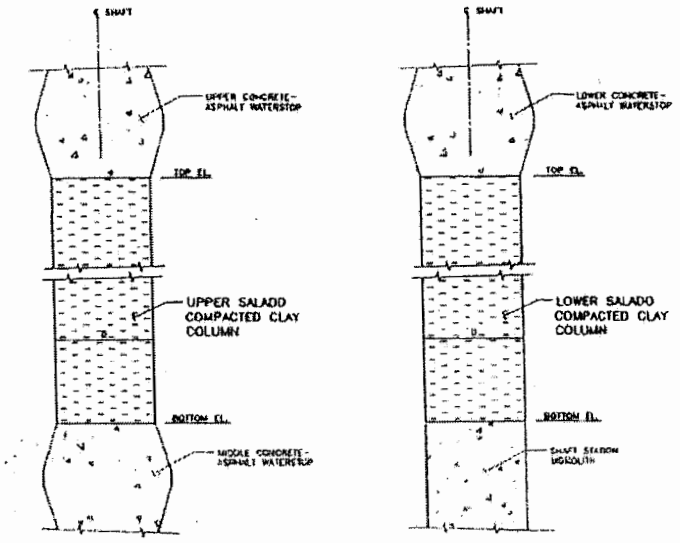


TABLE 1

SHAFT	NOMINAL SHAFT DIAMETER D	UPPER SALADO COMPACTED CLAY COLUMN			LOWER SALADO COMPACTED CLAY COLUMN		
		TOP EL. (FT. MSL)	BOTTOM EL. (FT. MSL)	TOTAL HT. (FT.)	TOP EL. (FT. MSL)	BOTTOM EL. (FT. MSL)	TOTAL HT. (FT.)
WASTE	20'-0"	2389.0	2037.5	351.5	1382.0	1286.0	96.0
AIR INTAKE	20'-3"	2397.0	2053.0	344.0	1389.5	1296.0	93.5
EXHAUST	15'-0"	2382.0	2042.0	340.0	1383.0	1285.0	98.0
SALT HANDLING	11'-10"	2386.0	2051.0	335.0	1391.0	1284.0	107.0

DETAIL
SEE TABLE 1 FOR DETAILS
NO SCALE

ALBERT W. DENNIS NEW MEXICO 5971 REGISTERED PROFESSIONAL ENGINEER
Albert W. Dennis 9-2-98

REV	DATE	DESCRIPTION	BY	CK	APP
0	8/3/98	ISSUED FOR BUSINESS PURPOSES			

SANDIA NATIONAL LABORATORIES
WIPP A/E SUPPORT
WIPP SHAFT SEALING SYSTEM
UPPER AND LOWER SALADO COMPACTED CLAY COLUMNS

Upper and Lower Salado Compacted Clay Columns

Sheet 24 of 28

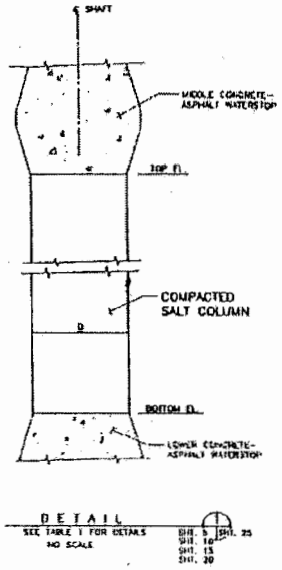


TABLE 1

SHAFT	NOMINAL SHAFT DIAMETER D	COMPACTED SALT COLUMN		
		TOP EL. (FT. MSL)	BOTTOM EL. (FT. MSL)	TOTAL HT. (FT.)
WASTE	20'-0"	1987.5	1432.0	555.5
AIR INTAKE	20'-3"	2003.0	1439.5	563.5
EXHAUST	15'-0"	1992.0	1433.0	559.0
SALT HANDLING	11'-10"	2001.0	1441.0	560.0

E-28

ALBERT W. DENNIS
NEW MEXICO
5971
REGISTERED PROFESSIONAL ENGINEER
Albert W. Dennis
8-2-96

REV.	DATE	DESCRIPTION	BY	CK.	APP.
0	8/2/96	ISSUED FOR BIDDING PACKAGE	AL	SH	AD

SANDIA NATIONAL LABORATORIES
WIPP A/E SUPPORT
WIPP SHAFT SEALING SYSTEM
COMPACTED SALT COLUMN

PARSONS ENGINEERING SCIENCE, INC. | SCALE: | SIZE: B | DWG. NO. 346-007 | SHEET NO. 25 OF 28

1

Compacted Salt Column

Sheet 25 of 28

0126

WIPP Shaft Sealing System Concrete Plug

Drawing SNL 007 26 of 28 not currently available. Drawing is not displayed in the Permit.

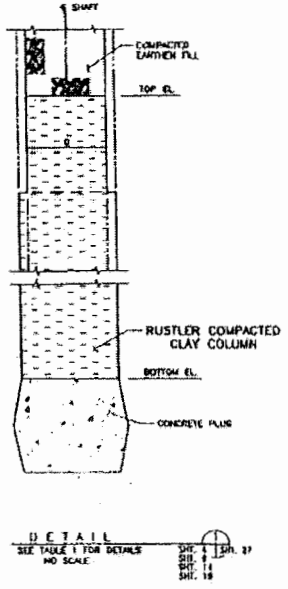


TABLE 1

SHAFT	NOMINAL SHAFT DIAMETER D	RUSTLER COMPACTED CLAY COLUMN		
		TOP EL. (FT. MSL)	BOTTOM EL. (FT. MSL)	TOTAL HT. (FT.)
WASTE	19'-0"	2836.0	2801.3	234.7
AIR INTAKE	16'-7"	2840.0	2805.3	234.7
EXHAUST	14'-0"	2829.0	2594.5	234.5
SALT HANDLING	10'-0"	2830.0	2596.0	234.0

ALBERT W. DENNIS NEW MEXICO 5971 REGISTERED PROFESSIONAL ENGINEER
Albert W. Dennis 7-2-96

REV.	DATE	DESCRIPTION	BY	CK	APP
0	6/5/96	ISSUED FOR ACCEPTANCE PACKAGE			

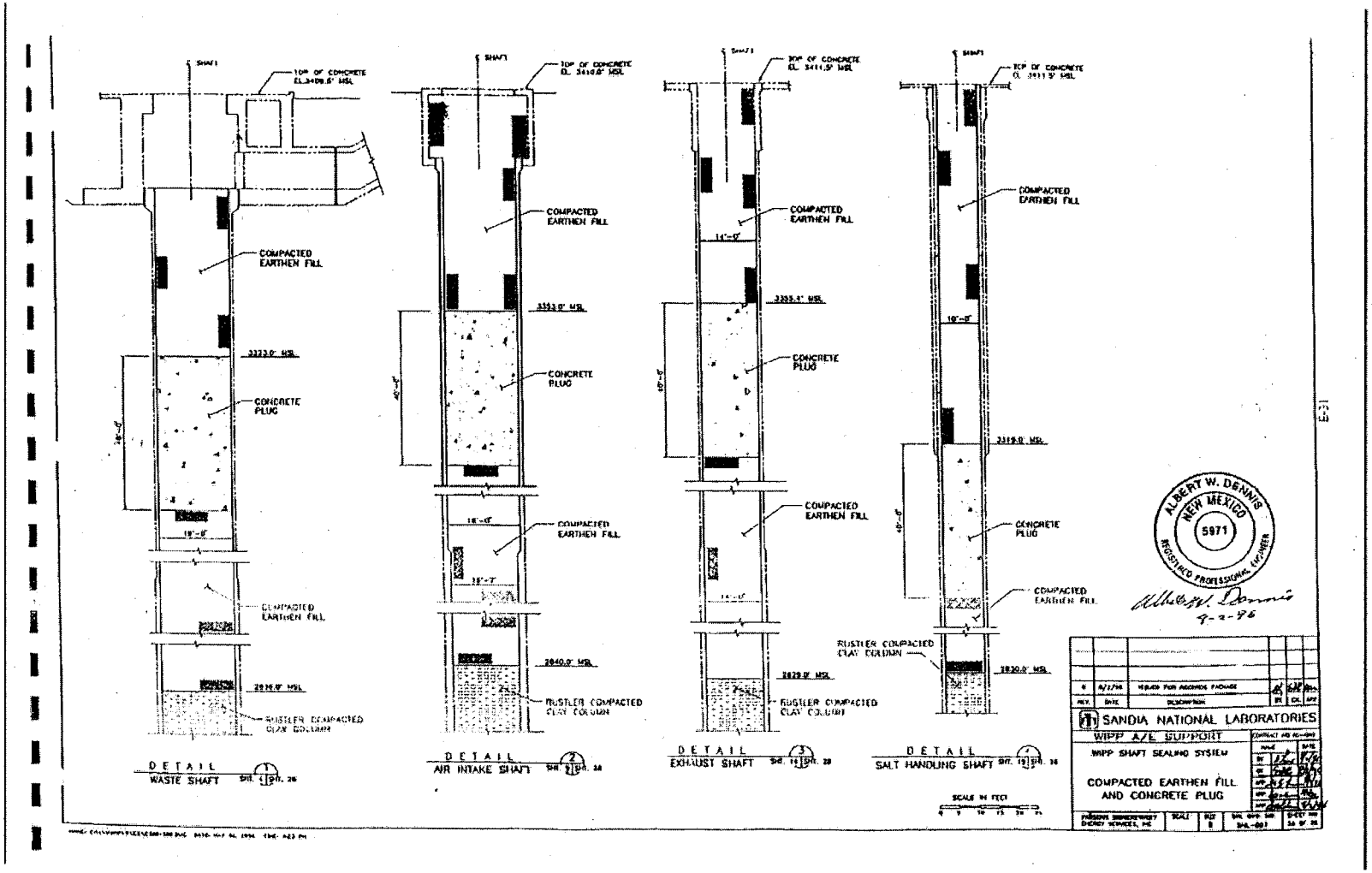
SANDIA NATIONAL LABORATORIES
WIPP A/E SUPPORT
WIPP SHAFT SEALING SYSTEM
RUSTLER COMPACTED CLAY COLUMN
SCALE: NONE
DWG. NO. SHL-002
SHEET NO. 27 OF 28

E-30

1

Rustler Compacted Clay Cloumn

Sheet 27 of 28



Compacted Earthen Fill and Concrete Plug

Sheet 28 of 28

WASTE ISOLATION PILOT PLANT

CARLSBAD, NM

SHAFT SEALING SYSTEM DESIGN

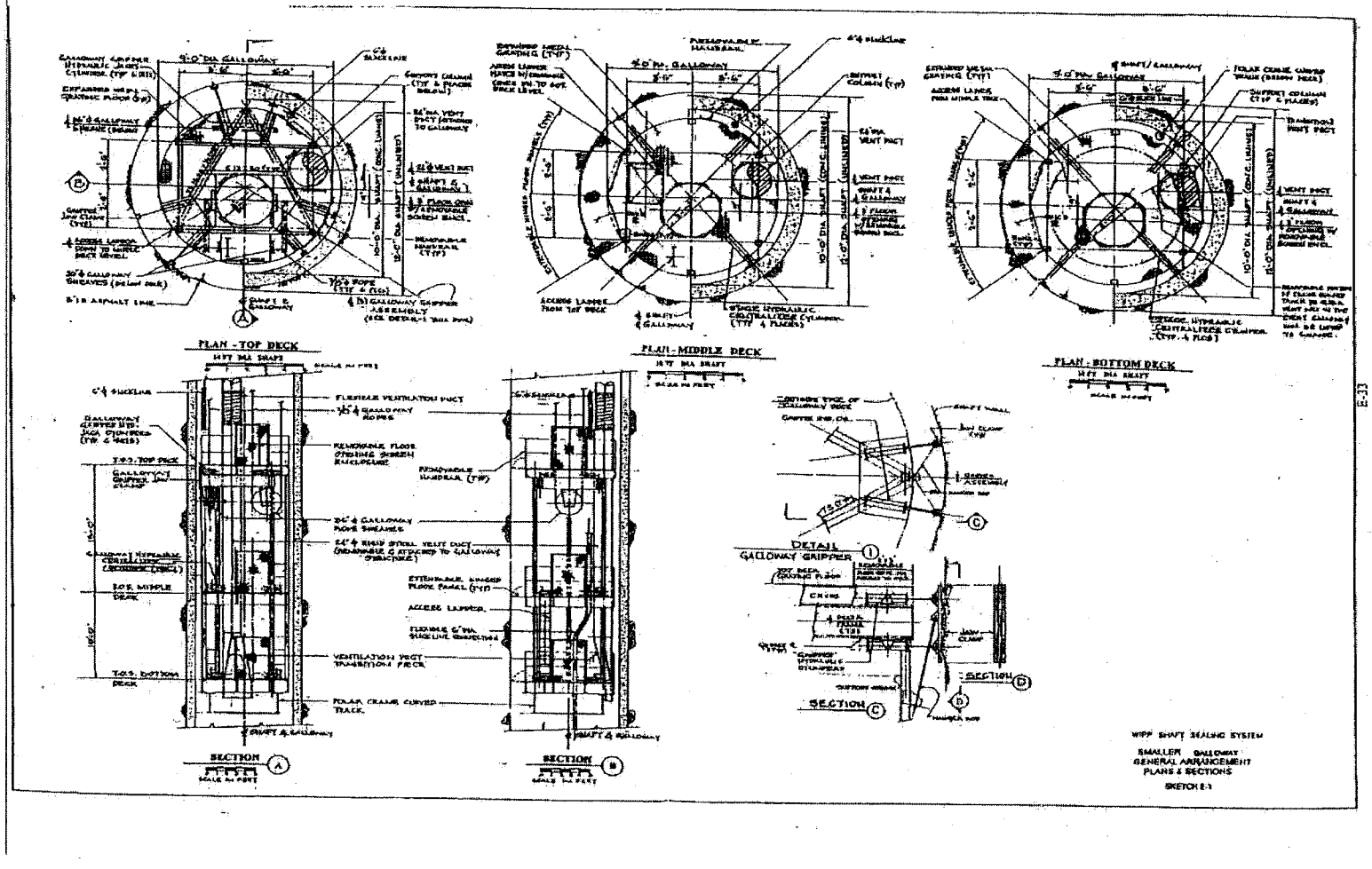
EQUIPMENT AND CONSTRUCTION SKETCHES

E-32

DRAWING NUMBER	TITLE
SKETCH E-1	WIPP SHAFT SEALING SYSTEM SMALLER GALLOWAY GENERAL ARRANGEMENT PLANS AND SECTIONS
SKETCH E-2	WIPP SHAFT SEALING SYSTEM LARGER GALLOWAY GENERAL ARRANGEMENT PLANS AND SECTIONS
SKETCH E-3	WIPP SHAFT SEALING SYSTEM TYPICAL HEADFRAME PLANS AND SECTIONS
SKETCH E-4	WIPP SHAFT SEALING SYSTEM PERSPECTIVE HEADFRAME AND ASSOCIATED SURFACE FACILITIES

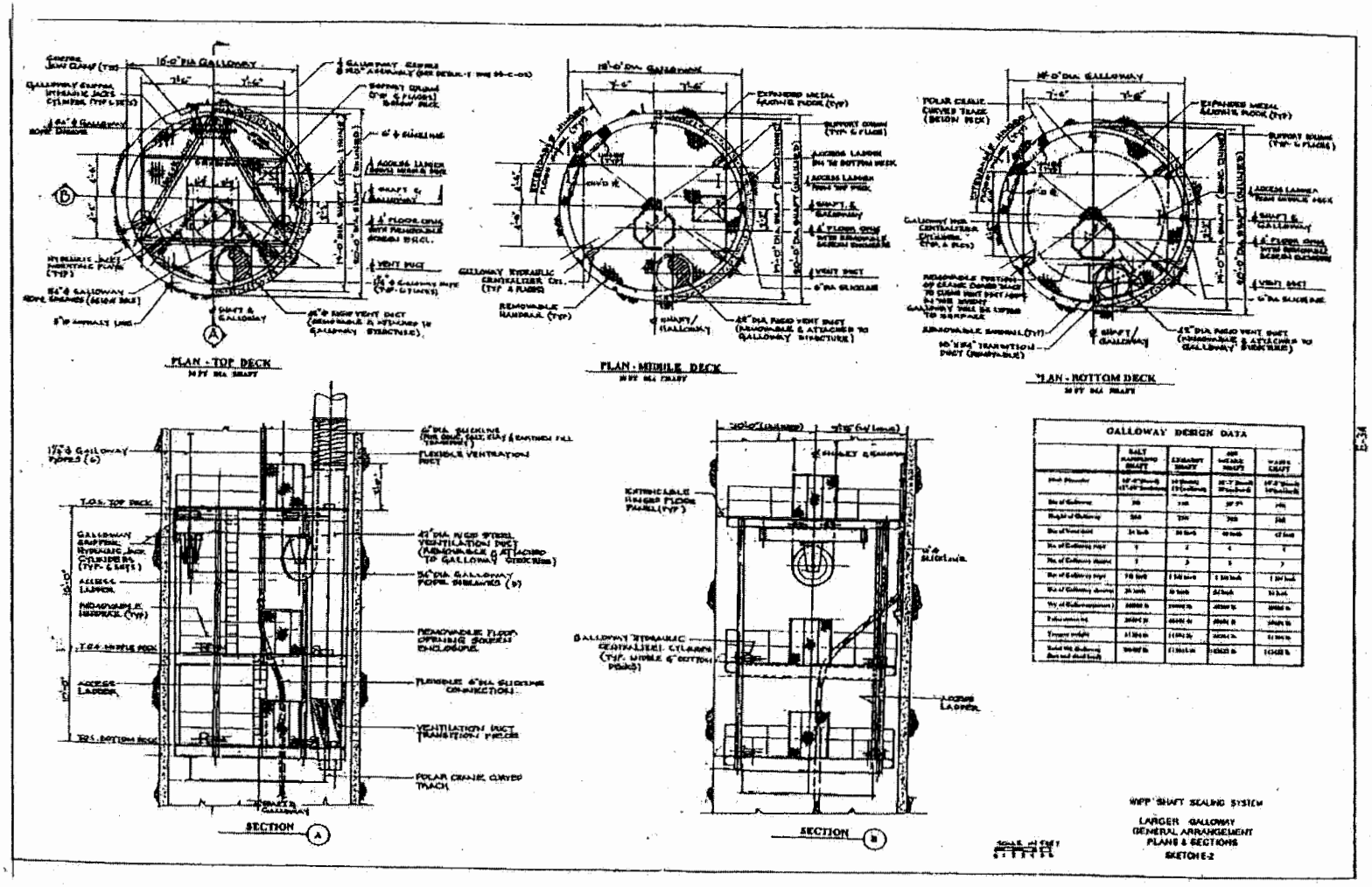
List of Sketches

1

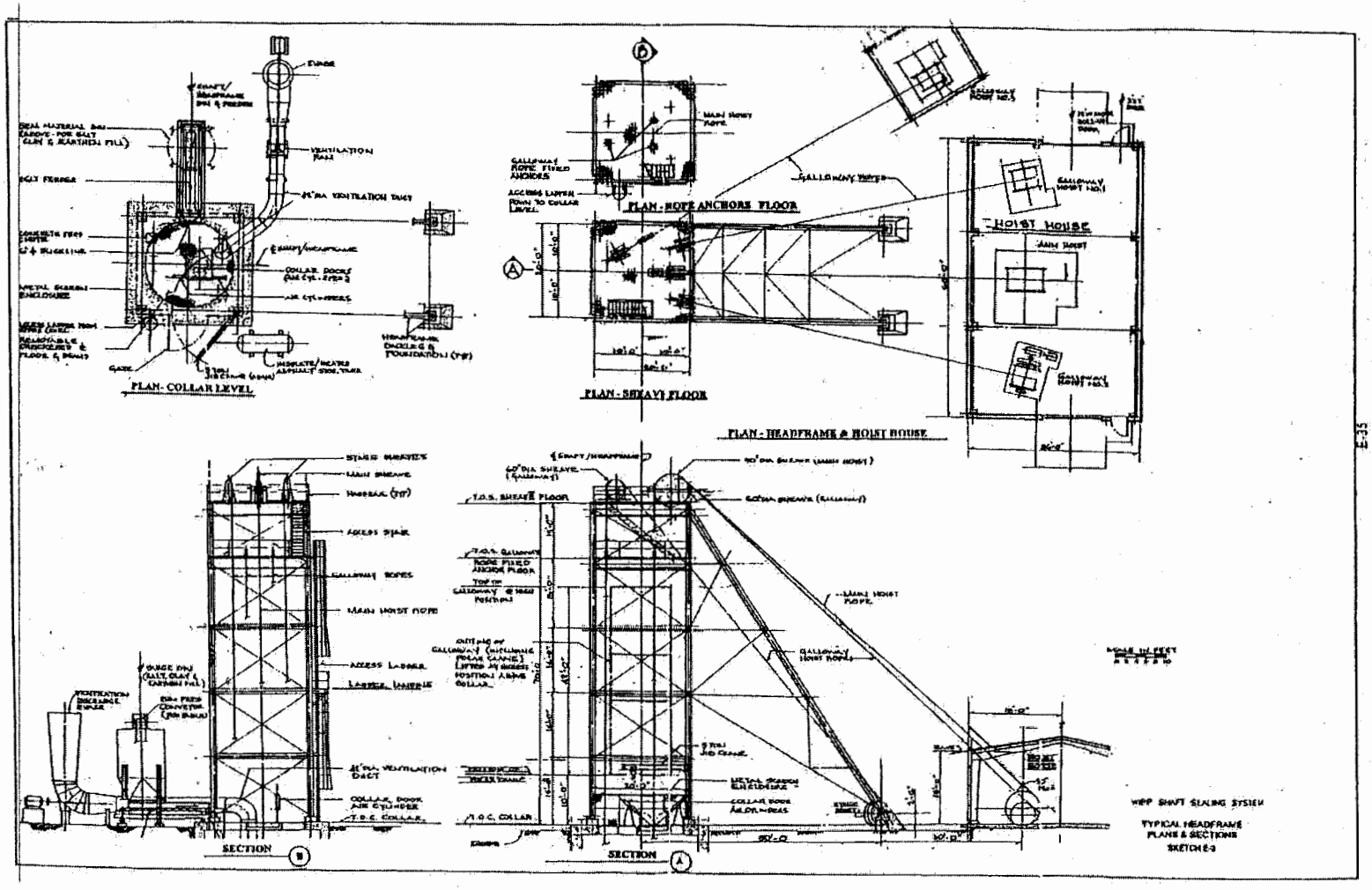


WIPP Shaft Sealing System Smaller Galloway Genral Arrangement Plans and Sections

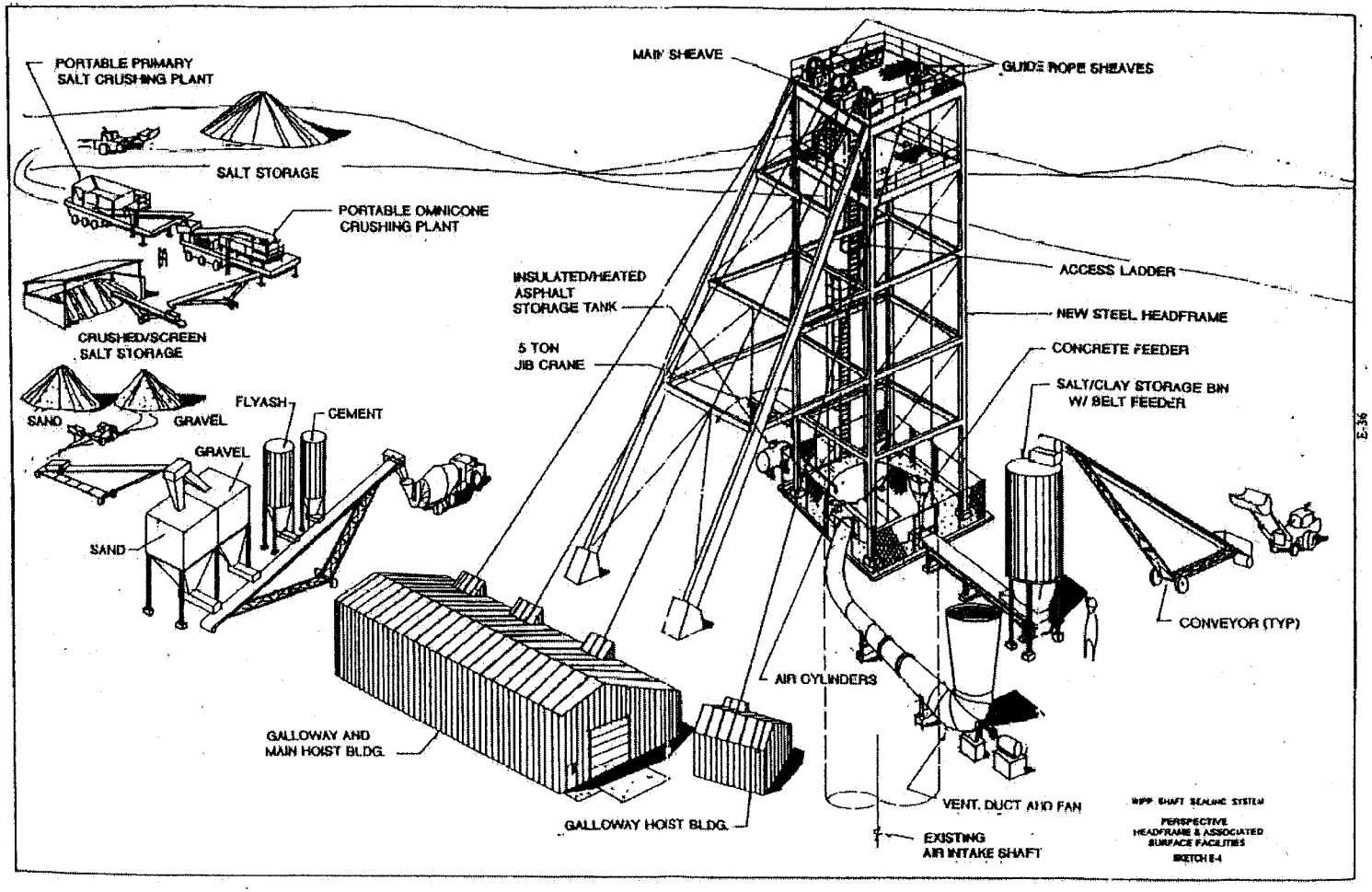
1



1 WIPP Shaft Sealing System Larger Galloway General Arrangement Plans and Sections



1 WIPP Shaft Sealing System Typical Headframe Plans and Sections



1 WIPP Shaft Sealing System Typical Headframe and Associated Surface Facilities

WIPP
UC721 Distribution List

Federal Agencies

US Department of Energy (4)
Office of Civilian Radioactive Waste Mgmt.
Attn: Deputy Director, RW-2
Acting Director, RW-10
Office of Human Resources & Admin.
Director, RW-30
Office of Program Mgmt. & Integ.
Director, RW-40
Office of Waste Accept., Stor., & Tran.
Forrestal Building
Washington, DC 20585

Attn: Project Director (2)
Yucca Mountain Site Characterization Office
Director, RW-3
Office of Quality Assurance
101 Convention Center Drive, Suite #P-110
Las Vegas, NV 89109

US Department of Energy
Albuquerque Operations Office
Attn: National Atomic Museum Library
P.O. Box 5400
Albuquerque, NM 87185-5400

US Department of Energy
Research & Waste Management Division
Attn: Director
P.O. Box E
Oak Ridge, TN 37831

US Department of Energy (8)
Carlsbad Area Office
Attn: G. Dials
D. Galbraith (3)
M. Matthews
M. McFadden
R. Lark
J. A. Mewhinney
P.O. Box 3090
Carlsbad, NM 88221-3090

US Department of Energy
Office of Environmental Restoration and
Waste Management
Attn: J. Lytle, EM-30
Forrestal Building
Washington, DC 20585-0002

US Department of Energy (3)
Office of Environmental Restoration and
Waste Management
Attn: M. Frei, EM-34, Trevion II
Washington, DC 20585-0002

US Department of Energy
Office of Environmental Restoration and
Waste Management
Attn: S. Schneider, EM-342, Trevion II
Washington, DC 20585-0002

US Department of Energy (2)
Office of Environment, Safety & Health
Attn: C. Borgstrom, EH-25
R. Pelletier, EH-231
Washington, DC 20585

US Department of Energy (2)
Idaho Operations Office
Fuel Processing & Waste Mgmt. Division
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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

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ATTACHMENT G3

RADIOLOGICAL SURVEYS TO INDICATE POTENTIAL HAZARDOUS WASTE RELEASES

G3-1 Purpose

Within the Resource Conservation and Recovery Act (**RCRA**) Permit for the Waste Isolation Pilot Plant (**WIPP**), radiological monitoring is used to determine whether a potential release of hazardous constituents has occurred. This method is used in addition to the visual examinations and container inspections mandated by the RCRA.

G3-2 Definition

This Permit Attachment describes procedures for performing radiological surveys to indicate the potential for hazardous waste releases from containers by virtue of detection of a radioactive constituent release. These procedures assume the potential co-release of hazardous and radioactive materials and applies to all releases except the release of volatile organic compounds (**VOC**) from transuranic (**TRU**) mixed waste containers. Radiological surveys are used to indicate the potential presence or absence of hazardous waste constituents based on the presence or absence of radioactivity. Radiological surveys do not provide any assessment with regard to concentration, since these surveys do not actually detect hazardous waste constituents.

G3-3 Discussion

Radiological surveys provide the WIPP facility with a very sensitive method of indicating the potential release of non-VOC hazardous waste constituents through the use of surface sampling (swipes) and radioactivity counting. This approach depends on the nature of the hazardous waste portion of the TRU mixed waste, the nature of the TRU mixed waste, and the nature of the spills. The sections below discuss each of these factors.

G3-3a Nature of the Hazardous Waste Portion of TRU Mixed Waste

Based on the waste codes listed in the Part A (Permit Attachment B) and discussed in the WIPP Waste Analysis Plan (Permit Attachment C), the hazardous waste constituents in WIPP TRU mixed waste consist mainly of EPA F-coded solvents and metals that exhibit the toxicity characteristic. The TRU mixed wastes that are to be shipped to the WIPP facility for disposal have been placed into waste categories based on their physical and chemical properties. Waste category information is summarized in Table G3-1 with emphasis on the process that generated the waste. The waste generating processes can be described in five general categories:

1. Wastes (such as combustible waste) that result from cleaning and decontamination activities in which items such as towels and rags become contaminated simultaneously with hazardous constituents and radioactivity. In these cases, the hazardous constituent and the radioactive constituent are intimately mixed, both on the rag or towel used for cleaning and as residuals on the surface of the object being cleaned. These waste forms are not homogeneous in nature; however, they are generated in a

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fashion that ensures that the hazardous and radioactive contaminants coexist throughout the waste matrix.

2. Wastes generated when materials that contain metals that are believed to exhibit the toxicity characteristic become contaminated with radioactivity as the result of plutonium operations (leaded rubber, some glass, and metal waste are typical examples). These materials may also become contaminated with solvents during decontamination or plutonium recovery activities.

3. A class of processes where objects that are not metals are used in plutonium processes and become contaminated with radioactivity. They are subsequently cleaned with solvents to recover plutonium. Surfaces of these objects (such as graphite, filters, and glass) are contaminated with both radioactive constituents and hazardous constituents.

4. Waste generating processes involving foundry operations where impurities are removed from plutonium. These impurities may result in the deposition of toxicity characteristic metals on the surfaces of objects, such as firebrick, ceramic crucibles, pyrochemical salts, and graphite, which are contaminated with residual quantities of radioactivity.

5. In all of the process waste categories in the second half of the attached table, the hazardous constituent and the radioactivity are physically mixed together as a result of the treatment process. In these wastes, the release of any portion of the waste matrix will involve both the hazardous waste and the radioactive waste components, because the treatment process generates a relatively homogeneous waste form.

Some waste forms only contain radioactive contamination on the surface, because they are not the result of a treatment process or are not porous in form. These include glass, leaded rubber, metals, graphite, ceramics, firebricks, and plastics. In theory, a hazardous waste release could occur if the interiors of these materials became exposed and were involved in a release or spill. Such an occurrence is not likely during operations, because no activities are planned or anticipated that would result in the breaking of these materials to expose fresh surfaces.

