ENTERED

State of New Mexico
ENVIRONMENT DEPARTMENT

Office of the Secretary

Harold Runnels Building
1190 Saint Francis Drive, PO Box 5469
Santa Fe, NM 87502-5469
Telephone (505) 827-2855 Fax (505) 827-2836
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGAGE
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

January 31, 2012

Edward Ziemianski, Acting Manager
Carlsbad Field Office
Department of Energy
P. O. Box 3090
Carlsbad, New Mexico 88221-3090

M. Farok Sharif
Washington TRU Solutions LLC
P. O. Box 2078
Carlsbad, New Mexico 88221-5608

RE: APPROVAL AND PARTIAL DENIAL OF PERMIT MODIFICATION REQUESTS TO UPDATE VENTILATION LANGUAGE, ADD A SHIELDED CONTAINER, AND REVISE THE WIPP GROUNDWATER DETECTION MONITORING PROGRAM PLAN
WIPP HAZARDOUS WASTE FACILITY PERMIT
EPA I.D. NUMBER NM4890139088
WIPP-11-010

Dear Messrs. Ziemianski and Sharif:

The New Mexico Environment Department (Department) has received a Permit Modification Request to Update Ventilation Language, Add a Shielded Container, and Revise the Waste Isolation Pilot Plant (WIPP) Groundwater Detection Monitoring Program Plan, dated September 29, 2011, from the U.S. Department of Energy Carlsbad Field Office and Washington TRU Solutions LLC (the Permittees). The Permittees seek to modify the Hazardous Waste Facility Permit for the WIPP and request that the Department process the request as a Class 2 permit modification under the regulations at 40 CFR § 270.42(b). For the reasons explained below, I approve with changes two items of the modification request and deny one item.

All items in the permit modification request were subject to a sixty (60) day public comment period, which ran from October 5, 2011 through December 5, 2011. The Department received written comments on the request from eighty individuals and organizations. A large majority (77) of public comments addressed item 2, the request to add provisions to the permit for shielded containers for remotely-handled radioactive waste. The Department received only a few minor public comments regarding item 1, the request to modify the ventilation requirements

120128

at the facility, and item 3, the request to modify the facility groundwater monitoring plan. The Department approves these modifications in accordance with 20.4.1.900 NMAC (incorporating 40 CFR § 270.42(b)). The Department has made some changes to the permit modification request. Changes include revision of the ventilation language so that the requirement for ventilation in an active remote handled waste room with workers present is not removed. This revision to the proposed language is made several section of the permit so that the requirement is consistent throughout the permit.

Under 20.4.1.900 NMAC (incorporating 40 CFR § 270.42(b)(7)), the Department may deny a Class 2 permit modification request if the modification request is incomplete; it does not comply with applicable requirements; or it fails to protect human health and the environment. During its technical review of the modification request for shielded containers, the Department noted that numerous sections in Part 3, Attachment A1, A2, C1, D, E and G must be revised to conform to the permit modification. In addition, 40 CFR 270.42(b), Appendix I, item F.3.a states changes of storage of different wastes in containers that do not require additional or different management practices from those authorized in the permit are Class 2 changes. The use of shielded containers does not fit this category as the facility will not be using different waste but will be using different containers.

Numerous public commenters identified similar issues with the modification request. Furthermore, the Department does not have sufficient information to correct the technical inadequacies in the application and approve the modifications "with changes" under 20.4.1.900 (incorporating 40 CFR § 270.42(b)(6)(i)(A)). Consequently, the Department is denying the permit modification request to add provisions for shielded containers.

Enclosed are the revised pages of the modified permit in redline-strikeout to help the reader rapidly identify each modification. Also enclosed is an electronic version of the modified permit, dated January 31, 2012. An electronic version of the modified permit has been posted for the public on the Department's WIPP Information Page at http://www.nmenv.state.nm.us/wipp/download.html

The enclosed revised permit also includes the two Class 1 permit modifications submitted since November 2011. A separate letter sent January 18, 2012 addressed the specifics of those changes.

The permit modification shall become effective thirty days after notice of the decision has been served on the Permittees pursuant to 20.4.1.901.A(10) NMAC. Thus, the effective date is March 1, 2012.

The Department will provide full response to all public comments under separate cover.

If you have any questions regarding this matter, please call Trais Kliphuis at (505) 476-6051.

Sincerely,

Dave Martin

Dave Martin
Cabinet Secretary

Enclosures:
Redline/strikeout pages showing modifications
Electronic version of modified permit dated January 31, 2012

cc: J. Davis, NMED RPD
J. Kieling, NMED HWB
T. Kliphuis, NMED HWB
R. Flynn, NMED OGC
C. de Saillan, NMED OGC
L. King, EPA Region 6
T. Peake, EPA ORIA
C. Walker, Trinity Engineering
File: WIPP 2012 and Reading

vehicle impacts. The substantial barrier incorporates the chain link and brattice cloth room closure specified in Permit Attachment A2.

1.5.14. Bulkhead

"Bulkhead" means a steel structure, with flexible flashing, that is used to block ventilation as specified in Permit Attachment A2 (Geologic Repository).

1.5.15. Explosion-Isolation Wall

"Explosion-isolation wall" means the 12-foot wall intended as an explosion isolation device that is part of the approved panel-closure system specified in Permit Attachment G1 (Detailed Design Report for an Operation Phase Panel Closure System).

1.5.16. Filled Panel

"Filled panel" means an Underground Hazardous Waste Disposal Unit specified in Permit Part 4 that will no longer receive waste for emplacement.

1.5.17. Internal Container

"Internal container" means a container inside the outermost container examined during radiography or visual examination (**VE**). Drum liners, liner bags, plastic bags used for contamination control, capillary-type labware, and debris not designed to hold liquid at the time of original waste packaging are not internal containers.

1.5.18. Observable Liquid

"Observable liquid" means liquid that is observable using radiography or VE as specified in Permit Attachment C (Waste Analysis Plan).

1.5.19. Filled Room

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

1.5.20. Active Room

"Active Room" means a room in an Underground Hazardous Waste Disposal Unit as specified in Permit Part 4 that contains emplaced TRU waste and is not a filled room.

PPA, whether by personnel or vehicles, shall be through controlled gates and doors. Only properly identified and authorized persons, vehicles, and property shall be allowed entrance to and exit from the active portion of the facility. Security shall require employees to identify themselves with an identification badge when entering or leaving the premises, and shall require visitors to show proper authorization prior to allowing them to enter the active portion of the facility. Visitors shall be required to wear an approved badge and may require an authorized escort.

For the purposes of entry control to areas where wastes are managed, stored, or disposed, these areas shall be posted as Controlled Areas, and access shall be limited to trained and qualified individuals and visitors escorted by trained and qualified individuals.

2.6.4. Warning Signs

The Permittees shall post "No Trespassing" signs and "Danger: Authorized Personnel Only" signs in English and Spanish at approximately 50 ft intervals on the permanent chain-link fence surrounding the PPA. The signs shall be legible from a distance of 25 ft and shall be visible from any approach to the facility. These same signs, plus security and traffic signs, shall also be located on the controlled gates, in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.14(c)).

2.7. GENERAL INSPECTION REQUIREMENTS

2.7.1. Inspection Schedule

The Permittees shall implement the inspection schedule specified in Permit Attachment E (Inspection Schedule, Process and Forms) to detect any malfunctions and deteriorations, operator errors, and discharges, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.2. Inspection Log Forms

The Permittees shall use the inspection logbooks and forms as specified in Permit Attachment E. Original copies of these completed forms are maintained in the Operating Record. The Permittees shall record the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(d)).

2.7.3. Inspection Frequency

The Permittees shall inspect monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment at the frequency specified in Tables E-1 and E-2 of Permit Attachment E, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)).

2.7.4. Inspection Remediation

The Permittees shall remedy any deterioration or malfunction of equipment or structures which an inspection reveals, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.15(c)).

2.7.5. Inspection Records

Beginning with the effective date of this Permit, the Permittees shall maintain inspection logbooks and forms in the operating record until closure, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.15(d) and 264.73(b)(5)).

2.8. PERSONNEL TRAINING

The Permittees shall conduct personnel training, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.1. Personnel Training Content

The personnel training program shall include the requirements specified in Permit Attachment F (Personnel Training) and Permit Attachment F2 (Training Course and Qualification Card Outlines), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.2. Personnel Training Requirements

The Permittees shall train all persons involved in the management of mixed and hazardous waste in procedures relevant to the positions in which they are employed, as specified in Permit Attachment F1 (RCRA Hazardous Waste Management Job Titles and Descriptions), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16).

2.8.3. Personnel Training Records

The Permittees shall maintain training documents and records, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.16(d) and (e)).

2.8.4. Continuing Training

Unless otherwise specified by this Permit, continuing training required by this Permit on an annual or biennial basis shall be completed by the end of the month of the anniversary date when the training was previously completed.

Prior to disposal of TRU mixed waste in a newly constructed Underground HWDU, the Permittees shall comply with the certification requirements specified in Permit Section 1.5.11.

4.5.3. Repository Operation

4.5.3.1. Underground Traffic Flow

The Permittees shall restrict and separate the ventilation and traffic flow areas in the underground TRU mixed waste handling and disposal areas from the ventilation and traffic flow areas for mining and construction equipment, except that during waste transport in W-30, ventilation need not be separated north of S-1600.

The Permittees shall designate routes for the traffic flow of TRU mixed waste handling equipment and construction equipment as required by Permit Attachment A4 (Traffic Patterns), Section A4-4, "Underground Traffic." These routes will be recorded on a mine map that is posted in a location where persons entering the underground can read it. Whenever the routes are changed, the map will be updated. Maps will be available in facility files until facility closure.

4.5.3.2. Ventilation

The Permittees shall maintain a minimum running annual average mine ventilation exhaust rate of 260,000 standard ft^3/min and a minimum active room ventilation rate of 35,000 standard ft^3/min in each active room where waste disposal is taking place and ~~when~~ workers are present in the room,~~-~~as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.5.3.3. Ventilation Barriers

The Permittees shall construct ventilation barricades in active Underground HWDUs to restrict the flow of mine ventilation air through full disposal rooms, as specified in Permit Attachment A2, Section A2-2a(3), "Subsurface Structures (Underground Ventilation System Description)" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601(c)).

4.6. MAINTENANCE AND MONITORING REQUIREMENTS

The Permittees shall maintain and monitor the Underground HWDUs as specified by the following conditions and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 and 264.602):

4.6.1. Geomechanical Monitoring

4.6.1.1. Implementation of Geomechanical Monitoring Program

The Permittees shall implement a geomechanical monitoring program in each Underground HWDU as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring" and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602).

4.6.1.2. Reporting Requirements

The Permittees shall submit to the Secretary an annual report in October evaluating the geomechanical monitoring program and shall include geomechanical data collected from each Underground HWDU during the previous year, as specified in Permit Attachment A2, Section A2-5b(2), "Geomechanical Monitoring", and shall also include a map showing the current status of HWDU mining. The Permittees shall also submit at that time an annual certification by a registered professional engineer certifying the stability of any explosion-isolation walls. The Permittees shall post a link to the geomechanical monitoring report transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.1.3. Notification of Adverse Conditions

When evaluation of the geomechanical monitoring system data identifies a trend towards unstable conditions which requires a decision whether to terminate waste disposal activities in any Underground HWDU, the Permittees shall provide the Secretary with the same report provided to the WIPP Operations Manager within seven calendar days of its issuance, as specified in Permit Attachment A2, Section A2-5b(2)(a), "Description of the Geomechanical Monitoring System". The Permittees shall post a link to the adverse condition notice transmittal letter on the WIPP Home Page and inform those on the e-mail notification list as specified in Permit Section 1.11.

4.6.2. Repository Volatile Organic Compound Monitoring

4.6.2.1. Implementation of Repository VOC Monitoring

The Permittees shall implement repository VOC monitoring as specified in Permit Attachment N (Volatile Organic Compound Monitoring Plan) and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)). The Permittees shall implement repository VOC monitoring until the certified closure of all Underground HWDUs.

Table 4.6.3.2 - Action Levels for Disposal Room Monitoring		
Compound	**50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv**	**95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv**
Carbon Tetrachloride	4,813	9,145
Chlorobenzene	6,500	12,350
Chloroform	4,965	9,433
1,1-Dichloroethene	2,745	5,215
1,2-Dichloroethane	1,200	2,280
Methylene Chloride	50,000	95,000
1,1,2,2-Tetrachloroethane	1,480	2,812
Toluene	5,500	10,450
1,1,1-Trichloroethane	16,850	32,015

4.6.3.3. Remedial Action

Upon receiving validated analytical results that indicate one or more of the VOCs specified in Table 4.4.1 in any of the closed rooms in an active panel has reached the "50% Action Level" in Table 4.6.3.2, the sampling frequency for such closed rooms will increase to once per week. The once per week sampling will continue either until the concentrations in the closed room(s) fall below the "50% Action Level" in Table 4.6.3.2, or until closure of Room 1 of the panel, whichever occurs first. If one or more of the VOCs in Table 4.4.1 in the active open room or immediately adjacent closed room reaches the "95% Action Level" in Table 4.6.3.2, another sample will be taken to confirm the existence of such a condition. If the second sample confirms that one or more of VOCs in the immediately adjacent closed room have reached the "95% Action Level" in Table 4.6.3.2, the active open room will be abandoned, ventilation barriers will be installed as specified in Permit Section 4.5.3.3, waste emplacement will proceed in the next open room, and monitoring of the subject closed room will continue at a frequency of once per week until commencement of panel closure.

4.6.4. Mine Ventilation Rate Monitoring

4.6.4.1. Implementation of Mine Ventilation Rate Monitoring Plan

The Permittees shall implement the Mine Ventilation Rate Monitoring Plan specified in Permit Attachment O (WIPP Mine Ventilation Rate Monitoring Plan) until the certified closure of all Underground HWDUs and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.602 and §264.601(c)).

4.6.4.2. Reporting Requirements

The Permittees shall report to the Secretary annually in October the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan.

4.6.4.3. Notification Requirements

The Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved, t~~The Permittees shall ~~notify~~ report to the Secretary in ~~writing within seven calendar days.~~the annual report specified in Permit Section 4.6.2.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in the Permit Section 4.5.3.2 have not been achieved.

4.6.5. Hydrogen and Methane Monitoring

4.6.5.1. Implementation of Hydrogen and Methane Monitoring

The Permittees shall implement the Hydrogen and Methane Monitoring Plan specified in Permit Attachment N1 (Hydrogen and Methane Monitoring Plan).

4.6.5.2. Reporting Requirements

The Permittees shall report to the Secretary semi-annually in April and October the data and analysis of the Hydrogen and Methane Monitoring Plan.

PART 5 - GROUND-WATER DETECTION MONITORING

5.1. DETECTION MONITORING PROGRAM

This Part specifies the requirements of the Detection Monitoring Program (**DMP**). The DMP shall establish background ground-water quality and monitor indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the ground-water, as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98).

The DMP consists of six Detection Monitoring Wells (**DMWs**) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground Hazardous Waste Disposal Units (**Underground HWDUs**). The DMWs are screened in the Culebra Member of the Rustler Formation.

A DMP is necessary to demonstrate compliance with the environmental performance standard for the Underground HWDUs, as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.601(a)). This environmental performance standard requires prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the ~~ground water~~ groundwater or subsurface environment.

5.2. IDENTIFICATION OF POINT OF COMPLIANCE

The point of compliance is the vertical surface located perpendicular to the groundwater flow direction at the DMWs that extends to the Culebra Member of the Rustler Formation [20.4.1.500 NMAC (incorporating 40 CFR §§264.95, 264.601, and 264.602)]. The Permittees shall conduct the DMP at DMWs specified in Table 5.3.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.98 and 264.601).

5.3. WELL LOCATION, MAINTENANCE, AND PLUGGING AND ABANDONING

The Permittees shall conduct the DMP according to the requirements of this Permit and 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) for the DMWs in the Culebra Member of the Rustler Formation.

The Permittees shall maintain the DMP in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.97), and as specified below:

5.3.1. Well Locations

The Permittees shall maintain the DMWs at the locations specified on the map in Figure L-~~8~~ 6 of Permit Attachment L (WIPP Ground-water Detection Monitoring Program Plan), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(a) and §264.98(b)), and as specified in Table 5.3.1 below:

Table 5.3.1 - Well Locations				
Well Name	**State Plane Coordinates**	**Top of Casing Elevation (ft amsl)**	**Screen Interval Depth (ft below ground surface)**	**Sampled Unit**
WQSP-1	663595E, 503784N	3419.2	702 - 727	Culebra
WQSP-2	667580E, 505537N	3463.9	811 - 836	Culebra
WQSP-3	670573E, 503991N	3480.1	844 - 869	Culebra
WQSP-4	670645E, 494986N	3433.1	764 - 789	Culebra
WQSP-5	667165E, 493665N	3384.4	646 - 671	Culebra
WQSP-6	663681E, 494948N	3364.7	581 - 606	Culebra

5.3.2. Well Maintenance

The Permittees shall maintain the DMWs specified in Table 5.3.1 and in Permit Attachment L, Section L-3b and Figures L-~~10~~ 7 through L-~~16~~12, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(c) and §264.98(b)).

5.3.3. Well Plugging and Abandoning

The Permittees may propose to plug and abandon a DMW by submitting a permit modification request to the Secretary in compliance with 20.4.1.900 NMAC (incorporating 40 CFR §270.42). The Permittees shall plug and abandon any DMW in a manner which eliminates physical hazards, prevents ground-water contamination, conserves hydrostatic head, and prevents intermixing of subsurface water. The Permittees shall submit a report to the Secretary which summarizes and certifies DMW plugging and abandoning methods within 90 calendar days from the date a DMW is removed from the DMP.

5.4. DETECTION MONITORING PROGRAM PARAMETERS AND CONSTITUENTS

The Permittees shall conduct the DMP at the DMWs as specified in Table 5.3.1 for the indicator parameters listed in Table 5.4.a and the hazardous constituents listed in Table 5.4.b below and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(a)):

Table 5.4.a – Indicator Parameters	
pH	Specific conductance
Total organic carbon (**TOC**)	~~Total organic halogen (**TOH**)~~
Total dissolved solids (**TDS**)	Total suspended solids (**TSS**)
~~Density~~Specific Gravity	Calcium
Magnesium	Potassium
Chloride	~~Iron (Total Fe)~~

Table 5.4.b – Hazardous Constituents	
Chloroform	1,2-dichloroethane
Carbon tetrachloride	Chlorobenzene
1,1-dichloroethylene	1,1-dichloroethane
Methylene chloride	1,1,2,2-tetrachloroethane
Toluene	1,1,1-trichloroethane
Cresols	1,4-dichlorobenzene
1,2-dichlorobenzene	trans-1,2-dichloroethylene
2,4-dinitrophenol	2,4-dinitrotoluene
Hexachloroethane	Hexachlorobenzene
Isobutanol	Methyl ethyl ketone
	Pentachlorophenol
Pyridine	Tetrachloroethylene
1,1,2-Trichloroethane	Trichloroethylene
Trichlorofluoromethane	Xylenes
Nitrobenzene	Vinyl chloride
Arsenic	Barium
Cadmium	Chromium
Lead	Mercury
Selenium	Silver
Antimony	Beryllium
Nickel	Thallium
Vanadium	

5.5. SAMPLING AND ANALYSIS PROCEDURES

Except as provided in Permit Section 5.6, the Permittees shall use the following techniques and procedures to obtain and analyze DMP samples~~, including background ground-water quality samples,~~ from the DMWs specified in Table 5.3.1, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(d) and (e)):

5.5.1. Sample Collection Procedures

The Permittees shall collect one DMP sample and one DMP sample duplicate ~~semi~~annually from each DMW using the procedures specified in Permit Attachment L, Section L-4c, as

required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g)(2), 264.98(d), and 264.601(a)).

5.5.2. Sample Preservation and Shipment Procedures

The Permittees shall preserve and ship DMP samples using the procedures specified in Permit Attachment L, Section L-4c(2)(iv).

5.5.3. Analytical Procedures

The Permittees shall analyze DMP samples using the procedures specified in Permit Attachment L, Section L-4c(3).

5.5.4. Chain of Custody Procedures

The Permittees shall track and control DMP samples using the chain of custody procedures specified in Permit Attachment L, Section L-4c(2)(v).

5.6. BACKGROUND GROUND-WATER QUALITY

For those hazardous constituents listed in Table 5.4.b, and for all substances listed in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), the background ground-water quality values specified in Table 5.6 are established as specified in 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(g) and 264.98(d)).

Table 5.6 – WQSP Well Background Values

Hazardous Constituent	WQSP-1	WQSP-2	WQSP-3	WQSP-4	WQSP-5	WQSP-6
Chloroform	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,2-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Carbon tetrachloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Chlorobenzene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1-dichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Methylene chloride	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L	~~3~~5.00 µg/L
1,1,2,2-tetrachloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Toluene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,1-trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Cresols	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,4-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
1,2-dichlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L

5.7. GROUND-WATER SURFACE ELEVATION DETERMINATION

5.7.1. DMP Ground-~~W~~water Surface Elevation Determination

The Permittees shall determine the ground-water surface elevation at each DMW specified in Table 5.3.1 each time the ground-water is sampled in compliance with Permit Sections 5.5.1 and 5.9.2, using the methods specified in Permit Attachment L, Section L-4c(1), and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)).

5.7.2. Regional Ground-~~W~~water Surface Elevation Determination

The Permittees shall determine the ground-water surface elevation on a monthly basis for each well completed in the Culebra Member of the Rustler Formation in the WIPP Ground-~~W~~water Level Monitoring Program, as specified in Permit Attachment L, Section L-4c(1).

5.8. GROUND-WATER FLOW DETERMINATION

The Permittees shall determine the ground-water flow rate and direction in the Culebra Member of the Rustler Formation at least annually, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(e)). The Permittees shall use ground-water surface elevation data specified in Permit Section 5.7 to determine ground-water flow.

5.9. DATA EVALUATION

5.9.1. Statistical Procedures

The Permittees shall use the statistical analysis methods specified in Permit Attachment L, Section L-4e, to evaluate DMP data for each hazardous constituent as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(h)). These statistical analysis methods shall comply with the appropriate performance standards specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.97(i)).

5.9.2. Groundw-~~W~~ater Quality Determination

The Permittees shall sample DMWs as specified in Permit Section 5.5.1 and conduct statistical tests to determine whether there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b during the active life of the WIPP facility and post-closure care period as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90(c)).

5.9.3. Data Evaluation

The Permittees shall determine whether there is statistically significant evidence of contamination for any hazardous constituent identified in Table 5.4.b each time the DMWs are sampled as specified in Permit Section 5.9.2. In determining whether statistically significant evidence of contamination exists, the Permittees shall compare the ground-water quality at each DMW specified in Table 5.3.1 to the background ground-water quality

Table 5.6 – WQSP Well Background Values						
Hazardous Constituent	**WQSP-1**	**WQSP-2**	**WQSP-3**	**WQSP-4**	**WQSP-5**	**WQSP-6**
trans-1,2-dichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
2,4-dinitrophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
2,4-dinitrotoluene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachloroethane	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Hexachlorobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Isobutanol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Methyl ethyl ketone	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pentachlorophenol	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Pyridine	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Tetrachloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
1,1,2-Trichloroethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichloroethylene	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Trichlorofluoromethane	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Xylenes	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Nitrobenzene	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L	5.00 µg/L
Vinyl chloride	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L	1.00 µg/L
Arsenic	0.10 mg/L	0.06 mg/L	0.21 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L
Barium	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L	1.00 mg/L
Cadmium	0.20 mg/L	0.50 mg/L	0.50 mg/L	0.50 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.50 mg/L	0.50 mg/L	2.00 mg/L	2.00 mg/L	0.50 mg/L	0.50 mg/L
Lead	0.11 mg/L	0.17 mg/L	0.80 mg/L	0.53 mg/L	0.05 mg/L	0.15 mg/L
Mercury	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L	.002 mg/L
Selenium	0.15 mg/L	0.15 mg/L	2.00 mg/L	2.00 mg/L	0.10 mg/L	0.10 mg/L
Silver	0.50 mg/L	0.50 mg/L	0.31 mg/L	0.52 mg/L	0.50 mg/L	0.50 mg/L
Antimony	0.33 mg/L	0.50 mg/L	1.00 mg/L	0.80 mg/L	0.07 mg/L	0.14 mg/L
Beryllium	0.02 mg/L	1.00 mg/L	0.10 mg/L	0.25 mg/L	0.02 mg/L	0.02 mg/L
Nickel	0.50 mg/L	0.50 mg/L	5.00 mg/L	5.00 mg/L	0.10 mg/L	0.50 mg/L
Thallium	1.00 mg/L	1.00 mg/L	5.80 mg/L	1.00 mg/L	0.21 mg/L	0.56 mg/L
Vanadium	0.10 mg/L	0.10 mg/L	5.00 mg/L	5.00 mg/L	2.70 mg/L	0.10 mg/L

determined pursuant to Permit Section 5.6, in compliance with the statistical procedures specified in Permit Section 5.9.1, and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)).

5.9.4. Data Evaluation Timeframe

The Permittees shall perform the data evaluations specified in Permit Section 5.9.3 within 120 calendar days after completion of DMP sampling, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f)(2)).

5.10. RECORDKEEPING AND REPORTING

5.10.1. Operating Record Requirements

The Permittees shall enter all DMP monitoring, testing, and analytical data in the operating record as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.73(b)(6)). The Permittees shall enter these data, as measured and in a form appropriate for the determination of statistically significant evidence of contamination, into the operating record as specified in Permit Section 5.9.1 and as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(c)).

5.10.2. Submittal of Results

5.10.2.1. Data Evaluation Results

The Permittees shall submit to the Secretary the analytical results required by Permit Sections 5.5.1 and 5.9.2, and the results of the statistical analyses required by Permit Section 5.9.3, ~~in compliance with the schedule on Table 5.10.2.1 below, and~~in the Annual Culebra Groundwater Report by November 30 of each year as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(j)).~~:~~

~~6. Table 5.10.2.1 – Analytical Results Submittal Schedule~~	
~~7. Samples to be collected during the preceding months of:~~	~~8. Results due to the NMED Secretary by:~~
~~9. March – May~~	~~10. 120calendar days after final sample is collected~~
~~11. September – November~~	~~12. 120 calendar days after final sample is collected~~

Formatted: BodyHeading4, None, No bullets or numbering

Formatted: BodyHeading4, None, No bullets or numbering

Formatted: BodyHeading4, Left, None, No bullets or numbering, Don't keep with next

Formatted: BodyHeading4, Left, None, No bullets or numbering, Don't keep with next

Formatted: BodyHeading4

Analytical results of a sampling round may be included in the report specified in Permit Section 5.10.2.3 if publication of the report coincides with the 120 calendar day report submittal schedule.

~~12.1.1.1.~~5.10.2.2. Groundw~~-W~~ater Surface Elevation Results

The Permittees shall submit to the Secretary ground-water surface elevation data specified in Permit Section 5.7. This submittal shall include both ground-water surface elevations calculated from field measurements and fresh-water head elevations calculated as specified in Permit Attachment L, Section L-4c(1). Water level data shall be submitted within 30 calendar days after data are collected.

~~12.1.1.2.~~5.10.2.3. Groundw~~-W~~ater Flow and Radionuclide Sampling Results

The Permittees shall submit to the Secretary an evaluation of the ground-water flow data specified in Permit Section 5.8 and the results of radionuclide-specific analysis of groundwaters sampled from the DMWs in the Annual Site Environmental Report by October 1 of each calendar year.

~~12.1.2.~~5.10.3. Determination of Contamination

If the Permittees determine, pursuant to Permit Section 5.9 and 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)), that there is statistically significant evidence of contamination for any hazardous constituent specified in Table 5.4.b, the Permittees shall comply with the following:

~~12.1.2.1.~~5.10.3.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days, indicating what hazardous constituents have shown statistically significant evidence of contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(1)).