Based on the information in the attached table and the discussion above, hazardous constituent releases could potentially occur in only one of two forms: 1) VOC and 2) particulate resulting from the catastrophic failure of a container. Mechanisms that can initiate releases in these forms are discussed subsequently. Regardless of how the release occurs, the nature of the waste and the processes that generated it is such that the radioactive and hazardous components are intimately mixed. A release of one without the other is not likely, except for releases of VOCs from containers.

G3-3b Nature of the TRU Mixed Waste

TRU mixed waste is defined as transuranic waste which is also a hazardous waste. The processes responsible for the radioactivity in the waste are, for the most part, the same processes responsible for making it a hazardous waste. Therefore, the TRU mixed waste forms are described in terms of both classes of waste (radioactive and hazardous). The Permit Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) in Permit Part 2 places limits on the waste that can be shipped to the WIPP facility based on the

characteristics of the waste form. According to the TSDF-WAC, certain waste forms with specific characteristics are not allowed at the WIPP facility. Waste with liquid in excess of the TSDF-WAC limits is one waste form that is not allowed. Other limitations include, but are not limited to, a prohibition on pyrophoric materials, corrosive materials, ignitable waste, and compressed gases. Furthermore, TRU waste must contain 100 nanocuries or more of transuranic elements per gram of waste, which means that the radioactive component of the waste will always be present within the waste in significant concentrations. The TSDF-WAC limitations and restrictions are provided to ensure that any waste form received at the WIPP facility is stable and can be managed safely.

One benefit of waste form restrictions, such as no liquid in excess of the TSDF-WAC limits, is that they limit the kinds of releases that could occur to those that would be readily detectable through visual inspection (i.e., large objects that fall out of ruptured containers) or through the use of radiation monitoring either locally or within the adjacent area to detect materials that have escaped from containers.

G3-3c Nature of the Releases

The WIPP facility will handle only sealed containers of waste and derived waste. The practice of handling sealed containers minimizes the opportunity for releases or spills. For the purposes of safety analysis (DOE 1997), it was assumed that releases and spills during operations occur by either of two mechanisms: 1) surface contamination and 2) accidents.

Surface contamination is documented in the WIPP Safety Analysis Report (**SAR**) (DOE 1997) to be the only credible source of contamination external to the containers during normal operations. Surface contamination is assumed to be caused by waste management activities at the generator site that result in the contamination of the outside of a waste container. Contamination would most likely be particulates (dirt or dust) that would be deposited during generator-site handling/loading activities. This contamination may not be detected by visible inspections. Surface contamination is monitored upon arrival at the WIPP facility through the use of swipes and radiation monitoring equipment, as specified in WIPP Procedure WP 12-HP1100, "Radiological Surveys" (DOE, 1995). WP 12-HP1100 is a technical procedure that provides specific methods and guidance for performing surface contamination and dose rate surveys of items, equipment, and areas, but does not cover the monitoring of personnel. Detection using radioactivity is very sensitive and allows for the detection of contamination that may not be visible on the surface of the container. This exceeds the capability required by the RCRA, which is generally limited to inspections that detect only visible evidence of spills or leaks. RCRA-required inspections are specified in Permit Part 3.

Releases due to accidents are modeled in the WIPP SAR. Significant accidents within the waste handling process are assumed to result in the release of radioactive contaminants and VOCs. Radioactive releases are detectable using surface-sampling (swipe) techniques.

G3-4 Application of Radiological Surveys

Radiological surveys apply to many situations calling for sampling or monitoring to indicate the potential for nonvolatile releases. This includes initial sampling for surface radiological contamination upon receipt, sampling for contamination during waste handling activities, sampling for contamination during decommissioning, sampling for contamination during packaging for off-site shipment, and sampling to demonstrate the effectiveness of

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decontamination activities that follow a release or spill and retrieval. Radiation monitoring and sampling are mandated by DOE Orders and provide an immediate indication of a release or spill, even when they are not visibly detectable. A release or spill involving hazardous constituents (except VOCs) will also likely involve a release or spill of radioactivity, based on the processes that generated the waste and the physical form of the waste. These processes mixed the hazardous and radioactive components, as described in Table G3-1, to the extent that detection of the radioactive component can indicate the potential that the hazardous component is also present. Radiological surveys to indicate the potential for hazardous waste releases will be performed as specified in the following sections.

G3-4a TRU Mixed Waste Processing

Tables G3-2 and G3-3 specify the various steps in the process of receiving and disposing containers of CH TRU mixed waste, including RH TRU mixed waste in shielded containers and RH TRU mixed waste, respectively, where radiological surveys will be performed by the Permittees. WIPP Procedure WP 12-HP1100 provides the detailed description of methods and equipment used when performing surface contamination surveys, dose rate surveys, and large area wipes.

G3-4b TRU Mixed Waste Releases

The RCRA Contingency Plan (Permit Attachment D) specifies actions required by the Permittees in the event of spills or leaking or punctured containers of CH and RH TRU mixed waste. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm the removal of hazardous waste constituents.

G3-4c Decontamination Activities at Closure

The Closure Plan (Permit Attachment G, Section G-1e(2)) specifies decontamination activities required by the Permittees at closure. Following completion of decontamination efforts, the Permittees will perform hazardous material sampling to confirm removal of hazardous waste constituents.

TABLES

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Table G3-1
Summary of Waste Generation Processes and Waste Forms

Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Combustibles	F001, F002, F003, D008, D019	Cloth and paper wipes are used to clean parts and wash down gloveboxes. Wood and plastic parts are removed from gloveboxes after they are cleaned. Lead may occur as shielding tape or as minor noncombustible waste in this category.	Materials such as metals may retain traces of organics left on surfaces that were cleaned. Waste may remain on the cloth and paper that was used for cleaning or for wiping up spills.
Graphite		Graphite molds, which may contain impurities of metals, are scraped and cleaned with solvents to remove the recoverable plutonium.	Surfaces may retain residual solvents. Lead may be used as shielding or may be an impurity in the graphite.
Filters	F001, F002	Filters are used to capture radioactive particulate in air streams associated with numerous plutonium operations and to filter particulate from aqueous streams.	Filter media may retain organic solvents that were present in the air or liquid streams.
Benelex® and Plexiglas®	F001, F002, D008	Materials are used in gloveboxes as neutron absorbers. The glovebox assembly often includes leaded glass. All surfaces may be wiped down with solvents to remove residual plutonium.	Surfaces may retain residual solvents from wiping operations. Leaded glass may also be present.
Firebrick and Ceramic Crucibles	F001, F002, F005, D006, D007, D008	Firebrick is used to line plutonium processing furnaces. Ceramic crucibles are used in plutonium analytical laboratories. Both may contain metals as surface contaminants.	Metals deposited during plutonium refining or analytical operations could remain as residuals on surfaces. Surfaces may retain residual solvents.
Leaded Rubber	D008	Leaded rubber includes lead oxide impregnated materials such as gloves and aprons.	The leaded rubber could potentially exhibit the toxicity characteristic.
Metal	F001, F002, D008	Metals range from large pieces removed from equipment and structures to nuts, bolts, wire, and small parts. Many times, metal parts will be cleaned with solvents to remove residual plutonium.	Solvents may exist on the surfaces of metal parts. The metals themselves potentially exhibit the toxicity characteristic.
Glass	F001, F002, D006, D007, D008, D009	Glass includes Raschig rings removed from processing tanks, leaded glass removed from gloveboxes, and miscellaneous laboratory glassware.	Solvents may exist as residuals on glass surfaces and in empty containers. The leader glass may exhibit the toxicity characteristic.
Inorganic Wastewater Treatment Sludge	F001-F003, D006-D009, P015	Sludge is vacuum filtered and stabilized with cement or other appropriate sorbent prior to packaging.	Traces of solvents and heavy metals may be contained in the treated sludge which is in the form of a solid dry monolith, highly viscous gel-like material, or dry crumbly solid.

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Waste Category	Hazardous Waste Codes	Description of Processes	Description of Waste Form
Organic Liquid and Sludge	F001, F003	Organic liquids such as oils, solvents, and lathe coolants are immobilized through the use of various solidification agents or sorbent materials.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Solidified Liquid	F001, F003, D006, D008	Liquids that are not compatible with the primary treatment processes and have to be batched. Typically these liquids are solidified with portland or magnesium cement.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Inorganic Process Solids and Soil	F001, F002, F003, D008	Solids that cannot be reprocessed or process residues from tanks, firebrick fines, ash, grit, salts, metal oxides, and filter sludge. Typically solidified with portland or gypsum-based cements.	Solvents and metals may be present within the matrix of the solids created through the immobilization process.
Pyrochemical Salts	D007	Molten salt is used to purify plutonium and americium. After the radioactive metals are removed, the salt is discarded.	Residual metals may exist in the salt depending on impurities in the feedstock.
Cation and Anion Exchange Resins	D008	Plutonium is sorbed on resins and is eluted and precipitated.	Feed solutions may contain traces of solvents or metals depending on the preceding process.

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1 **Table G3-2**
2 **Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-II/HalfPACT)**

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Contact Handled Package Outer Containment Assembly (**OCA**) lid interior and top of Inner Containment Vessel (**ICV**) lid	X		X
Contact Handled Package quick connect and vent port	X		
As ICV lid is raised		X	
ICV lid interior and top of payload	X		X
Payload assembly, guide tubes, standard waste box (**SWB**) connecting devices	X		
As payload assembly is raised, including bottom of payload		X	
After placement of payload on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under a Radiation Work Permit (**RWP**). The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-2a
Radiological Surveys During CH TRU Mixed Waste Processing (TRUPACT-III)

Step in CH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey	Large Area Wipes [a]
Exterior of TRUPACT-III on arrival at WIPP	X	X	
Interior of Overpack Cover and exterior of Containment Lid	X	X	X
TRUPACT-III Vent Port Tool Assembly quick connect	X		
Interior of Containment Lid and front of SLB2	X	X	X
As SLB2 is removed from TRUPACT-III		X	
After placement of SLB2 on facility pallet	X		X

[a] Surface contamination surveys of Contact Handled Packages are performed in accordance with Procedure WP 12-HP1100, which stipulates that all such work be performed under an RWP. The RWP will only stipulate large area wipes when necessary and not as a routine measure.

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Table G3-3
Radiological Surveys During RH TRU Mixed Waste Processing

Step in RH TRU Mixed Waste Processing	Surface Contamination Survey	Dose Rate Survey
Exterior of cask on arrival at WIPP	X	X
During removal of impact limiters on RH-TRU 72-B cask	X	X
During removal of outer lid closure from RH-TRU 72-B cask	X	X
During removal of inner lid closure from RH-TRU 72-B cask	X	
During removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of upper impact limiter on the CNS 10-160B cask	X	X
After removal of the CNS 10-160B cask from the lower impact limiter	X	X
After transfer of the CNS 10-160B cask lid into the Hot Cell	X	
During transfer of waste drum carriages into the Hot Cell	X	
During transfer of waste into the facility canister in the Hot Cell	X	
During transfer of the waste canister from the RH-TRU 72-B cask to the facility cask	X	
Interior of shipping cask inside the RH Bay after unloading of waste canister or drums	X	
Exterior of shield plug subsequent to final canister emplacement		X
Interior of facility cask after completion of waste emplacement	X	

ATTACHMENT H

POST-CLOSURE PLAN

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ATTACHMENT H

POST-CLOSURE PLAN

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ATTACHMENT H

POST-CLOSURE PLAN

Introduction

This Permit Attachment contains the Post-Closure Plan, which describes activities required to maintain the Waste Isolation Pilot Plant (**WIPP**) after completion of facility closure. Since the current plans for operations extend over several decades, the Permittees will periodically reapply for an operating permit in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.10(h)).

This plan was submitted to the New Mexico Environment Department (**NMED**) in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §270.14(b)(13)) and the U.S. Environmental Protection Agency (**EPA**). The Post-Closure Plan includes the implementation of institutional controls to limit access and groundwater monitoring to assess disposal system performance. Until final closure is complete and has been certified in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.115), a copy of the approved Post-Closure Plan and all approved revisions will be on file at the WIPP facility and will be available to the Secretary of the NMED or the EPA Region VI Administrator upon request.

H-1 Post-Closure Plan

The post-closure care period begins after completion of closure of the first underground hazardous waste disposal unit (**HWDU**) and continues for 30 years after final closure of the facility. The post-closure care period may be shortened or lengthened by the Secretary of the NMED, based on evidence that human health and the environment are being protected or are at risk. During the post-closure period, the WIPP shall be maintained in a manner that complies with the environmental performance standards applicable to the facility. During this period, the Permittees will employ active institutional controls as necessary.

This post-closure plan focuses on activities following final facility closure. However, some discussion of post-closure following panel closure is warranted since some panel closures will occur long before final facility closure. As discussed in Attachment G (Closure Plan), Section G-1e(1), panel closures have been designed to require no post-closure maintenance. The Permittees have defined a post-closure care program for closed panels that has three aspects. These are routine inspection of the openings in the vicinity of the closures, the sampling of ventilation air for harmful constituents, and a Volatile Organic Compound Monitoring Program. The rules of the Mine Safety Health Administration drive the implementation of the first two programs. These rules require that underground mines monitor air quality to assure good breathing air whenever personnel are underground and that mine operators provide safe ground conditions for personnel in areas that require access. Routine monitoring of the openings in the access ways to panels will be continued and these openings will be maintained for as long as access into them is needed. This includes continued reading of installed geomechanical instrumentation, sounding the areas, visual inspection and maintenance activities such as scaling, mining, or bolting as required and as described in Permit Attachment A2. In addition, all areas in the underground that are occupied by personnel are checked prior to each day's work activities for accumulations of harmful gases, including methane. Action levels for increasing

ventilation to areas that show high levels of harmful gases are specified as described in Permit Attachment D.

These monitoring programs will be carried out during the period between the closure of the first panel and the initiation of final facility closure for the underground facility. The Permittees have prepared a Volatile Organic Compound Monitoring Plan (**VOCMP**) which will be implemented to confirm that the annual average concentration of volatile organic compounds (**VOCs**) in the air emissions from the underground HWDUs do not exceed the VOC concentrations of concern listed in Permit Part 4 and Permit Attachment N, Table N-3.1. The VOCMP is provided in Attachment N. The VOCMP includes monitoring design, sampling and analysis procedures and quality assurance objectives. This plan is required to demonstrate compliance with 20.4.1.500 and .900 NMAC (incorporating 40 CFR §264.602 and §270.23(a)(2)).

The Permittees will collect air samples upstream of all open and closed panels, and down stream of Panel 1 until after certification of the closure of the last underground HWDU.

The VOCMP uses EPA Compendium Method TO-15. The Permittees have had success with TO-15 at the WIPP if care is taken in placing the sampler to avoid high dust and if stringent cleaning requirements are imposed for the clean canisters. This is necessary because of the extremely low concentrations that are being monitored.

The VOCMP will be implemented under a Quality Assurance Plan that conforms to the document entitled "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations". Quality Assurance criteria required for the target analytes are presented in Table N-4 in Permit Attachment N. Definitions of these criteria are given in Permit Attachment N along with a discussion of other requirements of the Quality Assurance Program including sample handling, calibration, analytical procedures, data reduction, validation and reporting, performance and system audits, preventive maintenance, and corrective actions.

H-1a Post-Closure Plan after Final Facility Closure

A number of regulations deal with the period of time that begins once the WIPP has undergone final facility closure and decommissioning. Under 40 CFR Part 191, the period consists of an active control period and a passive control period; only 100 years of the active control period can be used in performance assessment. The Land Withdrawal Act (LWA) of 1992 requires that the U.S. Department of Energy (DOE) prepare and submit a post-decommissioning land management plan. 20.4.1.500 NMAC (incorporating 40 CFR §264.117) requires post-closure care, including monitoring, security, and control of property use. Because of the numerous regulations, the Permittees have prepared a single strategy for post-closure management of the WIPP. This strategy consists of three elements: 1) active controls, 2) monitoring, and 3) passive controls. Only the first and second elements occur within the post-closure period covered by this permit.

H-1a(1) Active Institutional Controls

Once a facility is decommissioned, positive actions (referred to as "active institutional controls") will be taken to assure proper maintenance and monitoring. The EPA, in 40 CFR §191.14(a) has specified that active controls will be maintained for as long as practicable and that no more than 100 years of active institutional control can be assumed in predictions of long-term

performance. This assumption assures that future protection and control does not rely on positive actions by future generations.

The Permittees' active institutional control program has a primary objective of addressing all applicable requirements, including restoring the WIPP site as nearly as possible to its original condition, and thereby equalizing any preference over other areas for development by humans in the future. Restoration of the WIPP site includes any necessary remedial actions or cleanup of releases resulting from decommissioning. In addition, as part of the active institutional control program implemented under 40 CFR §194.14(a), the Permittees will implement monitoring systems suitable for assessing disposal system performance if such monitoring is feasible.

The Permittees will implement the active institutional control program as described in more detail below:

Identification of Active Institutional Control Measures

A detailed explanation of the active institutional controls selected by the Permittees as part of this first step is provided in Permit Attachment H1 (WIPP Active Institutional Controls). This is the Permittees' reference design for active institutional controls. The reference design will be reviewed periodically and updated by the Permittees as appropriate during WIPP disposal operations. The ongoing review and evaluation ensure that the active institutional controls implemented are appropriate for the conditions that may exist at that time. The Permittees will review the reference design prior to implementation and all affected regulatory agencies will be consulted as part of this review. If updating the reference design proposes any changes in the Post-Closure Plan as described in this permit, the Permittees shall apply for a permit modification to include those changes, or submit the reference design and revised Post-Closure Plan as part of a routine permit renewal application, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(d)).

As part of the active institutional controls program, the Permittees have developed a set of active institutional controls which will be implemented. These are as follows:

- A fence line shall be established to control access to the repository's footprint area (the waste disposal area projected to the surface). A standard wire fence shall be erected along the perimeter of the repository surface footprint. The fence shall have gates placed approximately midway along each of the four sides.

- An unpaved roadway along the perimeter of the barbed wire fence shall be constructed to provide ready vehicle access to any point around the fenced perimeter, to facilitate inspection and maintenance of the fence line, and to permit visual observation of the repository footprint to the extent permitted by the lay of the land. This roadway shall connect to the paved south access road.

- To ensure visual notification, the fence line shall be posted with signs having as a minimum, a legend reading "Danger—Unauthorized Personnel Keep Out" and a warning against entering the area without specific permission of the Permittees.

- Contractual arrangements shall be developed to ensure that periodic inspection and necessary corrective maintenance is conducted on the fence line, its associated warning signs, and the roadway. The Permittees will maintain control over all

contractual work and will maintain, in the operating record, the results of all inspections and maintenance activities.

- Through direct Permittee staffing support and/or contractual arrangements, procedures shall be established to provide routine periodic patrols and surveillances of the protected area by personnel trained in security surveillance and investigation.

- Mitigating actions will be taken to address any abnormal conditions[1] identified during periodic surveillance and inspections.

- Reports of activities associated with the post-disposal active access controls shall be prepared in accordance with regulatory requirements for submittal to the appropriate regulatory and legislative authority.

Details on meeting these criteria are found in Permit Attachment H1.

Preparation of a Post-Decommissioning Land Management Plan

Section 13(b) of the LWA requires the DOE to prepare and submit a plan for managing the land withdrawal area after decommissioning the WIPP facility. This plan will include a description of both the active and passive institutional controls that will be imposed after decommissioning is complete. This plan will be prepared in consultation with the Department of Interior and the state of New Mexico. If the land management plan proposes any changes in the Post-Closure Plan as described in this permit, the Permittees shall apply for a permit modification to include those changes, or submit the land management plan and revised Post-Closure Plan as part of a routine permit renewal application, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.118(d)).

Preparation of the Active Institutional Control Plan

An active institutional control plan will be initiated prior to actual plant closure, and will contain all the information needed to implement the active and passive institutional controls for the WIPP facility. Active institutional control planning will be based on the reference design and will take into account the most current information regarding the facility and its vicinity and will make use of state-of-the-art materials and techniques. This plan will include acceptable decontamination levels, sampling and analysis plans, and QA/QC specifications. If such future plan contains provisions different from those in this Post-Closure Plan or Permit Attachment H1 (Active Institutional Controls), the Permittees shall submit a request for modification of the Post-Closure Plan and the WIPP Permit. The changes must be approved and made part of the revised Permit before the changes are implemented, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.118(d)).

Implementation of Active Institutional Control Measures

Most of the active institutional control measures, such as long-term site monitoring and site remedial actions, will be implemented simultaneously with facility closure. However, it may be

[1] "Abnormal conditions" include any natural or human-caused conditions which could affect the integrity of Active Institutional controls required by the Permit or which could affect compliance of the WIPP with applicable RCRA standards.

possible to implement some measures earlier. For example, salt disposal may begin prior to final plant closure. Reclamation and restoration of unused disturbed surface areas has already begun. Guarding and maintenance activities, which are already in place, could evolve into an appropriate type of post-closure activity, subject to appropriate modifications of the Permit.

H-1a(2) Monitoring

Post-closure groundwater monitoring will involve a continuation of the monitoring plan in Permit Attachment L as described in Permit Part 5. The sampling frequency may be changed to a frequency of every two years after final facility closure is complete by modification of the Permit as approved by the Secretary of the NMED in accordance with 20.4.1.901.B NMAC (incorporating 40 CFR §270.42). In addition, the final target analyte list specified in Permit Attachment L may be changed by permit modification based on final volume of waste.

H-2 Notices Required for Disposal Facilities

H-2a Post-Closure Certification

Within 60 days of completion of the post-closure care period after final facility closure, the Permittees will submit to the Secretary of the NMED, via registered mail, a certification that post-closure care was performed in accordance with the specifications of the approved post-closure plan. The certification will be signed by the Permittees and by an independent New Mexico registered professional engineer. Documentation supporting the independent registered engineer's certification and a copy of the certification will be furnished to the Secretary of the NMED.

H-2b Post-Closure Notices

Within 60 days after certification of closure of each underground HWDU or final facility closure, the Permittees will submit to the Secretary of the NMED, and to the Eddy County government or other applicable local government agencies, a record of the type, location, and quantity of hazardous wastes disposed of in each underground HWDU as required in 20.4.1.500 NMAC (incorporating 40 CFR §264.119).

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

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ACRONYMS

CH	contact-handled
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LWA	Land Withdrawal Act
SWB	standard waste box
TRU	transuranic
WIPP	Waste Isolation Pilot Plant

ATTACHMENT H1

ACTIVE INSTITUTIONAL CONTROLS DURING POST-CLOSURE

Introduction

Under the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b), the following activities identified as active institutional controls during post-closure are incorporated into the Post-Closure Plan.

The post-closure requirements of this permit include 20.4.1.500 NMAC, incorporating:

- 40 CFR §264.117(a)(1), which requires that

  "Post-closure care for each hazardous waste management unit subject to the requirements of §264.117 through 264.120 must begin after completion of closure of the unit and continue for 30 years after that date..."

- 40 CFR §264.601, which requires that

  "A miscellaneous unit must be...maintained and closed in a manner that will ensure protection of human health and the environment..."

- and 40 CFR §264.603, which requires that

  "A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period."

The containment requirements for a disposal system for transuranic (**TRU**) radioactive wastes are defined in Title 40 CFR §191.13 (U.S. Environmental Protection Agency [**EPA**] 1993). 40 CFR §191.14 is titled Assurance Requirements. With regard to the active institutional controls aspect of Assurance Requirements, 40 CFR §191.14 states the following:

> "To provide the confidence needed for long-term compliance with the requirements of §191.13, disposal of spent fuel or high-level or transuranic wastes shall be conducted in accordance with the following provisions... (a) Active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contribution from active institutional controls for more than 100 years after disposal... "

40 CFR §191.12 states the following:

> "Active institutional controls mean:
> 1) controlling access to a disposal site by any means other than passive institutional controls,
> 2) performing maintenance operations or remedial actions at a site,
> 3) controlling or cleaning up releases from a site, or
> 4) monitoring parameters related to disposal system performance."

Purpose: This Permit Attachment describes the design of a system that the Permittees will implement for compliance with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.118(b)) and 40 CFR §191.14(a) to control access to the Waste Isolation Pilot Plant (**WIPP**) disposal site and implement maintenance and remedial actions pertaining to the site access controls. In addition, this Permit Attachment addresses the scheduling process for control of inspection, maintenance, and periodic reporting related to long-term monitoring. Long-term monitoring addresses the monitoring of disposal system performance, as required by 40 CFR §191.14(b), and environmental monitoring, in accordance with this Permit and the Consultation and Cooperation Agreement between the U.S. Department of Energy (**DOE**) and the state of New Mexico. The scheduling process will also address evaluation of testing activities related to the permanent marker system design contained within the passive institutional controls (not required by this permit).

Implementation of active institutional controls at the WIPP will commence when final facility closure is achieved, as specified in Permit Part 6 and Permit Attachment G. Implementation of active institutional controls marks the transition from the active life of the facility (which ends upon certification of closure) to the post-closure care period, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart G). The Permittees will continue the imposition of active institutional controls under this Permit until NMED approves the post-closure certification specified in Permit Part 7 and Permit Attachment H.

Decommissioning activities include decontamination and site restoration. The decontamination effort will be completed prior to sealing of the shafts to allow disposal of all derived waste (radioactive and/or mixed waste derived from TRU/TRU-mixed waste received at the WIPP) into the repository. The implementation of active institutional controls upon certification of facility closure will prevent human intrusion into the repository. The Permittees' restoration efforts will return the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Necessary exceptions to returning the site to its full pre-WIPP condition include measurements associated with long-term monitoring.

Scope: The active institutional control requirements include a means of controlling access to the site of the repository's surface footprint (the repository area projected to the surface) and maintenance, including corrective actions, for access control system components. Active control of access to the site will be exercised by the Permittees for the duration of the post-closure care period. Although the Permittees are only required to maintain active institutional controls until approval of the post-closure certification by NMED, the Permittees will continue active institutional controls for at least 100 years after final facility closure to satisfy other regulatory requirements. Control of access will prevent intrusion into the disposed waste by deep drilling or mining for natural resources. This Permit Attachment also specifies a process for scheduling activities related to the long-term monitoring of the repository. Some of the activities supporting the monitoring programs will be initiated during the active life of the facility to establish databases. These activities are planned to continue beyond closure through the time after removal of the site structures and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem. Long-term monitoring requirements will be necessarily integrated with efforts toward returning the land to a stable ecological state.

Background: The WIPP was sited and designed as a research and development facility to demonstrate the safe disposal of radioactive wastes. The wastes are derived from DOE defense-related activities. Specifically, the mission of the WIPP project is to conduct research,

demonstration, and siting studies relevant to the permanent disposal of TRU wastes. Most of these wastes will be contaminated with hazardous constituents, making them mixed wastes.

The LWA addresses the disposal phase of the WIPP project, the period following closure of the site, and the removal of the surface facilities. The LWA set aside 10,240 acres (4,144 hectares) located in Eddy County, 26 miles (42 kilometers) east of Carlsbad, New Mexico, as the WIPP site. A 277-acre (112-hectare) portion within the 10,240 acres (4,144 hectares) is bounded by a barbed wire fence. This fenced area contains the surface facilities and the mined salt piles for the WIPP site. Figure H1-1 is a cutaway illustrating the spatial relationship of the surface facilities and the underground repository.

Upon receipt of the necessary certifications and permits from the EPA and the New Mexico Environment Department, the Permittees will begin disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU and TRU mixed waste in the WIPP. This waste emplacement and disposal phase will continue until the regulated capacity of the repository of 6,200,000 cubic feet (175,588 cubic meters) of TRU and TRU mixed waste has been reached, and as long as the Permittees comply with the requirements of the Permit. For the purposes of this Permit Attachment, this time period is assumed to be 25 years. The waste will be shipped from DOE facilities across the country in specially designed transportation containers certified by the Nuclear Regulatory Commission. The transportation routes from these facilities to the WIPP have been predetermined. The CH TRU mixed waste will be packaged in 55-gallon (208-liter), 85-gallon (322-liter), 100-gallon (379-liter) steel drums, standard waste boxes (**SWBs**), ten drum overpacks (**TDOPs**), and/or standard large box 2s (**SLB2s**). An SWB is a steel container having a free volume of 66.3 cubic feet (1.88 cubic meters). Figure H1-2 shows the general arrangement of a seven-pack of drums and an SWB as received in a Contact-Handled Package. RH TRU mixed waste inside a Remote-Handled Package is contained in one or more of the allowable containers described in Permit Attachment A1. Some RH TRU mixed waste may arrive in shielded containers as described in Permit Attachment A1.

Upon receipt and inspection of the waste containers in the waste handling building, the containers will be moved into the repository 2,150 feet (655 meters) below the surface. The containers will then be transported to a disposal room. (See Figure H1-1 for room and panel arrangement.) The initial seven disposal rooms are in Panel 1. Panel 1 is the first of eight panels planned to be excavated. Special supports and ground control corrective actions have been implemented in Panel 1 to ensure its stability. Upon filling an entire panel, that panel will be closed to isolate it from the rest of the repository and the ventilation system. During the period of time it takes to fill a given panel, an additional panel will be excavated. Sequential excavation of Panels 2 through 8 will ensure that these individual panels remain stable during the entire time a panel is being filled with waste. Ground control maintenance and evaluation with appropriate corrective action will be required to ensure that Panels 9 and 10 (ventilation and access drifts in the repository) remain stable.

Decontamination of the WIPP facility will commence with a detailed radiation survey of the entire site. Contaminated areas and equipment will be evaluated and decontaminated in accordance with applicable requirements. Where decontamination efforts identify areas that meet clean closure standards for permitted container storage units and are below radiological release criteria, routine dismantling and salvaging practices will determine the disposition of the material or equipment involved. Material and equipment that do not meet these standards and criteria will be emplaced in the access entries (Panels 9 and/or 10). Upon completion of emplacement of the contaminated facility material, the entries will be closed and the repository

shafts will be sealed. Final repository closure includes sealing the shafts leading to the repository. Figure H1-3 illustrates the shaft sealing arrangement. Certification of closure will end disposal operations and initiate the post-closure care period for implementation of active institutional controls.

H1.1 Active Institutional Controls

Active institutional controls during post-closure consist of three elements:

- controlling access to a disposal site,
- performing maintenance operations or remedial actions at a site, and
- controlling or cleaning up releases from a site.

The LWA has removed the WIPP site from public use as a site for mining and other types of mineral resource extraction. Since any type of exploration activity would require authorization, the issuance of approval to intrude upon the repository is precluded by the LWA. The existence of the LWA as law permits meeting the requirements of the first element above by implementing low technology barriers. These barriers include a posted fence and active surveillance at a frequency that denies sufficient time for an individual or organization to intrude into the repository undetected using today's drilling technology. Maintenance and remedial actions at the WIPP site will be conducted by the Permittees at the time of implementing the access controls for the site. The control or cleanup of releases from the site will be conducted as part of the operational program prior to sealing of the shafts. This is necessary to ensure that all derived waste is disposed of within the repository prior to shaft sealing.

The Permittees shall maintain the access controls. This requirement includes the maintenance and corrective actions necessary to ensure that the fence and patrol requirements (surveillance) are met. The active institutional controls to be implemented by the Permittees after final closure are the following:

1. A fence line will be established to control access to the repository footprint area on the surface. A standard four-strand (three barbed and one unbarbed, in accordance with the Bureau of Land Management specifications) wire fence will be erected along the perimeter of the repository surface footprint. To provide access to the repository footprint during construction of the berm (which may be built in multiple sections simultaneously), the fence will have gates placed approximately midway along each of the four sides. these gates will remain locked with access controlled by the Permittees. The western gate will be 20 feet (6 meters) wide. The remaining three gates will each be 16 feet (4.9 meters) wide. Additional fencing will be constructed where appropriate for remote locations that are used for disposal system monitoring. Such fences will meet the same construction specifications as the repository footprint perimeter fence.

2. Unpaved roadways 16 feet (4.9 meters) wide will be established along the perimeter of the barbed wire fence as well as along the WIPP site boundary. These roadways will be constructed so as to provide ready vehicle access to any point around the fenced perimeter and the site boundary. These roadways will facilitate inspection and maintenance of the fenceline and will allow visual observation of the repository footprint and the site boundary to the extent permitted by the lay of the land. These roadways will connect to the paved south access road. Roads to remote sites will also be constructed and maintained where appropriate.

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3. The fence line will be posted with signs having, as a minimum, a legend reading "Danger—Unauthorized Personnel Keep Out" (20.4.1.500 NMAC (incorporating 40 CFR §264.14[c])) and warning against entering the area without specific permission of the Permittees. The legend must be written in English and Spanish. The signs must be legible from a distance of at least 25 feet (7.6 meters). The size of the visual warning and the spacing of the warning signs will be sufficiently large and close to ensure that one or more of the signs can be seen from any approach prior to an individual actually making contact with the fence line. In no case will the spacing be greater than 300 feet (91.5 meters).

4. The Permittees will ensure that periodic inspection and expedited corrective maintenance are conducted on the fence line, its associated warning signs, and roadways.

5. The Permittees will provide for routine periodic patrols and surveillance of all areas controlled by or under the authority of the Permittees by personnel trained in security surveillance and investigation.

6. The Permittees will implement the periodic monitoring requirements of the long-term monitoring system.

7. The Permittees will submit a Permit modification request for any proposed modifications to the active institutional controls appropriate for access control, as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

8. The Permittees will immediately take appropriate action to address abnormal conditions identified during periodic surveillance and inspections. Abnormal conditions include any natural or human-caused conditions which would affect the integrity of the active institutional controls.

9. Reports addressing activities associated with the performance of the active access controls after final closure will be prepared periodically according to applicable requirements by the Permittees for submittal to the appropriate regulatory and legislative authorities.

H1.1.1 Repository Footprint Fencing

Access to an area approximately 2,780 feet by 2,360 feet (875 meters by 720 meters) will be controlled by a four-strand barbed wire fence. A single gate will be included along each side of the fence for access. These gates will remain locked with access controlled by the Permittees. Around the perimeter of the fence, an unpaved roadway 16 feet (4.9 meters) wide will be cut to allow for patrolling of the perimeter. Figure H1-4 is an illustration of the fence line in relation to the repository footprint. Patrolling of the perimeter is based upon the need to ensure that no mining or well drilling activity is initiated that could threaten the integrity of the repository.

Fencing off an area larger than the disposal area footprint would not significantly reduce the risk of intrusion but would interfere with cattle grazing established prior to the LWA. The LWA states that the Secretary of Energy can allow grazing to continue where it was established prior to enactment of the LWA. Based upon current drilling technologies, discussions with local well drilling organizations, and observation of well drilling activities in the WIPP vicinity, it typically requires at least two to three days for a driller to set up a deep drilling rig and commence actual

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drilling operations. Attaining the 2,150-foot (655-meter) depth that would approach the repository horizon takes at least another week to 10 days. Based upon current drilling practices, patrolling the fenced area two to three times weekly would identify any potential drilling activity well before any breach of the repository could occur. Therefore, the perimeter fence will be patrolled three times weekly after final closure.

Construction of access control systems using higher technology than described is not required. Likewise, continuous surveillance whether human or electronic is not required.

H1.1.2 Surveillance Monitoring

The Permittees will conduct periodic surveillance of the site and the repository footprint during the post-closure period. Unpaved roadways around the WIPP site boundary and around the repository footprint will facilitate such surveillance. Contractual arrangements with a local organization such as the Eddy County Sheriff's Department may be established which would provide some distinct advantages. Among the advantages are the following:

- deputies are trained in patrol and surveillance activities,
- deputies are authorized to arrest members of the general public who are found to be violating trespassing laws,
- the liability associated with apprehension, attempted apprehension, or circumstances arising from attempts would remain with the Sheriff's Department, and
- the general area to be patrolled is already a part of the Sheriff's area of responsibility.

Surveillance will consist of drive-by patrolling around the fenced perimeter a minimum of three times per week. In the course of the patrol, particular note will be taken of the fence integrity. In addition, the locked condition of each gate will be checked to ensure that gate integrity is maintained and there is no evidence of tampering. Surveillance will also include visual observation of the entire enclosed area for any signs of human activity. Additionally, surveillance patrols will be conducted around the site boundary's perimeter for signs of unauthorized human activities. A routine summary of each month's surveillance activity will be prepared documenting the date and time of each patrol and any unusual circumstances that may have been observed. This surveillance routine will continue throughout the post-closure care period.

H1.1.3 Maintenance and Remedial Actions

Anticipated maintenance and remedial action issues during the post-closure care period are minimal and should encompass such issues as

- fence and road maintenance,
- repair of any damage that occurs,
- response to evidence of potential erection of drilling equipment, and
- response to unauthorized entry into prohibited areas.

The Permittees will provide maintenance services within a reasonable time after the need is identified during routine patrolling activity. Any observed vandalism or unauthorized entry will be investigated and action will be taken as the circumstances warrant.

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H1.1.4 Control and Clean-up of Releases

The decontamination process and disposal of the derived waste will be completed prior to sealing the shafts and final facility closure. With the location of the WIPP repository at 2,150 feet (655 meters) below the surface and with panels closed and shafts sealed, the potential for releases of radioactive material or hazardous constituents following the sealing of the shafts is precluded. There will be no credible pathway for releases from the repository other than human intrusion. Routine patrols in accordance with access control requirements will preclude human intrusion into the repository during the post-closure period.

H1.1.5 Groundwater Monitoring

Groundwater monitoring is the only monitoring program required by the Permit that will be conducted throughout the post-closure care period. The post-closure groundwater monitoring requirements are specified in Permit Part 7 and Permit Attachment L.

H1.2 Additional Post-Closure Activities

With the certification of closure of WIPP and return of the land disturbed by the WIPP activities to a stable ecological state that will assimilate with the surrounding undisturbed ecosystem, continuous occupancy of the site for operational and security purposes will cease. Any additional activities will be imposed through the Post-Closure Care Permit issued by NMED after certification of closure.

H1.3 Quality Assurance

The quality assurance and quality control plan will be applied to the procurement of materials for and the erection of the fencelines enclosing the repository footprint. In particular, quality control inspection of the placement and tensioning of the barbed wire and chain link fabric will be applied and utilized to provide reasonable assurance that the fencing structures will function during the post-closure care period with normal maintenance.

Quality assurance and quality control will also be applied to the sampling and analyses supporting the environmental monitoring program. Contractors collecting samples and laboratories conducting analyses for the Permittees shall be qualified in accordance with guidelines prescribed in the most current edition of the Permittees' quality assurance program document at the time that the contracts are awarded.

References

EPA (U.S. Environmental Protection Agency). 1993. 40 CFR Part 191 Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste; Final Rule. *Federal Register*, Vol. 58, No. 242, pp. 66398-66416, December 20, 1993. Office of Radiation and Indoor Air, Washington, D.C.

U.S. Congress. 1992. Waste Isolation Pilot Plant Land Withdrawal Act. Public Law 102-579, 106 Stat. 4777, October 1992. 102nd Congress, Washington, D.C.

FIGURES

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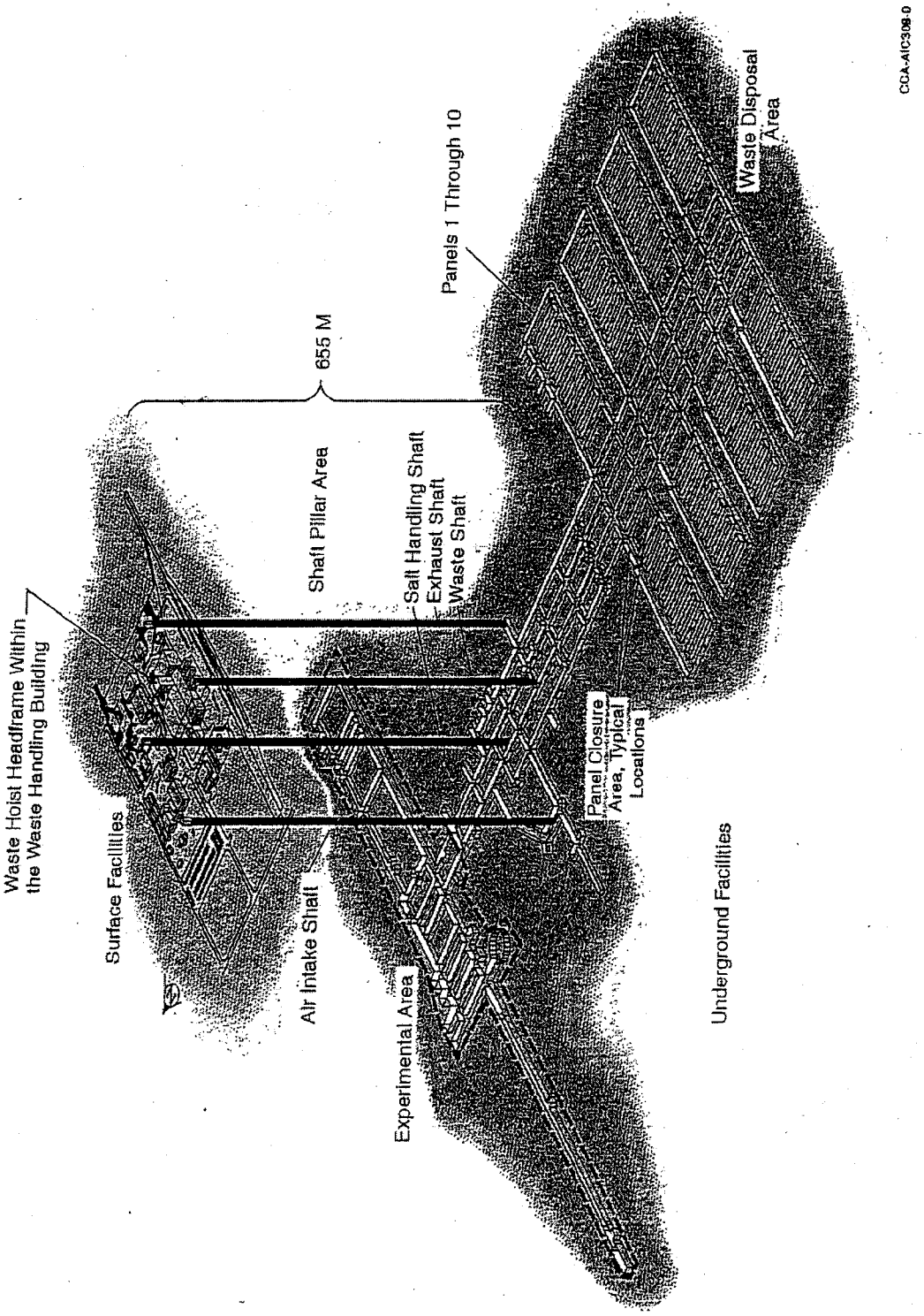
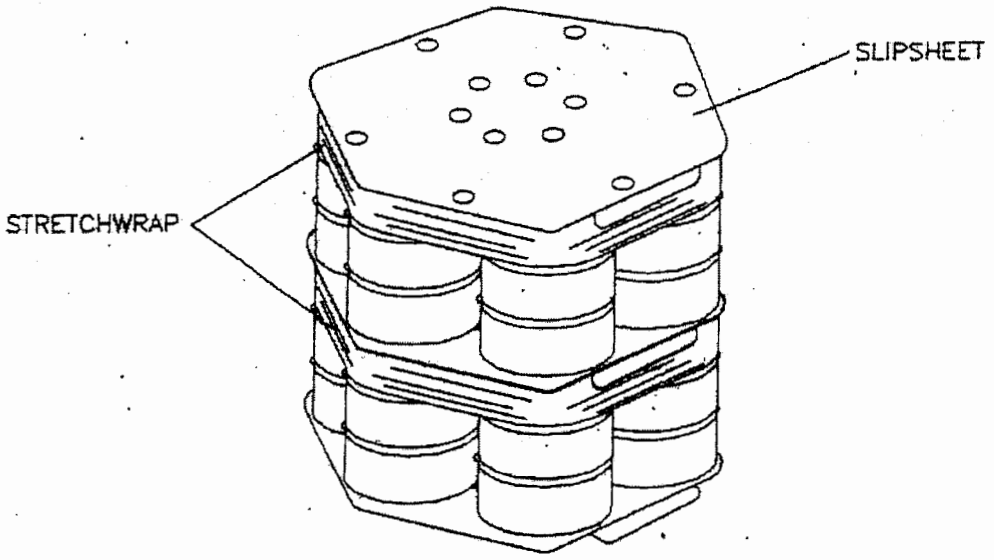
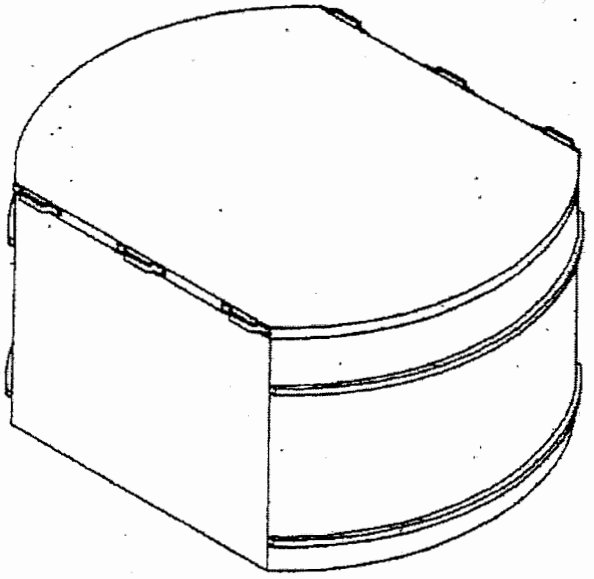


Figure H1-1
Spatial View of WIPP Surface and Underground Facilities



SEVEN–PACKS



STANDARD WASTE BOX

Figure H1-2
Standard Waste Box and Seven-Pack Configuration

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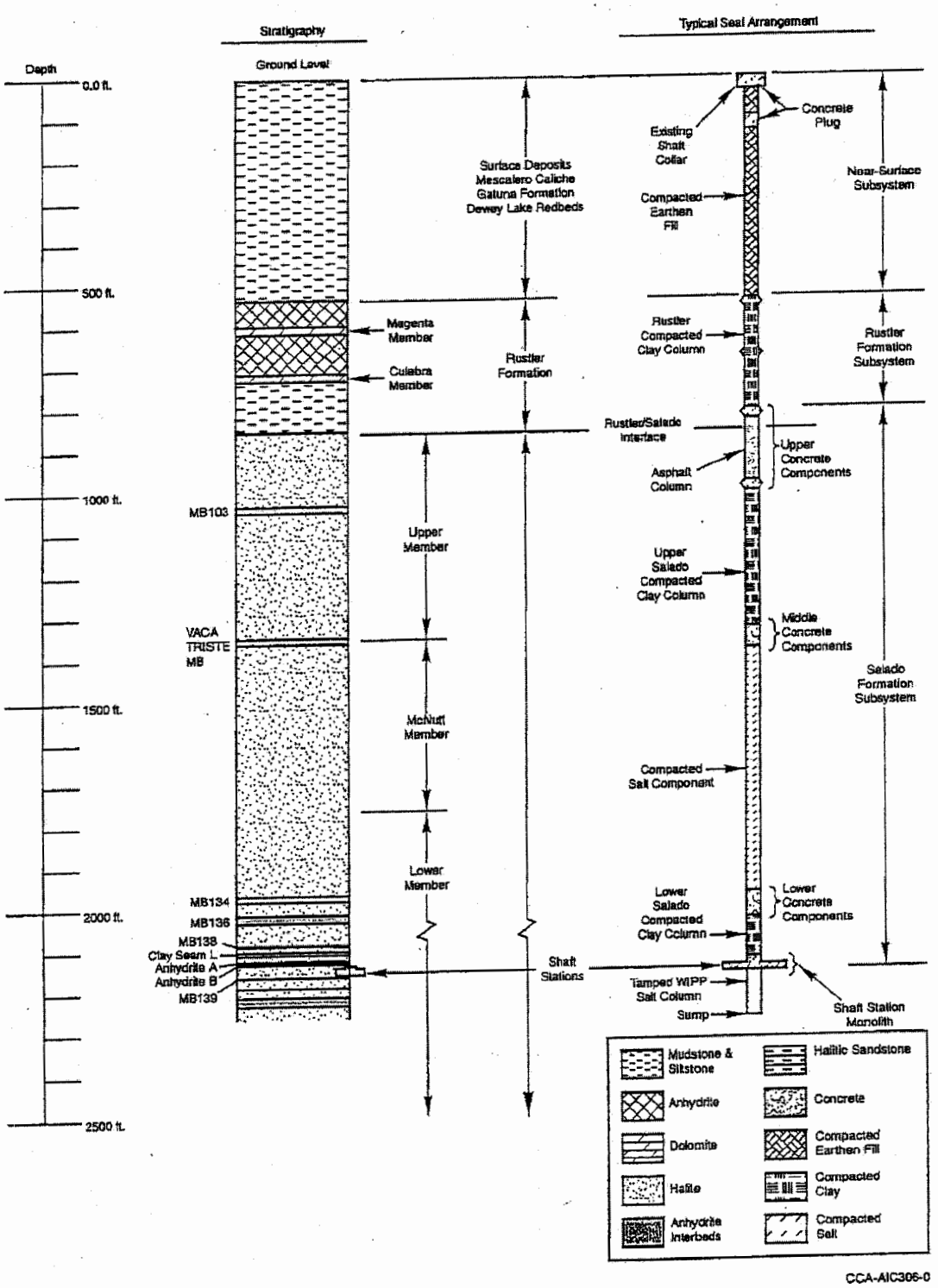

Figure H1-3
Typical Shaft Sealing System

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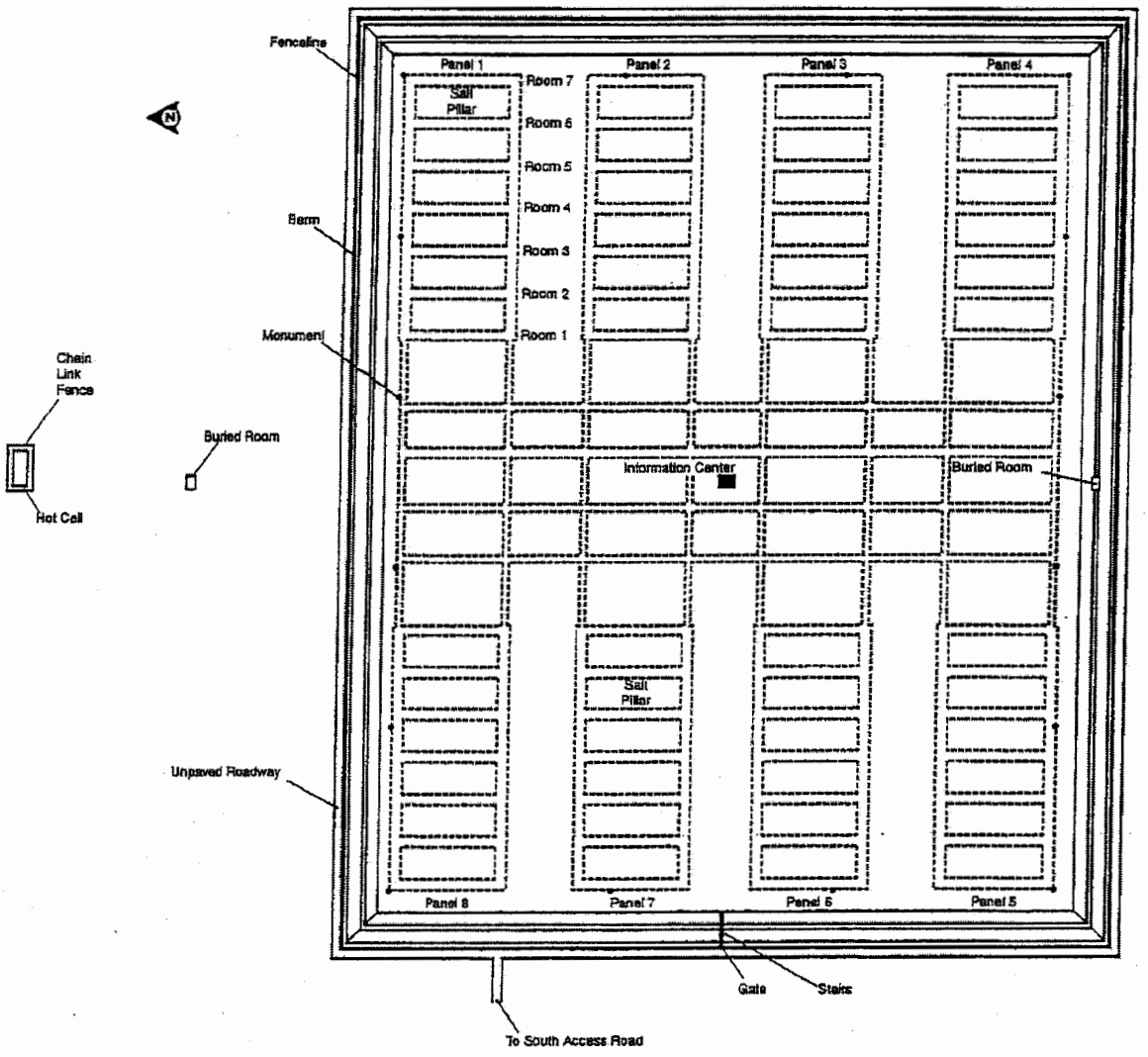

Figure H1-4
Perimeter Fenceline and Roadway

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ATTACHMENT I

COMPLIANCE SCHEDULE

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ATTACHMENT I

COMPLIANCE SCHEDULE

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ATTACHMENT J

HAZARDOUS WASTE MANAGEMENT UNIT TABLES

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ATTACHMENT J

HAZARDOUS WASTE MANAGEMENT UNIT TABLES

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Table J-1
Waste Handling Building (WHB) Container Storage Unit

Description	Area	Maximum Capacity	Container Equivalent
CH Bay Storage Area	32,307 ft^2 (3,001 m^2)	4,800 ft^3 (135.9 m^3)	13 loaded facility pallets and 4 CH Packages at the TRUDOCKS
CH Bay Surge Storage Area	included in CH Bay Storage Area	1,600 ft^3 (45.3 m^3)	5 loaded facility pallets
Derived Waste Storage Area	included in CH Bay Storage Area	66.3 ft^3 (1.88 m^3)	1 Standard Waste Box
Total for CH Waste	32,307 ft^2 (3,001 m^2)	**6,466.3 ft^3 183.1 m^3**	
RH Bay	12,552 ft^2 (1,166 m^2)	156 ft^3 (4.4 m^3)	2 loaded casks and 1 drum of derived waste
Cask Unloading Room	382 ft^2 (36 m^2)	74 ft^3 (2.1 m^3)	1 loaded cask
Hot Cell	1,841 ft^2 (171 m^2)	94.9 ft^3 (2.7 m^3)	12 drums and 1 drum of derived waste
Transfer Cell	1,003 ft^2 (93 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Facility Cask Loading Room	1,625 ft^2 (151 m^2)	31.4 ft^3 (0.89 m^3)	1 canister
Total for RH Waste	**17,403 ft^2 (1,617 m^2)**	**387.7 ft^3 (11.0 m^3)**	
WHB Unit Total	**49,710 ft^2 (4,618 m^2)**	**6,854 ft^3 (194.1 m^3)**	

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Table J-2
Parking Area Container Storage Unit

Description	Area	Maximum Capacity	Container Equivalent
Parking Area	137,050 ft^2 (12,730 m^2)	6,734 ft^3 (191 m^3)	40 Contact- Handled Packages containing waste and 8 Remote-Handled Packages containing waste. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.
Parking Area Surge Storage	Included in Parking Area	2,129 ft^3 (60 m^3)	12 Contact-Handled Packages and 4 Remote-Handled Packages. The total number of Contact-Handled Packages containing waste in the Parking Area Unit cannot exceed 50.

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Table J-3
Underground Hazardous Waste Disposal Units

Description[1]	Waste Type	Maximum Capacity[2]	Container Equivalent
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)	86,500 55-Gallon Drums
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)	86,500 55-Gallon Drums
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
	RH TRU	12,570 ft^3 (356 m^3)	400 RH TRU Canisters
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
	RH TRU	15,720 ft^3 (445 m^3)	500 RH TRU Canisters
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
	RH TRU	18,860 ft^3 (534 m^3)	600 RH TRU Canisters
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)	90,150 55-Gallon Drums
	RH TRU	22,950 ft^3 (650 m^3)	730 RH TRU Canisters
Total	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)**	**713,900 55-Gallon Drums**
	RH TRU	**93,050 ft^3 (2,635 m^3)**	**2960 RH TRU Canisters**

1 The area of each panel is approximately 124,150 ft^2 (11,533 m^2).

2 "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

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ATTACHMENT K

SOLID WASTE MANAGEMENT UNIT (SWMU) AND AREA OF CONCERN (AOC) TABLES

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ATTACHMENT K

SOLID WASTE MANAGEMENT UNIT (SWMU) AND AREA OF CONCERN (AOC) TABLES

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Table K-4	Hazardous Waste Management Units

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Table K-1
Solid Waste Management Units (SWMUs) & Areas of Concern (AOCs) Requiring Corrective Action

Unit ID Number	Unit Description	Comments
Reserved	Reserved	

Table K-2
SWMUs & AOCs Corrective Action Complete With Controls

Unit ID Number	Unit Description	Comments
Reserved	Reserved	

Table K-3
SWMUs & AOCs Requiring No Further Action (NFA)

Unit ID Number	Unit Description	Comments
SWMU 001g	H-14/P-1 Mud Pit (s)	NFA granted 10/23/2008
SWMU 001h	H-15/P-2 Mud Pit (s)	NFA granted 10/23/2008
SWMU 001j	P-3 Mud Pit	NFA granted 10/23/2008
SWMU 001k	P-4 Mud Pit	NFA granted 10/23/2008
SWMU 001l	WIPP-12/P-5 Drilling Mud Pit(s)	NFA granted 10/23/2008
SWMU 001m	P-6 Mud Pit	NFA granted 10/23/2008
SWMU 001n	P-15 Mud Pit	NFA granted 10/23/2008
SWMU 001o	Badger Unit Drilling Mud Pit(s)	NFA granted 10/23/2008
SWMU 001p	Cotton Baby Drilling Mud Pit(s)	NFA granted 10/23/2008
SWMU 001q	DOE-1 Drilling Mud Pit(s)	NFA granted 10/23/2008
SWMU 001s	ERDA-9 Mud Pit	NFA granted 10/23/2008
SWMU 001t	IMC-374 Mud Pit	NFA granted 10/23/2008
SWMU 001x	WIPP-13 Drilling Mud Pit(s)	NFA granted 10/23/2008
SWMU 004a	Portacamp Storage Yard, West Side	NFA granted 10/23/2008
SWMU 007b	SW Evaporation Pond	NFA granted 10/23/2008
AOC 001r	D-123 Mud Pit	NFA granted 10/23/2008
AOC 001u	IMC-376 Mud Pit	NFA granted 10/23/2008
AOC 001v	IMC-456 Mud Pit	NFA granted 10/23/2008
AOC 001w	IMC-457 Mud Pit	NFA granted 10/23/2008
AOC 001ac	DSP-207 Mud Pit	NFA granted 10/23/2008
AOC 001ae	IMC-377 Mud Pit	NFA granted 10/23/2008
AOC 010b	Waste Handling Shaft Sump	NFA granted 10/23/2008
AOC 010c	Exhaust Shaft Sump	NFA granted 10/23/2008

Table K-4
Hazardous Waste Management Units

Unit ID Number	Unit Description	Comments
SWMU 013a	Waste Handling Building Unit	
SWMU 013b	Parking Area Unit	
SWMU 013c	Underground HWDU - Panel 1	
SWMU 013d	Underground HWDU – Panel 2	
SWMU 013e	Underground HWDU – Panel 3	
SWMU 013f	Underground HWDU – Panel 4	
SWMU 013g	Underground HWDU – Panel 5	
SWMU 013h	Underground HWDU – Panel 6	

ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

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Figure L-14	Groundwater Level Surveillance Wells (insert represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

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LIST OF ABBREVIATIONS/ACRONYMS/UNITS

Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	chain of custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory control samples
LCSD	lab control sample duplicate
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler Formation
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department

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QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
TDS	total dissolved solids
TOC	total organic carbon
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
µg/L	microgram(s) per liter
µm	micrometers

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ATTACHMENT L

WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

Groundwater monitoring at the WIPP facility focuses on the Culebra Member (**Culebra**) of the Rustler Formation (**Rustler**) because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. Groundwater movement in the Culebra, using results

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from the basin-scale groundwater model is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, (DOE, 2009).

This monitoring plan addresses requirements for sample collection, Culebra groundwater surface elevation monitoring, Culebra groundwater flow direction and rate determination, data management, and reporting of Culebra groundwater monitoring data. It also identifies indicator parameters and hazardous constituents selected to assess Culebra groundwater quality for the WIPP groundwater detection monitoring program (**DMP**). Because quality assurance is an integral component of the groundwater sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this DMP are provided in the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d)). Procedures are required for each aspect of the Culebra groundwater sampling process, including Culebra groundwater surface elevation measurement, Culebra groundwater flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection. Data required by this plan will be collected by qualified personnel in accordance with SOPs (Table L-3).

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP facility is situated within the Delaware Basin bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler's upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of

mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the downward percolation of water into the evaporite units below. The Bell Canyon is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) (DOE, 2009)) and is confined above by the thick evaporite deposits of the Castile. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is approximately 2,200 pounds per square inch [lb/$in.^2$] or 14.9 megapascals [MPa]) and eventually deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) (DOE, 2009)).

L-1a(2) Groundwater Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional groundwater aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities

measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy.

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-5). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day.

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)). Detailed cross-hole hydraulic testing has been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ten orders of magnitude from east to west in the vicinity of WIPP. Transmissivities have been calculated at 1×10^{-7}

square feet per day (1×10^{-13} square meters per second) at well SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east.

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in groundwater geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the groundwater in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 (DOE, 2009)).

The radiogenic ages of the Culebra groundwater and the geochemical differences provide information potentially relevant to the groundwater flow directions and groundwater interaction with other units and are important constraints on conceptual models of groundwater flow.

The Permittees have proposed a conceptualization of groundwater flow that explains observed geochemical facies and groundwater flow patterns. The conceptualization, referred to as the basin-scale groundwater model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. The model assumes that the groundwater system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on groundwater flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south.

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area. Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (**TDS**) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6 - 5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4 - 8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra groundwater was inconsistent with flow directions. This was based on the premise that facies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 (DOE, 2009)).

Head distribution in the Culebra (see Amended Renewal Application Addendum L1 (DOE, 2009)) is consistent with basin-scale groundwater basin modeling results indicating that the generalized groundwater flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta Member (**Magenta**) of the Rustler across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale groundwater modeling.

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering.

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if groundwater monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that groundwater monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP

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facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP Detection Monitoring Program (DMP)—Overview

L-3a Scope

This DMP plan governs groundwater sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264 Subpart F), and ensures that such data are gathered in accordance with these and other applicable requirements. Analytical results collected during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

Wells WQSP-1, WQSP-2, and WQSP-3 are located directly upgradient (north) of the WIPP shaft area.

WQSP-4, WQSP-5, and WQSP-6 are located downgradient (south) of the WIPP shaft area. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra. Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009)).

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

Transport modeling suggests that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years. This assumes conditions where hazardous constituents migrate from the sealed repository (post closure) to the Culebra via the sealed shafts.

Potentiometric surfaces and groundwater flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

L-3b(1) Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

The six DMP Culebra wells were drilled between September 13 and October 16, 1994. The total depth of each well is shown in Table L-5. The wells were drilled through the Culebra into the Los Medaños as shown in Table L-5. The wells were drilled to the top of the Culebra using compressed air as the drilling fluid and a 9⅞-in. drill bit. The wells were then cored using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, DMP wells were reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were cased from the surface to total depth with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval as shown in Table L-5 . The annulus between the borehole wall and the casing/screen is packed with sand and with 8/16 Brady gravel as indicated in Table L-5.

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

Groundwater surface elevations will be monitored in each of the six DMWs on a monthly basis. The groundwater surface elevation in each DMW will also be measured prior to each annual sampling event. The groundwater surface elevation measurements in the WLMP wells will also be monitored on a monthly basis when accessible. The characteristics of the DMW (sampling frequency, location) will be evaluated if significant changes are observed in the groundwater flow direction or gradient.

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b are measured as part of the DMP.

Additional hazardous constituents may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP facility. If hazardous constituents are identified, these will be added to Part 5, Table 5.4.b, unless the Permittees provide justification for their omission (e.g. hazardous constituent not in 40 CFR §264 Appendix IX), and this omission is approved by NMED.

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L-4c Groundwater Surface Elevation Measurement, Sample Collection and Laboratory Analysis

Groundwater surface elevations will be measured in each DMW prior to groundwater sample collection. Groundwater will be extracted using serial and final sampling methods. Serial samples will be collected until groundwater field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.

L-4c(1) Groundwater Surface Elevation Monitoring Methodology

The WIPP groundwater level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3.