~~12.1.2.2.~~5.10.3.2. Appendix IX Sampling

The Permittees shall immediately, but no later than one month, sample the ground-water in all DMWs specified in Table 5.3.1 for which there was statistically significant evidence of contamination. The remaining DMWs shall be sampled within two months after statistically significant evidence of contamination is found in any DMW. All DMWs shall be sampled to determine the concentration of all substances identified in 20.4.1.500 NMAC (incorporating 40 CFR §264 Appendix IX), as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(2)).

~~12.1.2.3.~~5.10.3.3. Verification Sampling

As specified by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3)), for any substances found in the initial analysis pursuant to Permit Section 5.10.3.2, the Permittees may resample within one month and repeat the analysis for those compounds detected. If the results of the second analysis confirm the initial analysis, these substances shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4. If the Permittees do not resample, the substances found during the initial analysis specified in Permit Section 5.10.3.2 shall form the basis for compliance monitoring specified in Permit Section 5.10.3.4.

~~12.1.2.4.~~5.10.3.4. Submittal of Compliance Monitoring Program

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to establish a compliance monitoring program meeting the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.99). The application shall include the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(4)):

i. An identification of the concentration of any hazardous constituent specified in Table 5.4.b or any Appendix IX substance detected in the ground water at each DMW at the compliance point.

ii. Any proposed changes to the DMP necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iii. Any proposed additions or changes to the monitoring frequency, sampling and analysis procedures or methods, or statistical methods used necessary to meet the compliance monitoring requirements as specified in 20.4.1.500 NMAC (incorporating 40 CFR §264.99).

iv. For each hazardous constituent detected at the compliance point, a proposed concentration limit or a notice of intent to seek an alternate concentration limit for a hazardous constituent required by 20.4.1.500 NMAC (incorporating 40 CFR §264.94).

~~12.1.2.5.~~5.10.3.5. Submittal of Additional Information

The Permittees shall, within 180 calendar days, submit to the Secretary the following information, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(5)):

i. All data necessary to justify an alternate concentration limit proposed in compliance with Permit Section 5.10.3.4.iv.

ii. An engineering feasibility plan for corrective action required by 20.4.1.500 NMAC (incorporating 40 CFR §264.100), if necessary.

~~12.1.3.~~5.10.4. Demonstration of Outside Contamination

If the Permittees determine, pursuant to Permit Section 5.9, that there is a statistically significant difference for hazardous constituents specified in Table 5.4.b at any DMW at the compliance point, they may demonstrate that a source other than a regulated unit caused the increase or that the detection is an artifact caused by an error in sampling, analysis, statistical evaluation, or natural variation in the ground water. In such cases, the Permittees shall comply with the following:

~~12.1.3.1.~~5.10.4.1. Notification

The Permittees shall notify the Secretary in writing within seven calendar days of determining statistically significant evidence of contamination at the compliance point that they intend to make a demonstration of outside contamination, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(i)).

~~12.1.3.2.~~5.10.4.2. Submittal of Demonstration

The Permittees shall, within 90 calendar days, submit a report to the Secretary which demonstrates that a source other than a regulated unit caused the contamination, or that the contamination resulted from error in sampling, analysis, or evaluation, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(ii)).

~~12.1.3.3.~~5.10.4.3. Submittal of Modification Request

The Permittees shall, within 90 calendar days, submit to the Secretary an application for a permit modification to make any appropriate changes to the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iii)).

~~12.1.3.4.~~5.10.4.4. Continued Monitoring

The Permittees shall continue to monitor in compliance with the DMP, as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(6)(iv)).

~~12.2.~~5.11. REQUEST FOR PERMIT MODIFICATION

If the Permittees or the Secretary determines that the DMP no longer satisfies the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) and this Permit Part, the Permittees

shall, within 90 calendar days of the determination, submit an application for a permit modification to make any appropriate changes to the program in compliance with 20.4.1.500 and .900 NMAC (incorporating 40 CFR §264.98(h) and §270.42).

PERMIT ATTACHMENTS

Permit Attachment L (as modified from WIPP Hazardous Waste Facility Permit Amended Renewal Application, "WIPP Ground-water Detection Monitoring Program Plan" - Chapter L).

ATTACHMENT A2

GEOLOGIC REPOSITORY

TABLE OF CONTENTS

A2-1 Description of the Geologic Repository 1

A2-2 Geologic Repository Design and Process Description 2
- A2-2a Geologic Repository Design and Construction 2
  - A2-2a(1) CH TRU Mixed Waste Handling Equipment 2
  - A2-2a(2) Shafts 4
  - A2-2a(3) Subsurface Structures 6
  - A2-2a(4) RH TRU Mixed Waste Handling Equipment 10
- A2-2b Geologic Repository Process Description 11

A2-3 Waste Characterization 13

A2-4 Treatment Effectiveness 13

A2-5 Maintenance, Monitoring, and Inspection 13
- A2-5a Maintenance 13
  - A2-5a(1) Ground-Control Program 13
- A2-5b Monitoring 14
  - A2-5b(1) Groundwater Monitoring 14
  - A2-5b(2) Geomechanical Monitoring 14
    - A2-5b(2)(a) Description of the Geomechanical Monitoring System 14
    - A2-5b(2)(b) System Experience 15
  - A2-5b(3) Volatile Organic Compound Monitoring 16
- A2-5c Inspection 16

References 16

LIST OF TABLES

Table	Title
Table A2-1	CH TRU Mixed Waste Handling Equipment Capacities
Table A2-2	Instrumentation Used in Support of the Geomechanical Monitoring System
Table A2-3	RH TRU Mixed Waste Handling Equipment Capacities

LIST OF FIGURES

Figure	Title
Figure A2-1	Repository Horizon
Figure A2-2	Spatial View of the Miscellaneous Unit and Waste Handling Facility
Figure A2-3	Facility Pallet for Seven-Pack of Drums
Figure A2-5	Typical Backfill Sacks Emplaced on Drum Stacks
Figure A2-5a	Potential MgO Emplacement Configurations
Figure A2-6	Waste Transfer Cage to Transporter
Figure A2-7	Push-Pull Attachment to Forklift to Allow Handling of Waste Containers
Figure A2-8	Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration
Figure A2-9	Underground Ventilation System Airflow
Figure A2-11	Typical Room Barricade
Figure A2-11a	Typical Bulkhead
Figure A2-12	WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram
Figure A2-12	WIPP Facility Surface and Underground CH Transuranic Mixed Waste Process Flow Diagram (Continued)
Figure A2-13	Layout and Instrumentation - As of 1/96
Figure A2-14	Facility Cask Transfer Car (Side View)
Figure A2-15	Typical Horizontal Emplacement ~~and Retrieval~~ Equipment
Figure A2-15a	Typical Horizontal Emplacement Equipment
Figure A2-16	RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance
Figure A2-17	Facility Cask Installed on the ~~Horizontal~~ Typical Emplacement ~~and Retrieval~~ Equipment
Figure A2-18	Installing Shield Plug
Figure A2-19	Shield Plug Supplemental Shielding Plate(s)
Figure A2-20	Shielding Layers to Supplement RH Borehole Shield Plugs
Figure A2-21	Shield Plug Configuration

The W-30 waste transport route south of S-700 is mined to be 20 ft wide nominally and its height will be mined to at least 14 ft.

All other drifts that are part of the waste transport route will be at least 20 ft wide and 14 ft high to accommodate waste transport equipment.

Other drifts (i.e. mains and cross-cuts) vary in width and height according to their function typically ranging from 14 ft to 20 ft wide and 12 ft to 20 ft high.

The layout of these excavations is shown on Figure A2-1.

Underground Facilities Ventilation System

The underground facilities ventilation system will provide a safe and suitable environment for underground operations during normal WIPP facility operations. The underground system is designed to provide control of potential airborne contaminants in the event of an accidental release or an underground fire.

The main underground ventilation system is divided into four separate flows (Figure A2-9): one flow serving the mining areas, one serving the northern experimental areas, one serving the disposal areas, and one serving the Waste Shaft and station area. The four main airflows are recombined near the bottom of the Exhaust Shaft, which serves as a common exhaust route from the underground level to the surface.

Underground Ventilation System Description

The underground ventilation system consists of six centrifugal exhaust fans, two identical HEPA-filter assemblies arranged in parallel, isolation dampers, a filter bypass arrangement, and associated ductwork. The six fans, connected by the ductwork to the underground exhaust shaft so that they can independently draw air through the Exhaust Shaft, are divided into two groups. One group consists of three main exhaust fans, two of which are utilized to provide the nominal air flow of 425,000 standard ft^3 per min (SCFM) throughout the WIPP facility underground during normal operation. One main fan may be operated in the alternate mode to provide 260,000 SCFM underground ventilation flow. These fans are located near the Exhaust Shaft. The second group consists of the remaining three filtration fans, and each can provide 60,000 SCFM of air flow. These fans, located at the Exhaust Filter Building, are capable of being employed during the filtration mode, where exhaust is diverted through HEPA filters, or in the reduced or minimum ventilation mode where air is not drawn through the HEPA filters. In order to ensure the miscellaneous unit environmental performance standards are met, a minimum running annual average exhaust rate of 260,000 SCFM will be maintained.

The underground mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. During normal operating mode (simultaneous mining and waste emplacement operations), approximately 140,000 actual ft^3 (3,962 m^3) per min can be supplied to the panel area. This quantity is necessary in order to support the level of activity and the pieces of diesel equipment that are expected to be in operation.

At any given time during waste emplacement activities, there may be significant activities in multiple rooms in a panel. For example, one room may be receiving CH TRU mixed waste containers, another room may be receiving RH TRU mixed waste canisters, and the drilling of

RH TRU mixed waste emplacement boreholes may be occurring in another room. The remaining rooms in a panel will either be completely filled with waste; be idle, awaiting waste handling operations; or being prepared for waste receipt. A minimum ventilation rate of 35,000 ft^3 (990 m^3) per minute will be maintained in each active room where waste disposal is taking place ~~when~~ and workers are present in the room. This quantity of air is required to support the numbers and types of diesel equipment that are expected to be in operation in the area, to support the underground personnel working in that area, and to exceed a minimum air velocity of 60 ft (18 m) per minute. The remainder of the air is needed in order to account for air leakage through inactive rooms.

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

Once a disposal room is filled and is no longer needed for emplacement activities, it will be barricaded against entry and isolated from the mine ventilation system by removing the air regulator bulkhead and constructing chain link/brattice cloth barricades and, if necessary, bulkheads at each end. A typical bulkhead is shown in Figure A2-11a. There is no requirement for air for these rooms since personnel and/or equipment will not be in these areas.

The ventilation path for the waste disposal side is separated from the mining side by means of air locks, bulkheads, and salt pillars. A pressure differential is maintained between the mining side and the waste disposal side to ensure that any leakage is towards the disposal side. The pressure differential is produced by the surface fans in conjunction with the underground air regulators.

Underground Ventilation Modes of Operation

The underground ventilation system is designed to perform under two types of operation: normal (the HEPA exhaust filtration system is bypassed), and filtered (the exhaust is filtered through the HEPA filtration system, if radioactive contaminants are detected or suspected.

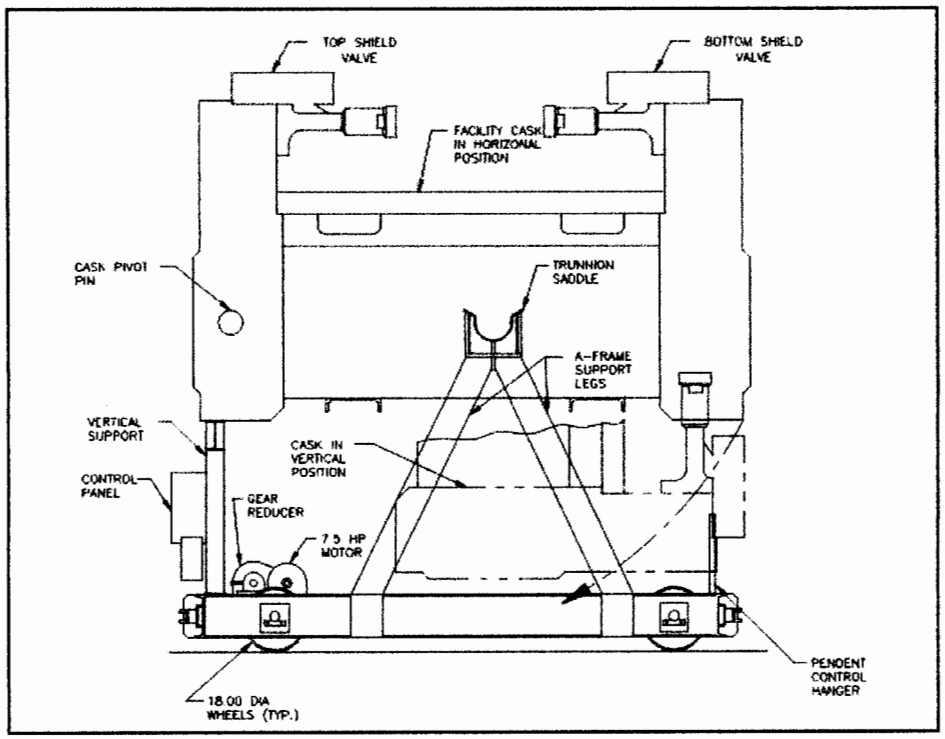


Figure A2-14
Facility Cask Transfer Car (Side View)

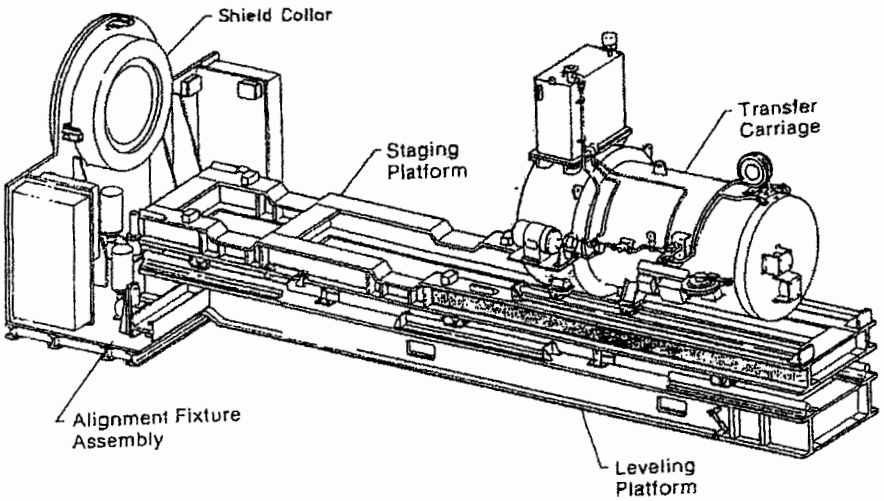


Figure A2-15
~~Horizontal~~ Typical Emplacement ~~and Retrieval~~ Equipment

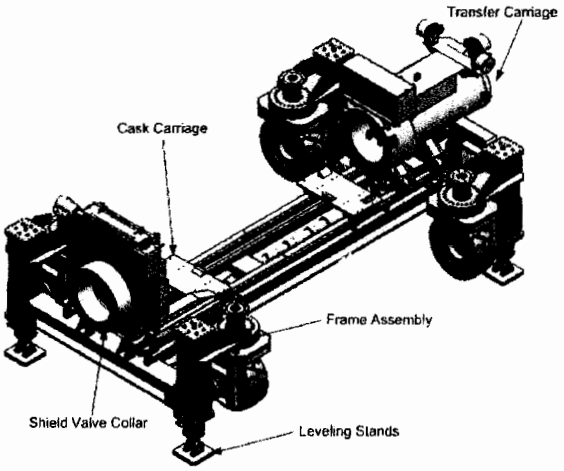


Figure A2-15a
Typical Emplacement Equipment

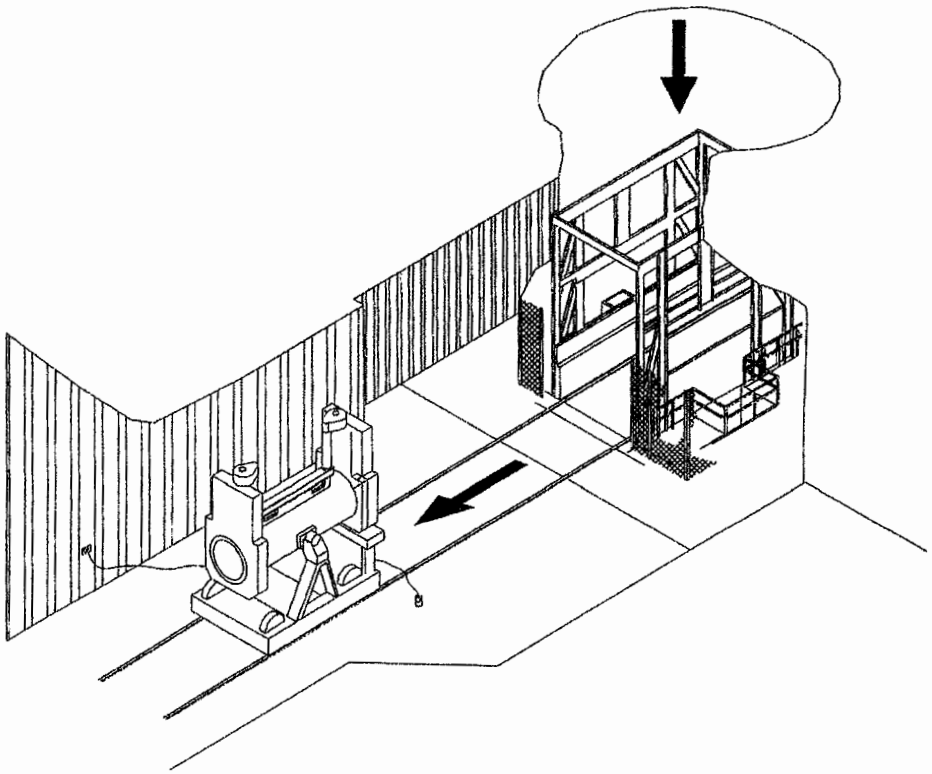


Figure A2-16
RH TRU Waste Facility Cask Unloading from Waste Shaft Conveyance

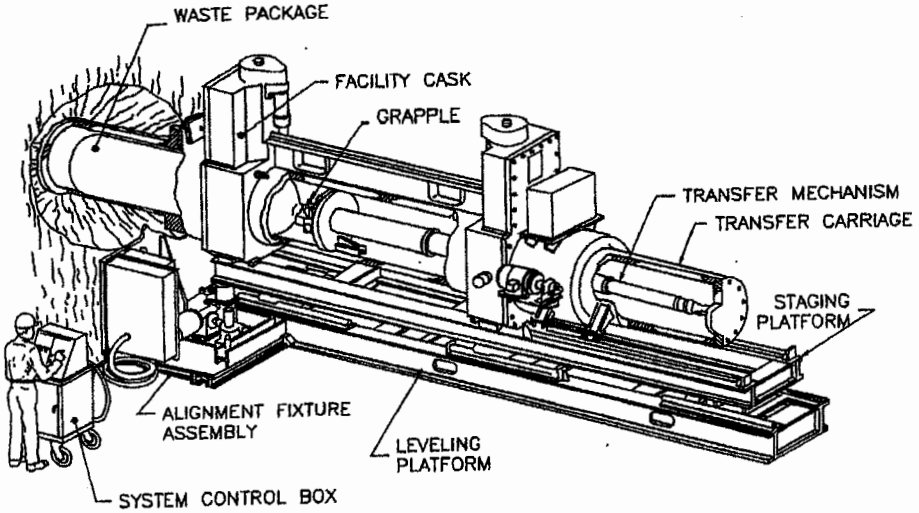


Figure A2-17
Facility Cask Installed on the ~~Horizontal~~ Typical Emplacement ~~and Retrieval~~ Equipment

FACILITY CASK AGAINST SHIELD COLLAR, TRANSFER CARRIAGE RETRACTED,
SHIELD PLUG CARRIAGE ON STAGING PLATFORM, SHIELD PLUG BEING INSTALLED

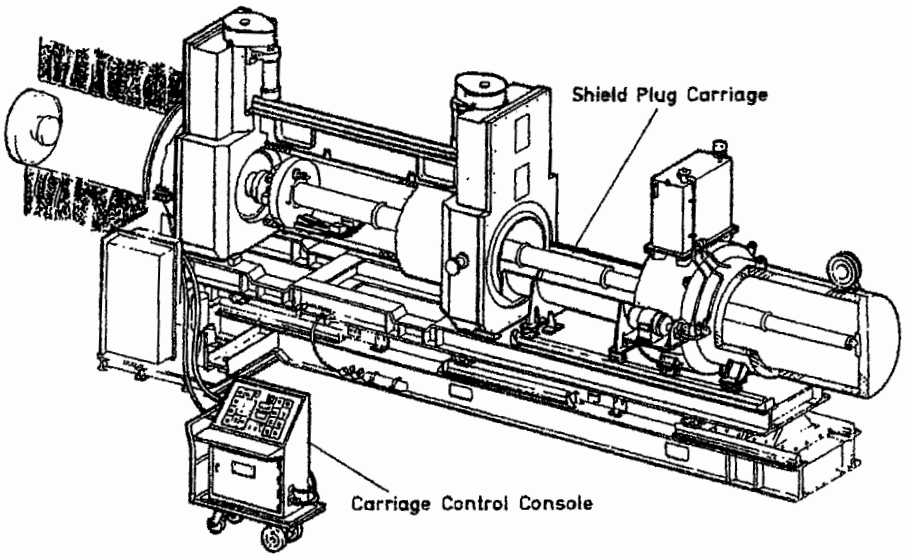


Figure A2-18
Installing Shield Plug

ATTACHMENT C3

QUALITY ASSURANCE OBJECTIVES AND DATA VALIDATION TECHNIQUES FOR WASTE CHARACTERIZATION SAMPLING AND ANALYTICAL METHODS

TABLE OF CONTENTS

C3-1 Validation Methods 1

C3-2 Headspace-Gas Sampling 6

C3-3 Sampling of Homogeneous Solids and Soils/Gravel 8

C3-4 Non Destructive Examination Methods 10
- C3-4a Radiography 10
- C3-4b Visual Examination 11

C3-5 Gas Volatile Organic Compound Analysis ..... 11~~12~~

C3-6 Total Volatile Organic Compound Analysis 13

C3-7 Total Semivolatile Organic Compound Analysis 15

C3-8 Total Metal Analysis 16

C3-9 Acceptable Knowledge 18

C3-10 Data Review, Validation, and Verification Requirements 19
- C3-10a Data Generation Level 20
  - C3-10a(1) Independent Technical Review 21
- C3-10b Project Level ..... 22~~23~~
  - C3-10b(1) Site Project Manager Review 23
  - C3-10b(2) Prepare Site Project Manager Summary and Data Validation Summary 24
  - C3-10b(3) Prepare Waste Stream Characterization Package 24
- C3-10c Permittee Level ..... 24~~25~~

C3-11 Reconciliation with Data Quality Objectives 25
- C3-11a Reconciliation at the Project Level 25
- C3-11b Reconciliation at the Permittee Level 27

C3-12 Data Reporting Requirements 27
- C3-12a Data Generation Level 27
- C3-12b Project Level ..... 27~~28~~
  - C3-12b(1) Waste Stream Profile Form 28
  - C3-12b(2) Characterization Information Summary ..... 28~~29~~
  - C3-12b(3) Waste Stream Characterization Package ..... 29~~30~~
  - C3-12b(4) WIPP Waste Information System (**WWIS**) Data Reporting 30

C3-13 Nonconformances 30

C3-14 Special Training Requirements and Certifications 32

C3-15 Changes to WAP-Related Plans or Procedures 33

C3-16 List of References 33

LIST OF TABLES

Table	Title
Table C3-1	Waste Material Parameters and Descriptions
Table C3-2	Gas Volatile Organic Compounds Target Analyte List and Quality Assurance Objectives
Table C3-3	Summary of Laboratory Quality Control Samples and Frequencies for Gas Volatile Organic Compound Analysis
Table C3-4	Volatile Organic Compounds Target Analyte List and Quality Assurance Objectives
Table C3-5	Summary of Laboratory Quality Control Samples and Frequencies for Volatile Organic Compound Analysis
Table C3-6	Semi-Volatile Organic Compound Target Analyte List and Quality Assurance Objectives
Table C3-7	Summary of Laboratory Quality Control Samples and Frequencies for Semi-Volatile Organic Compounds Analysis
Table C3-8	Metals Target Analyte List and Quality Assurance Objectives
Table C3-9	Summary of Laboratory Quality Control Samples and Frequencies for Metals Analysis
Table C3-10	Minimum Training and Qualifications Requirements [a]
Table C3-11	Testing Batch Data Report Contents
Table C3-12	Sampling Batch Data Report Contents
Table C3-13	Analytical Batch Data Report Contents
Table C3-14	Data Reporting Flags

LIST OF FIGURES

Figure	Title
Figure C3-1	Overall Headspace-Gas Sampling Scheme Illustrating Manifold Sampling

A NCR shall be prepared for each nonconformance identified. Each NCR shall be initiated by the individual(s) identifying the nonconformance. The NCR shall then be processed by knowledgeable and appropriate personnel. For this purpose, a NCR including, or referencing as appropriate, results of laboratory analysis, QC tests, audit reports, internal memoranda, or letters shall be prepared. The NCR must provide the following information:

- Identification of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Method(s) or suggestions for correcting the nonconformance (corrective action)
- Schedule for completing the corrective action
- An indication of the potential ramifications and overall usability of the data, if applicable
- Any approval signatures specified in the site nonconformance procedures

The Permittees shall require the Site Project Manager to oversee the NCR process and be responsible for developing a plan to identify and track all nonconformances and report this information to the Permittees. The Site Project Manager is also responsible for notifying project personnel of the nonconformance and verifying completion of the corrective action for nonconformances.

Nonconformance to DQOs

For any non-administrative nonconformance related to applicable requirements specified in this WAP which are first identified at the Site Project Manager signature release level (i.e., a failure to meet a DQO), the Permittees shall receive written notification within seven calendar days of identification and shall also receive a NCR within 30 calendar days of identification of the incident. DOE shall require the generator/storage site to implement a corrective action which remedies the nonconformance prior to management, storage, or disposal of the waste at WIPP. The Permittees shall send NMED a monthly summary of nonconformances identified during the previous month, indicating the number of nonconformances received and the generator/storage sites responsible.

DOE's Corrective Action Process

DOE shall initiate a corrective action process when internal nonconformances and nonconformances at the generator/storage sites are identified. Activities and processes that do not meet requirements are documented as deficiencies.

When a deficiency is identified by the Permittees, the following process action steps are required:

The condition is documented on a Corrective Action Report (**CAR**) by the individual identifying the problem.

DOE has designated the CAR Initiator and Assessment Team Leader to review the CAR, determine validity of the finding (determine that a requirement has been violated), classify the significance of the condition, assign a response due date, and issue the CAR to the responsible party.

The responsible organization reviews the CAR, evaluates the extent and cause of the deficiency and provides a response to DOE, indicating remedial actions and actions to preclude recurrence that will be taken.

DOE reviews the response from the responsible organization and, if acceptable, communicates the acceptance to the responsible organization.

The responsible organization completes remedial actions and actions to preclude recurrence of the condition.

After all corrective actions have been completed, DOE schedules and performs a verification to ensure that corrective actions have been completed and are effective. When all actions have been completed and verified as being effective, the CAR is closed by the CAR Initiator and Assessment Team Leader on behalf of DOE.

As part of the planning process for subsequent audits and surveillances, past deficiencies are reviewed and the previous deficient activity or process is subject to reassessment.

C3-14 Special Training Requirements and Certifications

Before performing activities that affect WAP quality, all personnel are required to receive indoctrination into the applicable scope, purpose, and objectives of the WAP and the specific QAOs of the assigned task. Personnel assigned to perform activities for the WAP shall have the education, experience, and training applicable to the functions associated with the work. Evidence of personnel proficiency and demonstration of competence in the task(s) assigned must be demonstrated and documented. All personnel designated to work on specific aspects of the WAP shall maintain qualification (i.e., training and certification) throughout the duration of the work as specified in this WAP and applicable QAPjPs/procedures. Job performance shall be evaluated and documented at periodic intervals, as specified in the implementing procedures.

Personnel involved in WAP activities shall receive continuing training to ensure that job proficiency is maintained. If not specified by this WAP, the due date for required continuing training courses and requalification shall be the end of the month of the anniversary date when the training was previously completed. Training includes both education in principles and enhancement of skills. Each participating site shall include in its QAPjP a description of the procedures for implementing personnel qualification and training. All training records that specify the scope of the training, the date of completion, and documentation of job proficiency shall be maintained as QA Records in the site project file.

Analytical laboratory line management must ensure that analytical personnel are qualified to perform the analytical method(s) for which they are responsible. The minimum qualifications for certain specified positions for the WAP are summarized in Table C3-10. QAPjPs, or their implementing SOPs, shall specify the site-specific titles and minimum training and qualification requirements for personnel performing WAP activities. QAPjPs/procedures shall also contain the requirements for maintaining records of the qualification, training, and demonstrations of proficiency by these personnel.

An evaluation of personnel qualifications shall include comparing and evaluating the requirements specified in the job/position description and the skills, training, and experience included in the current resume of the person. This evaluation also must be performed for

1 **Waste Analysis Plan (WAP) General Checklist for use at DOE'S Generator/Storage Sites**

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Waste Stream Identification					
1	Does the generator/storage site define "waste stream" as waste materials that have common physical form, that contain similar hazardous constituents, and that are -generated from a single process or ~~from an~~ activity ~~that is similar in material, physical form, and hazardous constituents~~? (Attachment C Section C-0a)					
2	Are procedures in place to ensure that the generator/storage site assigns one of the Summary Category Groups (S3000-homogeneous solids, S4000-soils/gravel, S5000-debris waste) to each waste stream? (Section C-1b)					
3	Are procedures in place to ensure that the generator/storage site assigns Waste Matrix Code Groups (e.g., solidified inorganics, solidified organics, salt waste, soils, combustible waste, filters, graphite, heterogeneous debris waste, inorganic nonmetal waste, lead/cadmium metal, uncategorized metal) to each waste stream? (Section C-0a)					
4	Are procedures in place to ensure that the generator/storage site assigns a Waste Stream WIPP Identifier (ID) to each waste stream? (Section C3-12b(1))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
4a	Are procedures in place for generator/storage sites to submit an AK Sufficiency Determination (Determination Request) to the Permittees to meet all or part of the waste characterization requirements including: • All information specified in Permit Attachment C4, Section C4-3d • Identification of relevant hazardous constituents, and correctly identifies all toxicity characteristic and listed hazardous waste numbers • All hazardous waste number assignments must be substantiated by supporting data and, if not, whether this lack of substantiation compromises the interpretation • Resolution of data discrepancies between different AK sources must be technically correct and documented • The AK Summary includes all the identification of waste material parameter weights by percentage of the material in the waste stream, and determinations are technically correct • All prohibited items specified in the TSDF-WAC should be addressed, and conclusions drawn are technically adequate and substantiated by supporting information • If the AK record includes process control information specified in Permit Attachment C4, Section C4-3b, the information should include procedures, waste manifests, or other documentation demonstrating that the controls were adequate and sufficient. • The site must provide the supporting information necessary to substantiate technical conclusions within the Determination Request, and this information must be correctly interpreted. (Section C-0b, Section C4-3d)					
4b	If a generator/storage site does not submit a Determination Request or if the Determination Request is not approved, are procedures in place for the generator/storage site to perform radiography or VE on 100% of the containers in a waste stream and chemical sampling and analysis on a representative sample of the waste stream using headspace gas sampling and analysis (for debris waste) or solids sampling and analysis (for homogeneous solid or soil/gravel waste) as specified in Permit Attachments C1 andC2? (Section C-0b)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
31	Are procedures in place to ensure that the following Quality Assurance Objectives are adequately defined and assessed for each characterization method: • Precision as a measure of the mutual agreement among multiple measurements. • Accuracy as the degree of agreement between a measurement result and a true or known value. • Completeness is a measure of the amount of valid data obtained from a method compared to the total amount of data obtained that is expressed as a percentage. • Comparability is the degree to which one data set can be compared to another data set. • Representativeness as an expression of the degree to which data represent characteristics of a population. (Section C-4a(2))					
32	With respect to data generation, are procedures in place to ensure that the generator/storage site's waste characterization program meets the following general requirements: • Analytical data packages and batch data reports must be reported accurately in a pre-approved format, must be maintained in permanent files, and must be traceable? • All data must receive a technical review by another qualified analyst ~~or the technical supervisor, and the laboratory QA officer~~? (Section C3-10a)					
33	Are procedures in place to ensure that the generator/storage site performs validation of waste characterization data for each waste container? (Section C-4)					
34	Are procedures in place to ensure that the generator/storage site has a pre-approved format for reporting waste characterization data? (Section C-4a(4))					
35	Are procedures in place to ensure that the generator/storage site prepares analytical, testing, and sampling batch data reports to meet the requirements of their own site-specific QAPjP and/or SOPs? (Section C-4a(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
36	Are procedures in place to ensure that all raw data is collected and managed at the data generation level in accordance with the following criteria: • All raw data shall be signed and dated in reproducible ink by the individual collecting the data, or signed and dated using electronic signatures • All data shall be recorded clearly, legibly, and accurately in field and laboratory records and include applicable sample identification numbers • All changes to original data shall be lined out, initialed, and dated by the individual making the change. Original data may not be obliterated or otherwise be made unreadable • All data shall be transferred and reduced from field and laboratory records completely and accurately • All field and laboratory records shall be maintained as specified in Table C- 6 of Attachment C • Data shall be organized into standard reporting formats for reporting purposes. • All electronic and video data must be stored to ensure that waste container, sample and QC data are readily retrievable (Section C3-10a)					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
200	Do procedures adequately assign the ~~Site~~ site ~~Project~~ project ~~QA Officer~~manager with the responsibility of monitoring field QC results and initiate the nonconformance report process in the event the following acceptance criteria are not met or sample collection frequencies are not met: • Field and equipment blanks shall be less than 3 times the detection limits specified in Table C3-2 and equipment blank results determined by FTIR shall be less than the PRQL specified in Table C3-2 (Section C1-1b(1) and C1-1b(2)) • Field reference standards shall have a recovery of between 70 and 130% (Table C1-3) • Field Duplicates shall have an RPD of less than or equal to 25 (Sections C1-1b and C1-1b(4); Table C1-3)					
201	Are procedures in place to ensure that field reference standards meet the following criteria: • Field reference standards shall contain a minimum of 6 analytes listed in Table C3-2 at a range of between 10 and 100 ppmv and at concentrations greater than the MDL • Field reference standards shall be traceable to a nationally recognized standard, if available • If commercial gases are used, they shall be accompanied by a Certificate of Analysis and all field reference standards are traceable to certificates. • Commercial gases are not used past the manufacturer specified shelf life. • Field reference samples are submitted blind to the laboratory at a frequency of one per sampling batch. (Note: Field reference standards may be discontinued for direct canister method if QAO accuracy objectives are met) (Section C1-1b(3))					
202	Are procedures in place to ensure that field duplicate samples are collected sequentially and in accordance with Table C1-1. (Section C1-1b(4))					

	WAP Requirement[1]	Procedure Documented		Example of Implementation/ Objective Evidence, as applicable		Comment (e.g., any change in procedure since last audit, etc.)
		Location	Adequate? Y/N (Why?)	Item Reviewed	Adequate? Y/N	
	Sample Equipment Testing, Inspection and Maintenance					
203	Are procedures in place to ensure that sample containers are cleaned in accordance with the following specifications: • All sampling components that contact sample gases are constructed of inert materials such as stainless steel or Teflon® • The sampling manifold and canisters are properly cleaned and leak checked prior to each sampling event in accordance to or equivalent with TO-14A or TO-15 methodology • SUMMA® canisters or equivalent are cleaned on an equipment cleaning batch basis. An equipment cleaning batch is defined as the number of canisters that can be cleaned together at one time using the same cleaning method • The cleaning system consists of an optional oven and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap backed by an oil sealed pump • Prior to cleaning a 24 hour leak check shall be performed (+/- 2 psig) on all canisters • Canisters that shall be checked for leaks, repaired, and reprocessed • One canister per equipment cleaning batch is filled with humid zero air or humid high purity nitrogen and analyzed for VOCs • A batch is considered clean if VOC concentrations are less than 3 times the MDLs specified in Table C3-2 • Certified leak-free canisters are evacuated to 0.1 mm Hg or less for storage • Canister cleaning certification documentation is available at the cleaning facility and the cleaning facility initiates canister tags. (Section C1-1c, C1-1c(1))					
204	Are procedures in place to ensure that manifold pressure sensors and ambient air temperature sensors are certified prior to initial use and annually using NIST traceable standards. In addition OVAs if used shall be calibrated daily using known calibration gases and the balance of the OVA calibration is consistent with the manifold purge gas. (Section C1-1d)					

Equipment	Description and Capabilities	Location
Hand Tools	Containment and cleanup; Underground rescue truck: (1)12# Sledge Hammer (1)3/8" Drive Socket Set (1)½" Drive Socket Set (1)3/4" Drive Socket Set (1)25' ½" Chain (1)6' Wrecking Bar (1)Bottle Jack (1)4# Hammer (1)18" Crescent Wrench (1)5' Pry Bar (1)2' Pry Bar (1)100' Extension Cord (1)4' Nylon Sling (1)6' Nylon Sling (1)10' Nylon Sling These tools are located in the HAZMAT Trailer. They are non-sparking. (1)14"L adjustable pipe wrench (1)15" multi-opening bung wrench (1)hammer/crate opener (1)8" pipe pliers (1)8" blade Phillips (1)#2 screwdriver (1)6" blade standard screwdriver (1)Claw Hammer	Underground rescue truck, HAZMAT trailer
Come-a-longs	(1) 4-ton; cable-type Ratchet lever tool designed specifically for lifting, lowering and pulling applications including jobs requiring rigging, positioning, and stretching. Used in rescue for extrication.	Surface rescue truck and underground rescue truck
Porta-power	(1) 10-ton hydraulic, hand-powered jaws used for extrication during rescues.	Surface rescue truck
Jugs	Containment or cleanup; (4) 1-gallon plastic	HAZMAT trailer
Pails	Containment or cleanup; (3) 5-gallon plastic with lid	HAZMAT trailer
Portable Lighting	(1) Emergency lighting system; 120 volts; 500-watt bulbs, suitable for wet location	Underground rescue truck
Patching Kit	Series A Hazardous Response Kit; Class A; contains nonsparking equipment to control and plug leaks.	HAZMAT trailer
Scoops and Shovels	Cleanup; plastic; various sizes; nonsparking; nonwood handles (1) Scoop (3) Shovels	HAZMAT trailer

Equipment	Description and Capabilities	Location
Medical Resources		
Ambulance #1	Equipped as per Federal Specifications KKK-A-1822 and New Mexico Emergency Medical Services Act General Order 35; equipped with a radio to Carlsbad Medical Center, VHF radio, UHF medical frequency, cellular phone	Surface (Safety and Emergency Services Facility)
Ambulance #2	Diesel and/or electric ~~hardcab~~ ambulance equipped with first aid kit, 2 stretchers, and other associated medical supplies	Underground
Rescue Truck	Special purpose vehicle; light and heavy duty rescue equipment; transports 1 litter patient, medical oxygen and supplies for mass casualties, fire suppression support equipment (rescue tool, air bag, K-12 Rescue Saw, 5,000-watt generator, self-contained breathing apparatus (SCBA), and much more equipment	Surface (Safety and Emergency Services Facility)
Fire Detection and Fire Suppression Equipment		
Building Smoke, Thermal Detectors, or Manual Pull Stations	Ionization and photoelectric or fixed temperature/rate of rise detectors; visual display and alarm in CMR; manual pull stations. The underground has manual fire alarm pull stations located where personnel have access when evacuating. These are connected to the U/G evacuation alarm.	Guard and Security Building, Warehouse/Shops, Support Building, CMR/Computer Room, Waste Handling Building, TRUPACT Maintenance Facility, Waste Shaft Collar, Underground Fuel Station, SH Hoisthouse, Engineering Building, Industrial Safety Building, Training Facility
Fire Truck # 1	Equipped per Class "A" fire truck per NFPA; capacity 750 gallons, with pump capacity of 1200 gallons per minute	Surface (Safety and Emergency Services Facility)
Rescue Truck # 2 (U/G)	(1) 125-pound dry chemical extinguisher (1) 150-pound foam extinguisher	Underground
Extinguishers	Individual fire extinguisher stations; various types located throughout the facility, conforming to NFPA-10.	Buildings, underground, and underground vehicles
Automatic Dry Chemical Extinguishing Systems	Automatic; 1,000-pound system (Dry Chemical); actuated by thermal detectors or by manual pull stations	Underground fuel station
Sprinkler Systems	Fire alarms activated by water flow	Pumphouse, Guard and Security Building, Support Building, Waste Handling Building (contact- transuranic waste area only), Warehouse/Shops Building, Auxiliary Warehouse Building, TRUPACT Maintenance Facility, Training Facility, SH Shaft Hoisthouse, Exhaust Filter Building, Engineering Building, and Safety Building

TRU underground transporter, the facility transfer vehicle, the trailer jockey, and the push-pull attachment. RH TRU mixed waste equipment that is controlled by a logbook includes the 140/25-ton RH Bay overhead bridge crane, cask transfer cars, 25-ton cask unloading room crane, transfer cell shuttle car, RH Bay cask lifting yoke, facility grapple, 6.2- ton overhead hoist, facility cask rotating device, hot cell overhead powered manipulator, 15-ton hot cell crane, facility cask transfer car, 41-ton forklift, facility cask, and ~~horizontal~~ emplacement ~~and retrieval~~ equipment. Inspections of the Cask Unloading Room, Hot Cell, Transfer Cell, Facility Cask Loading Room, RH Bay and radiation monitoring equipment will be recorded on data sheets. In addition to the inspections listed in Tables E-1 and E-1a, many pieces of equipment are subject to regular preventive maintenance. This includes more in-depth inspections of mechanical systems, load testing of lifting systems, calibration of measurement equipment and other actions as recommended by the equipment manufacturer or as required by DOE Orders. These preventive maintenance activities along with the inspections in Tables E-1 and E-1a make mechanical failure of waste handling equipment unlikely. The WIPP Safety Analysis Report (DOE, 1999) and the WIPP Remote-Handled Waste Preliminary Safety Analysis Report (RH PSAR) (DOE, 2000) contain the results of a systematic analysis of waste handling equipment and the hazards associated with potential mechanical failures. Equipment subject to failures that cannot practically be mitigated is retained for analysis and is the basis for contingency planning. The inspection procedures maintained in the Operating Record for operational and preventive maintenance are implemented to assure the equipment is maintained. An example equipment inspection checklist and a typical logbook form are shown as Figures E-1 and E-2. Actual checklists or forms are maintained within the Operating Record.

E-1a General Inspection Requirements

Tables E-1, E-1a, and E-2 of this Permit Attachment list the major categories of monitoring equipment, safety and emergency systems, security devices, and operating and structural equipment that are important to the prevention or detection of, or the response to, environmental or human health hazards caused by hazardous waste. These systems may include numerous subsystems. These systems are inspected according to the frequency listed in Tables E-1 and E-1a, a copy of which is maintained at the WIPP facility. The frequency of inspections is based on the nature of the equipment or the hazard and regulatory requirements. When in use, daily inspections are made of areas subject to spills, such as TRU mixed waste loading and unloading areas in the WHB Unit, looking for deterioration in structures, mechanical items, floor coatings, equipment, malfunctions, etc., in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

As required in 20.4.1.500 NMAC (incorporating 40 CFR §264.33), the WIPP facility inspection procedures for communication and alarm systems, fire-protection equipment, and spill control and decontamination equipment include provisions for testing and maintenance to ensure that the equipment will be operable in an emergency.

E-1a(1) Types of Problems

The inspections for the systems, equipment, structures, etc., listed in Tables E-1 and E-1a, include the types of problems (e.g., malfunctions, visible cracks in coatings or welds, and deterioration) to be looked for during the inspection of each item or system, if applicable, and are in compliance with 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(3)).

E-1a(2) Frequency of Inspections

Tables E-1, E-1a, and E-2 of this Permit Attachment list the inspection frequencies and monitoring schedule for equipment and systems subject to the 20.4.1 NMAC hazardous waste management requirements. The frequency is based on the rate of possible deterioration of the equipment and the probability of an environmental or human health incident if the deterioration or malfunction, or any operator error, goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, are inspected daily when in use, consistent with the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)).

When RH TRU mixed waste is present in the RH Complex, inspections are conducted visually and/or using closed-circuit video cameras in order to manage worker dose and to minimize occupational radiation exposures to as low as reasonably achievable (**ALARA**). More extensive inspections of these areas are performed at least annually during routine maintenance periods and when RH TRU mixed waste is not present.

E-1a(3) Monitoring Systems

There are two monitoring systems used at the WIPP to provide assurance that facility systems are operating correctly, that areas can be used safely, and that there have been no releases of hazardous waste constituents. These systems are shown in Table E-2 and include the geomechanical monitoring system and the central monitoring system (**CMS**). The geomechanical monitoring system is used to assess the condition of mined excavations to assure no unsafe conditions are allowed to develop. The CMS continuously assesses the status of the fixed radiation monitoring equipment, electrical power, fire alarm systems, ventilation system, and other facility systems including water tank levels. In addition, the CMS collects data from the meteorological monitoring system.

E-1b Specific Process Inspection Requirements

20.4.1.500 NMAC (incorporating 40 CFR §264.15(b)(4)), requires inspections of specific portions of a facility, rather than the general facility. These include container storage areas and miscellaneous units. Both are addressed below.

E-1b(1) Container Inspection

Containers are used to manage TRU mixed waste at the WIPP facility. These containers are described in Permit Part 3. Off-site CH TRU mixed waste will arrive in 55-gallon drums arranged as seven (7)-packs, in Ten Drum Overpacks (**TDOP**), in 85-gallon drums arranged as four (4) packs, in 100-gallon drums arranged as three (3) packs, in standard waste boxes (**SWB**) or in standard large box 2s (**SLB2s**). The waste containers will be visually inspected to ensure that the waste containers are in good condition and that there are no signs that a release has occurred. This visual inspection shall not include the center drums of 7-packs and waste containers positioned such that visual observation is precluded due to the arrangement of waste assemblies on the facility pallets. If CH TRU mixed waste handling operations should stop for any reason with containers located on the TRUPACT-II Unloading Dock (**TRUDOCK** storage area of the WHB Unit) or in room 108 while still in the Contact-Handled Packages, primary waste container inspections could not be accomplished until the containers of waste are removed from the shipping containers.

Table E-1
Inspection Schedule/Procedures

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Air Intake Shaft Hoist	Underground Operations	Preoperational [c] See Lists 1b and c	WP 04-HO1004 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with Mine Safety and Health Administration (MSHA) requirements
Ambulances (Surface and Underground) and related emergency supplies and equipment	Emergency Services	Weekly See List 11	~~PM00003~~012-FP0030 Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Adjustable Center of Gravity Lift Fixture	Waste Handling	Preoperational See List 8	WP 05-WH1410 Inspecting for Mechanical Operability[m] and Deterioration[b]
Backup Power Supply Diesel Generators	Facility Operations	Monthly See List 3	WP 04-ED1301 Inspecting for Mechanical Operability[m] and Leaks/Spills by starting and operating both generators. Results of this inspection are logged in accordance with WP 04-AD3008.
Facility Inspections (Water Diversion Berms)	Facility Engineering	Annually See List 4	WP 10-WC3008 Inspecting for Damage, Impediments to water flow, and Deterioration[b]
Central Monitoring Systems (CMS)	Facility Operations	Continuous See List 3	Automatic Self-Checking
Contact-Handled (CH) TRU Underground Transporter	Waste Handling	Preoperational See List 8	WP 05-WH1603 Inspecting for Mechanical Operability[m], Deterioration[b], and area around transporter clear of obstacles
Conveyance Loading Car	Waste Handling	Preoperational See List 8	WP 05-WH1406 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place
Facility Transfer Vehicle	Waste Handling	Preoperational See List 8	WP 05-WH1204 Inspecting for Mechanical Operability[m], Deterioration[b], path clear of obstacles, and guards in the proper place

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Exhaust Shaft	Underground Operations	Quarterly See List 1a	PM041099 Inspecting for Deterioration[b] and Leaks/Spills
Eye Wash and Shower Equipment	Equipment Custodian	Weekly See List 5	WP 12-IS1832 Inspecting for Deterioration[b]
		Semi-annually See List 2a	WP 12-IS1832 Inspecting for Deterioration[b] and Fluid Levels–Replace as Required
Fire Detection and Alarm System	Emergency Services	Semiannually See List 11	~~PM000027~~12-FP0027 Inspecting for Deterioration[b], Operability of indicator lights and, underground fuel station dry chemical suppression system. Inspection is per NFPA 17
Fire Extinguishers[j]	Emergency Services	Monthly See List 11	~~PM000036~~12-FP0036 Inspecting for Deterioration[b], Leaks/Spills, Expiration, seals, fullness, and pressure
Fire Hoses	Emergency Services	Annually (minimum) See List 11	12-FP0031~~PM000031~~ Inspecting for Deterioration[b] and Leaks/Spills
Fire Hydrants	Emergency Services	Semi-annual/ annually See List 11	~~PM000034~~12-FP0034 Inspecting for Deterioration[b] and Leaks/Spills
Fire Pumps	Emergency Services	Weekly/annually See List 11	WP 12-FP0026 Inspecting for Deterioration[b], Leaks/Spills, valves, and panel lights
Fire Sprinkler Systems	Emergency Services	Monthly/ quarterly See List 11	WP 12-FP0025 Inspecting for Deterioration[b], Leaks/Spills, static pressures, and removable strainers
Fire and Emergency Response Trucks (Seagrave Fire Apparatus, Emergency One Apparatus, and Underground Rescue Truck)	Emergency Services	Weekly See List 11	~~PM000033~~12-FP0033 Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Forklifts Used for Waste Handling (Electric and Diesel forklifts, Push-Pull Attachment)	Waste Handling	Preoperational See List 8	WP 05-WH1201, WP 05-WH1207, WP 05-WH1401, WP 05-WH1402, WP 05-WH1403, and WP 05-WH1412 Inspecting for Mechanical Operability[m], Deterioration[b], and On board fire suppression system

Table E-1 (Continued)
Inspection Schedule/Procedures Lists

List 1: Underground Operations

a. Mining Technician *
   Senior Mining Technician *
   Continuous Mining Specialist *
   Senior Mining Specialist *
   Mine OPS Supervisor *
b. Waste Hoist Operator
   Waste Hoist Shaft Tender
c. U/G Facility Operations* - Self Rescuers
   Shaft Technician *
d. Operations Engineer
   Supervisor U/G Services*
   Senior Operations Engineer*

List 2: Industrial Safety

a. Safety Technician *
   Senior Safety Technician *
   Safety Specialist *
   Safety Engineer *
   Industrial Hygienist *
b. Fire Protection Engineering *

List 3: Facility Operations

Facilities Technician *
Senior Facilities Technician *
Facility Operations Specialist *
Central Monitoring Room Operator *
Central Monitoring Room Specialist *
Operations Engineer
Senior Operations Engineer *
Facility Shift Manager
Operations Technical Coordinator *

List 4: Facility Engineering

Senior Engineer *

List 5: General

Equipment Custodian*

List 6: Security

Security Protective *
Security Protective Supervisor *

List 8: Waste Handling

Manager, Waste Operations
TRU-Waste Handler

List 9: Geotechnical Engineering

Engineer Technician *
Associate Engineer *
Engineer *
Senior Engineer *
Principal Engineer*

List 10: Maintenance Operations

Maintenance Technician *
Maintenance Specialist *
Senior Maintenance Specialist *
Contractor *

List 11: Emergency Services

Qualified Emergency Services Personnel
Fire Protection Technician

Table E-1 (Continued)
Inspection Schedule/Procedures Notes

[a] Inspection may be accomplished as part of or in addition to regularly scheduled preventive maintenance inspections for each item or system. Certain structural systems of the WHB, Waste Hoist and Station A are also subject to inspection following severe natural events including earthquakes, tornados, and severe storms. Structural systems include columns, beams, girders, anchor bolts and concrete walls.

[b] Deterioration includes: obvious visible cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration.

[c] "Preoperational" signifies that inspections are required prior to the first use during a calendar day. For calendar days in which the equipment is not in use, no inspections are required. For an area this includes: area is clean and free of obstructions (for emergency equipment); adequate aisle space; emergency and communications equipment is readily available, properly located and sign-posted, visible, and operational. For equipment, this includes: checking fluid levels, pressures, valve and switch positions, battery charge levels, pressures, general cleanliness, and that all functional components and emergency equipment is present and operational.

[e] These weekly inspections apply to container storage areas when containers of waste are present for a week or more.

[g] In addition, the water tank levels are maintained by the CMR and level readouts are available at any time.

[h] This organization is responsible for obtaining licenses for radios and frequency assignments. They do periodic checks of frequencies and handle repairs which are performed by a vendor.

[i] Radios are not routinely "inspected." They are operated daily and many are used in day-to-day operations. They are used until they fail, at which time they are replaced and repaired. Radios are used routinely by Emergency Services, Security, Environmental Monitoring, and Facility Operations.

[j] Fire extinguisher inspection is paperless. Information is recorded into a database using barcodes. The database is then printed out.

[k] Surface CH TRU mixed waste handling areas include the Parking Area Unit, the WHB unit, and unloading areas.

[l] No log forms are used for daily readings. However, readings that are out of tolerance are reported to the CMR and logged by CMR operator. Inspection includes daily functional checks of portable equipment.

[m] Mechanical Operability means that the equipment has been checked and is operating in accordance with site safety requirements (e.g. proper fluid levels and tire pressure; functioning lights, alarms, sirens, and power/battery units; and belts, cables, nuts/bolts, and gears in good condition), as appropriate.

[n] Required Equipment means that the equipment identified in Table F-6 is available and usable (i.e. not expired/depleted and works as designed).

[*] Positions are not considered RCRA positions (i.e., personnel do not manage TRU mixed waste).