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, groundwater surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, when accessible. Well locations are shown in Figure L-14. If a cumulative groundwater surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the Annual Culebra Groundwater Report specified in Permit Part 5. Abnormal, unexplained changes in groundwater surface elevation will be evaluated to determine if they indicate changes in site recharge/discharge which could affect the assumptions regarding DMW placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Groundwater surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual groundwater surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of groundwater surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density. To monitor the hydraulic gradients of the hydrologic flow systems accurately, actual groundwater surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 will be measured annually.

Measured Culebra water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho y h$$

where

p = freshwater head (length of freshwater head)
y = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)
p = freshwater density (mass/volume)
h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity.

Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate groundwater surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. An SOP will be used when making water-level measurements for this program. The SOP will specify the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records.

L-4c(1)(ii) Groundwater Surface Elevation Records and Document Control

Incoming data will be processed in a manner that ensures data integrity. The data management process for groundwater surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not possible (e.g., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to applicable SOPs (see Table L-3). These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program calculates groundwater surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet program adjusts groundwater surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent

of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. Groundwater surface elevation data and equivalent freshwater heads for the Culebra wells in Table L-4 will be transmitted to NMED by May 31 and November 30. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

L-4c(2) Groundwater Sampling

L-4c(2)(i) Groundwater Pumping and Sampling Systems

The groundwater pumping and sampling systems used to collect a groundwater sample from the six DMWs will provide continuous and adequate production of water so that a representative groundwater sample can be obtained.

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The DMWs are individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down-hole submersible pumps are controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged no more than three well bore volumes or until field parameters have stabilized, whichever comes first. Well purging will performed in accordance with an SOP in conjunction with serial sampling to determine when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater.

The DMWs are cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). An electric, submersible pump installation without the use of a packer is used in this instance. The largest amount of discharge from the submersible pump takes place from a discharge pipe. In addition to this main discharge pipe, a dedicated sample line running parallel to the discharge pipe is used. The sampling line is manufactured from a chemically inert material. Cumulative flow is measured using a totalizing flow meter. Flow from the discharge pipe is routed to a discharge tank for disposal.

The dedicated sampling line is used to collect the water sample that will undergo analysis. By using a dedicated sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow through the sample collection line is regulated by a flow-control valve. The sample line is insulated at the surface to minimize temperature fluctuations.

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the groundwater chemistry stabilizes and is therefore representative of undisturbed groundwater. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. Each DMW will be purged to no than more three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-

analyzed parameters are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile filed laboratory for field indicator parameters. The Permittees will provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the groundwater as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the Permittees, but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: pH, temperature, specific conductance, and specific gravity.

The three field indicator parameters of temperature, specific conductance, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a sample line at atmospheric pressure. Specific conductance and specific gravity samples will be collected from the sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the sample line.

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. Unfiltered groundwater will be used when determining temperature, pH, specific conductance, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. Temperature, pH, and specific conductance, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. Standard Operating Procedures (see Table L-3) defines the protocols for the collection of final and serial samples and analysis.

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

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Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-6 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head.

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (**DI**) water and rinsed in DI water. Sample containers will be new, certified clean containers that will be discarded after one use. Groundwater surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed in accordance with SOPs after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a rinsate blank sample will be collected to verify cleanliness.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered sampling lines. Detailed protocols, in the form of SOPs (see Table L-3) define how final samples will be collected in a consistent and repeatable fashion for analyses.

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-6). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory SOPs). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs generated, approved, and maintained by the contract analytical laboratory.

Final samples will be sent to the analytical laboratories and analyzed for parameters and hazardous constituents specified in Part 5, Tables 5.4a and 5.4b.

Duplicates of the final sample will be provided to WIPP Project oversight agencies when requested.

Wastes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3).

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated as requested by the analytical laboratory.

The analytical laboratory receiving the samples will prescribe the type and amount of preservative, the container material type, the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the

EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses uniquely numbered chain of custody/ request for analysis (CofC/RFA) forms. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes of interest. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample tracking protocol.

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3).

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking data, and CofC/RFA form. An example form is shown in Figure L-13.

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, custody seals that are adhesive-backed strips are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking

Sample tracking information will be completed for each sample collected. The sample tracking information includes the following information: CofC/RFA form number; date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

WQ6[1]C[2]R2[3]N1[4]

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document.

Chain of Custody and Request for Analysis

A CofC/RFA form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The CofC/RFA form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the CofC/RFA form. The completed original (top page) of the CofC/RFA will be returned to the Permittees with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed using methods selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall demonstrate, through laboratory SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility Operating Record. Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in groundwater and the complexity of brines associated with the Culebra groundwater.

The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (**QC**) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. A copy of the laboratory SOPs will be maintained in WIPP facility files. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record.

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration

The equipment used to collect data for this DMP will be calibrated in accordance with SOPs. The Permittees will be responsible for calibrating needed equipment on schedule and for maintaining current calibration records for each piece of equipment.

L-4d(2) Groundwater Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking groundwater surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). The Permittees will be responsible for ensuring equipment is calibrated on schedule in accordance with SOPs. The Permittees will also be responsible for maintaining copies of records of the most recent calibration for each piece of equipment.

L-4e Statistical Analysis of Laboratory Analytical Data

Analytical data collected as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees.

L-4e(1) Temporal and Spatial Analysis

Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

L-4e(2) Distributions and Descriptive Statistics

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (**UTLV**) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

L-4e(3) Action Levels

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the methodologies specified in "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities" (EPA, 2009).

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background groundwater quality hazardous constituent specified in Part 5, Table L-5.4b at every detection monitoring well during each of the ten background sampling events (with the exception of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed disposal began). These measurements serve as a statistical baseline (Part 5, Table 5.6) that is used for evaluating the significance of the results of subsequent sampling events during detection monitoring. Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)(4)). If the comparisons show that a constituent statistically exceeds the baseline of the DMWs (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)). The results of the statistical comparison will be reported annually to the NMED in the Annual Culebra Groundwater Report by November 30, as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)).

L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality

checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.

- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.

- Parameter and hazardous constituents, analytical results, reporting units, reporting limit, analytical method used.

- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specified in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from annual groundwater sampling activities will be compared and interpreted by the Permittees through generation of statistical analyses as specified in Section L-4e. The Permittees will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra Groundwater Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report. The report will include all applicable information that may affect the comparison of background groundwater quality and groundwater surface elevation data through time. This information will include but is not limited to:

- DMW and WLMP well configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).

- Pumping activities that may have taken place since publication of the last annual report (i.e., related to groundwater quality sampling, hydraulic testing, and shaft installation or grouting) that may have taken place since the last annual groundwater report.

- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

- The results of the annual measurements of densities.

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- Annotated hydrographs.
- Groundwater flow rate and direction.
- Potentiometric surface map generated using the following steps:
  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.
  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.
  - Fit trend surface through freshwater heads.
  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (**PABCs**) and define initial fixed-head boundary conditions based on the trend surface.
  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.
  - Run MODFLOW with optimal boundary conditions fit.
  - Contour MODFLOW head results on WIPP site.
  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.
  - Data analysis that will accompany the potentiometric surface map will include:
    - Measured versus modeled scatter plot diagram
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).
- Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2.

The DMP data used in generating the Annual Culebra Groundwater Report will be maintained as part of the WIPP facility Operating Record and will be provided to NMED for review as specified in the permit.

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L-6 Records Management

Records generated during groundwater sampling and water level monitoring will be maintained in either project files at the Permittees facility or the Operating Record. Project files will include, but are not limited to:

- Sampling and Analysis Plans (**SAPs**)
- SOPs
- Field Data Entry Sheets
- CofC/RFA forms
- Analytical Laboratory Data Reports
- Variance Logs and Nonconformance Reports
- Corrective Action Reports.

Detection Monitoring Program monitoring, testing, and analytical data and WLMP data will be maintained in the WIPP facility Operating Record.

L-7 Quality Assurance Requirements

Quality Assurance (**QA**) requirements specific to the DMP are presented in this section.

L-7a Data Quality Objectives and Quality Assurance Objectives

L-7a(1) Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support project decisions. DQOs have been established to ensure that the data collected will be of a sufficient and known quality for their intended uses. The overall DQOs for this DMP are shown in the following sections.

L-7a(1)(i) Detection Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the groundwater underlying the WIPP facility.

L-7a(1)(ii) Water Level Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility.

L-7a(2) Quality Assurance Objectives

Quality Assurance Objectives (**QAOs**) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability.

L-7a(2)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-7a(2)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (SC), temperature, specific gravity and static groundwater surface elevation. Field measurement accuracy will be determined using calibration standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ensure accuracy. Accuracy of groundwater surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs contains instructions that outline protocols for maintaining current calibration of groundwater surface elevation measurement instrumentation.

L-7a(2)(i)(B) Accuracy Objectives for Laboratory Measurements

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-7a(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{\left|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)\right|}{average\ of\ measured\ samples\ 1+2} \times 100$$

L-7a(2)(ii)(A) Precision Objectives for Field Measurements

Specific conductance, pH, and temperature will be measured during well purging and after sampling. SC measurements will be precise to ±10% pH to 0.10 standard unit, specific gravity to 0.01 by hydrometer and temperature to 0.10 degrees Celsius (°C). Water-level measurements will be precise to ± 0.01 ft. The precision of water density measurements, when measured in the

field using down hole instrumentation, will be determined on a well-by-well basis and will result in no more than a ± 2 ft of error in the derived fresh-water head.

L-7a(2)(ii)(B) Precision Objectives for Laboratory Measurements

Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (**LCSD**) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results. Laboratory analytical precision is also parameter dependent and will be prescribed in laboratory SOPs.

L-7a(2)(iii) Contamination

In addition to measurements of precision and bias, QC checks for contamination will be performed. QC samples including trip blanks, field blanks, and method blanks will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents and glassware. Trip blanks will be used to assess volatile organic compound (**VOC**) sample contamination during shipment and handling and will be collected and analyzed at a frequency of 1 sample per sample shipment. Field blanks will be used to assess field sample collection methods and will be collected and analyzed at a minimum frequency of one sample per 20 samples (five percent of the samples collected). Method blanks will be used to assess contamination resulting from the analytical process and will be analyzed at a minimum frequency of one sample per 20 samples, or five percent of the samples collected. Evaluation of sample blanks will be performed following U.S. EPA "National Functional Guidelines for Organic Data Review" (EPA, 1999) and "National Functional Guidelines for Evaluating Inorganics Analyses" (EPA, 2004). Only method blanks will be analyzed via wet chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed method reporting limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in method blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

L-7a(2)(iv) Completeness

Completeness is a measure of the amount of usable valid data resulting from a data collection activity, given the sample design and analysis. Completeness may be affected by unexpected conditions that may occur during the data collection process.

Occurrences that reduce the amount of data collected include sample container breakage during sample shipment or in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for analysis of Part 5, Table 5.4a parameters will be 90 percent and 100 percent analysis of Part 5, Table 5.4.b hazardous constituents. If the completeness objective for Part 5 Table 5.4.b hazardous constituents is not met, the Permittees will determine the need for resampling on a case-by-case basis. Numerical expression of the completeness (**%C**) of data is as follows:

$$\%C = \frac{number\ of\ accepted\ samples}{total\ number\ of\ samples\ collected} \times 100$$

L-7a(2)(v) Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this DMP will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures will be designed to minimize factors affecting the integrity of the samples. Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected will be those that will most accurately and precisely represent the true concentration of analytes of interest.

For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions.

L-7a(2)(vi) Comparability

Comparability is the extent to which one data set can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measures dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (µg/L) for VOCs and semivolatile organic compounds (**SVOC**s).

Culebra groundwater surface elevation measurements will be expressed as equivalent freshwater elevation in feet above mean sea level.

L-7b Design Control

The approved design for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with 20.4.1.900 NMAC (incorporating 40 CFR §§ 270.42).

L-7c Instructions, Procedures, and Drawings

The preparation and use of instructions and procedures at the WIPP facility are outlined in the WIPP facility document WP 13-1(see Table L-3). Activities performed for the DMP that may affect groundwater data quality will be performed in accordance with approved procedures which comply with the Permit.

L-7d Document Control

Permittees will ensure that the latest approved versions of WIPP facility SOPs will be used in performing groundwater monitoring functions and that obsolete materials will be adequately identified or removed from work areas.

L-7e Inspection and Surveillance

Inspection and surveillance activities will be conducted as outlined in WIPP document WP 13-1 (see Table L-3). The Permittees will be responsible for performing the applicable WIPP facility SOPs.

L-7f Control of Monitoring and Data Collection Equipment

WIPP document WP 13-1 (see Table L-3) outlines the basic requirements for control and calibrating monitoring and data collection (**M&DC**) equipment. M&DC equipment shall be properly controlled, calibrated, and maintained according to WIPP facility SOPs (see Table L-3) to ensure continued accuracy of groundwater monitoring data. Results of calibrations, maintenance, and repair will be documented. Calibration records will identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records will be maintained to track uses of M&DC equipment. If M&DC equipment is found to be out of tolerance, the equipment will be tagged and it will not be used until corrections are made.

L-7g Control of Nonconforming Conditions

In accordance with WP 13-1 (see Table L-3), equipment that does not conform to specified requirements will be controlled to prevent use. The disposition of defective items will be documented on records traceable to the affected items. Prior to final disposition, faulty items will be tagged and segregated. Repaired equipment will be subject to the original acceptance inspections and tests prior to use.

L-7h Corrective Action

Requirements for the development and implementation of a system to determine, document, and initiate appropriate corrective actions after encountering conditions adverse to quality at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). Conditions adverse to acceptable quality will be documented and reported in accordance with corrective action procedures and corrected as soon as practical. Immediate action will be taken to control work performed under conditions adverse to acceptable quality and its results to prevent quality degradation.

L-7i Quality Assurance Records

WIPP document WP 13-1(see Table L-3) outlines the policy that will be used at the WIPP facility regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records.

Records to be generated in the DMP will be specified by procedure. QA and RCRA operating records will be identified. This will be the basis for the labeling of records as "QA" or "RCRA operating record" on the Environmental Monitoring Records Inventory and Disposition Schedule.

L-8 References

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TABLES

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Table L-1
Hydrological Parameters for Rock Units above the Salado at WIPP

Unit		Hydraulic Conductivity	Storage	Thickness	Hydraulic Gradient
Santa Rosa		2×10^{-8} to 2×10^{-6} m/s (1) (2)		0 to 91 m	0.001 (5)
Dewey Lake		10^{-8} m/s	Specific storage 1×10^{-5} (1/m) (2)	152 m	0.001 (5)
Rustler	Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	13 to 23 m	NA (6)
	Magenta	$1 \times 10^{-8.5}$ to $1 \times 10^{-6.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	7 to 8.5 m	3 to 6
	Tamarisk	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	26 to 56 m	NA (6)
	Culebra	$1 \times 10^{-7.5}$ to $1 \times 10^{-5.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	4 to 11.6 m	0.003 to 0.007 (5)
	Los Medaños	6×10^{-15} to 1×10^{-13} m/s 1.5×10^{-11} to 1.2×10^{-11} m/s (basal interval)	Specific storage 1×10^{-5} (1/m) (2)	29 to 38 m	NA (6)

Matrix characteristics relevant to fluid flow include values used in this table such as permeability, hydraulic conductivity, gradient, etc.)

Table Notes:

(1) The Santa Rosa Formation is not present in the western portion of the WIPP site. It was combined with the Dewey Lake Red Beds in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996), and the range of values entered here are those used in that study for the Dewey Lake/Triassic hydrostratigraphic unit.

(2) Values or ranges of values given for these entries are the values used in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996). Values are estimated based on literature values for similar rock types, adjusted to be consistent with site-specific data where available. Ranges of values include spatial variation over the WIPP site and differences in values used in different simulations to test model sensitivity to the parameter.

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(3) Hydraulic gradient is a dimensionless term describing change in the elevation of hydraulic head divided by change in horizontal distance. Values given in these entries are determined from potentiometric surfaces. The range of values given for the Culebra reflects the highest and lowest gradients observed within the WIPP site boundary. Values for the Dewey Lake and Santa Rosa are assumed to be the same as the gradient determined from the water table. Note that the Santa Rosa Formation is absent or above the water table in most of the controlled area, and that the concept of a horizontal hydraulic gradient is not meaningful for these regions.

(4) Flow in units of very low hydraulic conductivity is slow, and primarily vertical. The concept of a horizontal hydraulic gradient is not applicable.

Sources: Beauheim, 1986; Domenico and Schwartz, 1990; Domski, Upton, and Beauheim, 1996; Earlough, 1977.

1

Table L-2
WIPP Groundwater Detection Monitoring Program Sample Collection and Groundwater Surface Elevation Measurement Frequency

Installation	Frequency
Groundwater Quality Sampling	
DMWs	Annually
Groundwater Surface Elevation Monitoring	
DMWs	Monthly and prior to sampling events
WLMP Wells (see Table L-4)	Monthly

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1
2

Table L-3
Standard Operating Procedures Applicable to the DMP

Number	Title/Description
WP 02-EM1010	Field Parameter Measurements and Final Sample Collection: This procedure provides general instructions necessary to perform field analyses of serial samples in support of the DMP. Serial samples are collected and analyzed at the field laboratory for field indicators. Serial sample results help determine if pumped groundwater is representative of undisturbed groundwater within the formation. This procedure also describes the steps for collecting groundwater samples from the DMWs near the WIPP facility. Samples are collected and analyzed at the Field Laboratory until stabilization of the field parameters occurs. Final samples for Resource Conservation and Recovery Act (RCRA) analyses are collected and analyzed by a contract laboratory.
WP 02-EM1014	Groundwater Level Measurement: This document describes the method used for groundwater level measurements in support of groundwater monitoring at the WIPP facility using a portable electronic water-level probe.
WP 02-EM1021	Pressure Density Survey: This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at non-detection monitoring wells. Because most pressure densities are obtained by Sandia National Laboratories via pressure transducers installed in wells, this procedure is used to obtain pressure densities at wells not equipped with fixed transducers.
WP 02-EM1026	Water Level Data Handling and Reporting: This procedure provides instructions on handling water level data. Data are collected and recorded on field forms in accordance with WP 02-EM1014. This procedure is initiated when wells in the water surveillance program have been measured for a given month.
WP 02-EM3001	Administrative Processes for Environmental Monitoring and Hydrology Programs: This procedure provides the administrative guidance environmental monitoring personnel use to maintain quality control associated with environmental monitoring sampling and reporting activities. This administrative procedure does not pertain to volatile organic compound (VOC) monitoring, with the exception of Section 5.0 which pertains to the regulatory reporting review process.
WP 02-EM3003	Data Validation and Verification of RCRA Constituents: This procedure provides instructions on performing verification and validation of laboratory data containing the analytical results of groundwater monitoring samples. This procedure is applied only to the non-radiological analyses results for compliance data associated with the detection monitoring samples. The data reviewed for this procedure includes general chemistry parameters and RCRA constituents.
WP-02-RC.01	Hazardous and Universal Waste Management Plan: This plan describes the responsibilities and handling requirements for hazardous and universal wastes generated at the WIPP facility. It is meant to ensure that these wastes are properly handled, accumulated, and transported to an approved Treatment, Storage, Disposal Facility (TSDF) in accordance with applicable state and federal regulations, U.S. Department of Energy (DOE) Orders, and Management and Operating Contractor (MOC) policies and procedures. This plan implements applicable sections of 20.4.1.100-1102 New Mexico Administrative Code (NMAC), *Hazardous Waste Management* (incorporating 40 *Code of Federal Regulations* [CFR] Parts 260-268 and 273).
WP 10-AD3029	Calibration and Control of Monitoring and Data Collection Equipment: This procedure provides direction for the control and calibration of Monitoring and Data Collection (M&DC) equipment at the WIPP facility, and ensures traceability to NIST (National Institute of Standards and Technology) standards, international standards, or intrinsic standards. This procedure also establishes requirements and responsibilities for identifying recall equipment, and for obtaining calibration services for WIPP facility M&DC equipment.
WP 13-1	Management and Operating Contractor Quality Assurance Program Description: This document establishes the minimum quality requirements for MOC personnel and guidance for the development and implementation of QA programs by MOC organizations.

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Table L-4
January 2011 Culebra WLMP

WELL ID	WELL ID	WELL ID
AEC-7	H-17	SNL-15
C-2737	H-19 pad*	SNL-16
ERDA-9	I-461	SNL-17
H-02b2	SNL-01	SNL-18
H-03b2	SNL-02	SNL-19
H-04bR	SNL-03	WQSP-1
H-05b	SNL-05	WQSP-2
H-06bR	SNL-06	WQSP-3
H-07b1	SNL-08	WQSP-4
H-9bR	SNL-09	WQSP-5
H-10c	SNL-10	WQSP-6
H-11b4	SNL-12	WIPP-11
H-12	SNL-13	WIPP-13
H-15R	SNL-14	WIPP-19
H-16		

*H-19b0 monthly

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 through 16, 1994	737 (225)	15 (5)	696 (212)	696 to 737 (212 to 225)	737 (225)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 225)	699 to 722 (213 to 220)
WQSP-2 Figure L-8	September 6 through 12, 1994	846 (258)	12 (4)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.1 to 833.7 (247 to 254)
WQSP-3 Figure L-9	October 20 through 26, 1994	880 (268)	10 (3)	833 (254)	833 to 880 (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 through 10, 1994,	800 (244)	9 (3)	740 (226)	740 to 798 (226 to 243)	800 (244)	764 to 789 (233 to 240)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 through 18, 1994,	681 (208)	7 (2)	648 (198)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205)
WQSP-6 Figure L-12	September 26 through October 3, 1994	616.6 (188)	10 (3)	568 (173)	568 to 617 (173 to 188)	617 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 174)	570 to 616.6 (174 to 188)	582 to 606.9 (177 to 185)

Table L-6
Analytical Parameter and Sample Requirements

(10) PARAMETERS	(12) NO. OF BOTTLES	(13) VOLUME	(14) TYPE	(15) ACID WASH	(16) SAMPLE FILTER	(17) PRESERVATIVE	(18) HOLDING TIME
Indicator[1] Parameters: • pH • SC • TOC	 - - 4	 25 ml[2] 100 ml[2] 15 ml[2]	 Glass Glass Glass	 Field determined Field determined yes	 No? No No	 Field determined Field determined HCl	 None None 28 days[2]
General Chemistry	1	1 Liter	Plastic	Yes	No	HNO_3,4pH<2	not specified in DMP
Phenolics	1	1 Liter	Amber Glass	Yes	No	H_2SO_4, pH<2	not specified in DMP
Metals/Cations	2	1 Liter	Plastic	Yes	No	HNO_3, pH<2	6 months[2],[3]
VOC	4	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Non-Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
BN/As	1	½ Gallon	Amber Glass	Yes	No	None	
TCLP	1	1 Liter	Plastic	Yes	No	HNO_3, pH<2	7 days[2]
Cyanide (Total)	1	1 Liter	Plastic	Yes	No	NaOH, pH>12	14 days[2]
Sulfide	1	250 ml	Amber Glass	Yes	No	NaOH + Zn Acetate	28 days[2]
Radionuclides	1	1 Gallon	Plastic Cube	Yes	Yes	HNO_3, pH<2	6 months[2]

1 = RCRA Detection Monitoring Analytes

2 = As specified in Table 4-1 of the RCRA TEGD

3 = Reduced holding time of 1 week for WIPP-specific Divalent cation 2 samples noted in the GMD

Note: Unless otherwise indicated, data are from DOE Procedure WP 02-EM1006 methods and are provided as information only.

Note: Deviations from this table are allowed with prior approval by the NMED.

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FIGURES

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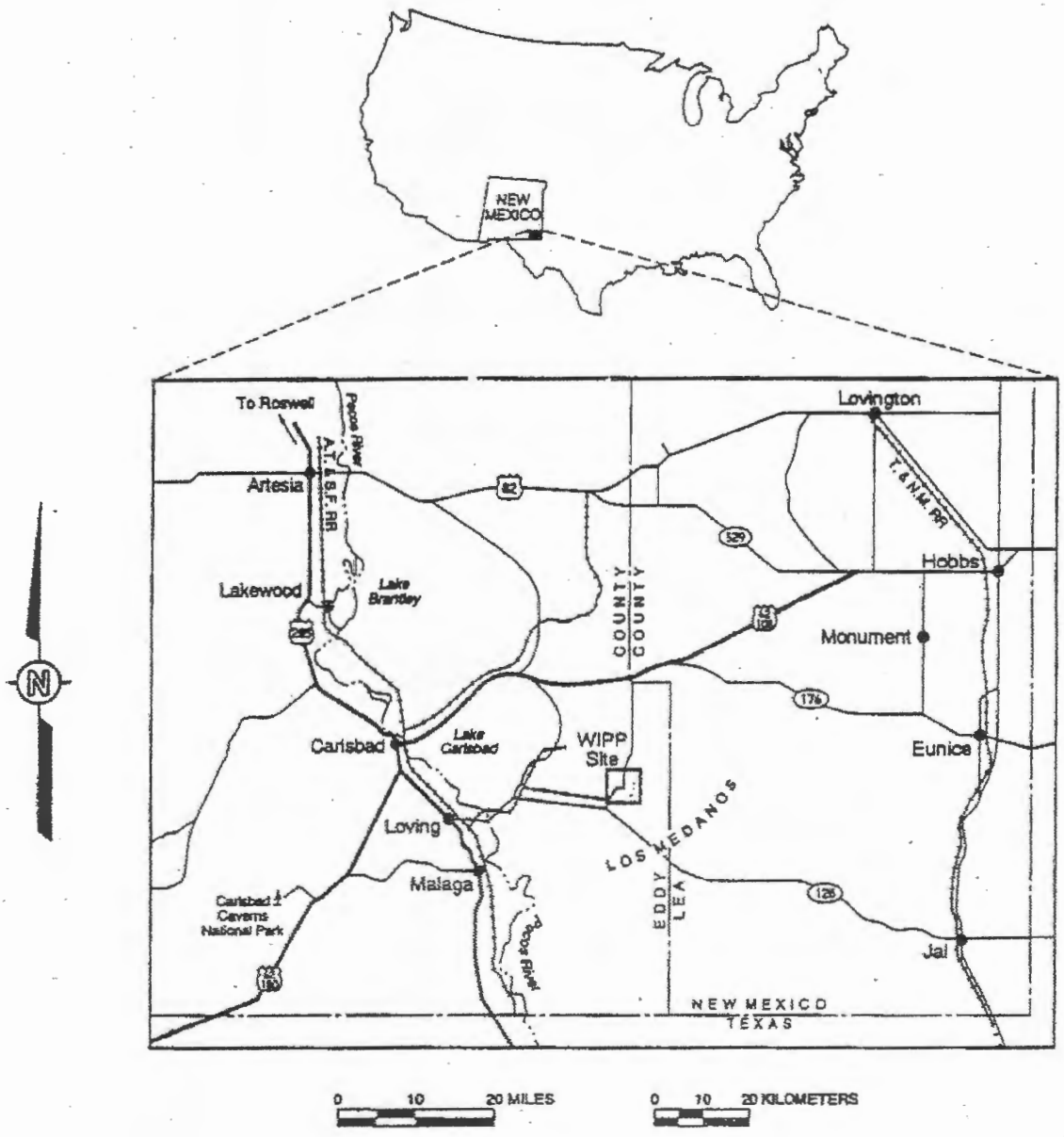


Figure L-1
General Location of the WIPP Facility

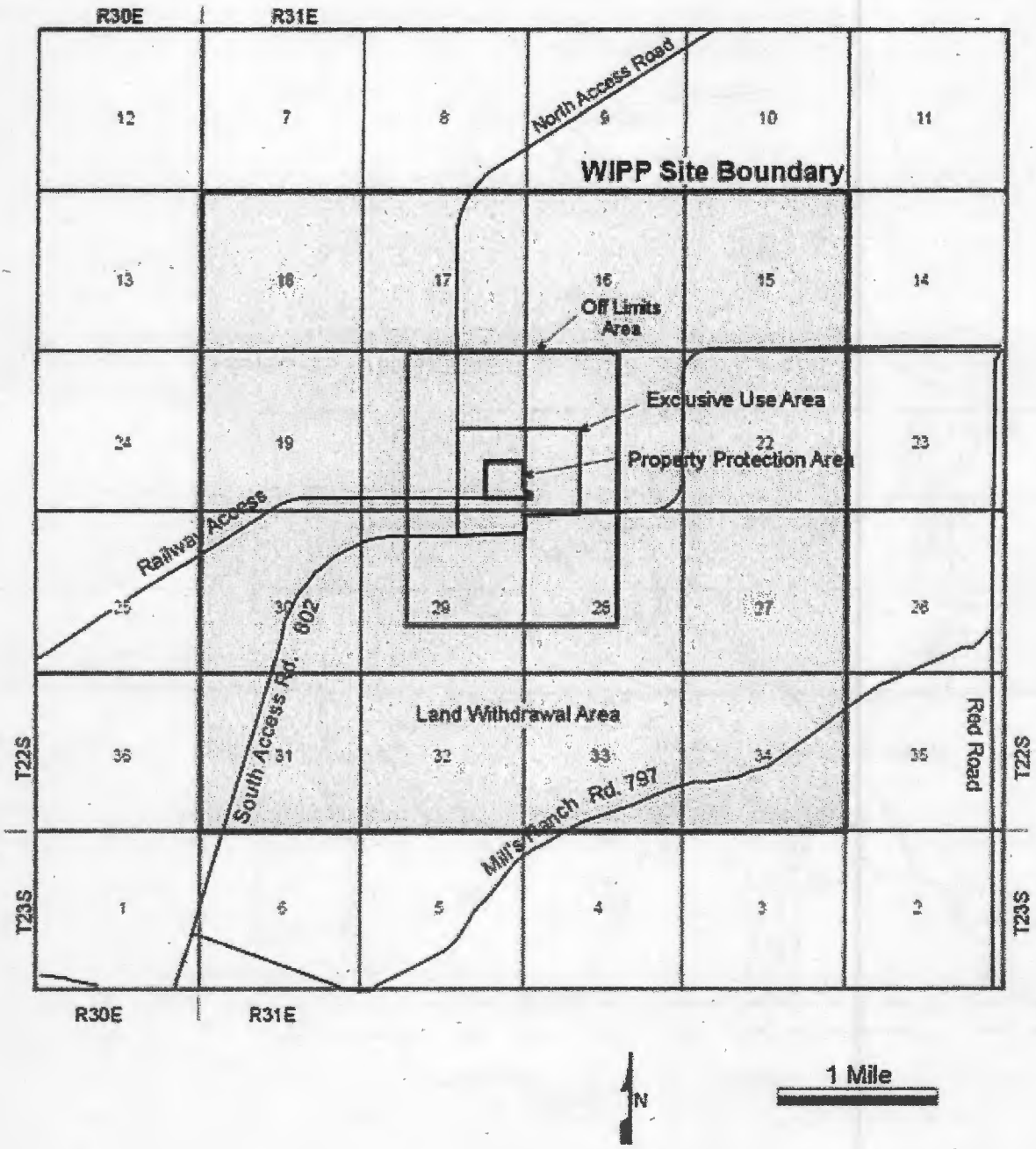


Figure L-2
WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		DEWEY LAKE	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