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Hazardous Material Response Equipment	Emergency Services	Weekly See List 11	12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], and Required Equipment[n]
Miners First Aid Station	Emergency Services	Quarterly See List 11	12-FP0035~~PM000035~~ Inspecting for Required Equipment[n]
Mine Pager Phones (between surface and underground)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations
MSHA Air Quality Monitor	Maintenance/ Underground Operations	Daily[l] See Lists 1 and 10	WP 12-IH1828 Inspecting for Air Quality Monitoring Equipment Functional Check
Perimeter Fence, Gates, Signs	Security	Daily See List 6	PF0-~~008~~010 Inspecting for Deterioration[b] and Posted Warnings
Personal Protective Equipment (not otherwise contained in emergency vehicles or issued to individuals): —Self-Contained Breathing Apparatus	Emergency Services	Weekly See List 11	12-FP0029~~PM000029~~ Inspecting for Deterioration[b] and Pressure
Public Address (and Intercom System)	Facility Operations	Monthly See List 3	WP 04-PC3017 Testing of PA and Underground Alarms and Mine Page Phones at essential locations Systems operated in test mode
Radio Equipment	Facility Operations	Daily[i] See List 3	Radios are operated daily and are repaired upon failure
Rescue Truck (Surface and Underground)	Emergency Services	Weekly See List 11	12-FP0030~~PM000030~~ and 12-FP0033~~PM000033~~ Inspecting for Mechanical Operability[m], Deterioration[b], Leaks/Spills, and Required Equipment[n]
Salt Handling Shaft Hoist	Underground Operations	Preoperational See List 1b and c	WP 04-HO1002 Inspecting for Deterioration[b], Safety Equipment, Communication Systems, and Mechanical Operability[m] in accordance with MSHA requirements

System/Equipment Name	Responsible Organization	Inspection a Frequency and Job Title of Personnel Normally Making Inspection	Procedure Number and Inspection Criteria
Self-Rescuers	Underground Operations	Quarterly See List 1c	WP 04-AU1026 Inspecting for Deterioration[b] and Functionality in accordance with MSHA requirements
Surface TRU Mixed Waste Handling Area[k]	Waste Handling	Preoperational or Weekly[e] See List 8	WP 05-WH1101 Inspecting for Deterioration[b], Leaks/Spills, Required Aisle Space, Posted Warnings, Communication Systems, Container Condition, and Floor coating integrity
TRU Mixed Waste Decontamination Equipment	Waste Handling	Annually See List 8	WP 05-WH1101 Inspecting for Required Equipment[n]
Underground Openings—Roof Bolts and Travelways	Underground Operations	Weekly See List 1a	WP 04-AU1007 Inspecting for Deterioration[b]
Underground—Geomechanical Instrumentation System (GIS)	Geotechnical Engineering	Monthly See List 9	WP 07-EU1301 Inspecting for Deterioration[b]
Underground TRU Mixed Waste Disposal Area	Waste Handling	Preoperational See List 8	WP 05-WH1810 Inspecting for Deterioration[b], Leaks/Spills, mine pager phones, equipment, unobstructed access, signs, debris, and ventilation
Uninterruptible Power Supply (Central UPS)	Facility Operations	Daily See List 3	WP 04-ED1542 Inspecting for Mechanical Operability[m] and Deterioration[b] with no malfunction alarms. Results of this inspection are logged in accordance with WP 04-AD3008.
TDOP Upender	Waste Handling	Preoperational See List 8	WP 05-WH1010 Inspecting for Mechanical Operability[m] and Deterioration[b]
Vehicle Siren	Emergency Services	Weekly See List 11	Functional Test included with inspection of the Ambulances, Fire Trucks, and Rescue Trucks
Ventilation Exhaust	Maintenance Operations	Quarterly See List 10	IC041098 Check for Deterioration[b] and Calibration of Mine Ventilation Rate Monitoring Equipment

System/ Equipment Name	Responsible Organization[J]	Inspection[a] Frequency and Job Title of Personnel Normally Making Inspection[J]	Procedure Number (Latest Revision)	Inspection Criteria		
				Deterioration[b]	Leaks/ spills	Other
Horizontal Emplacement and Retrieval Equipment or functionally equivalent equipment	Waste Operations	Pre-evolution [c,d,e,l] See List 1	WP05-WH1700 PM052010 (Semi-Annual)[k] PM052011 (Annual) PM052013 PM052012 PM052014 (Annual)	Yes	Yes	Assembly and Operating Instructions. Electrical Inspection. Position Transducer Calibration. Tilt Sensor Calibration.
41-Ton Forklift	Waste Operations	Preoperational [c,d,e,l] See List 1	WP05-WH1602 PM074061 PM052003 (Hours of Use) PM074027 (Quarterly) PM074029 & PM074051 (Annual)	Yes	Yes	Pre-Operational Checks. PM performed every 100 hours of operation, every 500 hours of operation or every 5 Years. Quarterly Engine Emission Test. Annual Electrical Inspection. Annual NDE.
RH Bay	Waste Operations	Preoperational [c,d,e,h,l] See List 1	WP05-WH1744	Yes	NA	Floor integrity
Surface RH TRU Mixed Waste Handling Area	Waste Operations	Preoperational [l] See List 1	WP- 05 WH1744	Yes	Yes	Posted Warning, Communications

1

Table E-1a (Continued)
RH TRU Mixed Waste Inspection Schedule/Procedures Lists

List 1: Waste Operations

RH Waste Handling Engineer

Qualified TRU-Waste Handler

List 2: Radiological Control

Radiological Control Technician

ATTACHMENT L

WIPP GROUND-WATER DETECTION MONITORING PROGRAM PLAN

TABLE OF CONTENTS

L-1 Introduction 1
- L-1a Geologic and Hydrologic Characteristics ..... 3~~2~~
  - L-1a(1) Geology ..... 3~~2~~
  - L-1a(2) Ground-water Hydrology ..... 4~~3~~
    - L-1a(2)(i) The Castile ..... 4~~3~~
    - L-1a(2)(ii) The Salado ..... 4~~4~~
    - L-1a(2)(iii) The Rustler ..... 5~~4~~
- L-2 General Regulatory Requirements ..... 10~~8~~
- L-3 WIPP Ground-water Detection Monitoring Program (DMP)—Overview ..... 10~~8~~
  - L-3a Scope ..... 10~~8~~
  - L-3b Current WIPP DMP ..... 11~~9~~
    - L-3b(1) ~~DMP~~ Detection Monitoring Well Construction Specification ..... 13~~10~~
      - ~~L-3b(1)(i) WQSP-1 ..... 13~~~~10~~
      - ~~L-3b(1)(ii) WQSP-2 ..... 14~~~~10~~
      - ~~L-3b(1)(iii) WQSP-3 ..... 14~~~~11~~
      - ~~L-3b(1)(iv) WQSP-4 ..... 14~~~~11~~
      - ~~L-3b(1)(v) WQSP-5 ..... 15~~~~11~~
      - ~~L-3b(1)(vi) WQSP-6 ..... 15~~~~12~~
- L-4 Monitoring Program Description ..... 15~~12~~
  - L-4a Monitoring Frequency ..... 15~~12~~
  - L-4b Analytical Parameters and Hazardous Constituents ..... 16~~13~~
  - L-4c Ground-water Surface Elevation Measurement, Sample Collection and Laboratory Analysis ..... 17~~13~~
    - L-4c(1) Ground-water Surface Elevation Monitoring Methodology ..... 17~~14~~
      - L-4c(1)(i) Field Methods and Data Collection Requirements ..... 19~~16~~
      - L-4c(1)(ii) Ground-water Surface Elevation Records and Document Control ..... 19~~16~~
    - L-4c(2) Ground-water Sampling ..... 20~~17~~
      - L-4c(2)(i) Ground-water Pumping and Sampling Systems ..... 20~~17~~
      - L-4c(2)(ii) Serial Samples ..... 22~~19~~
      - L-4c(2)(iii) Final Samples ..... 24~~20~~
      - L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation ..... 26~~22~~
      - L-4c(2)(v) Sample Documentation and Custody ..... 26~~22~~
    - L-4c(3) Laboratory Analysis ..... 28~~24~~
  - L-4d Calibration ..... 29~~25~~
    - L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration ~~Requirements~~ ..... 29~~25~~
    - L-4d(2) Ground-water Surface Elevation Monitoring Equipment Calibration Requirements ..... 29~~25~~
  - L-4e Statistical Analysis of Laboratory Analytical Data ..... 30~~25~~

L-4e(1) Temporal and Spatial Analysis ..... 30~~25~~
L-4e(2) Distributions and Descriptive Statistics ..... 30~~26~~
L-4e(3) ~~Data Anomalies~~Action Levels ..... 31~~26~~
L-4e(4) Comparisons and Reporting ..... 32~~27~~

L-5 Reporting ..... 33~~27~~
L-5a Laboratory Data Reports ..... 33~~27~~
L-5b Statistical Analysis and Reporting of Results ..... 33~~28~~
L-5c Annual ~~Site Environmental~~ Cuelbra Groundwater Report ..... 33~~28~~

L-6 Records Management ..... 35~~28~~

~~L-7 Project Organization and Responsibilities ..... 35~~29~~
~~L-7a Environmental Monitoring Manager ..... 35~~29~~
~~L-7b Team Leader ..... 36~~29~~
~~L-7c Field Team ..... 36~~30~~
~~L-7d Safety Manager ..... 36~~30~~
~~L-7e Analytical Laboratory Management ..... 37~~30~~
~~L-7f Quality Assurance (QA) Manager ..... 37~~30~~

L-~~8~~7 Quality Assurance Requirements ..... 37~~31~~
L-~~8a~~7a Data Quality Objectives and Quality Assurance Objectives~~QA Program—Overview~~ ..... 37~~31~~
L-~~8b~~7a(1) Data Quality Objectives 31
L-7a(1)(i) Detection Monitoring Program 31
L-7a(1)(ii) Water Level Monitoring Program 31
L-7a(2) Quality Assurance Objectives 31
~~L-8b DQOs ..... 37~~31~~
L-~~8b~~7a(2)(~~1~~i) Accuracy ..... 38~~31~~
L-7a(2)(ii) Precision 39
~~L-8b(1)(i) Accuracy Objectives for Field Measurements ..... 38~~31~~
~~L-8b(1)(ii) Accuracy Objectives for Laboratory Measurements ..... 39~~32~~
~~L-8b(2) Precision ..... 39~~32~~
~~L-8b(2)(i) Precision Objectives for Field Measurements ..... 39~~32~~
~~L-8b(2)(ii) Precision Objectives for Laboratory Measurements ..... 39~~32~~
L-~~8b(3)~~7a(2)(iii) Contamination ..... 39~~32~~
L-7a(2)(iv)~~8b(4)~~ Completeness ..... 40~~33~~
L-7a(2)(v)~~8b(5)~~ Representativeness ..... 40~~33~~
L-7a(2)(vi)~~8b(6)~~ Comparability ..... 41~~33~~
L-~~8c~~7b Design Control ..... 41~~34~~
L-~~8d~~7c Instructions, Procedures, and Drawings ..... 41~~34~~
L-~~8e~~7d Document Control ..... 41~~34~~
~~L-8f Control of Work Processes ..... 41~~34~~
L-~~8g~~7e Inspection and Surveillance ..... 42~~34~~
L-~~8h~~7f Control of Monitoring and Data Collection Equipment ..... 42~~35~~
L-~~8i~~7g Control of Nonconforming Conditions ..... 42~~35~~
L-~~8j~~7h Corrective Action ..... 42~~35~~
L-~~8k~~7j Quality Assurance Records ..... 43~~35~~

L-~~9~~8 References ..... 44~~36~~

LIST OF TABLES

Table	Title
Table L-1	Hydrological Parameters for Rock Units Above the Salado at WIPP
Table L-2	WIPP Ground-water Detection Monitoring Program Sample Collection and Ground-water Surface Elevation Measurement Frequency
~~Table L-3~~	~~Analytical Parameter List for the WIPP Detection Monitoring Program~~
Table L-3	Standard Operating Procedures Applicable to the DMP
Table L-4	List of Culebra Wells in the DMP, Current as of January 2011
Table L-5	Details of Construction for the Six Culebra Detection Monitoring Wells
Table L-~~4~~6	Analytical Parameter and Sample Requirements

Comment [tk1]: Need to add correct hyperlinks

LIST OF FIGURES

Figure	Title
Figure L-1	General Location of the WIPP Facility
Figure L-2	WIPP Facility Boundaries Showing 16-Square-Mile Land Withdrawal Boundary
Figure L-3	Site Geologic Column
Figure L-4	Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site
Figure L-5	~~Schematic North-South Cross Section Through the North Delaware Basin~~Culebra Freshwater-Head Potentiometric Surface
~~Figure L-6~~	~~Culebra Freshwater-Head Contour Surface~~
~~Figure L-7~~	~~Total Dissolved Solids Distribution in the Culebra~~
Figure L-~~8~~6	~~WQSP~~ Detection Monitoring Well Locations
~~Figure L-9~~	~~WIPP DMP Monitor Well Locations and Potentiometric Surface of the Culebra Near the WIPP Site as of 12/96 (adjusted to equivalent freshwater head)~~
Figure L-~~10~~7	As-Built Configuration of Well WQSP-1
Figure L-~~11~~8	As-Built Configuration of Well WQSP-2
Figure L-~~12~~9	As-Built Configuration of Well WQSP-3
Figure L-~~13~~10	As-Built Configuration of Well WQSP-4
Figure L-~~14~~11	As-Built Configuration of Well WQSP-5
Figure L-~~15~~12	As-Built Configuration of Well WQSP-6
~~Figure L-16~~	~~Reserved~~
Figure L-~~17a~~13	Example Chain-of-Custody Record
~~Figure L-17b~~	~~Example Request for Analysis~~
~~Figure L-18~~	~~Ground-water Surface Elevation Monitoring Locations~~
Figure L-14	Groundwater Level Surveillance Wells (insert represents the groundwater surveillance wells in WIPP Land Withdrawal Area)

LIST OF ABBREVIATIONS/ACRONYMS/UNITS

~~ASER~~	~~Annual Site Environmental Report~~
~~AR/VR~~	~~Approval/Variation Request~~
Bell Canyon	Bell Canyon Formation
bgs	below ground surface
Castile	Castile Formation
cm	centimeter(s)
Culebra	Culebra Member of the Rustler Formation
CofC/RFA	~~Chain~~ chain of ~~Custody~~custody/request for analysis
°C	degree(s) Celsius
%C	percent completeness
Dewey Lake	Dewey Lake Redbeds Formation
DI	deionized
DMP	Detection Monitoring Program
DMW	Detection Monitoring Well
DOE	U.S. Department of Energy
DQO	data quality objectives
~~EM~~	~~Environmental Monitoring~~
EPA	U.S. Environmental Protection Agency
~~ES&H~~	~~Environment, Safety, and Health Department~~
~~FEIS~~	~~Final Environmental Impact Statement~~
ft	foot (feet)
ft^2	square foot (square feet)
g/cm^3	gram(s) per cubic centimeter
~~GWSP~~	~~Groundwater Surveillance Program~~
HWDU	hazardous waste disposal unit(s)
km	kilometer(s)
km^2	square kilometer(s)
$lb/in.^2$	pound(s) per square inch
LCS	laboratory control samples
LCSD	lab control sample duplicate
~~LD~~	~~limit of detection~~
Los Medaños	Los Medaños Member of the Rustler Formation
LWA	Land Withdrawal Act
m	meter(s)
M&DC	monitoring and data collection
m^2	square meter(s)
Magenta	Magenta Member of the Rustler Formation
mg/L	milligram(s) per liter

mi	mile(s)
mi^2	square mile(s)
molal	moles per kilogram
MOC	Management and Operating Contractor
MPa	megapascal(s)
mV	millivolt(s)
NIST	National Institute for Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
~~PRS~~	~~Project Records Services~~
QA	Quality Assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Objective
QC	quality control
PABC	Performance Assessment Baseline Calculation
RCRA	Resource Conservation and Recovery Act
~~RFA~~	~~request for analysis~~
~~RIDS~~	~~Records Inventory and Disposition Schedule~~
RPD	relative percent difference
Rustler	Rustler Formation
%R	percent recovery
Salado	Salado Formation
SAP	Sampling and Analysis Plans
SC	specific conductance
SOP	Standard Operating Procedure
~~STLB~~	~~sample tracking logbook~~
TDS	total dissolved solids
TOC	total organic carbon
~~TOX~~	~~total organic halogens~~
TRU	transuranic
TSDF	treatment, storage, and disposal facilities
~~TSS~~	~~total suspended solids~~
UTLV	upper tolerance limit value
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
WLMP	WIPP Groundwater Level Monitoring Program
~~WQSP~~	~~Water Quality Sampling Program~~
µg/L	microgram(s) per liter

µm	micrometers

(This page intentionally blank)

ATTACHMENT L

WIPP GROUND-WATER DETECTION MONITORING PROGRAM PLAN

L-1 Introduction

The Waste Isolation Pilot Plant (**WIPP**) facility is subject to regulation under Title 20 of the New Mexico Administrative Code (**NMAC**), Chapter 4, Part 1, Subpart V (20.4.1.500 NMAC). As required by 20.4.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.

~~is a geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (hereinafter referred to as the Salado). At WIPP, water-bearing units occur both above and below the disposal horizon. Ground-water monitoring of the uppermost aquifer below the facility is not proposed at WIPP because that water-bearing unit (the Bell Canyon Formation) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon Formation are separated by over 2000 ft (610 m) of very low-permeability evaporite sediments (Addendum L1, Amended Renewal Application (DOE, 2009)). No natural credible pathway has been established for contaminant transport to aquifers below the repository horizon, as there is no hydrologic communication between the repository and underlying aquifer. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on their review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for ground-water monitoring through the Salado and the Castile Formation (hereinafter referred to as the Castile) into the Bell Canyon aquifer would compromise the isolation properties of the repository medium.~~

The WIPP facility is located in Eddy County in southeastern New Mexico (Figure L-1), within the Pecos Valley section of the southern Great Plains physiographic province. The facility is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico, in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses. ~~Disposal of TRU mixed waste in the WIPP facility is subject to regulation under 20.4.1.500 NMAC. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall demonstrate that the environmental performance standards for a miscellaneous unit, which are applied to the hazardous waste disposal units (**HWDUs**) in the underground, will be met.~~

The WIPP facility (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.

The WIPP facility includes a mined geologic repository for the disposal of transuranic (**TRU**) waste. The disposal horizon is located 2,150 feet (ft) (655 meters [m]) below the land surface in the bedded salt of the Salado Formation (**Salado**). At the WIPP facility, water-bearing units occur both above and below the disposal horizon. Groundwater monitoring of the uppermost aquifer below the facility is not required because the water-bearing unit (the Bell Canyon Formation (**Bell Canyon**)) is not considered a credible pathway for a release from the repository. This is because the repository horizon and water-bearing sandstones of the Bell Canyon are separated by over 2,000 ft (610 m) of very low-permeability evaporite sediments (Amended Renewal Application Addendum L1 (DOE, 2009)). No natural credible pathway has been established for contaminant transport to water-bearing zones below the repository horizon, as there is no hydrologic communication between the repository and underlying water-bearing zones. The U.S. Environmental Protection Agency (**EPA**) concluded in 1990 that natural vertical communication does not exist based on review of numerous studies (EPA, 1990). Furthermore, drilling boreholes for groundwater monitoring through the Salado and the Castile Formation (**Castile**) into the Bell Canyon would compromise the isolation properties of the repository medium.

Ground-water monitoring at the WIPP facility ~~in the past has focused~~ focuses on the Culebra ~~member~~ Member (**Culebra**) of the Rustler Formation (~~hereinafter referred to as the Culebra~~**Rustler**) because it represents the most significant hydrologic contaminant migration pathway to the accessible environment. The Culebra is the most significant water-bearing unit lying above the repository. ~~basin~~Groundwater movement in the Culebra, using results from the basin-scale groundwater model~~Modeling of ground-water movement in the Culebra, based on the concept of a ground-water basin~~ ~~,~~ is discussed in detail in Amended Renewal Application Addendum L1, Section L1-2a, ~~Amended Renewal Application~~ (DOE, 2009).

Formatted: Font: Bold

Formatted: Font: Bold

~~The WIPP site is located in Eddy County in southeastern New Mexico (Figure L-1) within the Pecos Valley section of the southern Great Plains physiographic province (Powers et al., 1978). The site is 26 miles (mi) (42 kilometers [km]) east of Carlsbad, New Mexico in an area known as Los Medaños (the dunes). Los Medaños is a relatively flat, sparsely inhabited plateau with little water and limited land uses.~~

~~The WIPP site (Figure L-2) consists of 16 sections of Federal land in Township 22 South, Range 31 East. The 16 sections of Federal land were withdrawn from the application of public land laws by the WIPP Land Withdrawal Act (**LWA**), Public Law 102-579. The WIPP LWA transferred the responsibility for the administration of the 16 sections from the Department of Interior, Bureau of Land Management, to the U.S. Department of Energy (**DOE**). This law specified that mining and drilling for purposes other than support of the WIPP project are prohibited within this 16 section area with the exception of Section 31. Oil and gas drilling activities are restricted in Section 31 from the surface down to 6,000 feet.~~

This monitoring plan addresses requirements for sample collection, Culebra ground-water surface elevation monitoring, Culebra ground-water flow direction and rate determination, data management, and reporting of Culebra ground-water monitoring data. It also identifies ~~analytical~~ indicator parameters and hazardous constituents selected to assess Culebra ground-water quality ~~, and establishes personnel responsibilities~~ for the WIPP ground-water detection monitoring program (**DMP**). Because quality assurance is an integral component of the ground-water sampling, analysis, and reporting process, quality assurance/quality control (**QA/QC**) elements and associated data acceptance criteria are included in this plan.

Instructions for performing field activities that will be conducted in conjunction with this ~~sampling and analysis plan~~ DMP are provided in the WIPP Standard Operating Procedures (**SOPs**) (see Table L-3), which are maintained in facility files and which comply with the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 (d))~~field operating procedures, referenced throughout this plan~~. Procedures are required for each aspect of the Culebra ground-water sampling process, including Culebra ground-water surface elevation measurement, Culebra ground-water flow direction and rate determination, sampling equipment installation and operation, field water-quality measurements, and sample collection~~. These procedures prescribe proper field sampling techniques~~. ~~Samples~~ Data required by this plan will be collected by ~~trained~~ qualified personnel ~~under the supervision and direction of qualified engineers, scientists, or other technical personnel.~~in accordance with SOPs (Table L-3).

L-1a Geologic and Hydrologic Characteristics

L-1a(1) Geology

The WIPP ~~site~~ facility is situated within the Delaware Basin~~,~~ bounded to the north and east by the Capitan Reef, which is part of the larger Permian Basin, located in the south-central region of North America. ~~During the Permian period, which came to a close about 245 million years ago, ancient seas covered the basin. Their later evaporation resulted in the deposition of a thick sequence of evaporites. Addendum L1, Section L1-1 of the Amended Renewal Application (DOE, 2009) presents a detailed discussion of the regional geologic history.~~ Three major evaporite-bearing formations were deposited in the Delaware Basin (see Figures L-3 and L-4 and Amended Renewal Application Addendum L1, Section L1-1 (DOE, 2009) for more detail):

- The Castile ~~, which formed through evaporation of the Permian Sea,~~ consists of interbedded anhydrites and halite. Its upper boundary is at a depth of about 2,825 ft (861 m) below ground surface (**bgs**), and its thickness at the WIPP facility is 1,250 ft (381 m).

- The repository is located in the Salado, which overlies the Castile and resulted from prolonged desiccation that produced predominantly halite, with some carbonates, anhydrites, and clay seams. Its upper boundary is at a depth of about 850 ft (259 m) bgs, and it is about 2,000 ft (610 m) thick in the repository area.

- The Rustler Formation ~~(hereinafter referred to as the Rustler)~~ was deposited in a lagoonal environment during a major freshening of the basin and consists of carbonates, anhydrites, and halites. Its beds consist of clay and anhydrite and contain small amounts of brine. The Rustler's upper boundary is about 500 ft (152 m) bgs, and it ranges up to 350 ft (107 m) in thickness in the repository area.

These evaporite-bearing formations lie between two other formations significant to the geology and hydrology of the WIPP ~~site~~facility. The Dewey Lake Redbeds Formation (**Dewey Lake**) overlying the Rustler is dominated by nonmarine sediments and consists almost entirely of mudstone, claystone, siltstone, and interbedded sandstone (see Amended Renewal Application Addendum L1, Section L1-1c(6) ~~of the Amended Renewal~~ Application (DOE, 2009)). This formation forms a 500-ft- (152-m) thick barrier of fine-grained sediments that retard the

Formatted: Font: Bold

downward percolation of water into the evaporite units below.[1] The Bell Canyon ~~Formation (hereinafter referred to as the Bell Canyon)~~ is the first water-bearing unit below the repository (see Amended Renewal Application Addendum L1, Section L1-1c(2) ~~of the Amended Renewal Application~~ (DOE, 2009)) ~~—~~and is confined above by the thick evaporite ~~sequences~~ deposits of the Castile ~~above~~. It consists of 1,200 ft (366 m) of interbedded sandstone, shale, and siltstone.

The Salado was selected to host the WIPP repository for several reasons. First, it is regionally extensive, underlying an area of more than 36,000 square mi (mi^2) (93,240 square kilometers [km^2]). Second, its permeability is extremely low. Third, salt behaves mechanically in a plastic manner under pressure (the lithostatic pressure at the disposal horizon is ~~more than~~approximately 2,~~000~~ 200 pounds per square inch [lb/in.^{2}] or 1~~3.8~~4.9 megapascals [MPa]) and eventually ~~moves~~ deforms to fill any opening (referred to as creep). Fourth, any fluid remaining in small fractures or openings is saturated with salt, is incapable of further salt dissolution, and has probably remained in place ~~for millions of years~~since deposition. Finally, the Salado lies between the Rustler and the Castile (Figure L-~~5~~4), which contain very low permeability layers that help confine and isolate waste within and keep water outside of the WIPP repository (see Amended Renewal Application Addendum L1, Section L1-1c(5) and L1-1c(3) ~~of the Amended Renewal Application~~ (DOE, 2009)).

L-1a(2) Ground-water Hydrology

The general hydrogeology of the area surrounding the WIPP facility is described in this section starting with the first geologic unit below the Salado. Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009) provides more detailed discussions of the local and regional hydrogeology. Relevant hydrological parameters for the various rock units above the Salado at WIPP are summarized in Table L-1.

L-1a(2)(i) The Castile

The Castile is a basin-filling evaporite sequence of sediments surrounded by the Capitan Reef. The Castile represents a major regional ground-water aquitard that effectively prevents upward migration of water from the underlying Bell Canyon. Fluid present in the Castile is very restricted because evaporites do not readily maintain pore space, solution channels, or open fractures at depth. Drill-stem tests conducted in the Castile during construction of the WIPP facility ~~found~~ determined its permeability to be lower than detection limits; however, the hydraulic conductivity has been conservatively estimated to be less than 10^{-8} ft (3×10^{-9} m) per day. A description of the Castile brine reservoirs outside the WIPP facility area is provided in Addendum L1, Section L1-2a(2)(b) of the Amended Renewal Application (DOE, 2009).

L-1a(2)(ii) The Salado

The Salado is an evaporite sequence that filled the remainder of the Delaware Basin and lapped extensively over the Capitan Reef and the back-reef sediments beyond. The Salado consists of approximately 2,000 ft (610 m) of bedded halite, with interbeds or seams of anhydrite, clay, and

---

~~[1] While there may be some uncertainty over the amount of vertical recharge occurring within the Rustler, the issue is only of significance to long-term performance calculations in which releases from the repository occur through the creation of a migration pathway resulting from drilling (inadvertently) in the WIPP area. The consequences of vertical recharge are bounded in the modeling by assuming that under future climate conditions (which are assumed to be cooler and wetter), the ground-water surface elevation (water table) raises near ground surface, at which time the water table tends to mimic topography.~~

polyhalite. It acts hydrologically as a regional confining bed. The porosity of the Salado is very low and naturally interconnected pores are probably nonexistent in halite at the depth of the disposal horizon. Fluids associated with the Salado occur mainly as very small fluid inclusions in the halite crystals and also occur between crystal boundaries (interstitial fluid) of the massive crystalline salt formation; fluids also occur in clay seams and anhydrite beds. Permeabilities measured from the surface in the area of the WIPP facility range from 0.01 to 25 microdarcies. The most reliable value, 0.3 microdarcy, was obtained from well DOE-2. The results of permeability testing at the disposal horizon are within the range of 0.001 to 0.01 microdarcy~~. As a comparison, the permeability of the Salado is roughly a thousand times less than that of a lower clay liner required of surface impoundments and landfills, assuming similar thicknesses~~.

L-1a(2)(iii) The Rustler

The Rustler has been the subject of extensive characterization activities because it contains the most transmissive hydrologic units overlying the Salado ~~Salado (specifically, the Culebra Member, hereafter referred to as the Culebra)~~. Within the Rustler, five members have been identified. Of these, the Culebra is the most transmissive and has been the focus of most of the Rustler hydrologic studies.

The Culebra is the first continuous water-bearing zone above the Salado and is up to approximately 30 ft (9 m) thick. Water in the Culebra is usually present in fractures and is confined by overlying gypsum or anhydrite and underlying clay and anhydrite beds. The hydraulic gradient within the Culebra in the area of the WIPP facility is approximately 20 ft per mi (3.8 m per km) and becomes much flatter south and southwest of the site (Figure L-5~~6~~). Culebra transmissivities in the Nash Draw range up to 1,250 square ft (ft^2) (116 square m [m^2]) per day; closer to the WIPP facility, they are as low as 0.007 to 74 ft^2 (0.00065 to 7.0 m^2) per day. ~~The Culebra is hydrologically confined.~~

The two primary types of field tests that are being used to characterize the flow and transport characteristics of the Culebra are hydraulic tests and tracer tests.

The hydraulic tests consist of pump, injection, and slug testing of wells across the study area (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). The most detailed hydraulic test data exist for the WIPP hydropads (e.g., H-19). The hydropads generally comprise a network of three or more wells located within a few tens of meters of each other. Long-term pumping tests have been conducted at hydropads H-3, H-11, and H-19 and at well WIPP-13 (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). These pumping tests provided transient pressure data both at the hydropad and over a much larger area. Tests often included use of automated data-acquisition systems, providing high-resolution (in both space and time) data sets. In addition to long-term pumping tests, slug tests and short-term pumping tests have been conducted at individual wells to provide pressure data that can be used to interpret the transmissivity at that well (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)). ~~(Additional short-term pumping tests have been conducted in the Water Quality Sampling Program (WQSP) wells (see Addendum L1, Section L1-2a(3)(a)(ii) of the Amended Renewal Application (DOE, 2009)).~~ Detailed cross-hole hydraulic testing has ~~recently~~ been conducted at the H-19 hydropad (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

~~The hydraulic tests are designed to yield pressure data for estimation of hydrologic characteristics~~ Pressure data are collected during hydraulic tests for estimation of hydrologic characteristics such as transmissivity, permeability, and storativity. The pressure data from long-term pumping tests and the interpreted transmissivity values for individual wells are used ~~for input to flow modeling~~in calibration of flow models. Some of the hydraulic test data and interpretations are also important for the interpretation of transport characteristics. For instance, the permeability values interpreted from the hydraulic tests at a given hydropad are needed for interpretations of tracer test data at that hydropad.

There is strong evidence that the permeability of the Culebra varies spatially and varies sufficiently that it cannot be characterized with a uniform value or range over the region of interest to WIPP. The transmissivity of the Culebra varies spatially over ~~six~~ ten orders of magnitude from east to west in the vicinity of WIPP. ~~Over the site, Culebra transmissivity varies over three to four orders of magnitude. Figure D6-30 shows variation in transmissivity in the Culebra in the WIPP region.~~ Transmissivities have been calculated at 1×10^{-7}~~^{3}~~ square feet per day (1×10^{-9}-^{13} square meters per second) at well ~~P-18~~SNL-15 east of the WIPP site to 1×10^{3} square feet per day (1×10^{-3} square meters per second) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

Transmissivity variations in the Culebra are believed to be controlled by the relative abundance of open fractures rather than by primary (that is, depositional) features of the unit (Roberts 2007). Lateral variations in depositional environments were small within the mapped region, and primary features of the Culebra show little map-scale spatial variability, according to Holt and Powers, 1988. Direct measurements of the density of open fractures are not available from core samples because of incomplete recovery and fracturing during drilling, but observation of the relatively unfractured exposures in the WIPP shafts suggests that the density of open fractures in the Culebra decreases to the east. ~~Qualitative correlations have been noted between transmissivity and several geologic features possibly related to open-fracture density, including (1) the distribution of overburden above the Culebra, (2) the distribution of halite in other members of the Rustler, (3) the dissolution of halite in the upper portion of the Salado, and (4) the distribution of gypsum fillings in fractures in the Culebra.~~

~~Measured matrix porosities of the Culebra vary from 0.03 to 0.30. Fracture porosity values have not been measured directly, but interpreted values from tracer tests at the H-3, H-6, and H-11 hydropads vary from 5×10^{-4} to 3×10^{-3}. Data are insufficient to determine whether the average porosity of the matrix and fractures varies significantly on a regional scale.~~

Geochemical and radioisotope characteristics of the Culebra have been studied. There is considerable variation in ground-water geochemistry in the Culebra. The variation has been described in terms of different hydrogeochemical facies that can be mapped in the Culebra. A halite-rich hydrogeochemical facies exists in the region of the WIPP site and to the east, approximately corresponding to the regions in which halite exists in units above and below the Culebra, and in which a large portion of the Culebra fractures are gypsum filled. An anhydrite-rich hydrogeochemical facies exists west and south of the WIPP site, where there is relatively less halite in adjacent strata and where there are fewer gypsum-filled fractures. Radiogenic isotopic signatures suggest that the age of the ground-water in the Culebra is on the order of 10,000 years or more (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

The radiogenic ages of the Culebra ground-water and the geochemical differences provide information potentially relevant to the ground-water flow directions and ground-water interaction with other units and are important constraints on conceptual models of ground-water flow. ~~Previous conceptual models of the Culebra (see Addendum L1 of the Amended Renewal Application (DOE, 2009)) have not been able to consistently relate the hydrogeochemical facies, radiogenic ages, and flow constraints (that is, transmissivity, boundary conditions, etc.) in the Culebra.~~

~~However, t~~The Permittees have proposed a ~~new~~ conceptualization of ground-water flow that ~~could~~ explains observed geochemical facies and ground-water flow patterns. The ~~new~~ conceptualization, referred to as the basin-scale ground-water ~~basin~~ model, offers a three dimensional approach to treatment of Supra-Salado rock units, and assumes vertical leakage (albeit very slow) between rock units of the Rustler exists (where hydraulic head is present).

Flow in the Culebra is considered transient. ~~This differs from previous interpretations, wherein no flow was assumed between Rustler units.~~ The model assumes that the ground-water system is dynamic and is responding to the drying of climate that has occurred since the late Pleistocene period. The Permittees assumed that recharge rates during the late Pleistocene period were sufficient to maintain the water table near land surface, but has since dropped significantly. Therefore, the impact of local topography on ground-water flow was greater during wetter periods, with discharge from the Rustler in the vicinity of the WIPP facility to the west toward Nash Draw; flow is currently dominated by more regional topographic effects during drier times, with flow in the Rustler from the vicinity of the WIPP facility towards the Balmorhea-Loving Trough to the south.~~to a more southerly direction.~~

~~Four hydrogeochemical facies within the Culebra in the WIPP area (DOE, 1997) have been identified:~~

- ~~Zone A - saline (2-3 molal) NaCl brines, Mg/Ca ratio of 1.2 to 2;~~
- ~~Zone B - dilute (<0.1 molal) CaSO4 - rich ground water;~~
- ~~Zone C - variable composition (0.3-1.6 molal); Mg/Ca ratio 0.3 to 1.2; and~~
- ~~Zone D - high salinities (3-7 molal); K/Na weight ratios (0.2).~~

~~Facies A ground-water flow is slow, has not changed over the last 14,000 years, and probably recharged more than 600,000 years ago. Vertical leakage occurs to Facies A, and both lateral and vertical ground-water flow rates are extremely low. Facies B occurs in an area with greater vertical fracturing in the Culebra, and therefore exhibits more vertical infiltration and more rapid lateral flow in the Culebra. Flow in Facies B is currently to the south (it may mix with Facies C water to the southeast) but was more toward the west during wetter climates; vertical infiltration from the Dewey Lake to the Culebra Facies B is assumed by the Permittees to have occurred during wetter climates in an area south of the WIPP site. Facies C water was not diluted to create Facies B water. Facies C occurs "in between" Facies A and B, and ground-water flow entered the Culebra prior to the climate change (to drier conditions) 14,000 years ago. Facies C ground-water flow is to the south at WIPP, where the Permittees theorized that it joins with a small amount of Facies A solute being transported from the east. Ground-water flow rate in Facies C is faster than in A but slower than in B, and the proposed recharge area from the Dewey Lake to the Culebra was to the northeast of the WIPP site. Facies C ground water~~

~~infiltrated into the Dewey Lake and then interacted with anhydrite and halite along its path to the Culebra, wherein it mixed with smaller amounts of Facies A water. the Permittees concluded that the presence of anhydrite within Rustler units does not preclude slow downward infiltration (DOE, 1997).~~

Using data from 22 wells, Siegel, Robinson, and Myers (1991) originally defined four hydrochemical facies (A, B, C, and D) for Culebra groundwater based primarily on ionic strength and major constituents. With the data now available from 59 wells, Domski and Beauheim (2008) defined transitional A/C and B/C facies, as well as a new facies E for high-moles per kilogram (molal) Na-Mg Cl brines.

- Zone B - Dilute (ionic strength ≤0.1 molal) $CaSO_4$-rich groundwater, from southern high-transmissivity area. Mg/Ca molar ratio 0.32 to 0.52.
- Zone B/C - Ionic strength 0.18 to 0.29 molal, Mg/Ca molar ratio 0.4 to 0.6.
- Zone C - Variable composition waters, ionic strength 0.3 to 1.0 molal, Mg/Ca molar ratio 0.4 to 1.1.
- Zone A/C - Ionic strength 1.1 to 1.6 molal, Mg/Ca molar ratio 0.5 to 1.2.
- Zone A - Ionic strength >1.66 molal, up to 5.3 molal, Mg/Ca molar ratio 1.2 to 2.4.
- Zone D - Defined based on inferred contamination related to potash refining operations. Ionic strength 3 molal, K/Na weight ratios of ~0.2.
- Zone E - Wells east of the mudstone-halite margins, ionic strength 6.4 to 8.6 molal, Mg/Ca molar ratio 4.1 to 6.6.

The low-ionic-strength (≤0.1 molal) facies B waters contain more sulfate than chloride, and are found southwest and south of the WIPP site within and down the Culebra hydraulic gradient from the southernmost closed catchment basins, mapped by Powers (2006), in the southwest arm of Nash Draw. These waters reflect relatively recent recharge through gypsum karst overlying the Culebra. However, with total dissolved solids (**TDS**) concentrations in excess of 3,000 mg/L, the facies B waters do not represent modern-day precipitation rapidly reaching the Culebra. They must have residence times in the Rustler sulfate units of thousands of years before reaching the Culebra.

The higher-ionic-strength (0.3-1 molal) facies C brines have differing compositions, representing meteoric waters that have dissolved $CaSO_4$, overprinted with mixing and localized processes. Facies A brines (ionic strength 1.6 - 5.3 molal) are high in NaCl and are clustered along the extent of halite in the middle of the Tamarisk Member of the Rustler Formation. Facies A represents old waters (long flow paths) that have dissolved halite and/or connate brine, or a mixture of the two from facies E. The facies D brines, as identified by Siegel, Robinson, and Myers (1991), are high-ionic-strength solutions found in western Nash Draw with high K/Na ratios representing waters contaminated with effluent from potash refining operations. Similar water is found at shallow depth (<36 ft (11 m)) in the upper Dewey Lake at SNL-1, just south of the Intrepid East tailings pile. The newly defined facies E waters are very high ionic strength (6.4 - 8.6 molal) NaCl brines with high Mg/Ca ratios. The facies E brines are found east of the WIPP

Formatted: No underline, Font color: Auto

site, where Rustler halite is present above and below the Culebra, and halite cements are present in the Culebra. They represent primitive brines present since deposition of the Culebra and immediately overlying strata.

Previously, the Permittees and others believed the geochemistry of Culebra ground-water was inconsistent with flow directions. This was based on the premise that f~~F~~acies C water must transform to facies B water (e.g. become "fresher"), which is inconsistent with the observed flow direction. It is now believed that the observed geochemistry and flow directions can be explained with different recharge areas and Culebra travel paths (Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)).

Head distribution in the Culebra (see Amended Renewal Application Addendum L1 ~~of the Amended Renewal Application~~ (DOE, 2009)) is consistent with basin-scale ground-water basin modeling results indicating that the generalized ground-water flow direction in the Culebra is currently north to south. However, the fractured nature of the Culebra, coupled with variable fluid densities, can cause localized flow patterns to differ from general flow patterns.

~~Ground-water levels in the Culebra in the WIPP region have been measured for several decades. Water-level rises have been observed in the WIPP region and are possibly related to recovery from impacts caused by shaft installation, response to potash effluent discharge, or are unexplained, as discussed below. The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the potential cause of the water-level rise appears to be a primary factor.~~

~~In the vicinity of the WIPP site, water-level rises are believed to be caused by recovery from drainage into the shafts. Drainage into shafts has been reduced by a number of grouting programs over the years, most recently in 1993 around the Air Intake Shaft. Northwest of the site, in and near Nash Draw, water levels appear to fluctuate in response to effluent discharge from potash mines. Correlation of water-level fluctuation with potash mine discharge, however, cannot be proven definitively because sufficient data on the timing and volumes of discharge are not available. Water-level rises in the vicinity of the H-9 hydropad, about 6.5 miles south of the site, are thought to be caused by neither WIPP activities nor potash mining discharge. They remain unexplained. The Permittees continue to monitor ground-water levels throughout the region.~~

Groundwater levels in the Culebra in the region around the WIPP facility have been measured in numerous wells. Water-level rises have been observed and are attributed to causes discussed in the Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009). The extent of water-level rise observed at a particular well depends on several factors, but the proximity of the observation point to the cause of the water-level change appears to be a primary factor.

Hydrological investigations conducted from 2003 through 2007 provided new information, some of it confirming long-held assumptions and some offering new insight into the hydrological system around the WIPP site. A Culebra monitoring network optimization study was completed by McKenna (2004) and updated by Kuhlman (2010) to identify locations where new Culebra monitoring wells would be of greatest value and to identify wells that could be removed from the network with little loss of information.

As discussed in Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) (DOE, 2009), extensive hydrological testing has been performed in the new wells. This testing has involved both single well tests, which provide information on local transmissivity and heterogeneity, and long-term (19 to 32 days) pumping tests that have created observable responses in wells up to 5.9 mi (9.5 km) away.

Inferences about vertical flow directions in the Culebra have been made from well data collected by the Permittees. Beauheim (1987) reported flow directions towards the Culebra from both the underlying ~~unnamed lower member~~ Los Medaños Member (**Los Medaños**) of the Rustler and the overlying Magenta ~~member~~ Member (**Magenta**) of the Rustler ~~over~~ across the WIPP site, indicating that the Culebra acts as a drain for the units around it. This is consistent with results of basin-scale ground-water ~~basin~~ modeling.

Formatted: Font: Bold

~~Recent simulations to enhance the conceptual understanding of the geohydrology of the Rustler can be found in Corbet and Knupp, 1996.~~

Use of water from the Culebra in the WIPP facility area is quite limited because of its varying yields and high salinity. The Culebra is not used for water supply in the immediate WIPP ~~site~~ facility vicinity. Its nearest use is approximately 7 mi (11 km) southwest of the WIPP facility, where salinity is low enough to allow its use for livestock watering ~~(shown, for example, as Well H-8 in Figure L-7). However, the Permittees identified the Culebra as potential aquifer in the Compliance Certification Application (DOE, 1996). Because of this, the Culebra will be the focus of future ground-water monitoring at WIPP as it is also the most transmissive continuous water-bearing zone at WIPP and is the most likely pathway for contaminant migration.~~

L-2 General Regulatory Requirements

Because geologic repositories such as the WIPP facility are defined under the Resource Conservation and Recovery Act (**RCRA**) as land disposal facilities and as miscellaneous units, the ground-water monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.600 through 264.603) shall be addressed. The requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101) ~~applies~~ apply to miscellaneous unit treatment, storage, and disposal facilities (**TSDF**) only if ground-water monitoring is needed to satisfy 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603) environmental performance standards.

The New Mexico Environment Department (**NMED**) has concluded that ground-water monitoring in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F) at the WIPP facility is necessary to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.601 through 264.603).

L-3 WIPP ~~Ground-water~~ Detection Monitoring Program (DMP)~~—~~Overview

L-3a Scope

~~The Permittees have established a RCRA "Ground-water Detection Monitoring Program (DMP) Plan" to define and protect ground-water resources at WIPP. One of the objectives of the WIPP DMP is to establish, by means of ground-water sampling and analysis, an accurate and representative ground-water database that is scientifically defensible and demonstrates regulatory compliance. In addition, the DMP will be used to determine background or existing~~

~~conditions of ground-water quality and quantity, including ground-water surface elevation and direction of flow, around the WIPP facility area.~~

This DMP plan governs ~~all~~ ground-water sampling events conducted to meet the applicable requirements of 20.4.1.500 NMAC (incorporating 40 CFR 264 Subpart F ~~§§264.90 through 264.101~~), and ensures that ~~all~~ such data are gathered in accordance with these and other applicable requirements. ~~The ground-water quality data generated by monitoring activities will provide a comprehensive background database against which future analytical~~ Analytical results ~~can be compared~~ collected during the DMP are compared to the baseline established in this Permit to determine whether or not a release has occurred.

~~Ground-water monitoring at WIPP has been historically conducted by several programs including the WIPP Site Characterization Program, the WIPP WQSP, and recently the WIPP Ground-water Surveillance Program (**GWSP**). Ground-water quality and ground-water surface elevation data have been collected by these programs for over 12 years at WIPP. Data from the WQSP wells (which are widely distributed across the area, see Figure L-8) will be used to continually define changes in the area's potentiometric surface and ground-water flow directions. New monitoring wells included in the WIPP GWSP (WQSP wells 1-6a) were constructed to the specifications provided in the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (EPA, 1986) and constitute the RCRA ground-water monitoring network specified in this DMP as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). These wells are being used to establish background ground-water quality, ground-water surface elevations and flow directions in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97(f) and (g) and 264.98(e)). Justification for the locations of these wells (3 upgradient and 4 downgradient) is presented below.~~

There are two separate components of the Groundwater Monitoring Program, the Detection Monitoring Program (DMP) and the Water Level Monitoring Program (WLMP). The first component consists of a network of six Detection Monitoring Wells (DMWs). The DMWs (WQSP 1-6) were constructed to be consistent with the specifications provided in the Groundwater Monitoring Technical Enforcement Guidance Document and constitute the RCRA groundwater monitoring network specified in the DMP. The DMWs were used to establish background groundwater quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.97 and 264.98 (f)). The second component of the Groundwater Monitoring Program is the WLMP, which is used to determine the groundwater surface elevation and flow direction. Table L-4 is a list of the wells used in the WLMP as of January 1, 2011. The list of wells is subject to change due to plugging and abandonment and drilling of new wells.

L-3b Current WIPP DMP

~~The WQSP wells 1 through 6 constitute the RCRA DMP for WIPP (Figure L-9 and Permit Attachment B, Figure B2-3) during detection monitoring as required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). This monitoring plan is a continuation of the current WIPP GWSP, and these wells will serve as the monitoring locations during background water-quality characterization and the RCRA DMP (Figure L-9 and Permit Attachment B, Figure B2-3).~~

Wells WQSP-1, WQSP-2, and WQSP-3 ~~were~~ are located directly upgradient (north) of the WIPP shaft area. ~~The locations of the three upgradient wells were selected to be representative of the flow vectors of ground water moving downgradient onto the WIPP site. Figure 34 of~~

~~Davies, 1989, shows the simulation of direction and magnitude of ground-water flow. The upgradient wells were located based on the flow vectors resulting from this model simulation. The original WQSP observation wells, as well as those in the RCRA DMP, have been and will continue to be used as piezometer wells to support collection of ground-water surface elevation and ground-water flow modeling data to demonstrate regulatory compliance. Well location surveys for each of the seven wells were performed by the Permittees' survey personnel using the State Plane Coordinates-North American Datum Model 27 method. Results of the surveys are on file with the New Mexico State Engineers Department along with the associated extraction permits for each well.~~

WQSP-4, WQSP-5, and WQSP-6 ~~were~~ are located downgradient (south) of the WIPP shaft area ~~in concert with the flow vectors shown by this model simulation~~. All three Culebra downgradient wells (WQSP-4, 5, and 6) were sited to be located generally in the path of contaminants that might be released from the shaft area in the Culebra.~~based on the greatest velocity magnitude of ground-water flow leaving the shaft area as shown on Figure 34 of Davies, 1989, and upgradient of the WIPP LWA boundary~~ ~~-~~Well WQSP-4 was also specifically located to monitor the zone of higher transmissivity ~~around wells DOE-1 and H-11,~~ which may represent faster flow path away from the WIPP shaft area to the LWA boundary (Amended Renewal Application Addendum L1, Section L1-2a(3)(a)(ii) ~~of the Amended Renewal Application~~ (DOE, 2009)).

~~The Culebra has been selected for the focus of the DMP due to it being regionally extensive and exhibiting the most significant transmissivity of the water-bearing units at WIPP. The Culebra has been extensively studied during all past hydrologic characterization programs and found to be the most likely hydrologic pathway to the accessible environment or compliance point for any potential contamination.~~

The compliance point is defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.95) as the vertical plane immediately downgradient of the hazardous waste management unit area (i.e., at the downgradient footprint of the WIPP repository). Permit Part 5 specifies the point of compliance as "the vertical surface located at the hydraulically downgradient limit of the Underground HWDUs that extends to the Culebra Member of the Rustler Formation." ~~The RCRA ground-water monitoring network was not installed immediately downgradient of this plane. However, because the Underground HWDUs at WIPP are Subpart X units, and due to the relatively unique containment and transport aspects of the site, monitoring at the proposed locations will allow for detection of releases prior to release of these contaminants to the general public at the LWA boundary.~~ Wells WQSP-4, 5, and 6 are situated to demonstrate that during the operating life of the facility (including closure), release of contaminants to the general public will not occur.

~~The DMP wells were located to intercept flow vectors downgradient away from the WIPP shafts area based on current density corrected potentiometric surfaces (Figure L-9). Based on natural contours of the potentiometric surface (Figure L-9) the selected well placement locations are downgradient of the general flow direction from the shaft area.~~ Transport modeling ~~of contaminant migration throughout the Culebra to the Land Withdrawal Act boundary~~ suggests~~s~~ that travel times from the Waste Handling Shaft to the LWA boundary could be on the order of thousands of years. ~~if, under worst case conditions,~~This assumes conditions where hazardous constituents ~~could~~ migrate from the sealed repository (post closure) to the Culebra via the

Formatted: No underline, Font color: Auto

sealed shafts. ~~. If contaminants were to migrate from the disposal facility, they would be detected by the DMP wells located midway between the shafts and LWA such that samples from wells could detect these contaminants long before they could reach the LWA boundary.~~

Potentiometric surfaces and ground-water flow directions defined for the Culebra prior to large-scale pumping in the WIPP facility -area and the excavation of WIPP facility shafts suggests that flow was generally to the south-southeast from the waste disposal and shaft areas (Mercer, 1983; Davies, 1989). ~~Recent (December 1996) p~~Potentiometric surface maps of the Culebra adjusted for density differences show very similar characteristics. The wells used for measuring the potentiometric surface of the Culebra are measured monthly and listed in Table L-4.

~~(Figure L-9). WQSP-4, WQSP-5, and WQSP-6 have been located downgradient of the waste emplacement areas according to present-day adjusted potentiometric surfaces.~~

~~Potentiometric surfaces that have not been corrected for density differences and that contain transient relics of previous pumping-drawdown events do not reflect accurate natural ground-water flow directions and should not be used to assess the adequacy of ground-water monitoring locations. Previous potentiometric surface maps showing a potentiometric low and hydrologic gradient toward the area between WQSP-3 and WQSP-4 had not been adjusted to freshwater head equivalents, and had also been influenced by the long-term pumping at well H-19. Hence, some historic maps may not represent natural Culebra flow directions or gradients, and appropriateness of the RCRA monitoring network cannot be definitively evaluated using these data.~~

L-3b(1) ~~DMP~~-Detection Monitoring Well Construction Specification

Diagrams of the six DMP wells are shown in Figures L-7 through L-12. Detailed descriptions of geology and construction methods may be found in DOE 1995.

~~L-3b(1)(i) WQSP-1~~

The six ~~WQSP~~ DMP Culebra wells were ~~Well WQSP-1 was~~ drilled between September 13 and October 16, 1994. The~~, to a~~ total depth of- each well is shown in Table L-5.~~737 ft (225 m) bgs~~ . The wells were ~~borehole was~~ drilled through the Culebra and ~~extends 15 ft (5 m) into the unnamed lower member of the Rustler~~Los Medaños as shown in Table L-5. The wells were~~was~~ drilled to the top of the Culebra ~~a depth of 693 ft (211 m) bgs~~ using compressed air as the drilling fluid and~~. The interval from 693 to 737 ft (225 to 211 m) bgs (the total depth) was drilled using air mist with a foaming agent as the drilling fluid. WQSP-1 was drilled to 695.6 ft (212 m) bgs using~~ a 9⅞-in. drill bit. The wells were then ~~and was~~ cored ~~from 695.6 to 737 ft (212 to 225 m) bgs~~ using a 5¼-in. core bit to cut 4-in. –(0.1-m) diameter core to total depth. See Table L-5 for the drilling and coring intervals for each well. After coring, ~~WQSP~~ DMP wells were ~~WQSP-1 was~~ reamed to 9⅞ -in. (0.3 m) in diameter to total depth. After reaming, wells were ~~WQSP-1 was~~ cased from the surface to total depth ~~737 ft (224.6 m) bgs~~ with 5-in. (0.1-m) (0.28-in. [0.7-centimeter (cm)] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval -as shown in Table L-5 ~~from 702 to 727 ft (214 to 222 m) bgs~~. The annulus between the borehole wall and the casing/screen is packed with sand ~~from 640 to 651 ft (195 to 198 m) bgs~~ and with 8/16 Brady gravel as indicated in Table L-5.~~from 651 to 737 ft (198 to 225 m) bgs. Based on core log results, the Culebra is located from 699 to 722 ft (213 to 220 m) bgs (see Figure L-10).~~

Formatted: Body

Comment [r2]: DMP? WQSP has been deleted from the acronyms table.

Comment [r3]: DMP?

~~L-3b(1)(ii) WQSP-2~~

~~Well WQSP-2 was drilled between September 6 and 12, 1994, to a total depth of 846 ft (257.9 m) bgs. The borehole was drilled through the Culebra and extends 12.3 ft (3.7 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 800 ft (244 m) bgs with a 9⅞-in. drill bit using compressed air as the drilling fluid. The interval from 800 to 846 ft (244 to 258 m) bgs (the total depth) was drilled with a 5¼-in. core bit to cut 4-in.- (0.1-m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-2 was reamed to 9⅞ in. (0.3 m) in diameter to total depth. WQSP-2 was cased from the surface to 846 ft (258 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 811 to 836 ft (247 to 255 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 790 to 793 ft (241 to 242 m) bgs and with 8/16 Brady gravel from 793 to 846 ft (242 to 258 m) bgs. Based on core log results, the Culebra is located from 810.1 to 833.7 ft (247 to 254 m) bgs (see Figure L-11).~~

~~L-3b(1)(iii) WQSP-3~~

~~Well WQSP-3 was drilled between October 21 and 26, 1994, to a total depth of 880 ft (268 m) bgs. The borehole was drilled through the Culebra and extends 10 ft (3.1 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 880 ft (268 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-3 was drilled to 833 ft (254 m) bgs using a 9⅞-in. drill bit and was cored from 833 to 879 ft (254 to 268 m) bgs using a 5¼-in. core bit to cut 4-in.- (0.1-m) diameter core. After coring, WQSP-3 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 880 ft (268 m) bgs. WQSP-3 was cased from the surface to 880 ft (268 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 844 to 869 ft (257 to 265 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 827 to 830 ft (252 to 253 m) bgs and with 8/16 Brady gravel from 830 to 880 ft (253 to 268 m) bgs. Based on core log results, the Culebra is located from 844 to 870 ft (257 to 265 m) bgs (see Figure L-12).~~

~~L-3b(1)(iv) WQSP-4~~

~~Well WQSP-4 was drilled between October 5 and 10, 1994, to a total depth of 800 ft (244 m) bgs. The borehole was drilled through the Culebra and extends 9.2 ft (2.8 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 740 ft (226 m) bgs with a 9⅞-in. drill bit using compressed air as the drilling fluid. The interval from 740.5 to 798 ft (225.7 to 243 m) bgs was cored with a 5¼-in. (0.13-m) core bit to cut 4-in.- (0.1-m) diameter core using air mist with a foaming agent as the drilling fluid. After coring, WQSP-4 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 800 ft (244 m) bgs. WQSP-4 was cased from the surface to 800 ft (244 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in.- (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 764 to 789 ft (233 to 241 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 752 to 755 ft (229 to 230 m) bgs and with 8/16 Brady gravel from 755 to 800 ft (230 to 244 m) bgs. Based on core log results, the Culebra is located from 766 to 790.8 ft (233 to 241 m) bgs (see Figure L-13).~~

~~L-3b(1)(v) WQSP-5~~

~~Well WQSP-5 was drilled between October 12 and 19, 1994, to a total depth of 681 ft (208 m) bgs. The borehole was drilled through the Culebra and extends into the unnamed lower member of the Rustler. The well was drilled to a depth of 676 ft (206 m) bgs using compressed air as the drilling fluid. The borehole was cleaned using air mist with a foaming agent. WQSP-5 was drilled to 648 ft (198 m) bgs using a 9⅞-in. drill bit and was cored from 648 to 676 ft (198 to 206 m) bgs using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core. After coring, WQSP-5 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 681 ft (208 m) bgs. WQSP-5 was cased from the surface to 681 ft (208 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 646 to 671 ft (197 to 205 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 623 to 626 ft (190 to 191 m) bgs and with 8/16 Brady gravel from 626 to 681 ft (191 to 208 m) bgs. Based on core log results, the Culebra is located from 648 to 674.4 ft (198 to 205.6 m) bgs (see Figure L-14).~~

~~L-3b(1)(vi) WQSP-6~~

~~Well WQSP-6 was drilled between September 26 and October 3, 1994, to a total depth of 616.6 ft (187.9 m) bgs. The borehole was drilled through the Culebra and extends 9.7 ft (3 m) into the unnamed lower member of the Rustler. The well was drilled to a depth of 367 ft (112 m) bgs using compressed air as the drilling fluid. The interval from 367 to 616 ft (112 to 188 m) bgs (the total depth) was drilled using brine as the drilling fluid. WQSP-6 was drilled to 568 ft (173 m) 4-in. (0.1-m) ft bgs using a 9⅞-in. drill bit and was cored from 568 to 616 ft (173 to 188 m) bgs using a 5¼-in. core bit to cut 4-in. (0.1-m) diameter core. After coring, WQSP-6 was reamed to 9⅞ in. (0.3 m) in diameter to total depth of 616.6 ft (188 m) bgs. WQSP-6 was cased from the surface to 616.6 ft (188 m) bgs with 5-in. (0.1-m) (0.28-in. [0.7-cm] wall) blank fiberglass casing with in-line 5-in. (0.1-m) diameter fiberglass 0.02-in. (0.1-cm) slotted screen across the Culebra interval from 581 to 606 ft (177 to 185 m) bgs. The annulus between the borehole wall and the casing/screen is packed with sand from 567 to 570 ft (173 to 173.7 m) bgs and with 8/16 Brady gravel from 570 to 616.6 ft (174 to 188 m) bgs. Based on core log results, the Culebra is located from 582 to 606.9 ft (177 to 185 m) bgs (see Figure L-15).~~

L-4 Monitoring Program Description

The WIPP DMP has been designed to meet the ground-water monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§264.90 through 264.101). The following sections of the monitoring plan specify the components of the DMP.