Figure L-3
Site Geologic Column

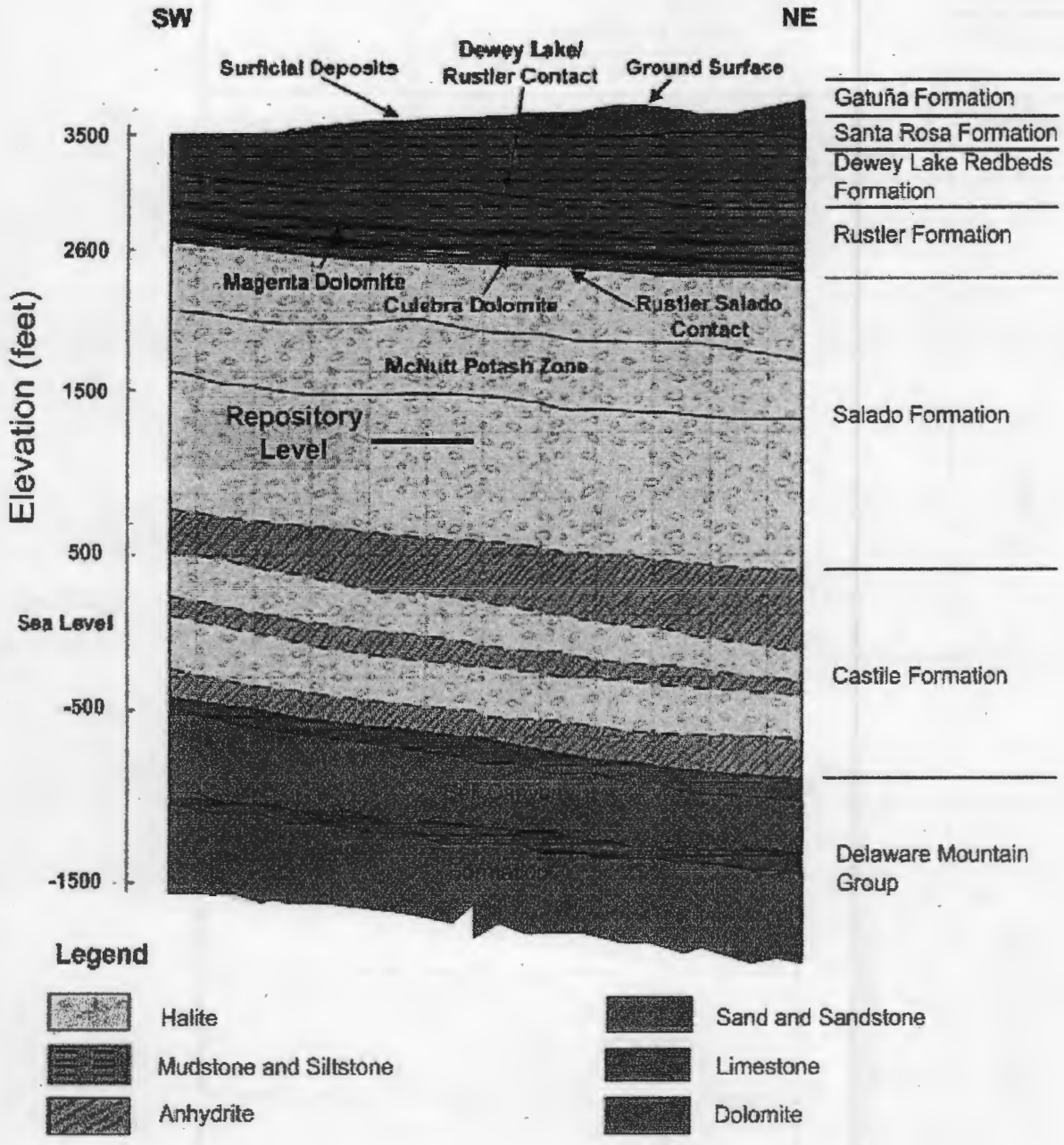


Figure L-4
Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site

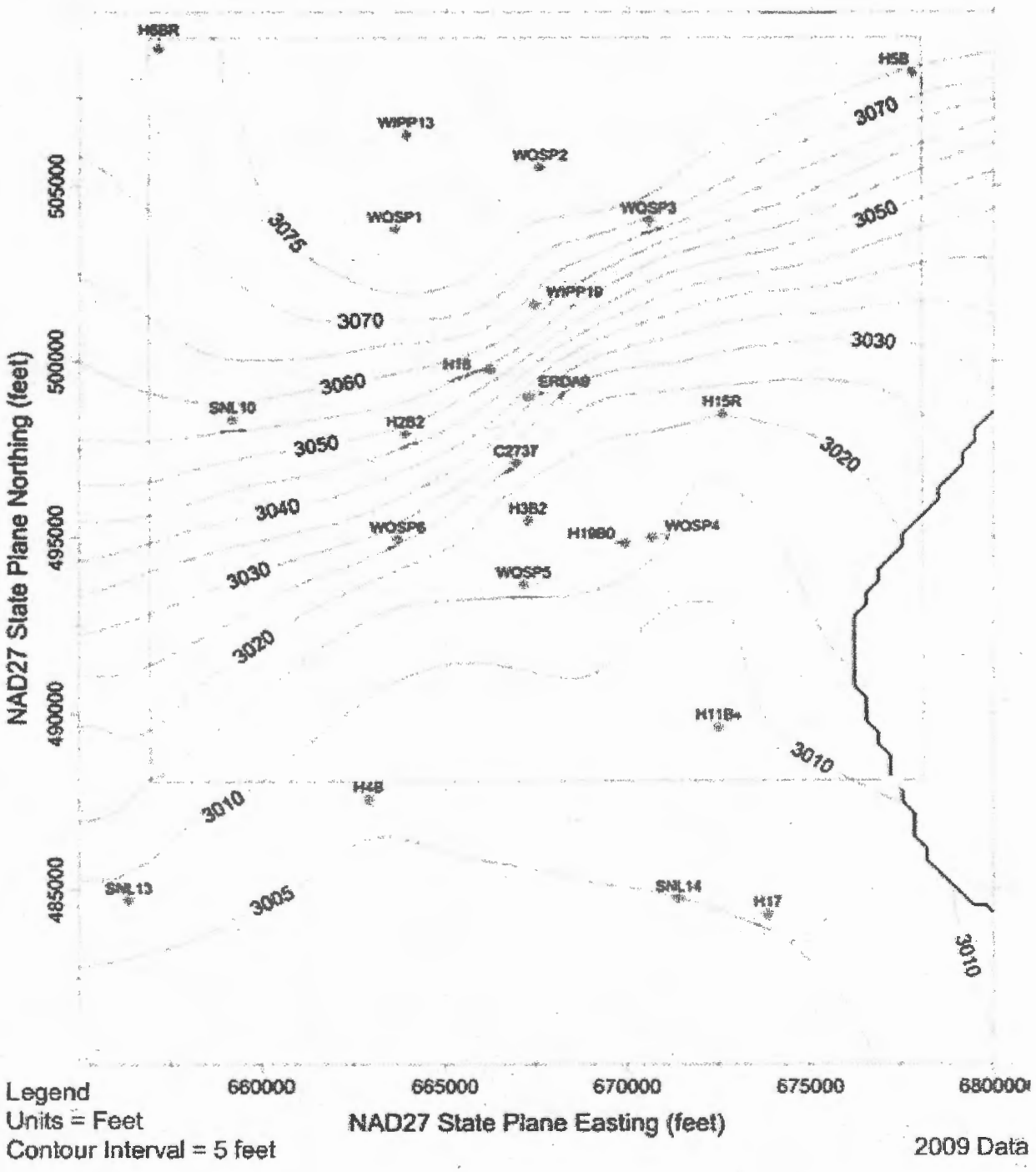
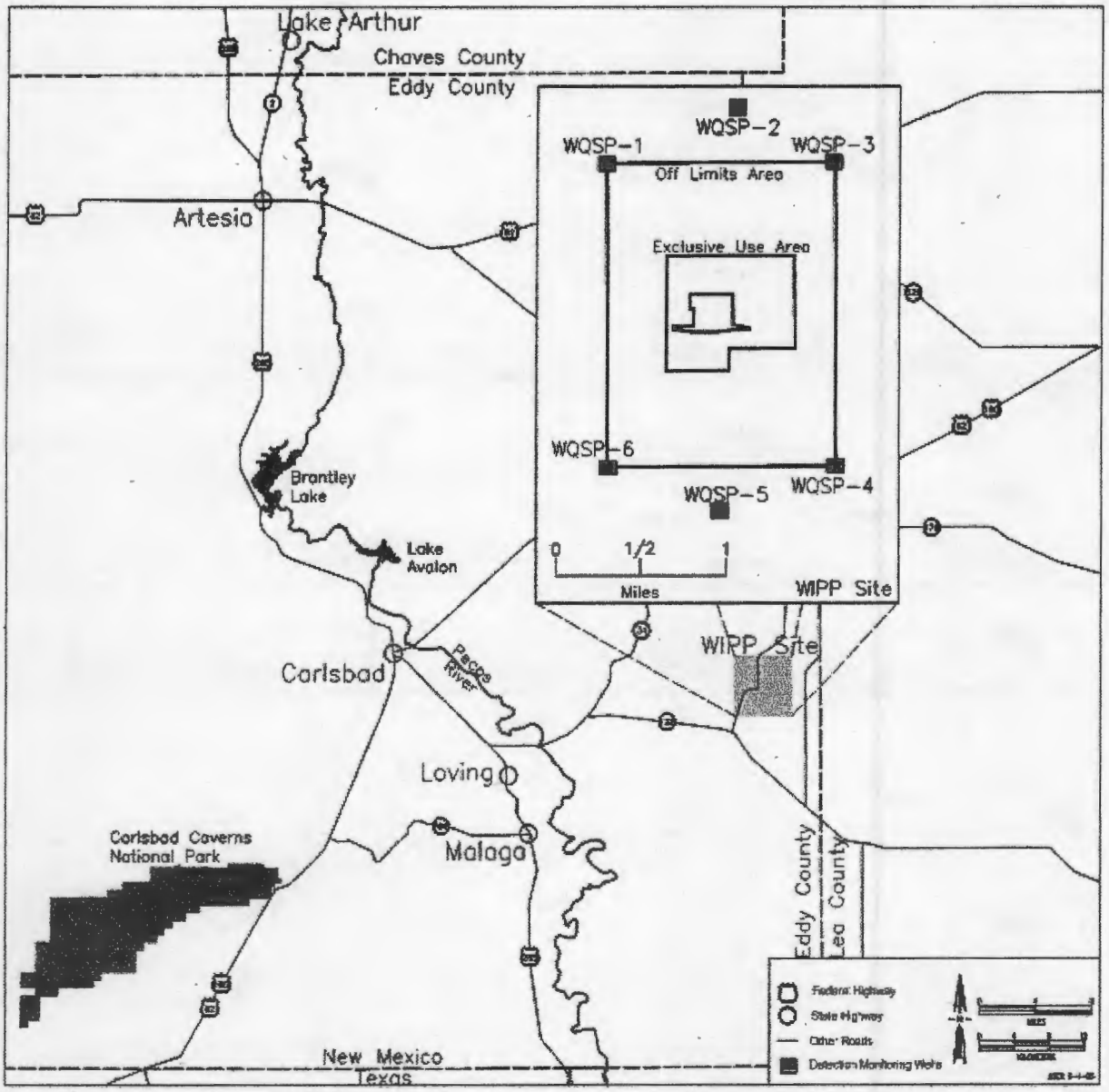


Figure L-5
Culebra Freshwater-Head Potentiometric Surface



NOTE: Point of compliance is defined in Part 5.3.1.

Figure L-6
Detection Monitoring Well Locations

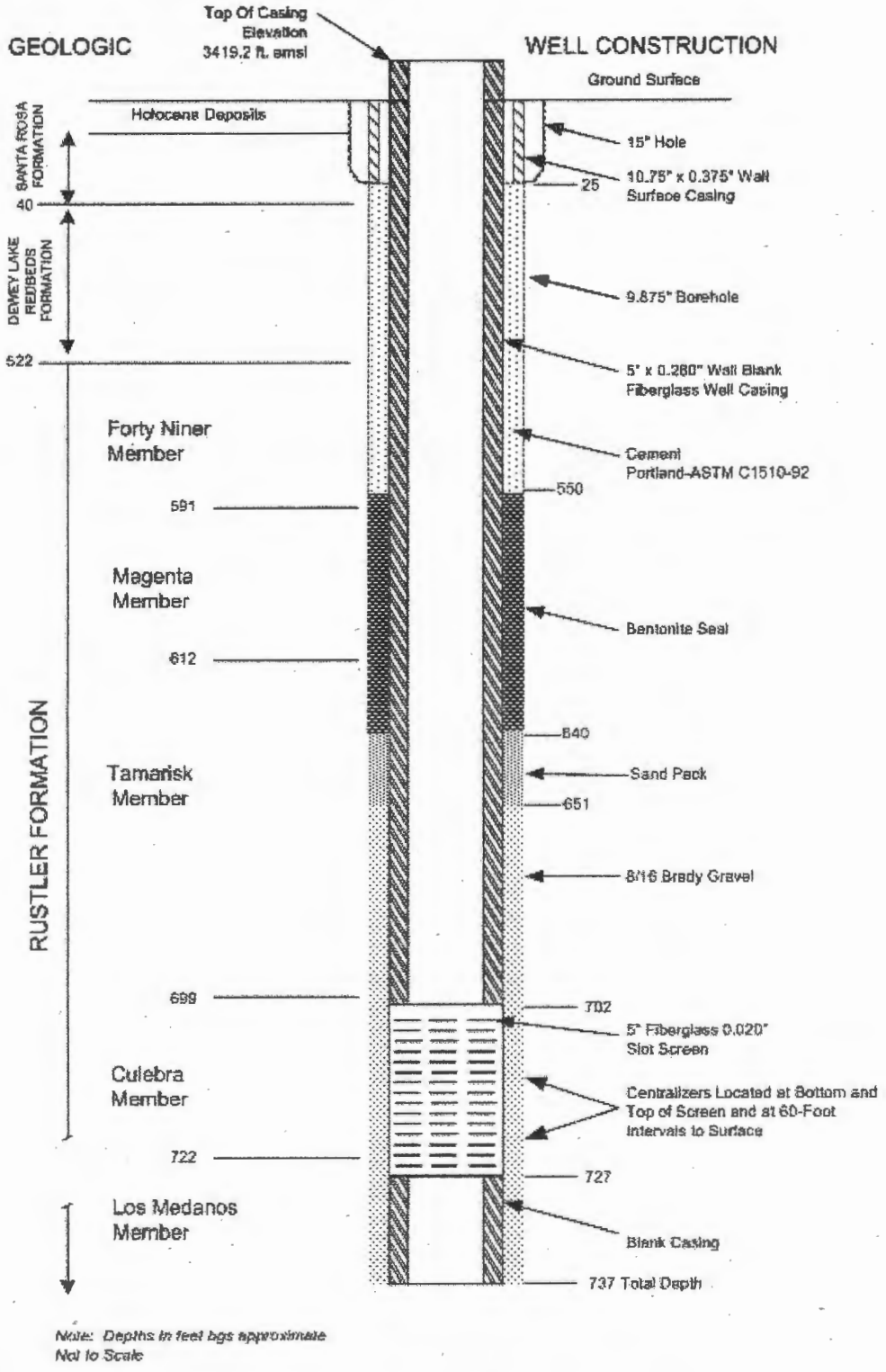


Figure L-7
As-Built Configuration of Well WQSP-1

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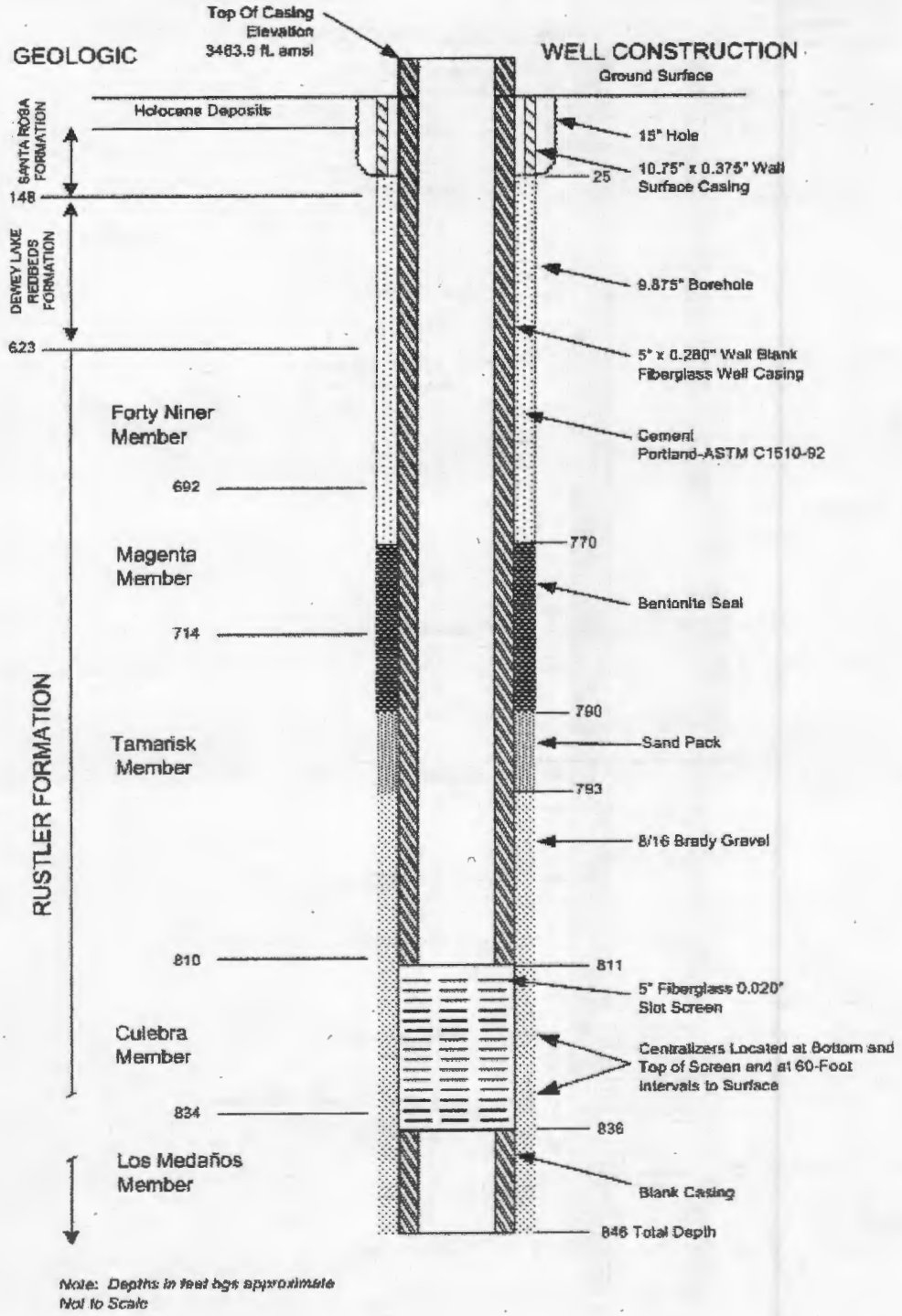
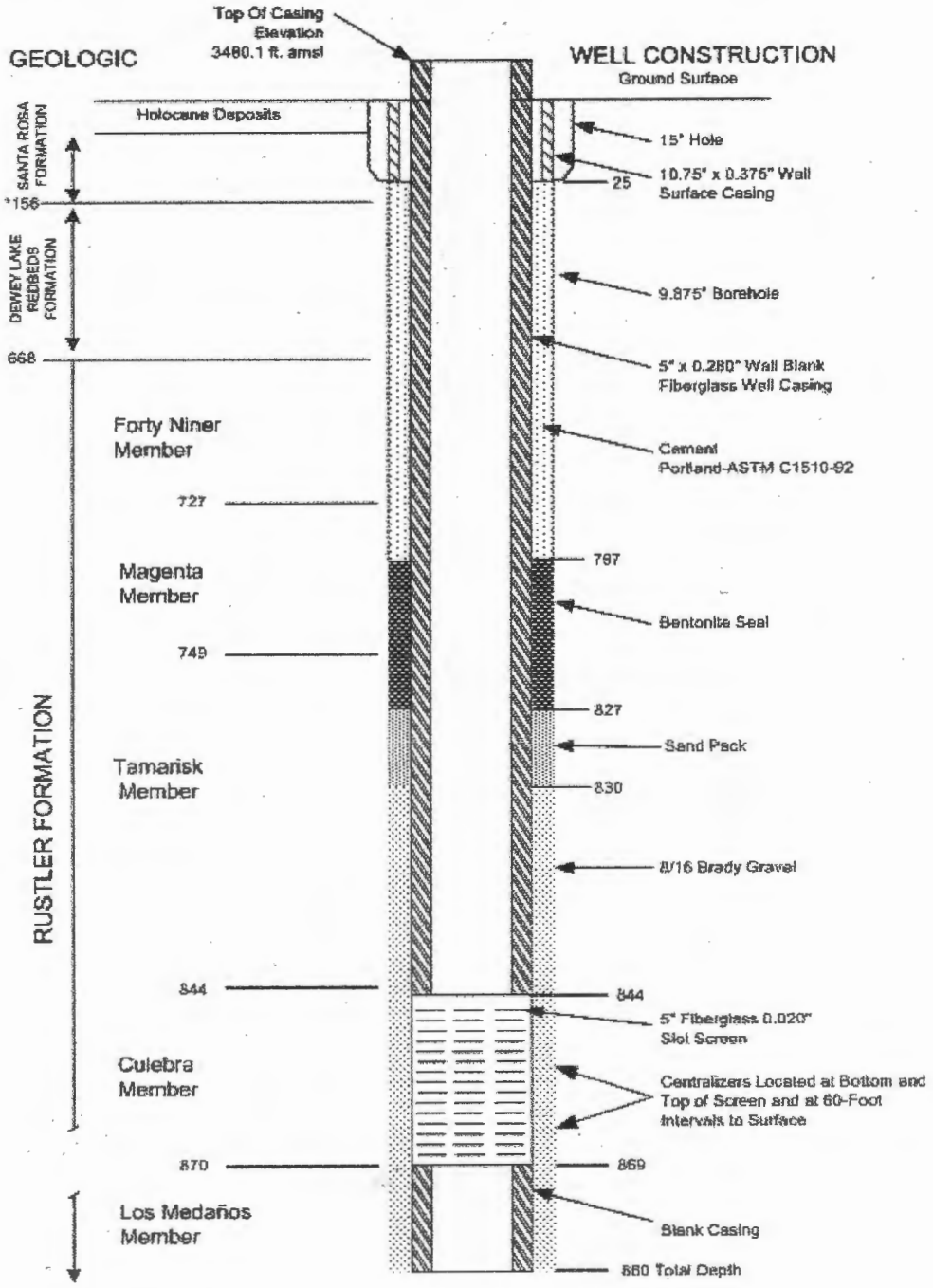


Figure L-8
As-Built Configuration of Well WQSP-2



Note: Depths in feet bgs approximate
Not to Scale

**from DOE/WIPP-95-2154*

Figure L-9
As-Built Configuration of Well WQSP-3

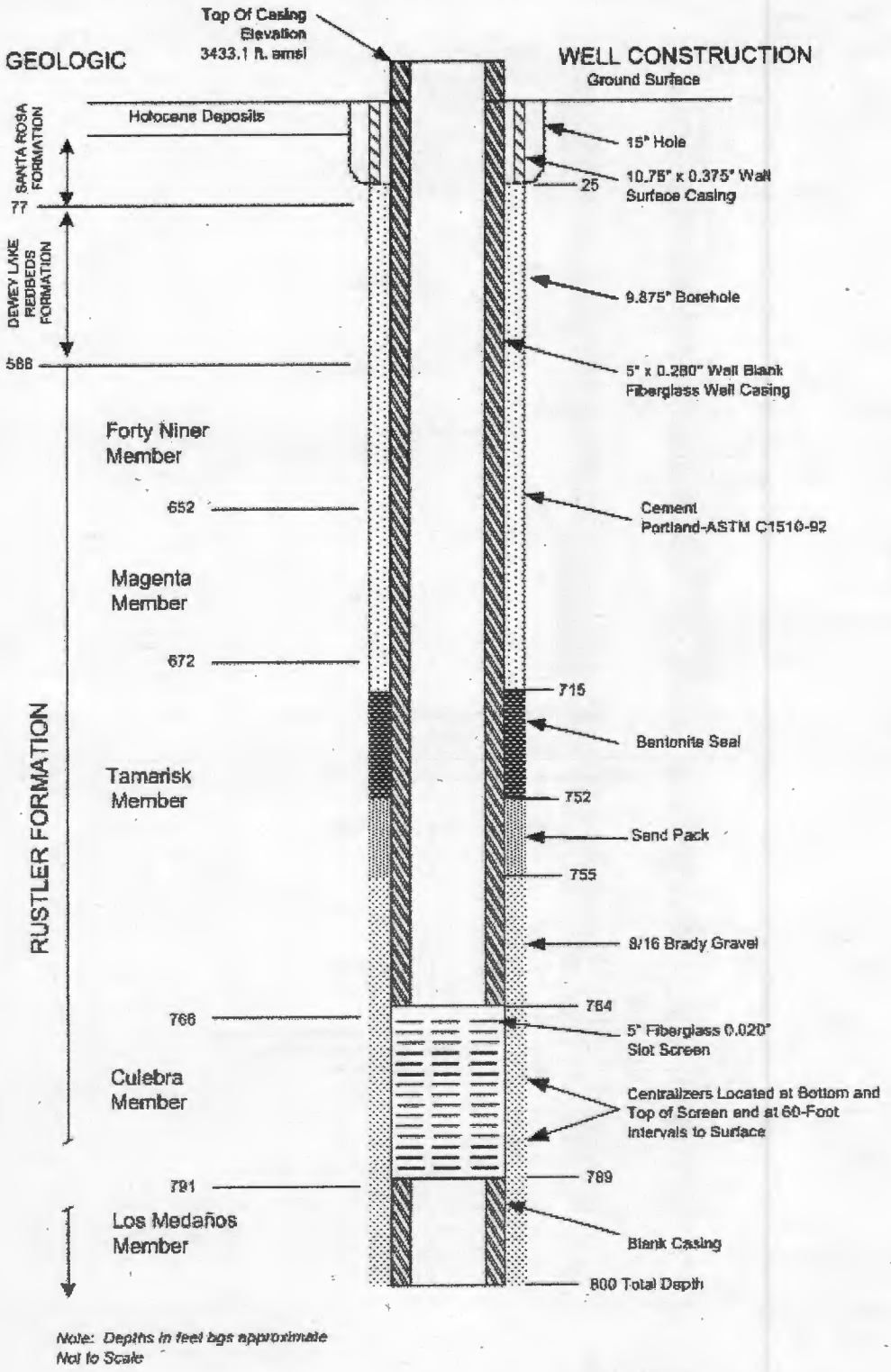


Figure L-10
As-Built Configuration of Well WQSP-4

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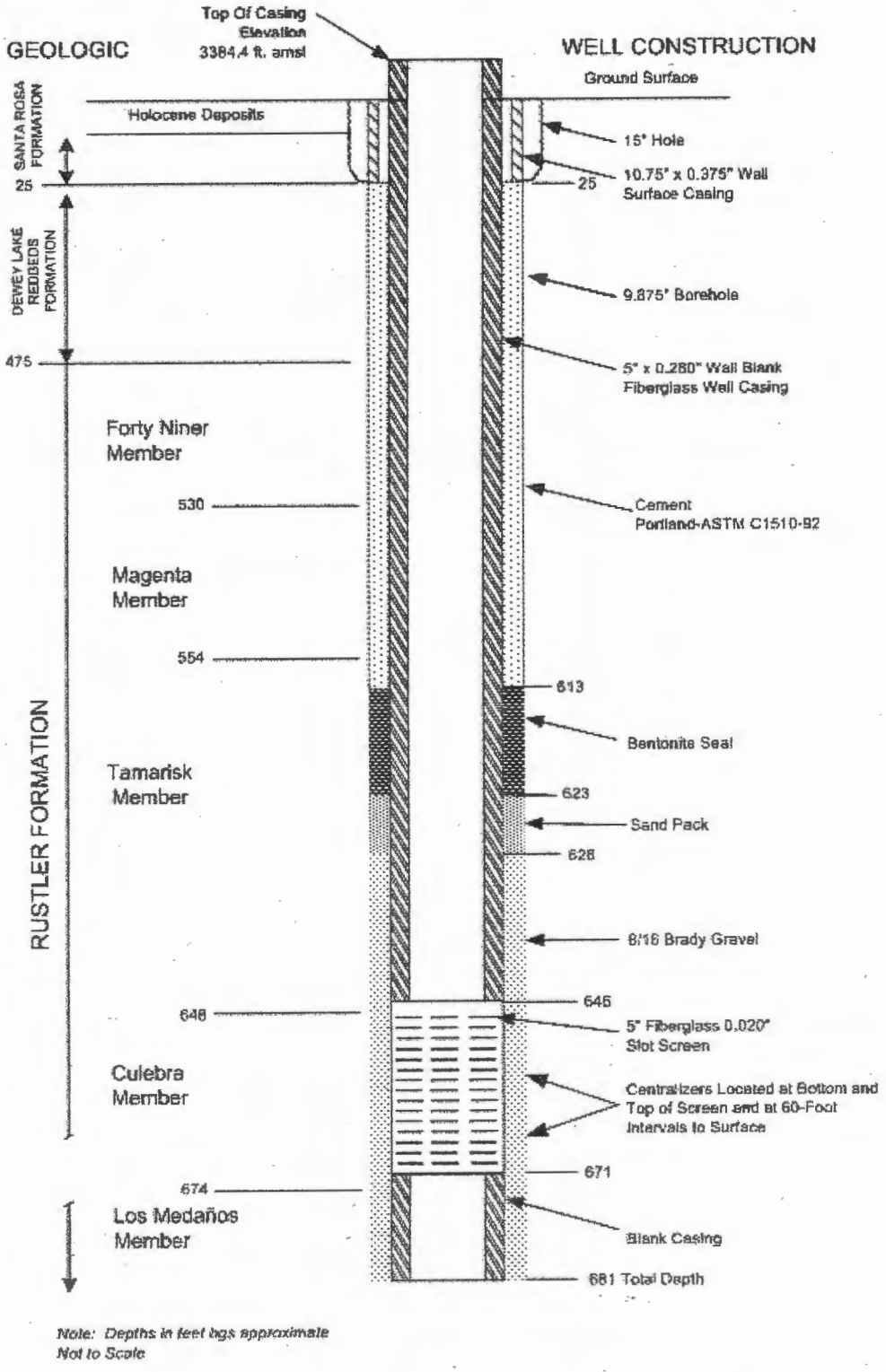
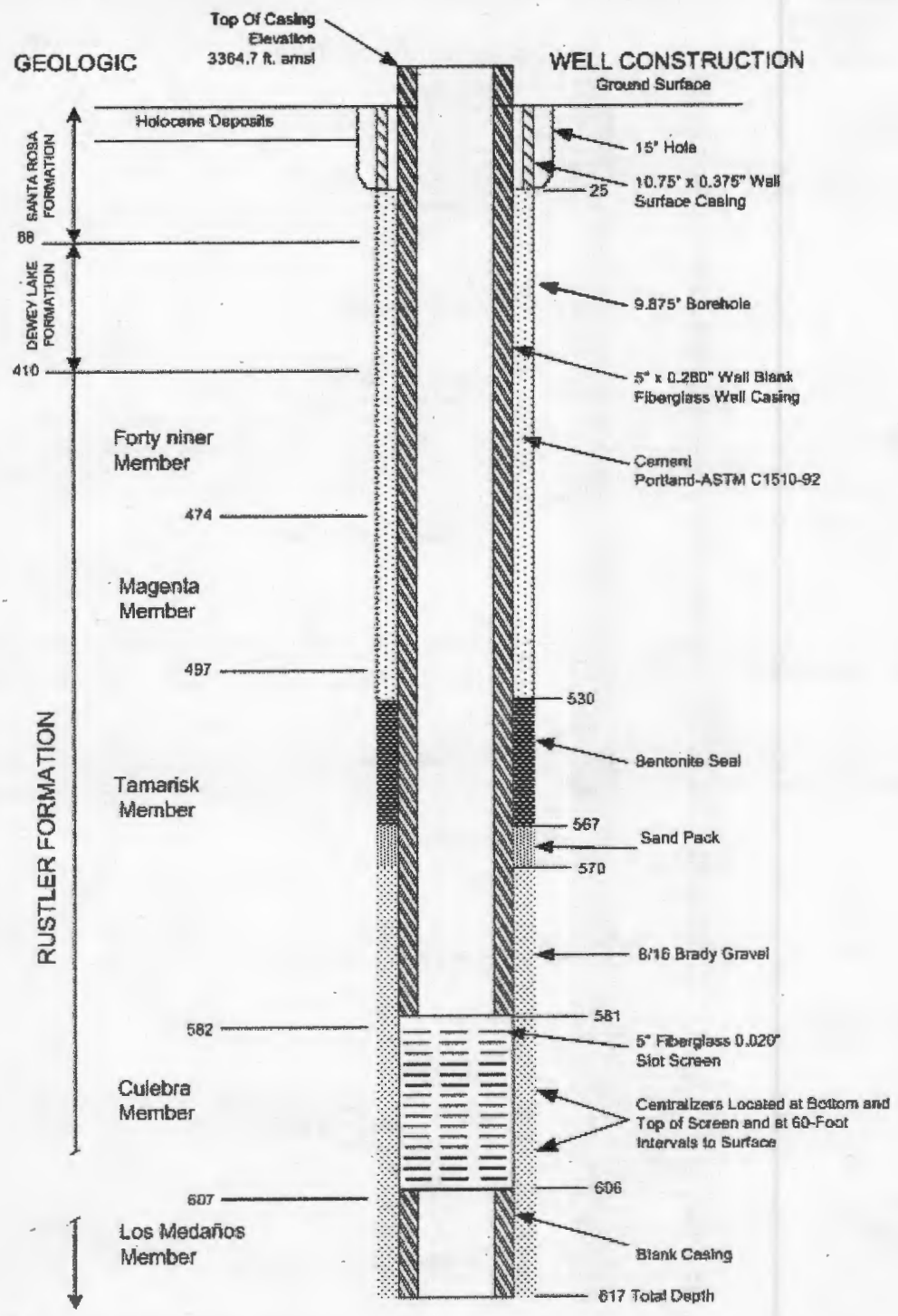


Figure L-11
As-Built Configuration of Well WQSP-5



Note: Depths in feet bgs approximate
Not to Scale

Figure L-12
As-Built Configuration of Well WQSP-6

CHAIN OF CUSTODY RECORD

Page ___ of ___

Project Number	Project Name:	Total Number of Containers	Container Size / Request Analyses	Contract Laboratory
Samplers:	Date:			

Date	Time	Matrix	Sample Number

EXAMPLE

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

Requested Turnaround Time:	Sample Receipt Remarks:	Special Instructions:
☐ Routine ☐ Rush		
Sample Disposal: ☐ Return to Client ☐ Disposal by Lab	Results To:	
Carrier / Airbill No.:		

WHITE – Testing Laboratory
AF – Air filter(s)
SE – Sediment
YELLOW – Field copy
AN – Animal(s)
SO – Soil
PINK – Record Copy
DI – Deionized Water
SW – Surface Water
GW – Ground Water
VG – Vegetation

WP 02-EM3301, revision xx

Figure L-13
Example Chain-of-Custody/Request for Analysis Form

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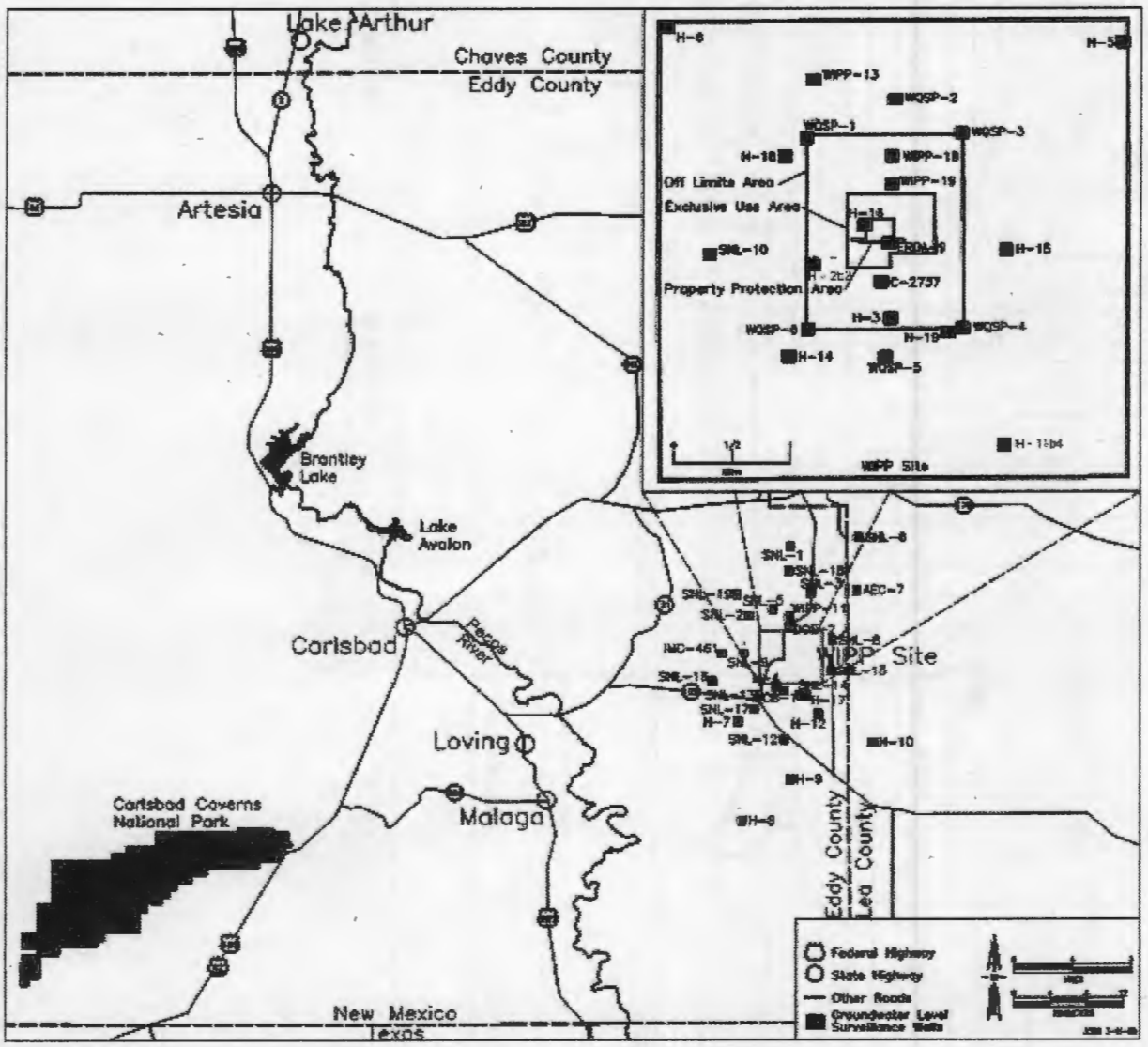

Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

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ATTACHMENT M

FIGURES

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ATTACHMENT M

FIGURES

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ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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Table N-2	Quality Assurance Objectives for Accuracy, Precision, Sensitivity, and Completeness

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Figure N-2	VOC Monitoring System Design
Figure N-3	Disposal Room VOC Monitoring
Figure N-4	VOC Sample Head Arrangement

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ACRONYMS AND ABBREVIATIONS

BS/BSD	blank spike/blank spike duplicate
CH	Contact-handled
CLP	Contract Laboratory Program
COC	concentration of concern
CRQL	contract-required quantitation limit
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
GC/MS	gas chromatography/mass spectrometry
HWDU	Hazardous Waste Disposal Unit
LCS	laboratory control sample
m	meter
MDL	method detection limit
MOC	Management and Operating Contractor (Permit Section 1.5.3)
MRL	method reporting limit
NIST	National Institute of Standards and Testing
ppbv	parts per billion by volume
QA	quality assurance
QAPD	Quality Assurance Program Description
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
TIC	tentatively identified compound
TRU	Transuranic
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant

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ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N-1 Introduction

This Permit Attachment describes the monitoring plan for volatile organic compound (**VOC**) emissions from mixed waste that may be entrained in the exhaust air from the U.S. Department of Energy (**DOE**) Waste Isolation Pilot Plant (**WIPP**) Underground Hazardous Waste Disposal Units (**HWDUs**) during the disposal phase at the facility. The purpose of VOC monitoring is to ensure compliance with the VOC limits specified in Permit Part 4. This VOC monitoring plan consists of two programs as follows; (1) Repository VOC Monitoring, which assesses compliance with the environmental performance standards in Table 4.6.2.3; and (2) Disposal Room VOC Monitoring, which assesses compliance with the disposal room performance standards in Table 4.6.3.2. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N-1a Background

The Underground HWDUs are located 2,150 feet (ft) (655 meters [m]) below ground surface, in the WIPP underground. As defined for this Permit, an Underground HWDU is a single excavated panel consisting of seven rooms and two access drifts designated for disposal of contact-handled (**CH**) and remote-handled (**RH**) transuranic (**TRU**) mixed waste. Each room is approximately 300 ft (91 m) long, 33 ft (10 m) wide, and 13 ft (4 m) high. Access drifts connect the rooms and have the same cross section. The Permittees shall dispose of TRU mixed waste in Underground HWDUs designated as Panels 1 through 8.

This plan addresses the following elements:

1. Rationale for the design of the VOC monitoring programs, based on:
    - Possible pathways from WIPP during the active life of the facility
    - Demonstrating compliance with the disposal room performance standards by monitoring VOCs in underground disposal rooms
    - VOC sampling operations at WIPP
    - Optimum location of the ambient mine air monitoring stations
2. Descriptions of the specific elements of the VOC monitoring programs, including:
    - The type of monitoring conducted
    - The location of the monitoring stations
    - The monitoring interval
    - The specific hazardous constituents monitored
    - The implementation schedule for the VOC monitoring programs
    - The equipment used at the monitoring stations
    - Sampling and analytical techniques used

- Data recording/reporting procedures
- Action levels for remedial action if limits are approached

The technical basis for Disposal Room VOC Monitoring is discussed in detail in the Technical Evaluation Report for Room-Based VOC Monitoring (WRES, 2003).

N-1b Objectives of the Volatile Organic Compound Monitoring Plan

The CH and RH TRU mixed waste disposed in the WIPP Underground HWDUs contain VOCs which could be released from WIPP during the disposal phase of the project. This plan describes how:

- VOCs released from waste panels will be monitored to confirm that the annual average concentration of VOCs in the air emissions from the Underground HWDUs do not exceed the VOC concentrations of concern (**COC**) identified in Permit Part 4, Table 4.6.2.3. Appropriate remedial action, as specified in Permit Section 4.6.2.4, will be taken if the limits in Permit Part 4, Table 4.6.2.3 are reached.

- VOCs released from waste containers in disposal rooms will be monitored to confirm that the concentration of VOCs in the air of closed and active rooms in active panels do not exceed the VOC disposal room limits identified in Permit Part 4, Table 4.4.1. Appropriate remedial action, as specified in Permit Section 4.6.3.3, will be taken if the Action Levels in Permit Part 4, Table 4.6.3.2 are reached.

N-2 Target Volatile Organic Compounds

The target VOCs for repository monitoring (Station VOC-A and VOC-B) and disposal room monitoring are presented in Table N-1.

These target VOCs were selected because together they represent approximately 99 percent of the risk due to air emissions.

N-3 Monitoring Design

Detailed design features of this plan are presented in this section. This plan uses available sampling and analysis techniques to measure VOC concentrations in air. Sampling equipment includes the WIPP VOC canister samplers used in both the Repository and Disposal Room VOC Monitoring Programs.

N-3a Sampling Locations

Air samples will be collected in the underground to quantify airborne VOC concentrations as described in the following sections.

N-3a(1) Sampling Locations for Repository VOC Monitoring

The initial configuration for the repository VOC monitoring stations is shown in Figure N-1. All mine ventilation air which could potentially be impacted by VOC emissions from the Underground HWDUs identified as Panels 1 through 8 will pass monitoring Station VOC-A, located in the E-300 drift as it flows to the exhaust shaft. Air samples will be collected at two

locations in the facility to quantify airborne VOC concentrations. VOC concentrations attributable to VOC emissions from open and closed panels containing TRU mixed waste will be measured by placing one VOC monitoring station just downstream from Panel 1 at VOC-A. The location of Station VOC-A will remain the same throughout the term of this Permit. The second station (Station VOC-B) will always be located upstream from the open panel being filled with waste (starting with Panel 1 at monitoring Station VOC-B (Figure N-1). In this configuration, Station VOC-B will measure VOC concentrations attributable to releases from the upstream sources and other background sources of VOCs, but not releases attributable to open or closed panels. The location of Station VOC-B will change when disposal activities begin in the next panel. Station VOC-B will be relocated to ensure that it is always upstream of the open panel that is receiving TRU mixed waste. Station VOC-A will also measure upstream VOC concentrations measured at Station VOC-B, plus any additional VOC concentrations resulting from releases from the closed and open panels. A sample will be collected from each monitoring station on designated sample days. For each quantified target VOC, the concentration measured at Station VOC-B will be subtracted from the concentration measured at Station VOC-A to assess the magnitude of VOC releases from closed and open panels.

The sampling locations were selected based on operational considerations. There are several different potential sources of release for VOCs into the WIPP mine ventilation air. These sources include incoming air from above ground and facility support operations, as well as open and closed waste panels. In addition, because of the ventilation requirements of the underground facility and atmospheric dispersion characteristics, any VOCs that are released from open or closed panels may be difficult to detect and differentiate from other sources of VOCs at any underground or above ground location further downstream of Panel 1. By measuring VOC concentrations close to the potential source of release (i.e., at Station VOC-A), it will be possible to differentiate potential releases from background levels (measured at Station VOC-B).

N-3a(2) Sampling Locations for Disposal Room VOC Monitoring

For purposes of compliance with Section 310 of Public Law 108-447, the VOC monitoring of airborne VOCs in underground disposal rooms in which waste has been emplaced will be performed as follows:

1. A sample head will be installed inside the disposal room behind the exhaust drift bulkhead and at the inlet side of the disposal room.

2. TRU mixed waste will be emplaced in the active disposal room.

3. When the active disposal room is filled, another sample head will be installed to the inlet of the filled active disposal room. (Figure N-3 and N-4)

4. The exhaust drift bulkhead will be removed and re-installed in the next disposal room so disposal activities may proceed.

5. A ventilation barrier will be installed where the bulkhead was located in the active disposal room's exhaust drift. Another ventilation barrier will be installed in the active disposal room's air inlet drift, thereby closing that active disposal room.

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6. Monitoring of VOCs will continue in the now closed disposal room. Monitoring of VOCs will occur in the active disposal room and all closed disposal rooms in which waste has been emplaced until commencement of panel closure activities (i.e., completion of ventilation barriers in Room 1).

This sequence for installing sample locations will proceed in the remaining disposal rooms until the inlet air ventilation barrier is installed in Room 1. An inlet sampler will not be installed in Room 1 because disposal room sampling proceeds to the next panel.

N-3a(3) Ongoing Disposal Room VOC Monitoring in Panels 3 through 8

The Permittees shall continue VOC monitoring in Room 1 of Panels 3 through 8 after completion of waste emplacement until final panel closure unless an explosion-isolation wall is installed in the panel.

N-3b Analytes to Be Monitored

The nine VOCs that have been identified for repository and disposal room monitoring are listed in Table N-1. The analysis will focus on routine detection and quantification of these compounds in collected samples. As part of the analytical evaluations, the presence of other compounds will be investigated. The analytical laboratory will be directed to classify and report all of these compounds as Tentatively Identified Compounds (**TICs**).

TICs detected in 10% or more of any VOC monitoring samples (exclusive of those collected from Station VOC-B) that are VOCs listed in Appendix VIII of 20.4.1.200 NMAC (incorporating 40 CFR §261), collected over a running 12-month timeframe, will be added to the target analyte lists for both the repository and disposal room VOC monitoring programs, unless the Permittees can justify the exclusion from the target analyte list(s).

TICs detected in the repository and disposal room VOC monitoring programs will be placed in the WIPP Operating Record and reported to NMED in the Semi-Annual VOC Monitoring Report as specified in Permit Section 4.6.2.2.

N-3c Sampling and Analysis Methods

The VOC monitoring programs include a comprehensive VOC monitoring program established at the facility; equipment, training, and documentation for VOC measurements are already in place.

The method used for VOC sampling is based on the concept of pressurized sample collection contained in the U.S. Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling concept uses 6-liter SUMMA® passivated (or equivalent) stainless-steel canisters to collect integrated air samples at each sample location. This conceptual method will be used as a reference for collecting the samples at WIPP. The samples will be analyzed using gas chromatography/mass spectrometry (**GC/MS**) under an established QA/quality control (**QC**) program. Laboratory analytical procedures have been developed based on the concepts contained in both TO-15 and 8260B. Section N-5 contains additional QA/QC information for this project.

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The TO-15 method is an EPA-recognized sampling concept for VOC sampling and speciation. It can be used to provide integrated samples, or grab samples, and compound quantitation for a broad range of concentrations. The sampling system can be operated unattended but requires detailed operator training. This sampling technique is viable for use while analyzing the sample using other EPA methods such as 8260B.

The field sampling systems will be operated in the pressurized mode. In this mode, air is drawn through the inlet and sampling system with a pump. The air is pumped into an initially evacuated SUMMA® passivated (or equivalent) canister by the sampler, which regulates the rate and duration of sampling. The treatment of tubing and canisters used for VOC sampling effectively seals the inner walls and prevents compounds from being retained on the surfaces of the equipment. By the end of each sampling period, the canisters will be pressurized to about two atmospheres absolute. In the event of shortened sampling periods or other sampling conditions, the final pressure in the canister may be less than two atmospheres absolute. Sampling duration will be approximately six hours, so that a complete sample can be collected during a single work shift.

The canister sampling system and GC/MS analytical method are particularly appropriate for the VOC Monitoring Programs because a relatively large sample volume is collected, and multiple dilutions and reanalyses can occur to ensure identification and quantification of target VOCs within the working range of the method. The contract-required quantitation limits (**CRQL**) for Repository Monitoring are 5 parts per billion by volume (**ppbv**) or less for the nine target compounds. Consequently, low concentrations can be measured. CRQLs are the EPA-specified levels of quantitation proposed for EPA contract laboratories that analyze canister samples by GC/MS. For the purpose of this plan, the CRQLs will be defined as the method reporting limits (**MRL**). The MRL is a function of instrument performance, sample preparation, sample dilution, and all steps involved in the sample analysis process. The MRL for Disposal Room Monitoring is 500 ppbv or less for the nine target compounds.

Disposal room VOC monitoring system in open panels will employ the same canister sampling method as used in the repository VOC monitoring. Passivated or equivalent sampling lines will be installed in the disposal room as described in Section N-3a(2) and maintained once the room is closed until the panel associated with the room is closed. The independent lines will run from the sample inlet point to the individual sampler located in the access drift to the disposal panel. The air will pass through dual particulate filters to prevent sample and equipment contamination.

N-3d Sampling Schedule

The Permittees will evaluate whether the monitoring systems and analytical methods are functioning properly. The assessment period will be determined by the Permittees.

N-3d(1) Sampling Schedule for Repository VOC Monitoring

Repository VOC sampling at Stations VOC-A and VOC-B will begin with initial waste emplacement in Panel 1. Sampling will continue until the certified closure of the last Underground HWDU. Routine sampling will be conducted two times per week.

N-3d(2) Sampling Schedule for Disposal Room VOC Monitoring

The disposal room sampling in open panels will occur once every two weeks, unless the need to increase the frequency to weekly occurs in accordance with Permit Section 4.6.3.3.

Beginning with Panel 3, disposal room sampling in filled panels will occur monthly until final panel closure unless an explosion-isolation wall is installed. The Permittees will sample VOCs in Room 1 of each filled panel.

N-3e Data Evaluation and Reporting

N-3e(1) Data Evaluation and Reporting for Repository VOC Monitoring

When the Permittees receive laboratory analytical data from an air sampling event, the data will be validated as specified in Section N-5d. After obtaining validated data from an air sampling event, the data will be evaluated to determine whether the VOC emissions from the Underground HWDUs exceed the COCs. The COCs for each of the nine target VOCs are presented in Permit Part 4, Table 4.6.2.3. The values are presented in terms of micrograms per cubic meter ($\mu g/m^3$) and ppbv.

The COCs were calculated assuming typical operational conditions for ventilation rates in the mine. The typical operational conditions were assumed to be an overall mine ventilation rate of 425,000 standard cubic feet per minute and a flow rate through the E-300 Drift at Station VOC-A of 130,000 standard cubic feet per minute.

Since the mine ventilation rates at the time the air samples are collected may be different than the mine ventilation rates during typical operational conditions, the Permittees will measure and/or record the overall mine ventilation rate and the ventilation rate in the E-300 Drift at Station VOC-A that are in use during each sampling event. The Permittees shall also measure and record temperature and pressure conditions during the sampling event to allow all ventilation rates to be converted to standard flow rates.

If the air samples were collected under the typical mine ventilation rate conditions, then the analytical data will be used without further manipulation. The concentration of each target VOC detected at Station VOC-B will be subtracted from the concentration detected at Station VOC-A. The resulting VOC concentration represents the concentration of VOCs being emitted from the open and closed Underground HWDUs upstream of Station VOC-A (or the Underground HWDU VOC emission concentration).

If the air samples were not collected under typical mine ventilation rate operating conditions, the air monitoring analytical results from both Station VOC-A and Station VOC-B will be normalized to the typical operating conditions. This will be accomplished using the mine ventilation rates in use during the sampling event and the following equation:

$$NVOC_{AB} = VOC_{AB} * \left(\frac{425{,}000_{scfm} / 130{,}000_{scfm}}{V_{O\ scfm} / V_{E-300\ scfm}} \right) \qquad \text{(N-1)}$$

Where: $NVOC_{AB}$ = Normalized target VOC concentration from Stations VOC-A or VOC-B

VOC_{AB} = Concentration of the target VOC detected at Station VOC-A or VOC-B under non-typical mine ventilation rates

scfm = Standard cubic feet per minute

Vo = Sampling event overall mine ventilation rate (in standard cubic feet per minute)

VE-300 = Sampling event mine ventilation rate through the E-300 Drift (in standard cubic feet per minute)

The normalized concentration of each target VOC detected at Station VOC-B will be subtracted from the normalized concentration detected at Station VOC-A. The resulting concentration represents the Underground HWDU VOC emission concentration.

The Underground HWDU VOC emission concentration for each target VOC that is calculated for each sampling event will be compared directly to its COC listed in Permit Part 4, Table 4.6.2.3. This will establish whether any of the concentrations of VOCs in the emissions from the Underground HWDUs exceeded the COCs at the time of the sampling.

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentrations of any target VOC listed in exceeds the concentration of concern specified in Permit Part 4, Table 4.6.2.3.

The Underground HWDU VOC emission concentration for each target VOC that is calculated for each sampling event will then be averaged with the Underground HWDU VOC emission concentrations calculated for the air sampling events conducted during the previous 12 months. This will be considered the running annual average concentration for each target VOC. For the first year of air sampling, the running annual average concentration for each target VOC will be calculated using all of the previously collected data.

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average concentration (calculated after each sampling event) for any target VOC exceeds the concentration of concern specified in Permit Part 4, Table 4.6.2.3.

If the results obtained from an individual air sampling event do not trigger the notification requirements of Permit Part 4, then the Permittees will maintain a database with the VOC air sampling data and the results will be reported to the Secretary as specified in Permit Part 4.

N-3e(2) Data Evaluation and Reporting for Disposal Room VOC Monitoring

When the Permittees receive laboratory analytical data from an air sampling event, the data will be validated as specified in Section N-5a, within 14 calendar days of receiving the laboratory analytical data. After obtaining validated data from an air sampling event, the data will be evaluated to determine whether the VOC concentrations in the air of any closed room, the

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active open room, or the immediately adjacent closed room exceeded the Action Levels for Disposal Room Monitoring specified in Permit Part 4, Table 4.6.3.2.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Permit Part 4, Table 4.4.1 exceeds the action levels specified in Permit Part 4, Table 4.6.3.2.

The Permittees shall submit to the Secretary the Semi-Annual VOC Monitoring Report specified in Permit Section 4.6.2.2 that also includes results from disposal room VOC monitoring.

N-4 Sampling and Analysis Procedures

This section describes the equipment and procedures that will be implemented during sample collection and analysis activities for VOCs at WIPP.

N-4a Sampling Equipment

The sampling equipment that will be used includes the following: 6-liter (L) stainless-steel SUMMA® canisters, VOC canister samplers, treated stainless steel tubing, and a dual filter housing. A discussion of each of these items is presented below.

N-4a(1) SUMMA® Canisters

Six-liter, stainless-steel canisters with SUMMA® passivated interior surfaces will be used to collect and store all ambient air and gas samples for VOC analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use, in a manner similar to that described by Compendium Method TO-15. The canisters will be certified clean to below the required reporting limits for the VOC analytical method for the target VOCs (see Table N-2). The vacuum of certified clean samplers will be verified at the sampler upon initiation of a sample cycle.

N-4a(2) Volatile Organic Compound Canister Samplers

A conceptual diagram of a VOC sample collection unit is provided in Figure N-2. Such units will be used at monitoring Stations VOC-A and VOC-B and at sampling locations for disposal room measurements. The sampling unit consists of a sample pump, flow controller, sample inlet, inlet filters in series to remove particulate matter, vacuum/pressure gauge, electronic timer, inlet purge vent, two sampling ports, and sufficient collection canisters so that any delays attributed to laboratory turnaround time and canister cleaning and certification will not result in canister shortages. Knowledge of sampler flow rates and duration of sampling will allow calculation of sample volume. The set point flow rate will be verified before and after sample collection from the mass flow indication. Prior to their initial use and annually thereafter, the sample collection units will be tested and certified to demonstrate that they are free of contamination above the reporting limits of the VOC analytical method (see Section N-5). Ultra-high purity humidified zero air will be pumped through the inlet line and sampling unit and collected in previously certified canisters as sampler blanks for analysis. The cleaning and certification procedure is derived from concepts contained in the EPA Compendium Method TO-15 (EPA, 1999).

N-4a(3) Sample Tubing

Treated stainless steel tubing is used as a sample path, from the desired sample point to the sample collection unit. This tubing is treated to prevent the inner walls from absorbing contaminants when they are pulled from the sample point to the sample collection unit.

N-4b Sample Collection

Six-hour integrated samples will be collected on each sample day. Alternative sampling durations may be defined for experimental purposes. The VOC canister sampler at each location will sample ambient air on the same programmed schedule. The sample pump will be programmed to sample continuously over a six-hour period during the workday. The units will sample at a nominal flow rate of 33.3 actual milliliters per minute over a six-hour sample period. This schedule will yield a final sample volume of approximately 12 L. Flow rates and sampling duration may be modified as necessary for experimental purposes and to meet the data quality objectives.

Sample flow will be checked each sample day using an in-line mass flow controller. The flow controllers are initially factory-calibrated and specify a typical accuracy of better than 10 percent full scale. Additionally, each air flow controller is calibrated at a manufacturer-specified frequency using a National Institute of Standards and Testing (**NIST**) primary flow standard.

Upon initiation of waste disposal activities in Panel 1, samples will be collected twice each week (at Stations VOC-A and VOC-B). Samples collected at the panel locations should represent the same matrix type (i.e., elevated levels of salt aerosols). To verify the matrix similarity and assess field sampling precision, field duplicate samples will be collected (two canisters filled simultaneously by the same sampler) from each sampling station (Stations VOC-A and VOC-B) during the first sampling event and at an overall frequency of 5 percent thereafter (see Section N-5a).

Prior to collecting the active open disposal room and closed room samples, the sample lines are purged to ensure that the air collected is not air that has been stagnant in the tubing. This is important in regard to the disposal room sample particularly because of the long lengths of tubing associated with these samples. The repository samples do not require this action due to the short lengths of tubing required at these locations.

N-4c Sample Management

Field sampling data sheets will be used to document the sampler conditions under which each sample is collected. These data sheets have been developed specifically for VOC monitoring at the WIPP facility. The individuals assigned to collect the specific samples will be required to fill in all of the appropriate sample data and to maintain this record in sample logbooks. The program team leader will review these forms for each sampling event.

All sample containers will be marked with identification at the time of collection of the sample. A Request-for-Analysis Form will be completed to identify the sample canister number(s), sample type and type of analysis requested.

All samples will be maintained, and shipped if necessary, at ambient temperatures. Collected samples will be transported in appropriate containers. Prior to leaving the underground for

analysis, sample containers may undergo radiological screening. No potentially contaminated samples or equipment will be transported to the surface. No samples will be accepted by the receiving laboratory personnel unless they are properly labeled and sealed to ensure a tamper free shipment.

An important component of the sampling program is a demonstration that collected samples were obtained from the locations stated and that they reached the laboratory without alteration. To satisfy this requirement, evidence of collection, shipment, laboratory receipt, and custody will be documented with a completed Chain-of-Custody Form. Chain-of-custody procedures will be followed closely, and additional requirements imposed by the laboratory for sample analysis will be included as necessary.

Individuals collecting samples will be responsible for the initiation of custody procedures. The chain of custody will include documentation as to the canister certification, location of sampling event, time, date, and individual handling the samples. Deviations from procedure will be considered variances. Variances must be preapproved by the program manager and recorded in the project files. Unintentional deviations, sampler malfunctions, and other problems are nonconformances. Nonconformances must be documented and recorded in the project files. All field logbooks/data sheets must be incorporated into WIPP's records management program.

N-4d Sampler Maintenance

Periodic maintenance for canister samplers and associated equipment will be performed during each cleaning cycle. This maintenance will include, but not be limited to, replacement of damaged or malfunctioning parts without compromising the integrity of the sampler, leak testing, and instrument calibration. Additionally, complete spare units will be maintained on-site to minimize downtime because of sampler malfunction. At a minimum, canister samplers will be certified for cleanliness initially and annually thereafter upon initial use, after any parts that are included in the sample flow path are replaced, or any time analytical results indicate potential contamination. All sample canisters will be certified prior to each usage.

N-4e Analytical Procedures

Analytical procedures used in the analysis of VOC samples from canisters are based on concepts contained in Compendium Method TO-15 (EPA, 1999) and in SW-846 Method 8260B (EPA, 1996).

Analysis of samples will be performed by a certified laboratory. Methods will be specified in procurement documents and will be selected to be consistent with Compendium Method TO-15 (EPA, 1999) or EPA recommended procedures in SW-846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in the appropriate Air Compendium or SW-846 method and that the laboratory follow EPA protocols. The selected laboratory shall demonstrate, through laboratory SOPs, that it will follow appropriate EPA SW-846 requirements and the requirements specified by the EPA Air Compendium protocols. The laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the facility operating record and will be available for review upon request by NMED.

The SOPs for the laboratory currently under contract will be maintained in the operating record by the Permittees. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis.

Data validation will be performed by the Permittees. Copies of the data validation report will be kept on file in the operating record for review upon request by NMED.

N-5 Quality Assurance

The QA activities for the VOC monitoring programs will be conducted in accordance with the documents: *EPA Guidance for Quality Assurance Project Plans QA/G-5* (EPA, 2002) and the *EPA Requirements for Preparing Quality Assurance Project Plans, QA/R-5* (EPA, 2001). The QA criteria for the VOC monitoring programs are listed in Table N-2. This section addresses the methods to be used to evaluate the components of the measurement system and how this evaluation will be used to assess data quality. The QA limits for the sampling procedures and laboratory analysis shall be in accordance with the limits set forth in the specific EPA Method referenced in standard operating procedures employed by either the Permittees or the laboratory. The Permittees standard operating procedures will be in the facility Operating Record and available for review by NMED at anytime. The laboratory standard operating procedures will also be in the facility Operating Record and will be supplied to the NMED as indicated in Section N-4e.

N-5a Quality Assurance Objectives for the Measurement of Precision, Accuracy, Sensitivity, and Completeness

QA objectives for this plan will be defined in terms of the following data quality parameters.

Precision. For the duration of this program, precision will be defined and evaluated by the RPD values calculated between field duplicate samples and between laboratory duplicate samples.

$$RPD = \left(\frac{(A - B)}{(A + B)/2} \right) * 100 \qquad \text{(N-2)}$$

where: A = Original sample result

B = Duplicate sample result

Accuracy. Analytical accuracy will be defined and evaluated through the use of analytical standards. Because recovery standards cannot reliably be added to the sampling stream, overall system accuracy will be based on analytical instrument performance evaluation criteria. These criteria will include performance verification for instrument calibrations, laboratory control samples, sample surrogate recoveries (when required by method or laboratory SOPs), and sample internal standard areas. Use of the appropriate criteria as determined by the analytical method performed, will constitute the verification of accuracy for target analyte quantitation (i.e., quantitative accuracy). Evaluation of standard ion abundance criteria for BFB will be used to evaluate the accuracy of the analytical system in the identification of targeted analytes, as well as the evaluation of unknown contaminants (i.e., qualitative accuracy).

Sensitivity. Sensitivity will be defined by the required MRLs for the program. Attainment of required MRLs will be verified by the performance of statistical method detection limit (**MDL**) studies in accordance with 40 *Code of Federal Regulations* § 136. The MDL represents the minimum concentration that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. An MDL study will be performed by the program analytical laboratory prior to sampling and analysis, and annually thereafter.

Completeness. Completeness will be defined as the percentage of the ratio of the number of valid sample results received (i.e., those which meet data quality objectives) versus the total number of samples collected. Completeness may be affected, for example, by sample loss or destruction during shipping, by laboratory sample handling errors, or by rejection of analytical data during data validation.