L-4a Monitoring Frequency

~~The seven RCRA monitoring wells have been sampled on a semiannual basis since their installation in 1995 to establish background ground-water quality in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98). This has included at least two full rounds of 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX analysis for samples from each of the proposed RCRA detection monitoring wells. In addition, ground-water samples were collected from the DMP wells (from March 1997 until waste emplacement) at a frequency of four sample replicates collected semiannually from each well for the indicator parameters of pH, specific conductance (**SC**), total organic carbon (**TOC**), and total organic halogen (**TOX**) to further establish background ground-water quality until detection monitoring in accordance with~~

~~20.4.1.500 NMAC (incorporating 40 CFR §264.98) becomes applicable. A total of four rounds of Appendix IX analysis will be conducted for samples from each well for use in background ground-water quality determinations.~~

~~Detection monitoring will start when the Permittees emplace waste and continue through the post-closure phase as required by 20.4.1.500 NMAC (incorporating 40 CFR §264.90[c]). During detection monitoring, one sample and one sample duplicate will be collected semiannually from each well in the RCRA detection monitoring network. As shown in Table L-2, the DMP will continue to collect ground-water quality samples for all seven wells on a semiannual basis during the life of the DMP. 20.4.1.500 NMAC (incorporating 40 CFR §264.97[g][2]) provides that an alternate sampling frequency to that provided in 20.4.1.500 NMAC (incorporating 40 CFR §264.98) may be proposed by the Permittees. Given the nature and rate of ground-water flow in the area surrounding WIPP, collecting and analyzing one sample semiannually will be protective of human health and the environment because any hazardous constituent leaving the underground disposal facility will not have the potential to migrate beyond the ground-water monitoring network in a one-year time frame. Ground-water flow characteristics are presented in detail in Addendum L1, Section L1-2a of the Amended Renewal Application (DOE, 2009).~~

Ground-water surface elevations will be monitored in each of the six~~seven~~ DMWs~~DMP wells~~ on a monthly basis. The ground-water surface elevation in each DMW ~~DMP well~~ will also be measured prior to each annual sampling event. The g~~G~~round-water surface elevation measurements in the WLMP wells~~other existing WQSP well sites~~ will also be monitored on a monthly basis when accessible ~~to supplement the area water-level database and to help define regional changes in ground-water flow directions and gradients~~. The characteristics of the DMW~~RCRA DMP~~ (sampling frequency, location) will be evaluated if significant changes are observed in the ground-water flow direction or gradient. ~~If any change occurs which could affect the ability of the DMP to fulfill the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F), the Permittees shall promptly notify NMED in writing and apply for a permit modification, if appropriate.~~

L-4b Analytical Parameters and Hazardous Constituents

The parameters listed in Part 5, Table 5.4.a and hazardous constituents listed in Part 5, Table 5.4.b ~~analytes of interest~~ are ~~analytes of interest~~ measured as part of the DMP. ~~to establish background ground-water quality prior to emplacement of waste include all indicator parameters and all other parameters listed in 20.4.1.500 NMAC (incorporating 40 CFR §264) Appendix IX. Field measurements of pH, SC, temperature, chloride, Eh, total iron, and alkalinity are also measured during background sampling.~~

~~The DMP was initiated upon waste emplacement, at which time the semiannual samples will be analyzed for the parameters listed in Table L-3. Parameters to be analyzed by the contract laboratory such as specific conductance, total dissolved solids, total suspended solids, density, pH, total organic carbon, and total organic halogens were included as indicator parameters because of their universal commonality to ground water. Parameters such as chloride, alkalinity, calcium, magnesium, and potassium were included as matrix-specific general indicator parameters. Calcium, magnesium, potassium, chloride, and iron may be deleted during detection monitoring, with prior approval of NMED. Organic and inorganic compounds on the right hand side of Table L-3 were chosen because they will occur in the waste to be disposed at the WIPP facility.~~ Additional hazardous ~~constituants~~constituents~~parameters~~ may be identified through changes to the list of hazardous waste numbers authorized for disposal at the WIPP

facility.~~the tentatively identified compound (TIC) process specified in the Waste Analysis Plan, Permit Attachment C.~~ If hazardous constituents~~compounds~~ are identified, these will be added to Part 5, Table 5.4.b~~the DMP list~~, unless the Permittees provide justification for their omission (e.g.~~,~~ hazardous constituent not in 40 CFR §264 Appendix IX)~~,~~, and this omission is approved by NMED.

Formatted: No underline, Font color: Auto

L-4c Ground-water Surface Elevation Measurement, Sample Collection and Laboratory Analysis

Ground-water surface elevations will be measured in each DMW~~well~~ prior to ground-water sample collection. Ground-water will be extracted using serial and final sampling methods. Serial samples will be collected until ground-water field indicator parameters stabilize or three well bore volumes, whichever occurs first, after which the final sample for complete analysis will be collected. Final samples will then be analyzed for the parameters and constituents in Part 5, Tables 5.4.a and 5.4.b.~~DMP analytical suite.~~

L-4c(1) Ground-water Surface Elevation Monitoring Methodology

The WIPP ground-water level monitoring program (**WLMP**) activities are conducted in accordance with the WIPP facility SOPs listed in Table L-3.~~is a subprogram of the DMP. The quality assurance activities of the WLMP are in strict accordance with WP 13-1, and the quality assurance implementing procedure specific to ground-water surface elevation monitoring is WIPP Procedure WP 02-EM1014[2]. Current versions of both WP 13-1 and WP 02-EM1014 are maintained in the WIPP Operating Record.~~

Groundwater surface elevation measurements will be taken monthly at each of the six DMWs and prior to the annual sampling event. Additionally, ~~Ground-water surface elevation monitoring is in progress now and will continue through the post-closure care period specified in Permit Part 7. This section of the plan addresses the activities of the WLMP during the preoperational and operational phases of WIPP.~~

~~Collection of ground-water surface elevation data is required by 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). These data also provide:~~

- ~~Data collection as required by the Environmental Monitoring Plan.~~
- ~~A means to fulfill commitments made in the Final Environmental Impact Statement (**FEIS**).~~
- ~~A means to comply with future ground-water inventory and monitoring regulations.~~
- ~~Input for making land use decisions, (i.e., designing long-term active and passive institutional controls for the site).~~

~~[2] WP 02-EM1014 "Groundwater Level Measurements" is a technical procedure that specifies the steps followed by Environmental Monitoring (**EM**) personnel for making manual ground-water level measurements in ground-water wells in the vicinity of the WIPP facility. The procedure provides general instructions including prerequisites, safety precautions, performance frequency, quality assurance, and records. Specific instructions are included for using the water level measurement electrical conductance probe and data management.~~

- ~~Assistance in understanding any changes to readings from the water-pressure transducers installed in each of the shafts to monitor water conditions behind the liners.~~

- ~~An understanding of whether or not the horizontal and vertical gradients of flow are changing over time.~~

~~The objective of the WLMP is to extend the documented record of ground-water surface elevation fluctuations in the Culebra and Magenta members of the Rustler in the vicinity of the WIPP facility and to meet the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264.97(f)). Ground-water surface elevation data will be collected from each well of the RCRA DMP. Ground-water surface elevation data will also be collected from other Culebra wells, as well as monitoring wells completed in other water-bearing zones overlying and underlying the WIPP repository horizon (see Figure L-18) when access to these zones is possible. This includes, but is not limited to, the Bell Canyon, the Forty-niner, the contact zone between the Rustler and Salado, and the Dewey Lake.~~

groundwater~~Ground-water~~ surface elevation measurements will be taken monthly in the other Culebra wells as listed in Table L-4, when accessible~~at least one accessible completed interval at each available well pad. At well pads with two or more wells completed in the same interval, quarterly measurements will be taken in the redundant wells (~~Wwell locations are shown in Figure L-14~~18)~~. ~~Ground-water surface elevation measurements will be taken monthly at each of the seven DMP wells, as well as prior to each sampling event.~~ If a cumulative ground-water surface elevation change of more than 2 feet is detected in any DMP well over the course of one year which is not attributable to site tests or natural stabilization of the site hydrologic system, the Permittees will notify NMED in writing and discuss the origin of the changes in the Annual Culebra Groundwater Report~~report~~ specified in Permit Part 5. Abnormal, unexplained changes in ground-water surface elevation will be evaluated to determine if they~~may~~ indicate changes in site recharge/discharge which could affect the assumptions regarding DMW~~DMP well~~ placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Ground-water surface elevation monitoring will continue through the post-closure care period specified in Permit Part 7. The Permittees may temporarily increase the frequency of monitoring to effectively document naturally occurring or artificial perturbations that may be imposed on the hydrologic systems at any point in time. This will be conducted in selected key wells by increasing the frequency of the manual ground-water surface elevation measurements or by monitoring water pressures with the aid of electronic pressure transducers and remote data-logging systems. The Permittees will include such additional data in the reports specified in Section L-5c.

Interpretation of ground-water surface elevation measurements and corresponding fluctuations over time is complicated at the WIPP facility by spatial variation in fluid density~~both vertically in well bores and areally from well to well~~. To monitor the hydraulic gradients of the hydrologic flow systems ~~at WIPP~~ accurately, actual ground-water surface elevation measurements will be monitored at the frequencies specified in Table L-2, and the Culebra groundwater densities of the fluids in the wells listed in Table L-4 ~~bores~~ will be measured annually. ~~When both of these parameters are known, equivalent freshwater heads will be calculated. The concept of freshwater head is discussed in Luszczynski (1961).~~

~~A discussion explaining the calculation of freshwater heads from mid-formation depth at WIPP can be found in Haug, et al. (1987). Freshwater heads are useful in identifying hydraulic gradients in aquifers of variable density such as those existing at the WIPP site. Freshwater head at a given point is defined as the height of a column of freshwater that will balance the existing pressure at that point (Lusczynski, 1961).~~

Measured Culebra ~~ground~~-water surface elevation data can be converted to equivalent freshwater head from knowledge of the density of the borehole fluid, using the following formula.

$$p = \rho_{\underline{v}}\underline{g}h$$

where

p = freshwater head (length of freshwater head~~pressure~~)
$\underline{v}$~~ρ~~ = average specific gravity of the borehole fluid (unitless ratio of borehole fluid density to density of fresh water)
$\underline{\rho}$~~g~~ = freshwater density (mass/volume)
h = fluid column height above the datum (length)

If the freshwater density is assumed to be 1.000 gram per cubic centimeter (g/cm^3), then the equivalent freshwater head is equal to the fluid column height times the average borehole fluid specific gravity.

Density measurements are made annually. Density for the DMWs will be expressed as specific gravity as measured in the field during sampling events using a hydrometer. Freshwater head for other Culebra wells will be calculated as described above from fluid density measurements obtained using pressure transducers.

~~density (expressed as specific gravity).~~

L-4c(1)(i) Field Methods and Data Collection Requirements

To obtain an accurate ground-water surface elevation measurement, a calibrated water-level measuring device will be lowered into a test well and the depth to water recorded from a known reference point. An SOP will be used when making water-level measurements for this program. The SOP will specify ~~When using an electrical conductance probe, the depth to water will be determined by reading the appropriate measurement markings on the embossed measuring tape when the alarm is activated at the surface. WIPP Procedure WP 02-EM1014 specifies~~ the methods to be used in obtaining groundwater-level measurements, and provide general instructions including prerequisites, safety precautions, performance frequency, quality assurance, data management, and records. ~~A current revision of this procedure will be maintained in the WIPP Operating Record.~~

L-4c(1)(ii) Ground-water Surface Elevation Records and Document Control

I~~All~~ incoming data will be processed in a ~~timely~~ manner that~~to~~ ensures~~assure~~ data integrity. The data management process for ground-water surface elevation measurements will begin with completion of the field data sheets. Date, time, tape measurement, equipment identification number, calibration due date, initial of the field personnel, and equipment/comments will be recorded on the field data sheets. If, for some unexpected reason, a measurement is not

possible (~~i~~e.~~g~~e., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report any security observations (i.e., well lock missing).

Data recorded on the field data sheets and submitted by field personnel will be subject to applicable SOPs (see Table L-3). ~~guidelines outlined in WIPP Procedures WP 02-EM3001[3] and WP 02-EM1014[4]. Current copies of these procedures are maintained within the WIPP Operating Record.~~ These procedures specify the processes for administering and managing such data. The data will be entered onto a computerized work sheet. The work sheet program ~~will~~ calculates ground-water surface elevation in both feet and meters relative to the top of the casing and also relative to mean sea level. The work sheet program adjusts ~~will also adjust~~ ground-water surface elevations to equivalent freshwater heads.

A check print will be made of the work sheet printout. The check print will be used to verify that data taken in the field was properly reported on the database printout. A minimum of 10 percent of the spreadsheet calculations will be randomly verified on the check print to ensure that calculations are being performed correctly. If errors are found, the work sheet will be corrected. ~~The data contained on the computerized work sheet will be translated into a database file. A printout will be made of the database file. The data each month will then be compiled into report format and transmitted to the appropriate agencies as requested by the Permittees.~~ Ground-water surface elevation data and equivalent freshwater heads for the~~all~~ Culebra wells in Table L-4 will be transmitted to NMED by May 31 and November 30~~one month after data are collected~~. Semi-annual groundwater reports will also include annotated hydrographs and trend analysis.

~~A computerized database file will be maintained for all ground-water surface elevation data. Monthly and quarterly data will be appended into a yearly file. Upon verification that the yearly database is free of errors, it will be appended into the project database file. A printed copy of the current project database (through December of the preceding year) will be kept in the Environment, Safety and Health Department (ES&H) EM fire-resistant storage area.~~

L-4c(2) Ground-water Sampling

L-4c(2)(i) Ground-water Pumping and Sampling Systems

~~The water-bearing units at WIPP are highly variable in their ability to yield water to monitoring wells. The Culebra, the most transmissive hydrologic unit in the WIPP area, exhibits transmissivities that range many orders of magnitude across the site area and is the primary focus of the DMP.~~

~~[3] WP 02-EM3001 "Administrative Processes for Environmental Monitoring Programs" is a management control procedure to provide the administrative guidance to be used by Environmental Monitoring (EM) personnel to maintain quality control (QC) associated with EM sampling activities and to assure that data acquired under the WIPP Environmental Monitoring Program are valid. The precautions and limitations portion of this procedure assure that only qualified personnel acquire samples under the EM program, that cross contamination of sampling equipment is prevented, and that sample hold times are not exceeded. The Performance portion of the procedure provides step-by-step instructions for Quality Assurance/Quality Control (QA/QC) implementation, the use of data sheets and sample tracking logbooks, sample tracking from collection to submittal, and actions to take if sample results indicate the potential for exceeding a regulatory limit.~~
~~[4] WP 02-EM1014 "Groundwater Level Measurement", is a technical procedure which lists the equipment required and the operational checks necessary to perform groundwater level measurements. This procedure as well as WP 02-EM3001 also provides information on performing validation and verification of laboratory data.~~

The ground-water pumping and sampling systems used to collect a ground-water sample from the six~~seven~~ -DMWs ~~new DMP wells~~ will provide continuous and adequate production of water so that a representative ground-water sample can be obtained. ~~The wells used for ground-water quality sampling vary in yield, depth, and pumping lift. These factors affect the duration of pumping as well as the equipment required at each well.~~

The type of pumping and sampling system to be used in a well depends primarily on the aquifer characteristics of the Culebra and well construction. The DMWs are ~~DMP wells will be~~ individually equipped with dedicated submersible pumping assemblies. Each well has a specific type of submersible pump, matched to the ability of the well to yield water during pumping. The down-~~-~~hole submersible pumps are ~~will be~~ controlled by a variable electronic flow controller to match the production capacity of the formation at each well.

~~The electronic flow controller allows personnel collecting samples to control the rate of discharge during well purging to minimize the potential for loss of volatiles from the sample.~~ As recommended in the "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986) the wells will be purged no more than~~a minimum of~~ three well bore volumes or ~~unit~~luntil fie~~lil~~ed parameters have stabilized, which-ever comes first. ~~at a rate that will minimize the agitation of recharge water. This will be accomplished by monitoring formation pressure and matching the rate of discharge from the well as nearly as possible to the rate of recharge to the well. WIPP Procedure WP 02-EM1002[5] specifies the methods used for controlling flow rates and monitoring formation pressure. A current version of this document will be maintained in the WIPP Operating Record.~~ Well purging will performed in accordance with an SOP ~~requirements will be used~~ in conjunction with serial sampling to determine when the ground-water chemistry stabilizes and is therefore representative of undisturbed ground-water.

The DMWs are~~DMP wells will be~~ cased and screened through the production interval with materials that do not yield contamination to the aquifer or allow the production interval to collapse under stress (high epoxy fiberglass). ~~Details of well construction are presented in Section L-3b(1).~~ An electric, submersible pump installation without the use of a packer is~~will be~~ used in this instance. The largest amount of discharge from the submersible pump ~~will~~ takes place from a discharge pipe. In addition to this main discharge pipe, a dedicated ~~Teflon®~~-sample line~~,~~ running parallel to the discharge pipe~~,~~ is ~~will also be~~ used. The sampling line is manufactured from a chemically inert material. ~~Flow through the pipe will be regulated on the surface by a flow control valve and/or variable speed drive controller.~~ Cumulative flow is~~will be~~ measured using a totalizing flow meter. Flow from the discharge pipe is ~~will be~~ routed to a discharge tank for disposal.

The dedicated ~~Teflon®~~-sampling line is~~will be~~ used to collect the water sample that will undergo analysis. By using a dedicated ~~Teflon®~~-sample line, the water will not be contaminated by the metal discharge pipe. The sample line will branch from the main discharge pipe a few inches above the pump. Flow from the sample line will be routed into the sample collection area. Flow

Comment [r4]: What is the difference b/w will/will not and is/is not? "is " is used throughout this paragraph

Comment [r5]: ???

---

[5] ~~WP 02-EM1002 "Electric Submersible Pump Monitoring System Installation and Operation" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples using electric submersible pumps (ESPs). The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure the correct installation and operation. The procedure details how to install the various subsystems such as the surface discharge and pressure monitoring system and the pressure monitoring bubbler and how to start up and shut down the ESP.~~

through the sample collection line is~~will be~~ regulated by a flow-control valve. The sample line is~~will be~~ insulated at the surface to minimize temperature fluctuations.

~~Pressure Monitoring Systems~~

~~The DMP wells do not require the installation of a packer because sample biases due to well construction deficiencies are not present. However, pressures will be monitored using down hole automatic air line bubblers in the formation to maintain the water level above the pump intake. Pressure transducers may be used in line with bubblers to provide continual electronic monitoring through data acquisition systems. WIPP Procedure WP 02-EM1002 provides instructions for monitoring formation pressure using automatic airline bubblers in conjunction with pressure transducers and data acquisition systems. A current version of this document will be maintained in the WIPP Operating Record.~~

~~The mobile field laboratory provides a work place for conducting field sampling and analyses. The laboratory will be positioned near the wellhead, will be climate controlled, and will contain the necessary equipment, reagents, glassware, and deionized water for conducting the various field analyses.~~

~~Sampling Overview~~

~~Two types of water samples will be collected: serial samples and final samples. Serial samples will be taken at regular intervals and analyzed in the mobile field laboratory for various physical and chemical parameters (called field indicator parameters). The serial sample data will be used to determine whether the sample is representative of undisturbed ground water as a direct function of the stabilization of field indicator parameters and the volume of the water being pumped from the well. Interpretation of the serial sampling data will enable the Team Leader (see Section L-7) to determine when conditions representative of undisturbed ground water are attained in the pumped ground water.~~

~~Final samples will be collected when the serially sampled field indicator parameters have stabilized and are therefore representative of undisturbed ground water.~~

L-4c(2)(ii) Serial Samples

Serial sampling is the collection of sequential samples for the purpose of determining when the ground-water chemistry stabilizes and is therefore representative of undisturbed ground-water. The Permittees' SOP for serial sampling will provide criteria for determining when a final sample should be taken. Each DMW will be purged to no more three well bore volumes, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when the field-analyzed parameter are within ± 5% of three consecutive measurements. A well bore volume is defined as the volume of water from static water level to the bottom of the well sump. Serial samples will be analyzed in the mobile filed laboratory for field indicator parameters. ~~will consider a serial sample representative of undisturbed ground water when the majority of field indicator parameter measurements have stabilized within ±5 percent of the average of analytical results for the field indicator parameter from the background ground-water quality for each DMP well. Nonstabilization of one or two field indicator parameters attributable to matrix interferences, instrument drift, or other unforeseen reasons will not preclude the collection of final samples, provided the volume of purged water exceeds three well bore volumes.~~ The Permittees ~~will report, in the operating record, any final samples collected when field indicator parameters were~~

~~not stabilized, and~~ will provide an explanation of why the sample was collected when field indicator parameters were not stabilized and place that explanation in the WIPP facility Operating Record.

Serial samples will be collected and analyzed to detect and monitor the chemical variation of the ground-water as a function of the volume of water pumped. Once serial sampling begins, the frequency at which serial samples are collected and analyzed will be left to the discretion of the Permittees,~~Team Leader (see Section L-7),~~ but will be performed a minimum of three times during a sampling round.

The Permittees will use appropriate field methods to identify stabilization of the following field indicator parameters: pH, ~~chloride, divalent cations (hardness), alkalinity, total iron, pH, Eh,~~ temperature, specific conductance, and specific gravity.

~~Protocols for collection of serial samples are specified in WIPP Procedure WP 02-EM1006[6]. Analysis of serial samples are specified in WIPP Procedure WP 02-EM1005[7]. Current versions of these procedures will be maintained in the WIPP Operating Record.~~

The three field indicator parameters of temperature, specific ~~conductance~~conductance ~~Eh~~, and pH will be determined by either an "in-line" technique, using a self-contained flow cell, or an "off-line" technique, in which the samples will be collected from a ~~Teflon®~~-sample line at atmospheric pressure. SS~~The iron, divalent cation, chloride, alkalinity, s~~pecific conductance~~,~~ and specific gravity samples will be collected from the ~~Teflon®~~-sample line at atmospheric pressure. Because of the lack of sophisticated weights and measures equipment available for field density assessments, field density evaluations will be expressed in terms of specific gravity, which is a unitless measure. Density is expressed as unit weight per unit volume.

New polyethylene containers, that are certified clean by the laboratory, will be used to collect the serial samples from the ~~Teflon®~~-sample line.

Serial samples collected in laboratory-certified clean containers do not require rinsing prior to sample collection. ~~Serial sampling water collected for solute and specific conductance determinations will be filtered through a 0.45 micrometers (µm) membrane filter using a stainless-steel, in-line filter holder. Filtered water will be used to rinse the sample bottle prior to serial sample collection.~~ Unfiltered ground-water will be used when determining temperature, pH, specific conductance ~~Eh~~, and specific gravity. Sample bottles will be properly identified and labeled.

Samples collected will immediately be analyzed for pH and specific conductance (SC) as these parameters are most sensitive to changes in ambient temperature. ~~The filtered sample collected~~

~~[6] WP 02-EM1006 "Final Sample and Serial Sample Collection" is a technical procedure that provides step-by-step instructions for acquiring ground-water samples from the WQSP wells and from privately-owned wells in the vicinity of WIPP. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, and prerequisite actions which assure the data quality. The procedure addresses collection of samples from private wells, collection of serial ground-water samples, the collection of final samples for submittal to the laboratory, and data review by the monitoring task leader.~~

~~[7] WP 02-EM1005 "Groundwater Serial Sample Analysis" is a technical procedure that provides step-by-step instructions for on-site analysis of ground-water to determine ground-water stability prior tot he collection of final samples for analysis. The procedure addresses the equipment in general, lists precautions and limitations which assure that only qualified individuals operate the equipment, prerequisite actions which assure data quality. The procedure addresses the field measurement of Eh, pH, temperature, specific gravity, specific conductance, alkalinity, chloride, divalent cation, and total iron as indicators of ground-water stability.~~

~~for solute analyses will be immediately analyzed for iron and alkalinity because these two solution parameters are extremely sensitive to changes in the ambient water-sample pressure and temperature. A sample and duplicate of filtered water will be collected and analyzed for solute parameters (alkalinity, chloride, divalent cations, and iron).~~ Temperature, pH, and specific conductance ~~Eh~~, when not measured in a flow cell, will be measured at the approximate time of serial sample collection. These samples will be collected from the unfiltered sample line.

~~Samples to be analyzed for chloride and divalent cations (after preservation with nitric acid and stored at 4°C) may be stored for one week prior to analysis with confidence that the analytical results will not be altered.~~

Upon completion of the collection of the last serial sample suite, the serial sample bottles accrued throughout the duration of the pumping of the well will be discarded. No serial sample bottles will be reused for sampling purposes of any sort. However, serial samples may be stored for a period of time depending upon the need. Standard Operating Procedures (see Table L-3) ~~WIPP Procedure WP 02-EM1006~~ defines the protocols for the collection of final and serial samples and analysis. ~~WIPP Procedure WP 02-EM1005 defines the protocols for serial sample analysis. Current versions of these procedures will be maintained in the WIPP Operating Record.~~

~~During the first two years of DMP well serial sampling, the first sample will be analyzed as soon as possible after the pump is turned on and daily thereafter for a period of four days or until the field indicator parameters (chloride, divalent cations, alkalinity, and iron) stabilize. Eh, pH, and SC will be continually monitored by using a flow cell with ion-specific electrodes and a real-time readout. When detection monitoring begins, the serial sampling process may be modified and the decision to collect final samples would then be based on the number of well bore volumes purged and results of the analysis of chloride, temperature, specific gravity, pH, Eh, and SC. Removal of serial sampling from the DMP will be accomplished through a permit modification and a modification to this plan.~~

L-4c(2)(iii) Final Samples

The final sample will be collected once the measured field indicator parameters have stabilized (refer to Section L-4(c)(2)(ii)). A serial sample will also be collected and analyzed for each day of final sampling to ensure that samples collected for laboratory analysis are still representative of stable conditions. Sample preservation, handling, and transportation methods will maintain the integrity and representativeness of the final samples.

Prior to collecting the final samples, the collection team shall consider the analyses to be performed so that proper shipping or storage containers can be assembled. Table L-~~6~~4 presents the sample containers, volumes, and holding times for laboratory samples collected as part of the DMP.

The monitoring system will use dedicated pumping systems and sample collection lines from the sampled formation to the well head. ~~Non-dedicated sample collection lines from the well head to the sample collection area will be discarded after each use.~~

Sample integrity will be ensured through appropriate decontamination procedures. Laboratory glassware will be washed after each use with a solution of nonphosphorus detergent and deionized (**DI**) water and rinsed in DI water. Sample containers will be new, certified clean

containers that will be discarded after one use. Ground-water surface elevation measurement devices will be rinsed with fresh water after each use. Non-dedicated sample collection manifold assemblies will be rinsed ~~with two gallons of fresh water, then rinsed~~ in accordance with SOPs ~~with five gallons of 5 percent nitric acid solution and rinsed with five gallons of DI water~~ after each use. The exposed ends will be capped off during storage. Prior to the next use of the sampling manifold, it will be rinsed a second time with DI water and a ~~blank~~ rinsate blank sample will be collected to verify cleanliness~~decontamination~~.

Water samples will be collected at atmospheric pressure using either the filtered or unfiltered ~~Teflon®~~-sampling lines ~~branching from the main sample line~~. Detailed protocols, in the form of SOPs (see Table L-3) define how ~~procedures, assure that~~ final samples will be collected in a consistent and repeatable fashion~~. WIPP Procedure WP 02-EM1006 defines the requirements for collection of final samples~~ for analyses.

~~A current version of this procedure will be maintained in the WIPP Operating Record.~~

Final samples will be collected in the appropriate type of container for the specific analysis to be performed. The samples will be collected in new and unused glass and plastic containers (refer to Table L-~~6~~4). For each parameter analyzed, a sufficient volume of sample will be collected to satisfy the volume requirements of the analytical laboratory (as specified by laboratory ~~Standard Operating Procedures [~~**SOPs**~~]~~). This includes an additional volume of sample water necessary for maintaining quality control standards. All final samples will be treated, handled, and preserved as required for the specific type of analysis to be performed. Details about sample containers, preservation, and volumes required for individual types of analyses are found in the applicable SOPs~~procedures~~ generated, approved, and maintained by the contract analytical laboratory.

~~Before the final sample is taken, all plastic and glass containers will be rinsed with the pumped ground water, either filtered or unfiltered, dependent upon analysis protocol. When the rinsing procedure is completed the final sample will be collected.~~

Final samples will be sent to the analytical ~~contract~~ laboratories and analyzed for parameters and hazardous constituents specified in Part 5, table 5.4a and 5.4b.

~~general chemistry, radionuclides, metals, and selected VOCs that are specific to the waste anticipated to arrive at WIPP. Table L-3 presents the specific analytes for the DMP.~~

Duplicates of the final sample will be provided to WIPP Project oversight agencies when~~as~~ requested. ~~by the Permittees or NMED.~~

W~~Resulting w~~astes resulting from the sampling and field analysis of groundwater are disposed of in accordance with the WIPP SOPs (see Table L-3).~~Procedure WP 02-RC.01[8]. A current version of this procedure will be maintained in the WIPP Operating Record.~~

~~[8] WP 02-RC.01 "Site-Generated, Non-Radioactive Hazardous Waste Management Plan" is a step-by-step procedure that defines site-generate non-radioactive hazardous waste (SGNRHW) and lists responsibilities of waste management organizations including the generator, waste handlers, sampling personnel, safety personnel, and compliance personnel. In addition, the procedure defines training requirements, container marking requirements, spill response, and list prohibitions. A Section of the procedure is focused on~~

L-4c(2)(iv) Sample Preservation, Tracking, Packaging, and Transportation

Many of the chemical constituents measured by the DMP are not chemically stable and require preservation and special handling techniques. Samples requiring acidification will be treated ~~with either high purity hydrochloric acid, nitric acid, or sulfuric acid (ULTREX or equivalent), depending upon the standard method of treatment required for the particular parameter suite or~~ as requested by the analytical ~~contract~~ laboratory ~~SOPs (see Table L-4)~~.

The analytical ~~contract~~ laboratory receiving the samples will ~~use procedures that~~ prescribe the type and amount of preservative, the container material type, ~~and~~ the required sample volumes that shall be collected, and the shipping requirements. This information will be recorded on the Final Sample Checklist for use by field personnel when final samples are being collected. The Permittees will follow the EPA "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Table 4-1 (EPA, 1986), when~~if~~ laboratory SOPs do not specify sample container, volume, or preservation requirements. WIPP SOPs (see Table L-3) provide instructions to ensure proper sample preservation and shipping.

The sample tracking system at the WIPP facility uses~~will use~~ uniquely numbered chain of custody/ ~~(**CofC**) Forms and~~ request for analysis -(CofC/RFA) forms~~(**RFA**) Forms~~. The primary consideration for storage or transportation is that samples shall be analyzed within the prescribed holding times for the analytes~~parameters~~ of interest. WIPP SOPs (see Table L-3) ~~Procedure WP 02-EM3001~~ provides instructions to ensure proper sample tracking protocol. ~~A current revision of this procedure will be maintained within the WIPP Operating Record.~~

~~Insulated shipping containers packaged with crushed ice or reusable ice packs will be used to keep the samples cool during transport to the contract laboratory. Holding times for specific analytical parameters require samples to be shipped by express air freight. The coolers will be packaged to meet Department of Transportation and International Air Transportation Association commercial carrier regulations.~~

L-4c(2)(v) Sample Documentation and Custody

To ensure the integrity of samples from the time of collection through reporting date, sample collection, handling, and custody shall be documented. Sample custody and documentation procedures for ~~EM~~ sampling and analysis activities are detailed in WIPP facility SOPs (see Table L-3). ~~Procedure WP 02-EM3001. These procedures will be strictly followed throughout the course of each sample collection and analysis event. A current revision of this procedure will be maintained in the WIPP Operating Record.~~

Standardized forms used to document samples will include sample identification numbers, sample labels, custody tape, the sample tracking -data~~log books~~, and CofC/RFA ~~the request for analysis/chain of custody (RFA and CofC)~~ form~~.~~. An example form is shown in Figure L-13. ~~The forms are briefly defined in the following subsections.~~

~~All sample documentation will be completed for each sample and reviewed by the Team Leader or his/her designee for completeness and accuracy.~~

~~waste management practices including the management in satellite accumulation areas, the hazardous waste staging area for materials awaiting analysis, the establishment of accumulation times, and hazardous waste disposal.~~

Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. ~~The Team Leader (see Section L-7) will assign the numbers prior to sample collection.~~ The sample identification numbers will be used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory for analysis will be identified with a label affixed to it. Sample label information will be completed in ~~permanent,~~ indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

Custody Seals

Custody seals will be used to detect unauthorized sample tampering from collection through analysis. For example, ~~The~~ custody seals that are~~will be~~ adhesive-backed strips ~~that~~ are destroyed when removed or when the container is opened. The seal will be dated, initialed, and affixed to the sample container in such a manner that it is necessary to break the seal to open the container. Seals will be affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal will invalidate the sample.

Sample Identification and Tracking~~ Logbook~~

~~A~~S~~ s~~ample tracking information will be completed for each sample collected~~logbook (STLB) form will be completed for each sample collected~~. The sample tracking information~~STLB will~~ includes the following information: CofC/RFA form ~~C of C~~ number; ~~RFA No.~~ ~~,~~ date sample(s) were sent to the lab; laboratory name; acknowledgment of receipt or comments; well name and round number. Sample codes will indicate the well location; the geologic formation where the water was collected from, the sampling round number; and the sample number. The code is broken down as follows:

$$WQ6^{1}C^{2}R2^{3}N1^{4}$$

[1] Well identification (e.g., WQSP-6 in this case)
[2] Geologic formation (e.g., the Culebra in this case)
[3] Sample round no. (Round 2)
[4] Sample no. (N1)

To distinguish duplicate samples from other samples, a "D" is added as the last digit to signify a duplicate. Sample tracking~~STLB~~ information will be completed in the field by the sampling team.

Sample tracking is monitored and documented with the CofC/RFA form and the shipping airbill. Both of these documents are included in the data packets. Receipt at the analytical laboratory may be monitored, if necessary, via the shipper's website tracking application. Samples are considered complete when a copy of the original CofC/RFA form is merged with the Field Lab copy of the same document~~, and checked by the Team Leader. When samples are shipped, the STLB will remain in the custody of the EM Section for sample tracking purposes.~~

Formatted: Font color: Auto

Formatted: Underline

~~Request for Analysis and~~ Chain of Custody and Request for Analysis

A CofC/RFA~~n RFA and CofC~~ form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal.~~ An example of the RFA and CofC form is presented in Figures L-17a and L-17b~~ . ~~-~~The CofC/RFA ~~RFA and CofC~~ form will be signed and dated each time the sample custody is transferred. A sample will be considered to be in a person's custody if: the sample is in his/her physical possession; the sample is in his/her unobstructed view; and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's air bill number serves as custody verification. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the ~~-~~CofC/RFA form. ~~RFA and CofC.~~ The completed original (top page) of the CofC/RFA ~~RFA and CofC~~ will be returned to the Permittees ~~Team Leader~~ with the laboratory analytical report and becomes part of the permanent record of the sampling event. The CofC/RFA ~~RFA and CofC~~ form also contains specific instructions to the analytical laboratory for sample analysis, potential hazards, and disposal instructions.

L-4c(3) Laboratory Analysis

Analysis of samples will be performed ~~by~~ using m~~a commercial laboratory. M~~ethods ~~will be specified in procurement documents and will be~~ selected to be consistent with EPA recommended procedures in SW 846 (EPA, 1996). Additional detail on analytical techniques and methods will be given in laboratory SOPs. In Part 5, Tables 5.4.a and 5.4.b ~~L-3~~ presents the analytical parameters and hazardous constituents for the WIPP DMP.

The Permittees will establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in SW 846 and that the laboratory follow EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical ~~selected~~ laboratory shall demonstrate, through laboratory ~~SOPs, that~~SOPs that it will follow appropriate EPA SW 846 requirements and the requirements specified by the EPA protocols unless alternate methods or protocols are approved by the NMED. The analytical laboratory shall also provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation will be retained in the WIPP facility O~~o~~perating R~~r~~ecord. ~~and will be available for review upon request by NMED.~~ Instrumentation sensitivity needs to be considered because of regulatory requirements governing constituent concentrations in ground water and the complexity of brines associated with the Culebra groundwater~~WIPP repository~~.

The laboratory will maintain documentation of sample handling and custody, analytical results, and internal quality control (**QC**) data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside of laboratory acceptance limits will trigger an evaluation and, if appropriate, corrective action as directed by the Permittees. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above. ~~Once the initial qualification criteria, as specified above, have been met, the Permittees will select a laboratory based upon competitive bid. The selected laboratory will perform analytical work for the Permittees for a predetermined period of time, as specified in the contract between the Permittees and the selected laboratory. As this period of performance comes to an end, a new laboratory selection/competitive bid process will be initiated by the Permittees. The same or a~~

~~different laboratory may be selected for the new contract period.~~ A copy of the laboratory~~The~~ SOPs ~~for the laboratory currently under contract~~ will be maintained ~~in a file~~ in ~~-~~WIPP facility files~~the operating record by the Permittees~~. The Permittees will provide NMED with an initial set of applicable laboratory SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis by January 31.

Data validation will be performed and reported in the Annual Culebra Groundwater Report and will be maintained in the WIPP facility Operating Record. ~~on behalf of the Permittees by the Management and Operating Contractor (**MOC**) Environmental Monitoring (**EM**). Data validation results are documented on an Approval/Variation Request (**AR/VR**) form (Procedure WP 15-PC3041). If no discrepancies are found in the data, the AR/VR form will be signed and the approved box will be checked. If however, discrepancies are found, the AR/VR form will be signed and the disapproved or approved-on-condition box will be checked and the form will be returned to the team leader accompanied by an attached report discussing the data validation results, any anomalies, and resolutions. Copies of the data validation report will be distributed to the EM Manager, QA Manager, the Team Leader, and the Contract Administrator. Copies of the data validation report will be kept on file in the EM records section for review upon request by NMED.~~

L-4d Calibration

L-4d(1) Sampling and Groundwater Elevation Monitoring Equipment Calibration ~~Requirements~~

The equipment used to collect data for ~~the WQSP and~~ this DMP will be calibrated in accordance with SOPs~~maintenance administrative procedures specified below~~. The Permittees ~~EM Section~~ will be responsible for calibrating needed equipment on schedule and~~, in accordance with written procedures. The EM Section will also be responsible~~ for maintaining current calibration records for each piece of equipment.

L-4d(2) Ground-water Surface Elevation Monitoring Equipment Calibration Requirements

The equipment used in taking ground-water surface elevation measurements will be maintained in accordance with WIPP facility SOPs (see Table L-3). ~~Procedure WP 10-AD3029[9] A current revision of this procedure will be maintained in the WIPP Operating Record.~~ The Permittees ~~EM Section~~ will be responsible for ensuring ~~calibrating the needed~~ equipment is calibrated on schedule in accordance with ~~-~~SOPs~~written procedures~~. The Permittees ~~EM Section~~ will also be responsible for maintaining copies of records of the most recent ~~current~~ calibration ~~records~~ for each piece of equipment.

~~[9] WP 10-AD3029 "Calibration and Control of Monitoring and Data Collection Equipment" provides the step-by-step protocols for the establishment and maintenance of a master database of monitoring and data collection (**M&DC**) equipment, the recall process for equipment needing calibration, the performance of calibrations, the management of calibration results to determine the adequacy of recall frequencies, functional testing of M&DC equipment, and reporting including out-of-tolerance reporting and expired calibration reporting. In addition, the procedure provides step-by-step process for the storage of calibrated M&DC equipment and the use of rental equipment.~~

L-4e Statistical Analysis of Laboratory Analytical Data

Analytical data collected ~~As required by 20.4.1.500 NMAC (incorporating 40 CFR §§264.97 and 264.98), data collected to establish background ground-water quality and~~ as part of the DMP will be evaluated using appropriate statistical techniques. The following specifies the statistical analysis to be performed by the Permittees.~~DMP. Statistical analysis of DMP data will conform to EPA guidance "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (EPA, 1989) and "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

L-4e(1) Temporal and Spatial Analysis

Temporal and spatial analyses of the data were completed as part of establishing the water quality baseline (Crawley and Nagy, 1998; IT, 2000). As a result, the Permittees determined to evaluate changes relative to baseline on an individual location basis and to report the concentrations of constituents as a time series, either in tabular form or as time plots. No particular seasonal variations have been noted in the concentrations of groundwater samples collected during the spring and autumn; therefore, continuing temporal analysis is not required.

The analytical results for constituents will be reported as time series, either in tabular form or as time plots or both, and compared to the 95th percentile values or reporting limits identified in Part 5, Table 5.6.

~~Environmental parameters vary with space and time. The effect of one or both of these two factors on the expected value of a point measurement will be statistically evaluated through spatial analysis and time series analysis. These methods often require extensive sampling efforts that may exceed the practical limits of the DMP sampling procedures.~~

~~Spatial analysis may have limited use DMP during the operational period, although the effect of spatial auto-correlation on the interpretation of the data will be considered for each parameter. Spatial variability will be accounted for by the use of predetermined key sampling locations. Data analysis will be performed on a location-specific basis, or data from different locations will be combined only when the data are statistically homogeneous. Statistical homogeneity will be determined by evaluating mean values and variances from the residuals from the individual well data.~~

~~Time series analysis plays a more important role in data analysis for the DMP. Parameters will be reported as time series, either in tabular form or as time plots. For key time series parameters, these plots will be in the form of control charts on which control levels will be identified based on preoperational database, fixed standards, control location databases, or other standards for comparison. Where significant seasonal changes in the expected value of the parameter are identified in the preoperational database or in the control locations, corrections in the control levels which reflect the seasonal change will be made and documented.~~

L-4e(2) Distributions and Descriptive Statistics

Techniques were established to compare detection monitoring data generated during the baseline studies. A 95th upper tolerance limit value (**UTLV**) or 95th percentile was determined from those data sets where target analytes were measured at concentrations above the method

detection limits. The UTLV is provided for normal or lognormal distributions and a 95th percentile confidence interval is provided for data sets that are nonparametric or have greater than 15 percent non-detects. For analytes with only a few detects (greater than 95 percent non-detects), an accurate 95th percentile cannot be calculated. For these analytes, the maximum detected concentration is used as the baseline value. For the analytes that are non-detect in all the samples, the method reporting limit was used as the baseline value.

~~For data sets which include more than ten data points that are homogeneous in space and time (including seasonal homogeneity) and have less than ten percent missing data, a test for conformance to the normal distribution will be performed. The test for normality of the data will be performed in accordance with the methodologies presented in "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992).~~

~~If normality is not met, the data will be log-transformed (or transformed using a suitable mathematical transformation, e.g., square root) and retested for normality. If the transformed data fit a normal distribution, the original data will be accepted as having lognormal or an otherwise mathematically-transformed normal distribution. If normality is still not found, two courses may be taken. One will be to continue to test the fit to standard families of distributions, such as the gamma, beta, and Weibull, with proper modifications to subsequent analyses based on these results. The other course will be to use nonparametric methods of data analysis.~~

~~For data sets smaller than ten, but homogeneous and complete, the lognormal distribution will be assumed. Data sets with more than ten percent missing data will be analyzed using nonparametric methods. Nonhomogeneous data sets will be subdivided into homogeneous sets and each of these analyzed individually.~~

~~Descriptive statistics will be calculated for each homogeneous data set. At a minimum, these include a central value and a range of variation. The central value is the arithmetic mean of the untransformed data if the data are not censored at either end. If the data are censored, either a trimmed mean or the median will be used as the central value (which may be within the censored range). If the data set is greater than ten and is uncensored, the standard deviation will be calculated and used as a basis for the reported range in variation. If these criteria are not met, the range between the 0.25 and 0.75 cartelist will be used.~~

L-4e(3) Action Levels~~Data Anomalies~~

Using baseline distributions, actions levels were identified in accordance with methodologies described in the baseline documents. Action levels are based on the 95th percentile or reporting limits identified in the baseline. If the groundwater concentration of a constituent identified in Part 5, Table 5.6 is found to exceed an action level, a test for outliers is performed in accordance with the ~~Data anomalies include data points reported as being below the limit of detection (LD) or otherwise censored over a specific range of values, missing data points occurring randomly in the data set, and outliers that cannot be ascribed to a known source of variation.~~

~~Whenever possible, sample values which are reported below detection limits will be incorporated into the database as sample values measured at one-half the detection limit for statistical analysis. When values are not available, alternative methods of analysis, as specified~~

~~in previous sections, will be used. In particular, the use of nonparametric statistics will be required.~~

~~Missing data points comprising less than 10 percent of the data set do not significantly affect data analyses. Results based on data in which more than 10 percent is missing will be identified as such at the time of reporting. Consideration of the potential effect of missing data shall be made when the majority of the data are missing from a discrete time span.~~

~~Formal testing for outliers will only be done in accordance with EPA guidance. The~~ methodologies specified in ~~Section 8.2 of the~~ "Statistical Analysis of Ground-w~~W~~ater Monitoring Data at RCRA Facilities" (EPA, 2009~~1989~~). ~~will be used to check for outliers.~~

~~If an outside source of variation is not identified to account for outliers in a data set, it will be included in the data set and all subsequent analyses. If the inclusion of such outliers is found to affect the final results of the analyses significantly, both results (with and without outliers) will be reported.~~

L-4e(4) Comparisons and Reporting

Prior to TRU mixed waste receipt, measurements were made of each background ground-water quality hazardous constituent specified in Part 5, Table L-5.4b~~3~~ at every detection ~~DMP ground-water~~ monitoring well during each of the ten background sampling events (with the exception of trans-1,2-dichloroethylene and vanadium that were added after TRU mixed disposal began). ~~If any background ground-water quality parameter or constituent has not been measured prior to waste receipt, measurements will be made for those parameters or constituents in hydraulically upgradient DMP ground-water monitoring wells for a sequence of four sampling events. Following completion of the four sampling events, the arithmetic mean and variance shall then be calculated by the field supervisor or designee for each well.~~ These measurements ~~will then~~ serve as a statistical baseline (Part 5, Table 5.6)~~background value~~ that is ~~against which~~ used ~~statistical values~~ for evaluating the significance of the results of subsequent sampling events during detection monitoring ~~will be compared.~~ Time-trend control charts with associated screening values for each hazardous constituent are used for this evaluation. The Permittees will compare the results from groundwater hazardous constituents of ongoing annual groundwater sample analysis to these baseline values in accordance with ~~Statistical analysis and comparison will be accomplished using one of the five statistical tests specified in~~ 20.4.1.500 NMAC (incorporating 40 CFR §264.97~~98~~(h)(4)), ~~which may include Cochran's Approximation to the Behrens-Fisher students' t-test at the 0.01 level of significance (described in Appendix IV to 20.4.1.500 NMAC (incorporating 40 CFR §264).~~ If the comparisons show that a constituent statistically exceeds the baseline ~~a significant increase at any~~ of the DMWs ~~monitoring site~~ (as defined in 20.4.1.500 NMAC (incorporating 40 CFR §264.98(f))), the well shall be resampled and an analysis performed as soon as possible, in accordance with 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)(3~~2~~)). The results of the statistical comparison will be reported annually to ~~in~~ the NMED in the Annual Culebra Groundwater ~~Site Environmental~~ Report by November 30, ~~(**ASER**), and will be reported to NMED~~ as required under 20.4.1.500 NMAC (incorporating 40 CFR §264.98(g)). ~~in October.~~

L-5 Reporting

L-5a Laboratory Data Reports

Laboratory data will be provided in electronic and hard copy reports to the Permittees~~. Laboratory data reports will be forwarded to the Team Leader (see Section L-7) and NMED~~ and will contain the following information for each analytical report:

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.
- Header information for each analytical data summary sheet including: sample number and corresponding laboratory identification number; sample matrix; date of collection, receipt, preparation and analysis; and analyst's name.
- Parameter and hazardous constituents~~Analytical parameter~~, analytical results, reporting units, reporting limit, analytical method used.
- Results of QC sample analyses for all concurrently analyzed QC samples.

All analytical results will be provided to NMED as specified~~s~~ in the Permit Part 5.

L-5b Statistical Analysis and Reporting of Results

Analytical results for hazardous constituents from ~~semi-~~annual ground-water sampling activities will be compared and interpreted by the Permittees ~~Team Leader~~ through generation of statistical analyses as specified in Section L-4e. The Permittees ~~Team Leader~~ will perform statistical analyses; the results will be included in the Annual Culebra Groundwater Report ~~ASER~~ in summary form, and will also be provided to NMED as specified in Permit Part 5.

L-5c Semi-Annual Groundwater Surface Elevation Report and Annual Culebra Groundwater ~~Site Environmental~~ Report

Data collected from this DMP will be reported to NMED as specified in Permit Part 5 in the Annual Culebra Groundwater Report~~, and to the EM Manager and NMED in the ASER~~. The report~~ASER~~ will include all applicable information that may affect the comparison of background ground-water quality and ground-water surface elevation data through time. This information will include but is not limited to:

- DMW and WLMP w~~W~~ell configuration changes that may have occurred from the time of the last measurement (i.e., plug installation and removal, packer removal and reinstallation, or both; and the type and quantity of fluids that may have been introduced into the test wells).
- P~~Any~~ pumping activities that may have taken place since publication of the last annual report (i.e., related to ground-water quality sampling, hydraulic testing, and shaft installation or grouting~~ activities~~) that may have taken place since the last annual groundwater report.

- A discussion of the origins of abnormal unexpected changes in the groundwater surface elevation, which is not attributable to site tests or natural stabilization of the site hydrologic system that exceeds 2 ft in a DMP well over the course of the period covered by the Annual Culebra Groundwater Report (this may indicate changes in recharge/discharge which would affect the assumptions regarding DMP well placement and constitute new information as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.41(a)(2)).

Formatted: Font color: Auto

- The results of the annual measurements of densities.
- Annotated hydrographs.
- Groundwater flow rate and direction.
- Potentiometric surface map generated using the following steps:
  - Examine hydrographs to identify month having the largest number of Culebra water levels available with the fewest wells affected by pumping or other anthropogenic events.
  - Convert water levels from subject month to equivalent freshwater heads using fluid densities appropriate to the date.
  - Fit trend surface through freshwater heads.
  - Extrapolate the trend surface to the boundaries of the model domain used for the current Performance Assessment Baseline Calculations (**PABCs**) and define initial fixed-head boundary conditions based on the trend surface.
  - Using the ensemble-average Culebra transmissivity field used for the current PABC, optimize the model boundary heads to improve the fit of the model to the freshwater heads at the wells using optimization software interactively with MODFLOW.
  - Run MODFLOW with optimal boundary conditions fit.
  - Contour MODFLOW head results on WIPP site.
  - Compute particle path and travel time from the Waste Handling Shaft to the LWA Boundary.
  - Data analysis that will accompany the potentiometric surface map will include:
    - Measured versus modeled scatter plot diagram
    - Frequency of modeled head residuals
    - Modeled residual freshwater head at each well
    - Explanations for modeled misfit residuals greater than 16.4 feet (5 meters).

- Semi-annual groundwater surface elevation results will be reported as specified in Permit Part 5, Condition 5.10.2.2.

- ~~Radionuclide-specific data collected during the previous year.~~

Formatted: Bullet 2nd Indent, Indent: Left: 0.5"

The DMP data used in generating the Annual Culebra Groundwater Report~~ASER~~ will be maintained as part of the WIPP facility O~~o~~perating R~~r~~ecord and will be provided to NMED for review as specified in the permit.

L-6 Records Management

Records generated during ground-water sampling and water level ~~ground-water surface elevation~~ monitoring ~~events~~ will be maintained in either ~~the form~~ project files -at the Permittees facility or the Operating Record~~in the EM section~~. Project files ~~records~~ will include, but are not limited to:

- Sampling and Analysis Plans (**SAPs**)
- SOPs
- Field Data Entry Sheets
- CofC/~~STLBs~~
- RFA ~~and CofC~~ forms
- ~~Contract~~ Analytical Laboratory Data Reports
- Variance Logs and Nonconformance Reports
- Corrective Action Reports.