N-5a(1) Evaluation of Laboratory Precision

Laboratory sample duplicates and blank spike/blank spike duplicates (**BS/BSD**) will be used to evaluate laboratory precision. QA objectives for laboratory precision are listed in Table N-2, and are based on precision criteria proposed by the EPA for canister sampling programs (EPA, 1994). These values will be appropriate for the evaluation of samples with little or no matrix effects. Because of the potentially high level of salt-type aerosols in the WIPP underground environment, the analytical precision achieved for WIPP samples may vary with respect to the EPA criteria. RPDs for BS/BSD analyses will be tracked through the use of control charts. RPDs obtained for laboratory sample duplicates will be compared to those obtained for BS/BSDs to ascertain any sample matrix effects on analytical precision. BS/BSDs and laboratory sample duplicates will be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

N-5a(2) Evaluation of Field Precision

Field duplicate samples will be collected at a frequency of 5 percent for both monitoring locations. The data quality objective for field precision is 35 percent for each set of duplicate samples.

N-5a(3) Evaluation of Laboratory Accuracy

Quantitative analytical accuracy will be evaluated through performance criteria on the basis of (1) relative response factors generated during instrument calibration, (2) analysis of laboratory control samples (**LCS**), and (3) recovery of internal standard compounds. The criteria for the initial calibration (5-point calibration) is $\leq$ 30 percent relative standard deviation for target analytes. After the successful completion of the 5-point calibration, it is sufficient to analyze only a midpoint standard for every 24 hours of operation. The midpoint standard will pass a 30 percent difference acceptance criterion for each target compound before sample analysis may begin.

A blank spike or LCS is an internal QC sample generated by the analytical laboratory by spiking a standard air matrix (humid zero air) with a known amount of a certified reference gas. The reference gas will contain the target VOCs at known concentrations. Percent recoveries for the target VOCs will be calculated for each LCS relative to the reference concentrations. Objectives for percent recovery are listed in Table N-2, and are based on accuracy criteria proposed by the

EPA for canister sampling programs (EPA, 1994). LCSs will be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

Internal standards will be introduced into each sample analyzed, and will be monitored as a verification of stable instrument performance. In the absence of any unusual interferences, areas should not change by more than 40 percent over a 24-hour period. Deviations larger than 40 percent are an indication of a potential instrument malfunction. If an internal standard area in a given sample changes by more than 40 percent, the sample will be reanalyzed. If the 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a performance check and the midpoint standard will be reanalyzed to verify proper operation. Response and recovery of internal standards will also be compared between samples, LCSs, and calibration standards to identify any matrix effects on analytical accuracy.

N-5a(4) Evaluation of Sensitivity

The presence of aerosol salts in underground locations may affect the MDL of the samples collected in those areas. The intake manifold of the sampling systems will be protected sufficiently from the underground environment to minimize salt aerosol interference.

The MDL for each of the nine target compounds will be evaluated by the analytical laboratories before sampling begins. The initial and annual MDL evaluation will be performed in accordance with 40 *Code of Federal Regulations* §136 and with EPA/530-SW-90-021, as revised and retitled, "Quality Assurance and Quality Control" (Chapter 1 of SW-846) (1996).

N-5a(5) Completeness

The expected completeness for this program is greater than or equal to 95 percent. Data completeness will be tracked monthly.

N-5b Sample Handling and Custody Procedures

Sample packaging, shipping, and custody procedures are addressed in Section N-4c.

N-5c Calibration Procedures and Frequency

Calibration procedures and frequencies for analytical instrumentation are listed in Section N-4e.

N-5d Data Reduction, Validation, and Reporting

A dedicated logbook will be maintained by the operators. This logbook will contain documentation of all pertinent data for the sampling. Sample collection conditions, maintenance, and calibration activities will be included in this logbook. Additional data collected by other groups at WIPP, such as ventilation airflow, temperature, pressure, etc., will be obtained to document the sampling conditions.

Data validation procedures will include at a minimum, a check of all field data forms and sampling logbooks will be checked for completeness and correctness. Sample custody and analysis records will be reviewed routinely by the QA officer and the laboratory supervisor.

Electronic Data Deliverables (**EDDs**) are provided by the laboratory prior to receipt of hard copy data packages. EDDs will be evaluated within five calendar days of receipt to determine if VOC concentrations are at or above action levels in Table 4.6.3.2 for disposal room monitoring data or concentrations of concern in Table 4.6.2.3 for repository monitoring data. If the EDD indicates that VOC concentrations are at or above these action levels or concentrations, the hard copy data package will be validated within five calendar days as opposed to the fourteen (14) calendar day time frame provided by Section N-3e(2).

Data will be reported as specified in Section N-3(e) and Permit Part 4.

Acceptable data for this VOC monitoring plan will meet stated precision and accuracy criteria. The QA objectives for precision, accuracy, and completeness as shown in Table N-2 can be achieved when established methods of analyses are used as proposed in this plan and standard sample matrices are being assessed.

N-5e Performance and System Audits

System audits will initially address start-up functions for each phase of the project. These audits will consist of on-site evaluation of materials and equipment, review of canister and sampler certification, review of laboratory qualification and operation and, at the request of the QA officer, an on-site audit of the laboratory facilities. The function of the system audit is to verify that the requirements in this plan have been met prior to initiating the program. System audits will be performed at or shortly after to the initiation of the VOC monitoring programs and on an annual basis thereafter.

Performance audits will be accomplished as necessary through the evaluation of analytical QC data by performing periodic site audits throughout the duration of the project, and through the introduction of third-party audit cylinders (laboratory blinds) into the analytical sampling stream. Performance audits will also include a surveillance/review of data associated with canister and sampler certification, a project-specific technical audit of field operations, and a laboratory performance audit. Field logs, logbooks, and data sheets will be reviewed weekly. Blind-audit canisters will be introduced once during the sampling period. Details concerning scheduling, personnel, and data quality evaluation are addressed in the QAPjP.

N-5f Preventive Maintenance

Sampler maintenance is described briefly in Section N-4d Maintenance of analytical equipment will be addressed in the analytical SOP.

N-5g Corrective Actions

If the required completeness of valid data (95 percent) is not maintained, corrective action may be required. Corrective action for field sampling activities may include recertification and cleaning of samplers, reanalysis of samples, additional training of personnel, modification to field and laboratory procedures, and recalibration of test equipment.

Laboratory corrective actions may be required to maintain data quality. The laboratory continuing calibration criteria indicate the relative response factor for the midpoint standard will be less than 30 percent different from the mean relative response factor for the initial calibration. Differences greater than 30 percent will require recalibration of the instrument before samples

can be analyzed. If the internal standard areas in a sample change by more than 40 percent, the sample will be reanalyzed. If the 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a performance check and the midpoint standard reanalyzed to verify proper operation. Deviations larger than 40 percent are an indication of potential instrument malfunction.

The laboratory results for samples, duplicate analyses, LCSs, and blanks should routinely be within the QC limits. If results exceed control limits, the reason for the nonconformances and appropriate corrective action must be identified and implemented.

N-5h Records Management

The VOC Monitoring Programs will require administration of record files (both laboratory and field data collection files). The records control systems will provide adequate control and retention for program-related information. Records administration, including QA records, will be conducted in accordance with applicable DOE, MOC, and WIPP requirements.

Unless otherwise specified, VOC monitoring plan records will be retained as lifetime records. Temporary and permanent storage of QA records will occur in facilities that prevent damage from temperature, fire, moisture, pressure, excessive light, and electromagnetic fields. Access to stored VOC Monitoring Program QA Records will be controlled and documented to prevent unauthorized use or alteration of completed records.

Revisions to completed records (i.e., as a result of audits or data validation procedures) may be made only with the approval of the responsible program manager and in accordance with applicable QA procedures. Original and duplicate or backup records of project activities will be maintained at the WIPP site. Documentation will be available for inspection by internal and external auditors.

N-6 Sampling and Analysis Procedures for Disposal Room VOC Monitoring in Filled Panels

Disposal room VOC samples in filled panels will be collected using the subatmospheric pressure grab sampling technique described in Compendium Method TO-15 (EPA, 1999). This method uses an evacuated SUMMA® passivated canister (or equivalent) that is under vacuum (0.05 mm Hg) to draw the air sample from the sample lines into the canister. The sample lines will be purged prior to sampling to ensure that a representative sample is collected. The passivation of tubing and canisters used for VOC sampling effectively seals the inner walls and prevents compounds from being retained on the surfaces of the equipment. By the end of each sampling period, the canisters will be near atmospheric pressure.

The analytical procedures for disposal room VOC monitoring in filled panels are the same as specified in Section N-4e.

N-7 References

U.S. Environmental Protection Agency. 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency. 1999 *Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry*, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives Process*, QA/G-4. EPA 600/R-96/055, August 2000, Washington, D.C.

U.S. Environmental Protection Agency. 2001. *EPA Guidance for Quality Assurance Project Plans, QA/G*, EPA 240/B-01/003, March 2001, Washington, D.C.

U.S. Environmental Protection Agency. 2002. *EPA Requirements for Preparing Quality Assurance Project Plans*, QA/R-5, EPA 240/R-01/009, December 2002, Washington, D.C.

Washington Regulatory and Environmental Services, 2004. *Technical Evaluation Report for WIPP Room-Based VOC Monitoring*.

TABLES

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2
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Table N-1
Target Analytes and Methods for Repository VOC (Station VOC-A and VOC-B) Monitoring and Disposal Room Monitoring

Target Analyte	EPA Standard Analytical Method
Carbon tetrachloride	EPA TO-15[a] EPA 8260B[b]
Chlorobenzene	
Chloroform	
1,1-Dichloroethylene	
1,2-Dichloroethane	
Methylene chloride	
1,1,2,2 -Tetrachloroethane	
Toluene	
1,1,1- Trichloroethane	

[a] U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air- Second Edition, http://www.epa.gov/ttn/amtic/airtox.html

[b] U.S. Environmental Protection Agency, SW-846 Test Methods for Evaluation Solid Wastes, Chemical and Physical Methods, http://www.epa.gov/epaoswer/hazwaste/test/main.htm

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Table N-2
Quality Assurance Objectives for Accuracy, Precision, Sensitivity, and Completeness

Compound	Accuracy (Percent Recovery)	Precision (RPD) Laboratory	Precision (RPD) Field	Required Repository Monitoring MRL (ppbv)	Required Disposal Room MRL (ppbv)	Completeness (Percent)
Carbon tetrachloride	60 to 140	25	35	2	500	95
Chlorobenzene	60 to 140	25	35	2	500	95
Chloroform	60 to 140	25	35	2	500	95
1,1-Dichloroethylene	60 to 140	25	35	5	500	95
1,2-Dichloroethane	60 to 140	25	35	2	500	95
Methylene chloride	60 to 140	25	35	5	500	95
1,1,2,2-Tetrachloroethane	60 to 140	25	35	2	500	95
Toluene	60 to 140	25	35	5	500	95
1,1,1-Trichloroethane	60 to 140	25	35	5	500	95

MRL maximum method reporting limit for undiluted samples
RPD relative percent difference

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FIGURES

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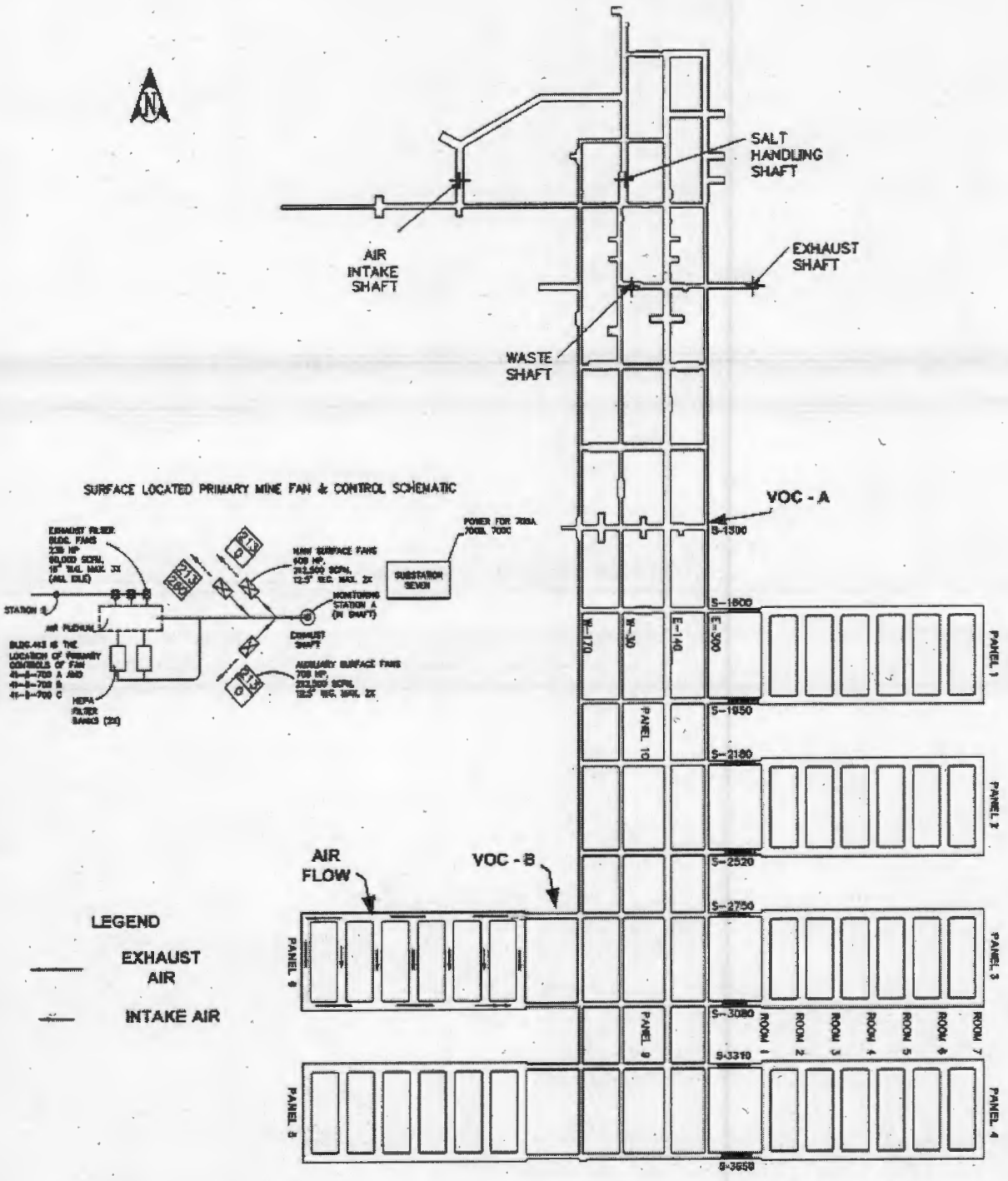

Figure N-1
Panel Area Flow

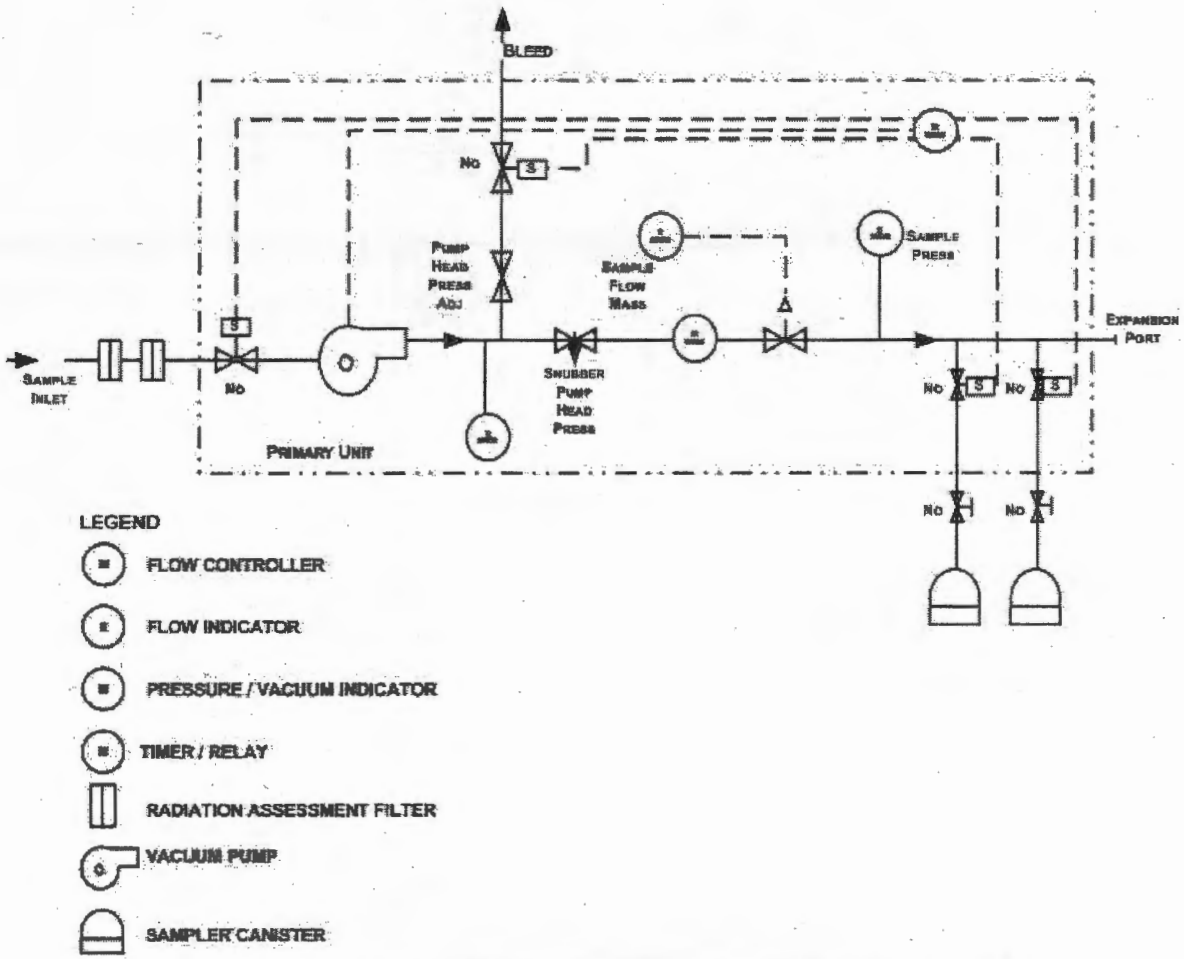

Figure N-2
VOC Monitoring System Design

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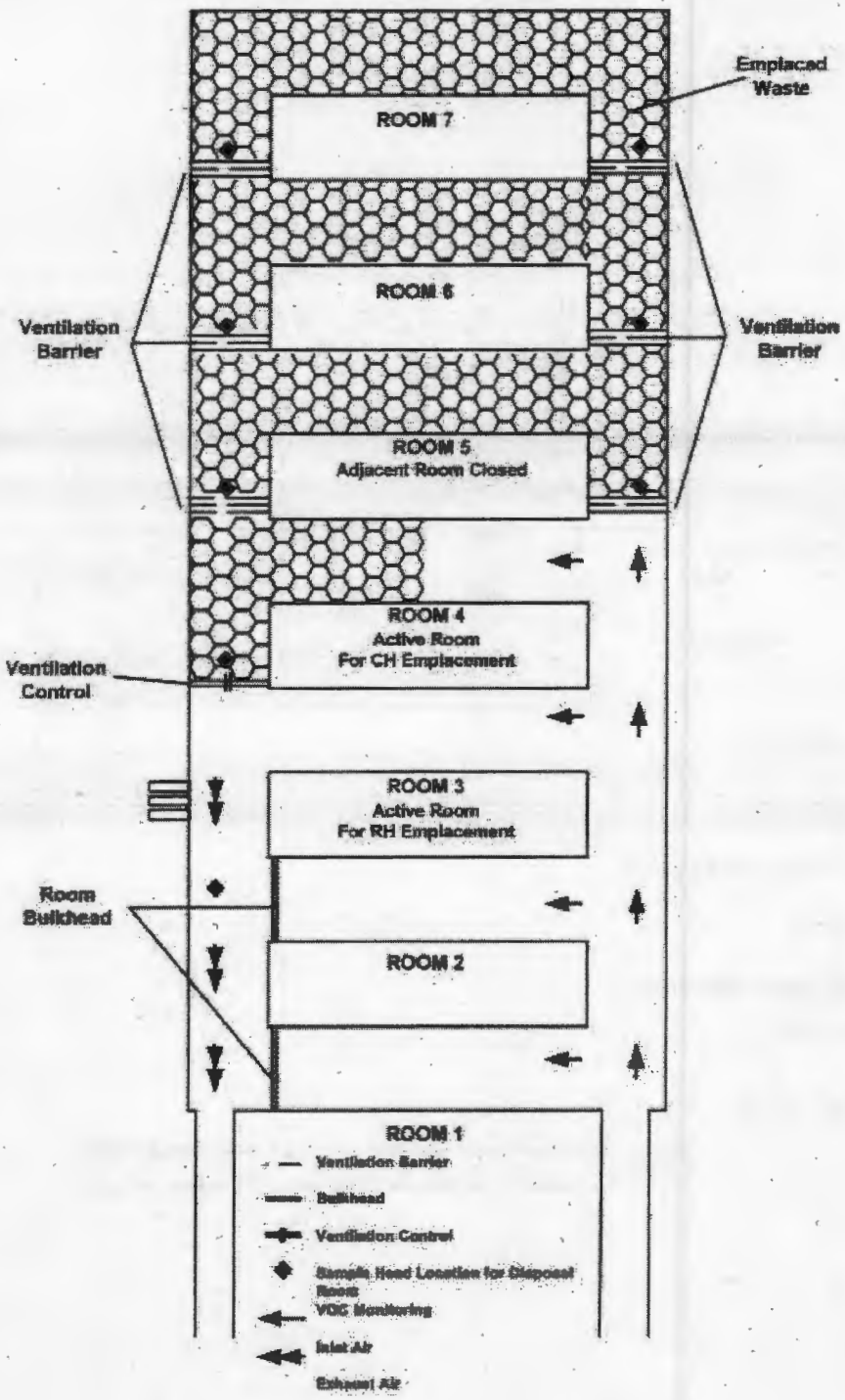

Figure N-3
Disposal Room VOC Monitoring

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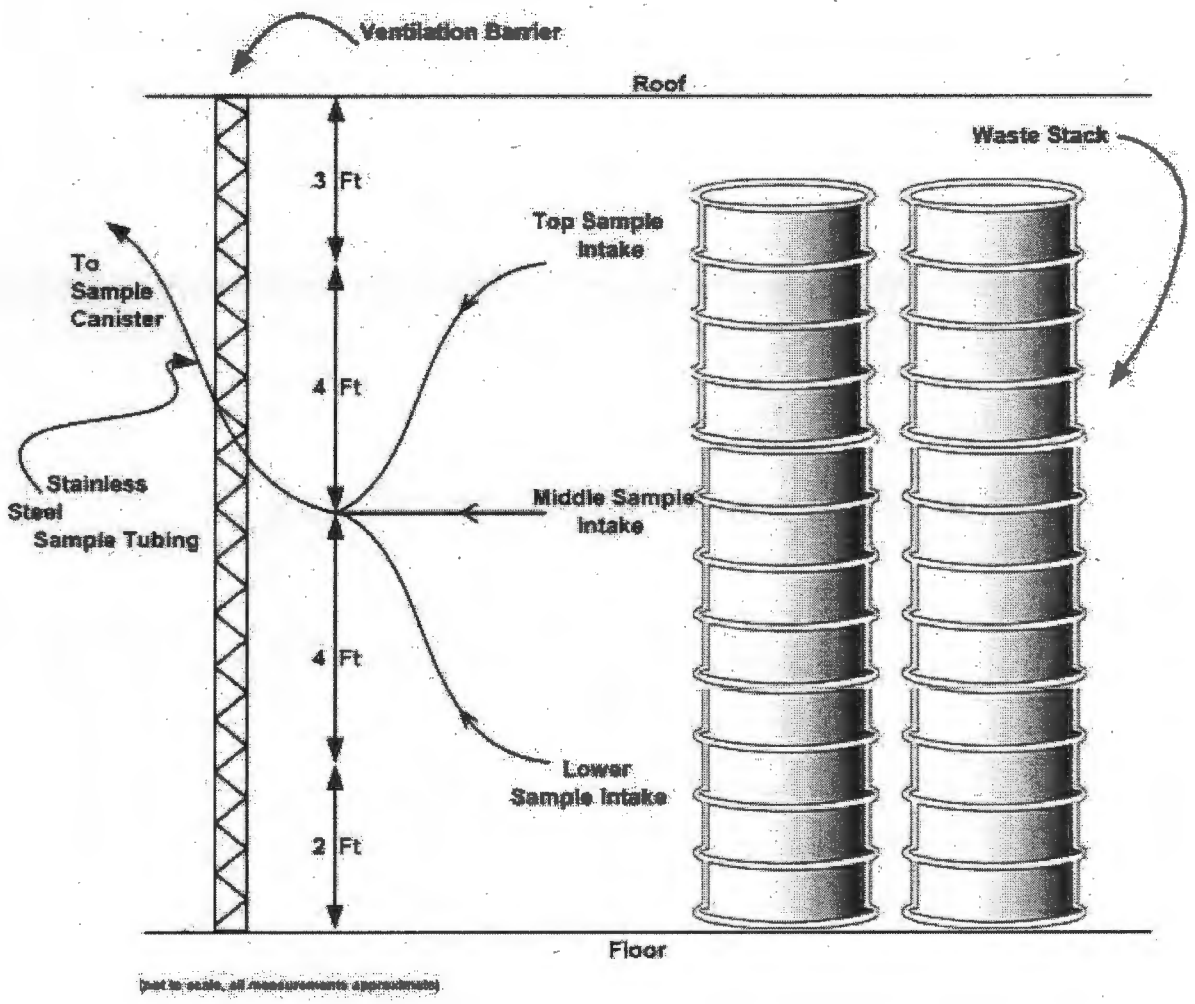

Figure N-4
VOC Sample Head Arrangement

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ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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ATTACHMENT N1

HYDROGEN AND METHANE MONITORING PLAN

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ATTACHMENT N1

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N1-1 Introduction

This Permit Attachment describes the monitoring plan for hydrogen and methane generated in Underground Hazardous Waste Disposal Units (**HWDUs**) 3 through 8, also referred to as Panels 3 through 8.

Monitoring for hydrogen and methane in Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed, may be an effective way to gather data to establish realistic gas generation rates. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N1-2 Parameters to be Analyzed and Monitoring Design

The Permittees will monitor for hydrogen and methane in filled Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed. A "filled panel" is an Underground HWDU that will no longer receive waste for emplacement.

Monitoring of a filled panel will commence after installation of the following items in each filled panel:

- substantial barriers
- bulkheads
- five additional monitoring locations.

The substantial barriers serve to protect the waste from events such as ground movement or vehicle impacts. The substantial barrier will be constructed from available non-flammable materials such as mined salt (Figure N1-1).

The bulkheads (Figure N1-2) serves to block ventilation at the intake and exhaust of the filled panel and prevent personnel access. The bulkhead is constructed as a typical WIPP bulkhead with no access doors or panels. The bulkhead will consist of a steel member frame covered with galvanized sheet metal, and will not allow personnel access. Flexible flashing will be used as a gasket to attach the steel frame to the salt, thereby providing an effective yet flexible blockage to ventilation air. Over time, it is possible that the bulkhead may be damaged by creep closure around it. If the damage is such as to indicate a possible loss of functionality, then the bulkhead will be repaired or an additional bulkhead will be constructed outside of the original one.

The existing VOC monitoring lines as specified in Attachment N, Section N-3a(2), "Sampling Locations for Disposal Room VOC Monitoring", will be used for sample collection in each disposal room for Panels 3 and 4. The sample lines and their construction are shown in Figure N1-3. In addition to the existing VOC monitoring lines, five more sampling locations will be used to monitor for hydrogen and methane. These additional locations include:

- the intake of room 1
- the waste side of the exhaust bulkhead,

- the accessible side of the exhaust bulkhead,
- the waste side of the intake bulkhead,
- the accessible side of the intake bulkhead.

These additional sampling locations (Figure N1-4) will use a single inlet sampling point placed near the back (roof) of the panel access drifts. This will maximize the sampling efficiency for these lighter compounds.

N1-3 Sampling Frequency

Sampling frequency will vary depending upon the levels of hydrogen and methane that are detected.

- If monitored concentrations are at or below Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted monthly.

- If monitored concentrations exceed Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted weekly in the affected filled panel.

N1-4 Sampling

Samples for hydrogen and methane will be collected using subatmospheric pressure grab sampling as described in Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling method uses passivated stainless-steel sample canisters to collect integrated air samples at each sample location. Flow rates and sampling duration may be modified as necessary to meet data quality objectives.

Sample lines shall be purged prior to sample collection.

N1-5 Sampling Equipment

N1-5a SUMMA® Canisters

Stainless-steel canisters with passivated or equivalent interior surfaces will be used to collect and store gas samples for hydrogen and methane analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use in a manner similar to that described by Compendium Method TO-15 (EPA, 1999). The vacuum of certified clean canisters will be verified upon initiation of a sample cycle. Sampling will be conducted using subatmospheric pressure grab sampling techniques as described in TO-15.

N1-5b Sample Tubing

Treated stainless steel tubing shall be used as a sample path and treatment shall prevent the inner walls from absorbing contaminants.

Any loss of the ability to purge a sample line will be evaluated. The criteria used for evaluation are shown in Figure N1-5.

The Permittees will first suspect that a line is not useable when it is purged prior to sampling. If the line cannot be purged, then it will not be used for sampling unless the line is a bulkhead line

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that can be easily replaced. Replacement of bulkhead lines will occur before the next scheduled sample. Non-bulkhead lines will be evaluated by first determining if adjacent sampling lines are working. If the answer is no, then the previous sample from the failed line will be examined. If the previous sample was between the first and second action levels, then the explosion-isolation wall will be installed since without the ability to monitor it is unknown whether the area is approaching the second action level or decreasing. If the previous sample was below the first action level then continued sampling is acceptable without the lost sample.

If an adjacent line is working, the prior concentrations measured in that line will be evaluated to determine if it is statistically similar to the prior measurements from the lost line. If the prior sampling results are statistically similar, the lines can be grouped. Statistical similarity will be determined using the Student's "t" test to evaluate differences.

The magnitude of *t* will be compared to the critical *t* value from SW-846, Table 9-2 (EPA, 1996), for this statistical test.

If the lost line can be grouped with an adjacent line, no further action is necessary because the unmonitored area is considered to be represented by the adjacent areas. If the lost sample line cannot be grouped with an adjacent line, the previous concentration measurement will be compared to the Action Levels. If the concentration is below Action Level 1, monitoring will continue. If the concentration is between Action Level 1 and Action Level 2, the explosion-isolation wall will be installed in the panel.

N1-6 Sample Management

Sample containers shall be sealed and uniquely marked at the time of collection of the sample. A Request-for-Analysis Form shall be completed to identify the sample canister number(s), sample type, and type of analysis requested.

N1-7 Analytical Procedures

The samples will be analyzed using gas chromatography equipped with the appropriate detector under an established QA/quality control (**QC**) program. Analysis of samples shall be performed by a laboratory that the Permittees select and approve through established QA processes.

N1-8 Data Evaluation and Notifications

Analytical data from sampling events will be evaluated to determine whether the sample concentrations of flammable gases exceed the Action Levels.

If any Action Level is exceeded, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of obtaining validated analytical data.

If any sampling line loss occurs, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of learning of a sampling line loss. After the evaluation of the impact of sampling line loss as shown in Figure N1-5, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within seven calendar days of completing the sampling line loss evaluation.

N1-9 References

U.S. Environmental Protection Agency (EPA), 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1999. *Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry*, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

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FIGURES

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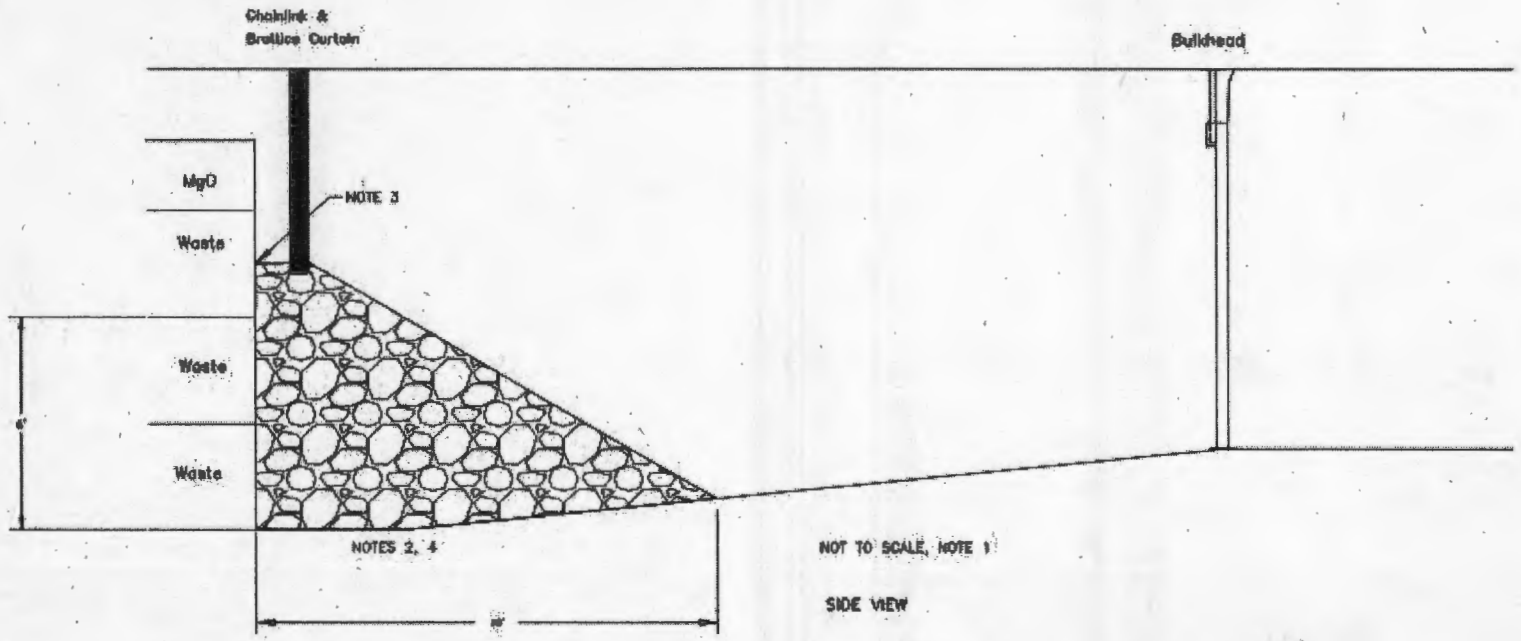
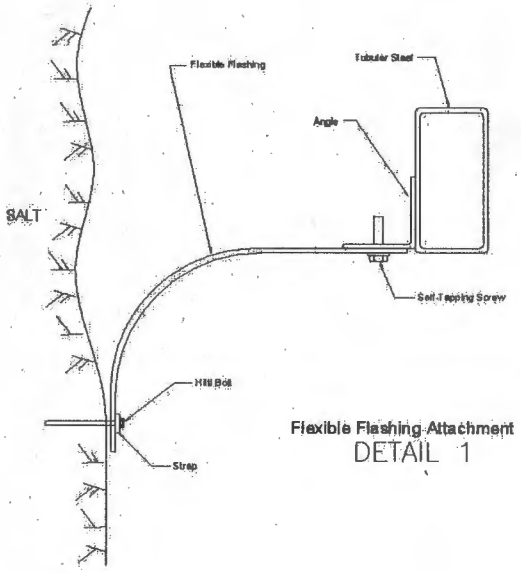


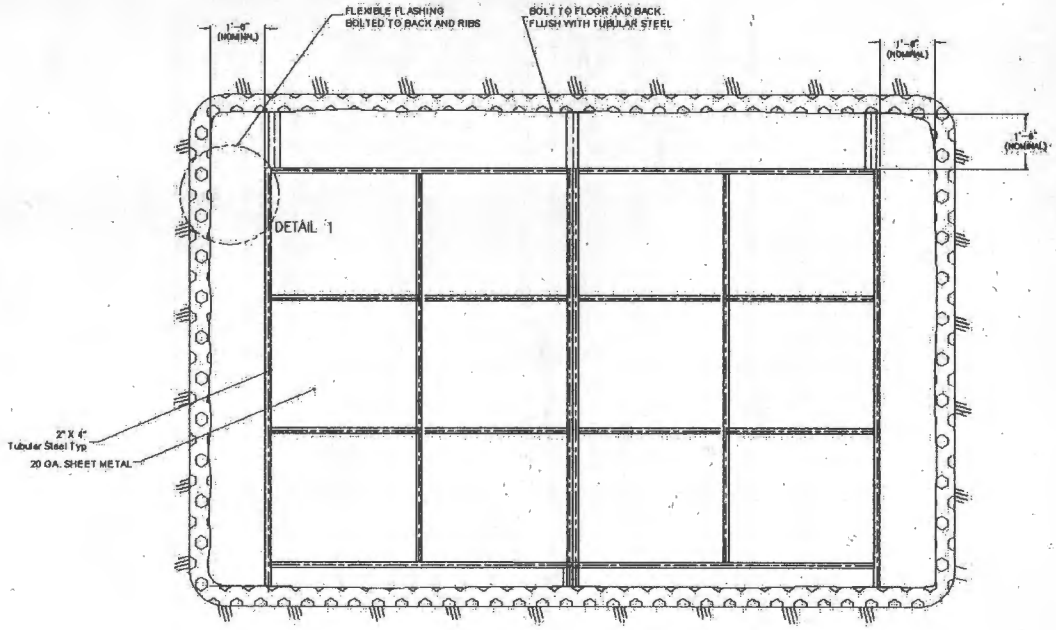
NOTES

1. CONFIGURATION AND PLACEMENT OF THE SUBSTANTIAL BARRIER AND THE BULKHEAD DICTATED BY AS-FOUND (FIELD) CONDITIONS, AS DESIGNATED BY THE COGNIZANT ENGINEER.
2. SUBSTANTIAL BARRIER MATERIAL WILL CONSIST OF RUN-OF-MINE SALT OR OTHER SUITABLE NON-FLAMMABLE MATERIAL AS DESIGNATED BY THE COGNIZANT ENGINEER.
3. SUBSTANTIAL BARRIER MATERIAL SHOULD BE AGAINST THE WASTE FACE. THE HEIGHT OF THE SUBSTANTIAL BARRIER NEAR THE WASTE WILL BE AT LEAST EQUAL TO THE HEIGHT OF THE BOTTOM OF THE TOP ROW OF WASTE.
4. DIMENSIONS INDICATED ARE MINIMUMS. THE HEIGHT OF THE SUBSTANTIAL BARRIER IS MEASURED AT THE WASTE FACE. THE LENGTH OF THE SUBSTANTIAL BARRIER IS MEASURED FROM THE BOTTOM OF THE WASTE FACE TO THE TOE OF THE SUBSTANTIAL BARRIER MATERIAL.

Figure N1-1
Typical Substantial Barrier and Bulkhead



Flexible Flashing Attachment
DETAIL 1



Not to Scale. All dimensions are nominal.

Figure N1-2
Typical Bulkhead

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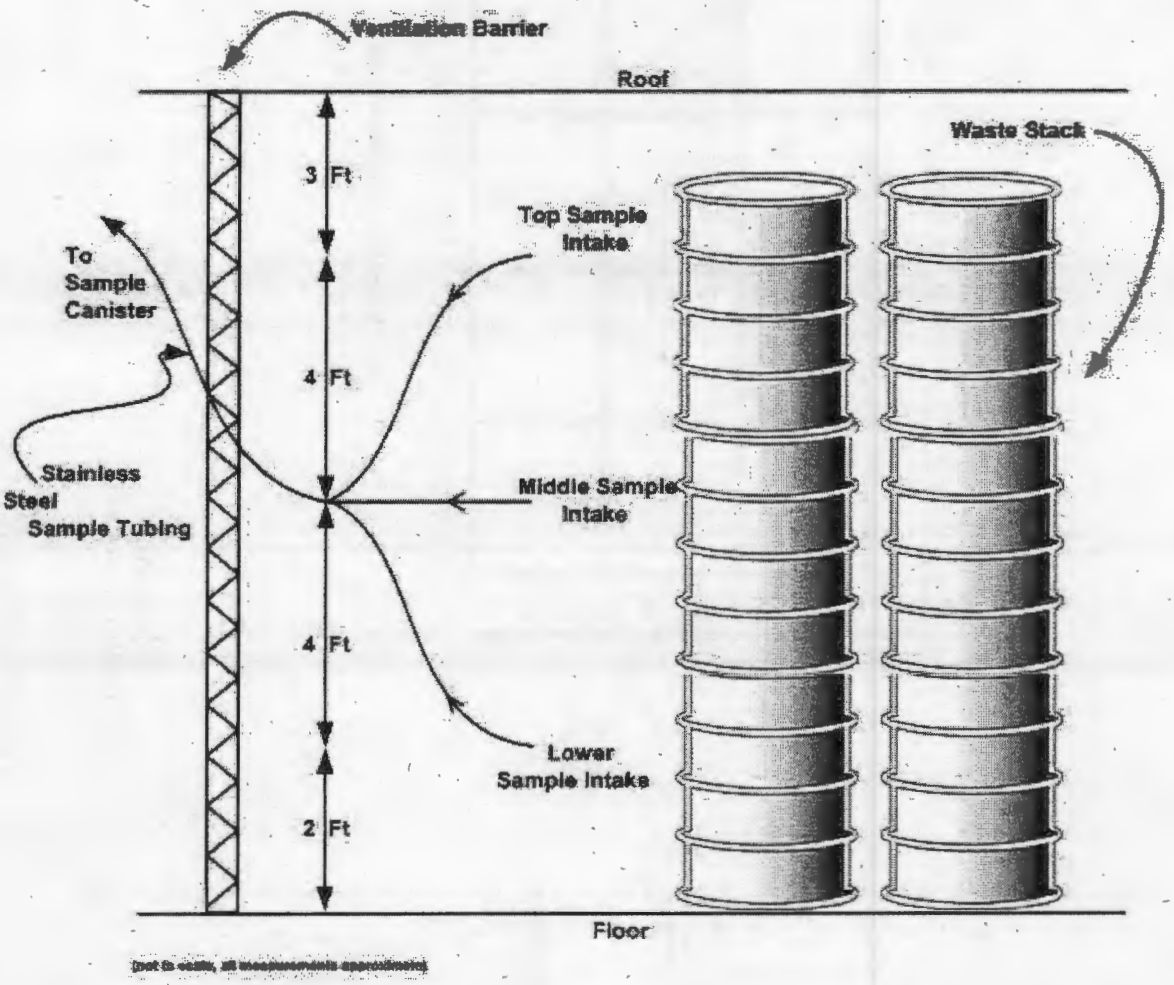

Figure N1-3
Typical Hydrogen and Methane Monitoring System

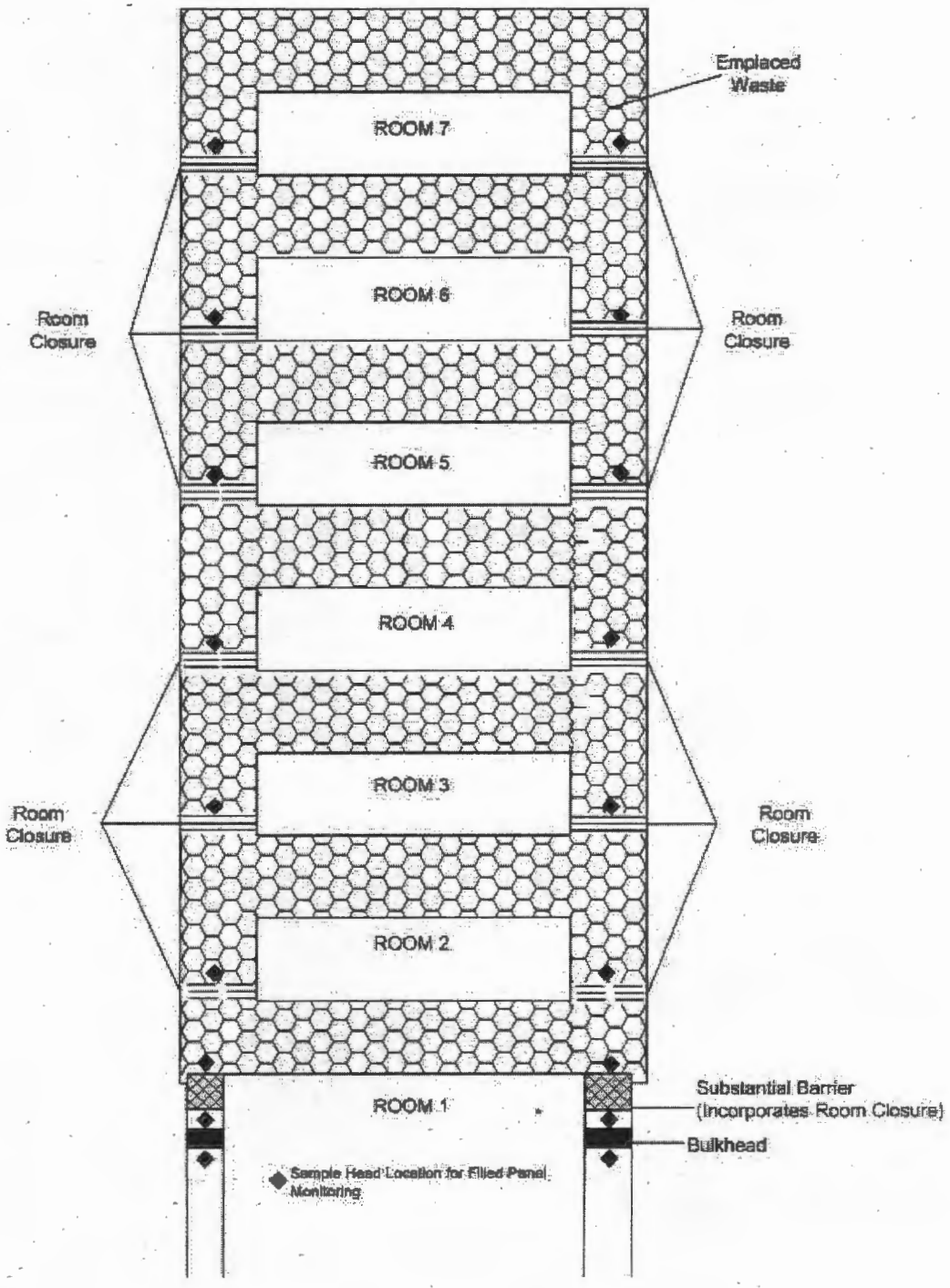

Figure N1-4
Typical Hydrogen and Methane Sampling Locations

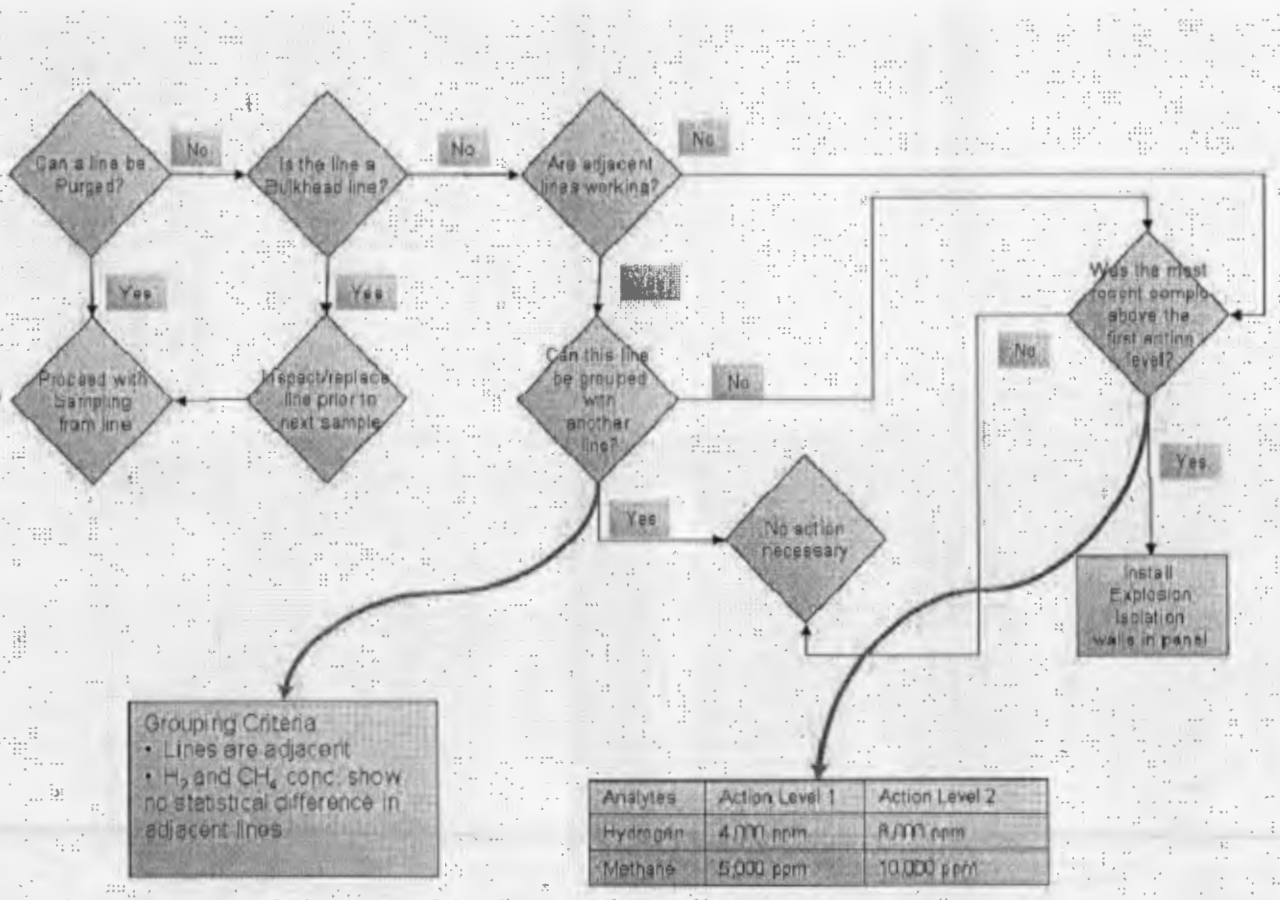

Figure N1-5
Logic Diagram for Evaluating Sample Line Loss

ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

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ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

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O-3c Active Disposal Room Minimum Airflow 6
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O-2	Mine Ventilation Rate Testing Equipment
O-3	Active Disposal Room Ventilation Rate Log Sheet (Example)

ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

O-1 Definitions

Compliance with the mine ventilation requirements set forth in Permit Part 4 and Permit Attachment A2 requires the use and definition of the following terms:

Actual cubic feet per minute (**acfm**): The volume of air passing a fixed point in an excavation, normally determined as the product of the cross section of the excavation and the mean velocity of the air.

Standard cubic feet per minute (**scfm**): The actual cubic feet per minute passing a fixed point adjusted to standard conditions. In the Imperial measurement system, the standard condition for pressure is 14.7 pounds per square inch (**psi**) (sea level) and the standard condition for temperature is 492 degrees Rankine (freezing point of water or 32 degrees Fahrenheit). The greatest difference between acfm and scfm occurs in the summer when the pressure at the repository horizon is about 14.2 psi and the temperature is about 560 degrees Rankine (100 degrees Fahrenheit). Then

$$1 \text{ scfm} \times (560/492) \times (14.7/14.2) = 1.2 \text{ acfm}$$

A reasonably conservative conversion factor, therefore, is 1.2. Using this factor, 35,000 scfm is very nearly 35,000 x 1.2 or 42,000 acfm.

Restricted Access: If the required ventilation rate in an active room when waste disposal is taking place cannot be achieved or cannot be supported due to operational needs, access is restricted by the use of barriers, signs and postings, or individuals stationed at the entrance to the active disposal room when ventilation rates are below 35,000 scfm. Note: As provided in O-3c(2) entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed.

Shift: Those work shifts when there is normal access to the Waste Isolation Pilot Plant (**WIPP**) underground.

Worker: Anyone who has normal access to the WIPP underground.

O-2 Objective

The objective of this plan is to describe how the ventilation requirements in the Permit will be met. This plan achieves this objective and documents the process by which the Permittees demonstrate compliance with the ventilation requirements by:

- Maintaining an annual running average of 260,000 scfm through the underground repository
- Maintaining a minimum of 35,000 scfm of air through the active rooms when waste disposal is taking place and when workers are present in the rooms

This plan contains the following elements: Objective; Design and Procedures; Equipment Calibration and Maintenance; Reporting and Record Keeping; Quality Assurance.

O-3 Design and Procedures

This section describes the four basic processes that make up the mine ventilation rate monitoring plan:

- Test and Balance, a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components
- Monitoring and calculation of the Running Annual Average of the Total Mine Airflow to verify achievement of the 260,000 scfm minimum requirement
- Monitoring of active room(s) to ensure a minimum flow of 35,000 scfm whenever waste disposal is taking place and workers are present in the room
- Quarterly verification of the total mine airflow

O-3a Test and Balance

O-3a(1) Test and Balance Process

The WIPP ventilation system and the underground ventilation modes of operation are described in Permit Application A2-2a(3). The Permittees shall verify underground ventilation system performance by conducting a periodic Test and Balance. The Test and Balance is a comprehensive series of measurements and adjustments designed to ensure that the system is operating within acceptable design parameters. The Test and Balance is an appropriate method of verifying system flow because it provides consistent results based on good engineering practices. The testing of underground ventilation systems is described in McPherson, 1993. Once completed, the Test and Balance data become the baseline for underground ventilation system operation until the next Test and Balance is performed.

The "Test" portion of the process shall involve measuring the pressure drop and air quantity of every underground entry excluding alcoves or other dead end drifts. In addition, the tests shall verify resistance curves for each of the main regulators, measure shaft resistance, and measure main fan pressure and quantity. This is done at the highest achievable airflow to facilitate

accurate measurements. From these measurements the frictional resistance of the system is determined.

Pressure shall be measured using the gage and tube method, which measures the pressure drop between two points using a calibrated pressure recording device and pitot tubes. Pressure drops across the shafts shall be measured by either calibrated barometers at the top and bottom of shafts or the gage and tube method. Airflow shall be measured using a calibrated vane anemometer to take a full entry traverse between system junctions. Fan pressure shall be measured using a calibrated pressure recording device and pitot tube to determine both static and velocity pressure components.

Multiple measurements shall be taken at each field location to ensure accurate results. Consecutive field values must fall within ±5% to be acceptable. These data shall be verified during the testing process by checking that:

- the sum of airflows entering and leaving a junction is equal to zero; and,
- the sum of pressure drops around any closed loop is equal to zero.

Once the measurements are taken, data shall be used to calculate the resistance of every underground drift, as well as shafts and regulators using Atkinson's Square Law

$$P=R \times Q^2$$

where the pressure drop of an entry (P) is equal to a resistance (R) times the square of the quantity of air flowing (Q) through the circuit.

The "Balance" portion of the process shall involve adjusting the settings of the system fans and regulators to achieve the desired airflow distribution in all parts of the facility for each mode of operation. Particular emphasis shall be given to the active disposal room(s) in the Waste Disposal Circuit to ensure that a minimum airflow of 35,000 scfm is achieved. The system baseline settings for the current Balance shall be established from the previous Test and Balance. Adjustments shall then be made to account for changes in system resistance due to excavation convergence due to salt creep, approved system modifications, or operational changes.

The Permittees shall use a commercially available ventilation simulator to process Test and Balance field data. The simulator uses the Hardy-Cross Iteration Method (McPherson, 1993) to reduce field data into a balanced ventilation network, including the appropriate regulator settings necessary to achieve proper airflow distribution for the various operating modes. Once balanced, the same simulator shall be used to evaluate changes such as future repository development and potential system modification before they are implemented.

The Test and Balance process culminates in a final report which is retained on site. Following receipt of the Test and Balance Report, the Permittees shall revise the WIPP surface and underground ventilation system procedures to incorporate any required changes to the ventilation system configuration. The Test and Balance data shall be used to adjust the operating range of fan controls, waste tower pressure, auxiliary air intake tunnel regulator settings, underground regulator settings, and door configurations. The model data and procedure changes shall be used to establish normal configuration settings to achieve the desired airflow in the underground. These settings shall then be modified by operations

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personnel throughout the year to compensate for system fluctuations caused by seasonal changes in psychrometric properties, and to meet specific operations needs. This ensures that the facility is operated at the design airflow rate for each ventilation mode.

O-3a(2) Test and Balance Schedule

The Test and Balance is generally conducted on a 12- to 18-month interval, but in no case shall the interval between consecutive Test and Balance performances exceed 18 months. This interval is sufficient to account for changes in the mine configuration since over this period the ventilated volume changes very little. The quality and maintenance of ventilation control structures (e.g., bulkheads) is excellent, so leakage is small and relatively constant. Historic test and balance results confirm that changes between test and balances fall within anticipated values.

O-3b Running Annual Average of the Total Mine Airflow

O-3b(1) Monitoring Total Mine Airflow

The Permittees shall use the Central Monitoring Room Operator's (**CMRO**) Log to monitor total mine airflow. Run-times for the various modes of operation shall be entered into the CMRO Log. For example, if the CMRO Log indicates that the ventilation system was configured for Alternate Mode (one main fan) at 8:00 am, and that this configuration was maintained until 11:30 am, a total of 3.5 hours of run-time in Alternate Mode would be recorded. Run times are recorded to the nearest quarter hour. The CMRO shall record each time when the ventilation system configuration is changed, including periods when there is no ventilation.

O-3b(2) Calculation of the Running Annual Average of Total Mine Airflow

The Permittees shall calculate the running average flow rate on a monthly basis. The Permittees shall use the logged runtime data for various modes of operation (as described in O-3b(1)) and the nominal design flow-rates for the various modes presented in Table O-1 to calculate the average monthly flow rate for the facility.

The average monthly mine flow rate is computed monthly using the following formula:

Monthly Average Flow Rate = {[Normal Mode Run-time (hrs.) x 425,000 scfm]
+ [Alternate Mode Run-time (hrs.) x 260,000 scfm]
+ [Maintenance Bypass Run-time (hrs.) x 260,000 scfm]
+ [Reduced Mode Run-time (hrs.) x 120,000 scfm]
+ [Minimum Mode Run Time (hrs.) x 60,000 scfm]
+ [Filtration Mode Run-time (hrs.) x 60,000 scfm]}
/ 730 Hours per month.

The running annual average of total mine airflow annual average flow rate shall be calculated using the monthly averages and the following formula:

$$\text{Annual Average Flow Rate} = \frac{\sum \text{Monthly Average for Previous 12 Months}}{12}$$

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The use of an average value of 730 hours per month in the monthly average calculation is reasonable, given that all the numbers involved are very large and that the final use of the monthly average flow is in an annual calculation.

O-3c Active Room Minimum Airflow

O-3c(1) Verification of Active Room Minimum Airflow

Whenever workers are present, the Permittees shall verify the minimum airflow through active room(s) when waste disposal is taking place of 35,000 scfm at the start of each shift, any time there is an operational mode change, or if there is a change in the ventilation system configuration.

O-3c(2) Measurement and Calculation of the Active Room Airflow

The Permittees shall measure the airflow rate and use the room cross-sectional area to calculate the volume of air flowing through a disposal room. The measurement of airflow shall use a calibrated anemometer and a moving traverse (McPherson, 1993). Airflow measurements shall be collected at an appropriate location, chosen by the operator to minimize airflow disturbances, near the entrance of each active room. The excavation dimensions at the measurement location are taken and the cross-sectional area is calculated. The flow rate is the product of the air velocity and the cross-section area. The value shall be entered on a log sheet (see Table O-3) and compared to the required minimum. The format and content of the log sheet may vary, but will always contain the data and information shown on Table O-3. Working values are in acfm and the conversion to scfm is described in section O-1 above. Measurements shall be collected, recorded, and verified by qualified operators.

The operator shall compare the recorded acfm value with the minimum acfm value provided at the top of the log sheet. The airflow shall be re-checked and recorded whenever there is an operational mode change or a change in ventilation system configuration. Once the ventilation rate has been recorded and verified to be at least the required minimum, personnel access to the room is unrestricted in accordance with normal underground operating procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room shall be restricted. Those periods when active disposal room access is restricted shall be documented on the log sheet for that active disposal room. Entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed. Such entry shall be documented on the log sheet including a reference to the SOP used for reentry,

O-3d Quarterly Verification of Total Mine Airflow

The Permittees shall perform a quarterly verification of the total mine airflow to ensure that rates established by the Test and Balance for various operational modes are reasonably maintained. These checks are identified in Permit Attachment E, Table E-1, and are performed as indicated in Table E-1.

O-4 Equipment Calibration and Maintenance

Equipment used for the periodic Test and Balance, quarterly flow verification checks, and daily verification of active disposal room flow rate shall be calibrated in accordance with appropriate WIPP calibration and data collection procedures. Work performed by subcontractors shall also

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be calibrated to an equivalent standard. Equipment shall be inspected before each use to ensure that it is functioning properly and that the equipment calibration is current. Maintenance of equipment shall be completed by qualified individuals or by qualified off-site service vendors.

Equipment used to conduct the Test and Balance, Quarterly Verification of Total Mine Airflow, and to determine the airflow through the active disposal room(s) are provided in Table O-2.

O-5 Reporting and Recordkeeping

O-5a Reporting

The Permittees shall submit an annual report to NMED presenting the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In the years that the Test and Balance is performed, the Permittees will provide a summary of the results in the annual report.

The Permittees shall calculate the running annual average mine ventilation rate on a monthly basis and evaluate compliance with the minimum ventilation rate for an active room specified in Permit Section 4.5.3.2 on a monthly basis. The Permittees shall report the Secretary in the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved..

O-5b Recordkeeping

The Permittees shall retain the following information in the Operating Record:

- The CMRO Log documenting the ventilation system operating mode.
- The underground facility running annual average mine ventilation rate on a monthly basis.
- Active disposal room ventilation flow rate readings as documented on the Active Disposal Room Ventilation Rate Log Sheet (Table O-3).
- The quarterly flow verification check and associated documentation.

These records will be maintained in the facility Operating Record until closure of the WIPP facility.

O-6 Quality Assurance

Quality assurance associated with the Mine Ventilation Rate Monitoring Plan shall comply with the requirements of the WIPP Quality Assurance Program Description (**QAPD**). The Permittees shall verify the qualification of personnel conducting ventilation flow measurements. The instrumentation used for monitoring both underground and active disposal shall be calibrated in accordance with the applicable provisions of the WIPP procedures. The software used to calculate the monthly and annual running averages and the ventilation simulation software programs shall be controlled in accordance with the WIPP QAPD and WIPP computer software quality assurance plans.

Data generated by this plan, as well as records, and procedures to support this plan shall be maintained and managed in accordance with the WIPP QAPD. Nonconformance or conditions adverse to quality as identified in performance of this plan will be addressed and corrected as necessary in accordance with applicable WIPP Quality Assurance Procedures.

REFERENCES

McPherson, M. J., 1993. *Subsurface Ventilation and Environmental Engineering*, Chapman & Hall, London, First Edition.

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TABLES

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TABLE O-1
Ventilation Operating Modes and Associated Flow Rates

Mode of Operation	Flow Rate (scfm) Nominal Design Values
Normal (two main fans)	425,000
Alternate (one main fan)	260,000
Maintenance Bypass [parallel operation of main fan(s) and filtration Fan(s)]	260,000 to 425,000
Reduced (two filtration fans)	120,000
Minimum (one filtration fan)	60,000
Filtration (one filtration fan)	60,000

TABLE O-2
Mine Ventilation Rate Testing Equipment

Equipment Used to Conduct Test	Ventilation Test Performed		
	Test and Balance	Active Disposal Room(s)	Quarterly Flow Verification Check
Calibrated Anemometer	X	X	
Calibrated Differential Pressure Sensor	X		
Pitot Tubes	X		X
Tubing	X		X
Temperature Sensing Device	X		X
Relative Humidity Sensor	X		X
Calibrated Barometers	X		X
Electronic Manometer	X		X

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TABLE O-3
Active Disposal Room Ventilation Rate Log Sheet (Example)

ROOM NUMBER _____

NOTE: When airflow reading is below 42,000 acfm, access will be restricted.

DATE	TIME	AIRFLOW READING	WAS 42,000 ACFM ACHIEVED?		ROOM ACCESS WAS RESTRICTED?		SIGNATURE	VERIFIED BY
			YES	NO	YES	NO		