Detection Monitoring Program monitoring, testing, and analytical data ~~These and all raw analytical records generated in conjunction with ground-water sampling~~ and WLMP data ~~ground-water surface elevation monitoring~~ will be maintained in the WIPP facility Operating Record. ~~stored in fire resistant cabinets in the EM section according to the Records Inventory and Disposition Schedule (**RIDS**) and will be made available for inspection upon request. The following records will be transmitted to the Permittees' Project Records Services (**PRS**) for long-term storage in accordance with the RIDS:~~

- ~~Instrument maintenance and calibration records~~
- ~~QC sample data~~
- ~~Control charts and calculation~~
- ~~Sample tracking and control documentation~~
- ~~Raw analytical results.~~

~~L-7 Project Organization and Responsibilities~~

~~L-7a Environmental Monitoring Manager~~

~~The EM Manager will be responsible for the overall design and implementation of the DMP. The EM Manager will develop and approve specific procedures all DMP activities, and will review and approve programmatic reports. The EM Manager will provide oversight of appropriate levels of cooperation and consultation between the EM Section and the State of New Mexico regarding environmental monitoring and will revise the QA section of the DMP, if necessary, and~~

~~submit revisions as permit modifications as specified in 20.4.1.900 NMAC (incorporating 40 CFR §270.42).~~

~~The EM Manager and staff will be responsible for achieving and maintaining quality in the DMP. All DMP data will be reviewed and approved by the EM Manager, or designee, prior to release.~~

~~The EM Manager will establish minimum qualification criteria and training requirements for all DMP personnel. The EM Manager will assure that position descriptions for assigned DMP personnel are adequately prepared. The EM Manager and/or Team Leader will assure that training is performed on an individual basis to maintain an acceptable level of proficiency by all new or temporary DMP staff and by all permanent GWSP staff. The EM Manager will assure that documents detailing all staff training are current and properly filed. Copies of training records will be on file for the Permittees in the MOC Technical Training Section.~~

~~The EM Manager will appoint a DMP Team Leader and Field Team, and assign the following responsibilities specified below.~~

~~L-7b – Team Leader~~

~~The Team Leader will coordinate and oversee field sampling activities, ensuring that sampling and associated procedures will be followed and that QA/QC and safety guidelines will be met. The Team Leader will direct the DMP per written approved procedures, and initiate the review of programmatic plans and procedures. The Team Leader will review and evaluate sample data, prepare and review programmatic reports, and assure that appropriate samples will be collected and analyzed. The Team Leader will assure that adequate technical support is provided to the Quality Assurance (QA) Department, when required during audits of vendor facilities. Any nonconformances or project changes will be immediately communicated to the Team Leader.~~

~~L-7c – Field Team~~

~~The field team members will consist of one or more scientists, engineers, or technicians, who will be responsible for sample collection, handling, shipping, and preparation and maintenance of appropriate data sheets, and completion of sample tracking documentation under the direction of the Team Leader, in accordance with this DMP and associated field procedures. The field team will inspect, maintain, and ensure proper calibration of equipment prior to use at each site, while ensuring that site health and safety requirements will be met at all times. The field team will communicate any nonconformances, malfunctions, or project changes to the Team Leader immediately.~~

~~L-7d – Safety Manager~~

~~The Safety Manager will be responsible for ensuring that the necessary requirements for the health and safety of personnel associated with sampling and analysis activities are met. The cognizant manager will be responsible for ensuring that field team members operate in a safe manner and personnel have appropriate training. The Safety Manager will ensure that periodic health and safety assessments are conducted and that the cognizant manager will initiate corrective actions where deficiencies are identified.~~

~~L-7e Analytical Laboratory Management~~

~~Sample collection containers supplied by the laboratory will be certified as clean by either the laboratory or their supplier. The Permittees will supply containers for radiological samples. The analytical laboratory will be responsible for performing analyses in accordance with this DMP Plan and regulatory requirements. The laboratory will maintain documentation of sample handling and custody, analytical results, and internal QC data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside laboratory acceptance limits will trigger an investigation and, if appropriate, corrective action, as directed by the EM Manager. The laboratory will report the results of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one analytical laboratory is used (e.g., for different analyses), each one will have the responsibilities specified above.~~

~~L-7f Quality Assurance (QA) Manager~~

~~The QA Manager will provide independent oversight of the DMP, via the assigned cognizant QA engineer, to verify that quality objectives are defined and achieved. The QA Manager will ensure objective, independent assessments of the DMP quality performance and the quality performance of the contract analytical laboratory. The QA Manager has been delegated authority on behalf of the Permittees by the MOC General Manager and will have access to work areas, identify quality problems, initiate or recommend corrective actions, verify implementation of corrective actions, and ensure that work will be controlled or stopped until adequate disposition of an unsatisfactory condition has been implemented.~~

L-7~~8~~ Quality Assurance Requirements

~~Specific~~ Quality Assurance (**QA**) r~~requirements for WIPP are defined in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record. R~~equirements specific to the DMP are presented in this section.

L-7a~~8a~~ Data Quality Objectives and Quality Assurance Objectives~~QA Program—Overview~~

~~The QA program was developed to assure that integrity and quality will be maintained for all samples collected and that equipment and records will be maintained in accordance with EPA guidance. The QA Program identifies data quality objectives (**DQO**), processes for assuring sample quality, and processes for generating and maintaining quality records.~~

L-7a(1) ~~8b~~ Data Quality ~~Oblectives~~Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support project decisions. DQOs have been ~~will be~~ established to ensure that the data collected will be of a sufficient and known quality for their intended uses. The overall DQOs for this DMP are shown in the following sections.

L-7a(1)(i) Detection Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the groundwater underlying the WIPP facility.

L-7a(1)(ii) Water Level Monitoring Program

Collect accurate and defensible data of known quality that will be sufficient to assess the groundwater flow direction and rate at the WIPP facility.

L-7a(2) Quality Assurance Objectives

Quality Assurance Objectives (**QAOs**) for measurement data have been specified in terms of accuracy, precision, completeness, representativeness, and comparability.

~~project will be to collect accurate and defensible data of known quality that will be sufficient to assess the concentrations of constituents in the ground water underlying the WIPP area. The data generated thus far by the DMP has been used to establish background ground-water quality. For the purpose of this DMP, DQOs for measurement data will be specified in terms of accuracy, precision, completeness, representativeness, and comparability. Measurements of data quality in terms of accuracy and precision will be derived from the analysis of QC samples generated in the field and laboratory. Appropriate QC procedures will be used so that known and acceptable levels of accuracy and precision will be maintained for each data set. This section defines the acceptance criteria for each QC analysis performed. The following subsections define each DQO.~~

L-7a~~8b~~(2~~1~~)(i) Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. When applied to a set of observed values, accuracy is a combination of a random component and a common systematic error (bias) component. Measurements for accuracy will include analysis of calibration standards, laboratory control samples, matrix spike samples, and surrogate spike recoveries~~samples~~. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{(measured\ sample\ concentration)}{true\ concentration} \times 100$$

L-7a~~8b~~(2~~1~~)(i)(A) Accuracy Objectives for Field Measurements

Field measurements will include pH, Specific Conductance (SC), temperature, ~~Eh~~specific gravity~~,~~ and static ground-water surface elevation. Field measurement accuracy will be determined using calibration check standards. Thermometers used for field measurements will be calibrated to the National Institute for Standards and Technology (**NIST**) traceable standard on an annual basis to ensure~~assure~~ accuracy. Accuracy of ground-water surface elevation measurements will be checked before each measurement period by verifying calibration of the device within the specified schedule. WIPP document WP 13-1 outlines the basic requirements for field equipment use and calibration. WIPP facility SOPs ~~Procedure WP 10-AD3029~~ contains instructions that outline protocols for maintaining current calibration of ground-water surface elevation measurement instrumentation. ~~A current revision of this document or procedure will be maintained in the WIPP Operating Record.~~

L-7a~~8b~~(~~21~~)(ii)(B) Accuracy Objectives for Laboratory Measurements

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, laboratory control samples (**LCS**), laboratory blanks, matrix and surrogate spike recoveries~~samples~~. Single LCSs and matrix spike and surrogate spike sample analyses will be expressed as %R. Laboratory analytical accuracy is parameter dependent and will be prescribed in the laboratory SOP.

L-7a~~8b~~(2)(ii) Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision data will be derived from duplicate field and laboratory measurements. Precision will be expressed as relative percent difference (**RPD**), which is calculated as follows:

$$RPD = \frac{|(measured\ value\ sample\ 1 - measured\ value\ sample\ 2)|}{average\ of\ measured\ samples\ 1 + 2} \times 100$$

L-7a~~8b~~(2)(ii)(A) Precision Objectives for Field Measurements

Specific conductance, ~~Precision of field measurements of water-quality parameters will meet or exceed required reporting levels. SC,~~ pH, and temperature~~, and optionally Eh~~ will be measured during well purging and after sampling. SC measurements will be precise to ±10% pH to 0.10 standard ~~unit,~~ unit, specific gravity to 0.01 by hydrometer and ~~and~~ temperature to 0.10 degrees Celsius (°C). Water-level measurements will be precise to ± 0.01 ft. The precision of water density measurements, when measured in the field using down hole instrumentation, will be determined on a well-by-well basis and ~~and~~ will result in no more than a ± 2 ft of error in the derived fresh-water head.~~, Eh to 10 millivolts (mV).~~

L-7a~~8b~~(2)(ii)(B) Precision Objectives for Laboratory Measurements

Precision of laboratory analyses will be determined by analyzing a LCS and a lab control sample duplicate (**LCSD**) or by analyzing one of the field samples in duplicate depending on the requirements of the particular standard method. The precision is measured as the RPD of the recoveries for the spiked LCS/LCSD pair or the RPD of the duplicate sample analysis results. ~~Precision of laboratory analyses will be assessed by performing the same analyses twice on LCSs with each analytical batch assessed at a minimum frequency of 1 in 20 ground-water samples for nonradiological parameters and 1 in 10 for radiological parameters. The laboratory will determine analytical precision control limits by performing replicate analyses of control samples. Precision measurements will be expressed as RPD.~~ Laboratory analytical precision is also parameter dependent and will be prescribed in laboratory SOPs.

L-7a~~8b~~(~~23~~)(iii) Contamination

In addition to measurements of precision and bias, QC checks for contamination will be performed. QC samples including trip blanks, field blanks, and method blanks will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents and glassware. Trip blanks will be used to assess volatile organic compound (**VOC**) sample contamination during shipment and handling

and will be collected and analyzed at a frequency of 1 sample per sample shipment. Field blanks will be used to assess field sample collection methods and will be collected and analyzed at a minimum frequency of one sample per 20 samples (five percent of the samples collected). Method blanks will be used to assess contamination resulting from the analytical process and will be analyzed at a minimum frequency of one sample per 20 samples, or five percent of the samples collected. Evaluation of sample blanks will be performed following U.S. EPA "National Functional Guidelines for Organic Data Review" (EPA, 1999~~1991~~) and "National Functional Guidelines for Evaluating Inorganics Analyses" (EPA, 2004~~1988~~). Only method blanks will be analyzed via wet chemistry methods. The criteria for evaluating method blanks will be established as follows: If method blank results exceed method reporting limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in method blank samples may be used to disqualify some samples, requiring resampling and additional analyses on a case-by-case basis.

L-7a~~8b~~(24)(iv) Completeness

Completeness is a measure of the amount of usable valid data resulting from a data collection activity, given the sample design and analysis. Completeness may be affected by unexpected conditions that may occur during the data collection process.

Occurrences that reduce the amount of data collected include sample container breakage during sample shipment or in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost data whenever possible. The completeness objective for analysis of Part 5, Table 5.4a parameters ~~noncritical measurements (i.e., field measurements)~~ will be 90 percent and 100 percent analysis of Part 5, Table 5.4.b hazardous constituents. ~~for critical measurements (i.e., compliance data).~~ If the completeness ~~objective~~ objective for Part 5 Table 5.4.b hazardous constituents is not met, the Permittees ~~WIPP EM Manager~~ will determine ~~on behalf of the Permittees~~ the need for resampling on a case-by-case basis. Numerical expression of the completeness (**%C**) of data is as follows:

$$\%C = \frac{number\ of\ accepted\ samples}{total\ number\ of\ samples\ collected} \times 100$$

L-~~8~~7a~~b~~(2~~5~~)(v) Representativeness

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this DMP will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures will be designed to minimize factors affecting the integrity of the samples. Ground-water samples will only be collected after well purging criteria have been met. The analytical methods selected will be those that will most accurately and precisely represent the true concentration of analytes of interest.

For water levels and density, representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. The SOPs for measurement ensure that samples are representative of site conditions.

L-7a~~8b~~(2~~6~~)(vi) Comparability

Comparability is the extent to which one data set can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measures dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals
- Micrograms per liter (µg/L) for VOCs and **semivolatile** organic compounds (**SVOCs**).

Comment [r6]: Should we include a "-" as in semi-volatile.

Formatted: Font: Bold

Culebra g~~G~~round-water surface elevation measurements will be expressed as equivalent freshwater elevation in feet above mean sea level.

L-7b~~8c~~ Design Control

The approved ~~ground-water monitoring system was~~ design for the DMP is specified in this Permit. Modifications to the DMP will be processed in accordance with ~~ed and will be maintained to meet specifications established in~~ 20.4.1.900~~500~~ NMAC (incorporating 40 CFR §§~~264 Subpart F and~~ 270.42).~~264.601 through 264.603).~~

L-7c~~8d~~ Instructions, Procedures, and Drawings

The ~~Provisions and responsibilities for the~~ preparation and use of instructions and procedures at the WIPP facility are outlined in the WIPP facility document WP 13-1(see Table L-3). A~~Any~~ activities performed for the DMP ~~ground-water monitoring~~ that may affect ground-water data quality will be performed in accordance with ~~documented and~~ approved procedures which comply with the Permit ~~and the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §264 Subpart F)~~.

~~Technical procedures, as specified elsewhere in this DMP, have been developed for each quality-affecting function performed for ground-water monitoring. The technical procedures unique to the DMP will be controlled by the ES&H at WIPP. The procedures are sufficiently detailed and include, when applicable, quantitative or qualitative acceptance criteria.~~

~~Procedures were prepared in accordance with requirements in WIPP document WP 13-1. A current revision of this document will be maintained in the WIPP Operating Record.~~

L-7d~~8e~~ Document Control

Permittees ~~Document controls~~ will ensure that the latest approved versions of WIPP facility SOPs ~~procedures~~ will be used in performing ground-water monitoring functions and that obsolete materials will be adequately identified or removed from work areas.

~~L-8f Control of Work Processes~~

~~Process control requirements, defined in WIPP document WP 13-1 are met, and will continue to be met, for this DMP. A current revision of this document will be maintained in the WIPP Operating Record.~~

L-7e~~8g~~ Inspection and Surveillance

Inspection and surveillance activities will be conducted as outlined in WIPP document WP 13-1 (see Table L-3). The Permittees ~~QA Department~~ will be responsible for performing the applicable WIPP facility SOPs. ~~inspections and surveillance on the scope of work. EM section personnel will be responsible for performance checks as defined in applicable procedures and determined for the Permittees by MOC metrology laboratory personnel. Performance checks for the DMP will determine the acceptability of purchased items and assess degradation that occurs during use. A current revision of this document will be maintained in the WIPP Operating Record.~~

L-7f~~8h~~ Control of Monitoring and Data Collection Equipment

WIPP document WP 13-1 (see Table L-3) outlines the basic requirements for control and calibrating monitoring and data collection (**M&DC**) equipment. M&DC equipment shall be properly controlled, calibrated, and maintained according to WIPP facility SOPs (see Table L-3)~~Procedure WP 10-AD3029~~ to ensure continued accuracy of ground-water monitoring data. Results of calibrations, maintenance, and repair will be documented. Calibration records will identify the reference standard and the relationship to national standards or nationally accepted measurement systems. Records will be maintained to track uses of M&DC equipment. If M&DC equipment is found to be out of tolerance, the equipment will be tagged and it will not be used until corrections are made. ~~A current revision of this document or procedure will be maintained in the WIPP Operating Record.~~

L-7g~~8i~~ Control of Nonconforming Conditions

In accordance with ~~WIPP document~~ WP 13-1 (see Table L-3), e~~specifies the system used at WIPP for ensuring that appropriate measures are established to control nonconforming conditions. Nonconforming conditions connected to the DMP will be identified in and controlled by documented procedures. E~~quipment that does not conform to specified requirements will be controlled to prevent use. The disposition of defective items will be documented on records traceable to the affected items. Prior to final disposition, faulty items will be tagged and segregated. Repaired equipment will be subject to the original acceptance inspections and tests prior to use. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

L-7h~~8j~~ Corrective Action

Requirements for the development and implementation of a system to determine, document, and initiate appropriate corrective actions after encountering conditions adverse to quality at the WIPP facility are outlined in WIPP document WP 13-1 (see Table L-3). Conditions adverse to acceptable quality will be documented and reported in accordance with corrective action procedures and corrected as soon as practical. Immediate action will be taken to control work performed under conditions adverse to acceptable quality and its results to prevent quality degradation. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

L-7i~~8k~~ Quality Assurance Records

WIPP document WP 13-1(see Table L-3) outlines the policy that will be used at the WIPP facility regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records. ~~A current revision of this document will be maintained in the WIPP Operating Record.~~

Records to be generated in the DMP will be specified by procedure. QA and RCRA operating records will be identified. This will be the basis for the labeling of records as "QA" or "RCRA operating record" on the Environmental Monitoring Records Inventory and Disposition Schedule ~~EM RIDS~~.

~~QA records will document the results of the DMP implementing procedures and will be sufficient to demonstrate that all quality-related aspects are valid. The records will be identifiable, legible, and retrievable.~~

L-~~89~~ References

Beauheim, R.L., 1986. "Hydraulic-Test Interpretations for Well DOE-2 at the Waste Isolation Pilot Plant (WIPP) Site," *SAND86-1364*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Beauheim, R.L., 1987. "Analysis of Pumping Tests at the Culebra Dolomite Conducted at the H-3 Hydropad at the Waste Isolation Pilot Plant (WIPP) Site," *SAND86-2311*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Corbet, T.F., and P.M. Knupp, 1996. "The Role of Regional Groundwater Flow in the Hydrogeology of the Culebra Member of the Rustler Formation at the Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico," *SAND96-2133*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Crawley, M. and M. Nagy, 1998. "WIPP RCRA Background Groundwater Quality Baseline Report," DOE/WIPP-98-2285.

Davies, P.B., 1989. "Variable-Density Ground-Water Flow and Paleohydrology in the Waste Isolation Pilot Plant (WIPP) Region, Southeastern New Mexico," U.S. Geological Survey Open-File Report 88-490, Albuquerque, New Mexico.

DOE, see U.S. Department of Energy.

Domenico, P.A., and F.W. Schwartz, 1990. "Physical and Chemical Hydrogeology," New York: John Wiley & Sons, Textbook.

Domski, P.S., and R.L. Beauheim. 2008. Evaluation of Culebra Brine Chemistry. AP-125. ERMS 549336. Carlsbad, NM: Sandia National Laboratories. ~~.~~(In development)

Formatted: No underline, Font color: Auto

Domski, P.S., D.T. Upton, and R.L. Beauheim, 1996. "Hydraulic Testing Around Room Q: Evaluation of the Effects of Mining on the Hydraulic Properties of Salado Evaporites," *SAND96-0435*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Earlough, E.C., Jr., 1977. "Advances in Well Test Analysis,": Society of Petroleum Engineers of AIME, Textbook, Dallas, Texas.

EPA, see U.S. Environmental Protection Agency.

~~Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York.~~

~~Haug, A., V.A. Kelly, A.M. LaVenue, and J.F. Pickens, 1987. "Modeling of Ground-Water Flow in the Culebra Dolomite at the Waste Isolation Pilot Plant (WIPP) Site: Interim Report," *SAND86-7167*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.~~

Holt, R.M., and D.W. Powers, 1988. "Facies Variability and Post-Deposition Alteration Within the Rustler Formation in the Vicinity of the Waste Isolation Pilot Plant, Southeastern New Mexico," *DOE-WIPP-88-04*, U.S. Department of Energy, Carlsbad, New Mexico.

IT Corporation, "2000 Addendum 1 Waste Isolation Pilot Plant RCRA Background Groundwater Quality Baseline Update Report." Albuquerque, New Mexico.

Kuhlman, K.L. 2010. Analysis Report, AP-111 Revision 1, Culebra Water Level Monitoring Network Design. ERMS 554054. Carlsbad, NM: Sandia National Laboratories.

~~Lusczynski, N.J., 1961. "Head and Flow of Ground Water of Variable Density," *Journal of Geophysical Research*, Vol. 66, No. 12, pp. 4247–4256.~~

McKenna, S. A. 2004. Analysis Report: Culebra Water Level Monitoring Network Design. AP-111. ERMS 540477. Carlsbad, NM: Sandia National Laboratories.

~~Lusczynski, N.J., 1961. "Head and Flow of Ground Water of Variable Density," *Journal of Geophysical Research*, Vol. 66, No. 12, pp. 4247–4256.~~

Mercer, J.W., 1983. "Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medaños Area, Southeastern New Mexico," U.S. Geological Survey, Water Resources Investigations 83-4016, 113 pp.

Powers, D. W. 2006. Analysis Report: Task 1B of AP-114; Identify Possible Area of Recharge to the Culebra West and South of WIPP (April 1). ERMS 543094. Carlsbad, NM: Sandia National Laboratories.

Roberts, R. M. 2007. Analysis of Culebra Hydraulic Tests Performed Between June 2006 and September 2007. ERMS 547418. Carlsbad, NM: Sandia National Laboratories.

Siegel, M.D., K. L. Robinson, and J. Myers. 1991. "Solute Relationships in Groundwaters from the Culebra Dolomite and Related Rocks in the Waste Isolation Pilot Plant Area, Southeastern New Mexico," SAND88-0196.

U.S. Department of Energy (DOE), 1995. "Basic Data Report for WQSP-1 through WQSP-6A," DOE/WIPP-95-2154.

~~Powers, D.W., S.J. Lambert, S.E. Shaffer, L.R. Hill, and W.D. Weart, eds., 1978. "Geologic Characterization Report for the Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico," *SAND78-1596*, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.~~

~~U.S. Department of Energy (DOE), 1996. "United States Department of Energy Waste Isolation Pilot Plant Compliance Certification Application," *DOE/CAO-1996-2184*, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.~~

~~U.S. Department of Energy (DOE), 1997. Responses to EPA's Request in EPA's March 19, 1997 Letter on the WIPP CCA. May 14, 1997.~~

U.S. Department of Energy (DOE), 2009, WIPP Hazardous Waste Facility Permit Amended Renewal Application, Carlsbad, New Mexico.

U.S. Environmental Protection Agency (EPA), 2009~~1992~~. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance~~Addendum to Interim Final Guidance~~," U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1999~~1991~~. "National Functional Guidelines for Organic Data Review," U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1990. "Background Documentation for the U.S. Environmental Protection Agency's Proposed Decision on the No-Migration Variance for U.S. Department of Energy's Waste Isolation Pilot Plant," U.S. Environmental Protection Agency, Washington, D.C.

~~U.S. Environmental Protection Agency (EPA), 1989. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities," U.S. Environmental Protection Agency, Washington, D.C.~~

U.S. Environmental Protection Agency (EPA), 2004~~1988~~. "Functional Guidelines for Evaluating Inorganics Analyses," U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1986. "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1996. "Test Methods for Evaluating Solid Waste," *SW-846*, third ed., Office of Solid Waste and Emergency Response, Washington, D.C.

TABLES

(This page intentionally blank)

Table L-1
Hydrological Parameters for Rock Units aAbove the Salado at WIPP

Unit		Hydraulic Conductivity	Storage ~~Coefficient~~	Thickness	Hydraulic Gradient
Santa Rosa		2×10^{-8} to 2×10^{-6} m/s (1) (2)	~~Specific capacity 0.029 to 0.041 ℓ/s/m~~	0 to 91 m	0.001 (5)
Dewey Lake		10^{-8} m/s	Specific storage 1×10^{-5} (1/m) (2)	152 m	0.001 (5)
Rustler	Forty-niner	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	13 to 23 m	NA (6)
	Magenta	$1 \times 10^{-8.5}$ to $1 \times 10^{-6.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	7 to 8.5 m	3 to 6
	Tamarisk	1×10^{-13} to 1×10^{-11} m/s (anhydrite) 1×10^{-9} m/s (mudstone) (2)	Specific storage 1×10^{-5} (1/m) (2)	26 to 56 m	NA (6)
	Culebra	$1 \times 10^{-7.5}$ to $1 \times 10^{-5.5}$ m/s (2)	Specific storage 1×10^{-5} (1/m) (2)	4 to 11.6 m	0.003 to 0.007 (5)
	Los Medaños~~Un named lower member~~	6×10^{-15} to 1×10^{-13} m/s 1.5×10^{-11} to 1.2×10^{-11} m/s (basal interval)	Specific storage 1×10^{-5} (1/m) (2)	29 to 38 m	NA (6)

Formatted Table

Matrix characteristics relevant to fluid flow include values used in this table such as permeability, hydraulic conductivity, gradient, etc.)

Table Notes:

(1) The Santa Rosa Formation is not present in the western portion of the WIPP site. It was combined with the Dewey Lake Red Beds in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996), and the range of values entered here are those used in that study for the Dewey Lake/Triassic hydrostratigraphic unit.

(2) Values or ranges of values given for these entries are the values used in three-dimensional regional groundwater flow modeling (Corbet and Knupp, 1996). Values are estimated based on literature values for similar rock types, adjusted to be consistent with site-specific data where available. Ranges of values include spatial variation over the WIPP site and differences in values used in different simulations to test model sensitivity to the parameter.

~~(3) The range of values given here for transmissivity of the Santa Rosa is estimated for the center of the site. Transmissivity is the product of the thickness of the productive interval times its hydraulic conductivity. Thickness of the Santa Rosa is estimated to be 30 meters at the center of the WIPP site, and the range of derived transmissivities are based on the range of hydraulic conductivity values used by Corbet and Knupp (1996) for the combined Dewey Lake/Triassic unit.~~

~~(4) The range of values given here by transmissivity of the Dewey Lake is estimated for the center of the site. Transmissivity is the product of the thickness of the productive interval times its hydraulic conductivity. Thickness of the Dewey Lake is estimated to be 140 meters at the center of the WIPP site, and the range of derived transmissivities are based on the range of hydraulic conductivity values used by Corbet and Knupp (1996) for the combined Dewey Lake/Triassic unit.~~

(~~3~~5) Hydraulic gradient is a dimensionless term describing change in the elevation of hydraulic head divided by change in horizontal distance. Values given in these entries are determined from potentiometric surfaces. The range of values given for the Culebra reflects the highest and lowest gradients observed within the WIPP site boundary. Values for the Dewey Lake and Santa Rosa are assumed to be the same as the gradient determined from the water table. Note that the Santa Rosa Formation is absent or above the water table in most of the controlled area, and that the concept of a horizontal hydraulic gradient is not meaningful for these regions.

Comment [r7]: RM Change

(~~4~~6) Flow in units of very low hydraulic conductivity is slow, and primarily vertical. The concept of a horizontal hydraulic gradient is not applicable.

Comment [r8]: RM Change

Sources: Beauheim, 1986; Domenico and Schwartz, 1990; Domski, Upton, and Beauheim, 1996; Earlough, 1977.

Table L-2
WIPP Ground-water Detection Monitoring Program Sample Collection and Ground-water Surface Elevation Measurement Frequency

Installation	Frequency
Ground-water Quality Sampling	
DMWs~~DMP monitoring wells~~	A~~Semi~~annually
~~All other WIPP surveillance wells~~	~~On special request only~~
Ground-water Surface Elevation Monitoring	
DMWs~~DMP monitoring wells~~	Monthly and prior to sampling events
WLMP Wells (see Table L-4)~~All other WIPP surveillance well sites~~	Monthly
~~Redundant wells at all other WIPP surveillance well sites~~	~~Quarterly~~

Table L-3
Standard Operating Procedures Applicable to the DMP

Number	Title/Description
WP 02-EM1005	Groundwater Serial Sample Analysis: This procedure provides general instructions necessary to perform field analyses of serial samples in support of the DMP. Serial samples are collected and analyzed at the field laboratory for field indicators. Serial sample results help determine if pumped groundwater is representative of undisturbed groundwater within the formation.
WP 02-EM1006	Final and Serial Sample Collection: This procedure describes the steps for collecting groundwater samples from the DMWs near the WIPP facility. Serial samples are collected and analyzed at the Field Laboratory until stabilization of the field parameters occurs. Final samples for Resource Conservation and Recovery Act (RCRA) analyses are collected and analyzed by a contract laboratory.
WP 02-EM1014	Groundwater Level Measurement: This document describes the method used for groundwater level measurements in support of groundwater monitoring at the WIPP facility using a portable electronic water-level probe.
WP 02-EM1021	Pressure Density Survey: This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at non-detection monitoring wells. Because most pressure densities are obtained by Sandia National Laboratories via pressure transducers installed in wells, this procedure is used to obtain pressure densities at wells not equipped with fixed transducers.
WP 02-EM1026	Water Level Data Handling and Reporting: This procedure provides instructions on handling water level data. Data are collected and recorded on field forms in accordance with WP 02-EM1014. This procedure is initiated when wells in the water surveillance program have been measured for a given month.
WP 02-EM3001	Administrative Processes for Environmental Monitoring and Hydrology Programs: This procedure provides the administrative guidance environmental monitoring personnel use to maintain quality control associated with environmental monitoring sampling and reporting activities. This administrative procedure does not pertain to volatile organic compound (VOC) monitoring, with the exception of Section 5.0 which pertains to the regulatory reporting review process.
WP 02-EM3003	Data Validation and Verification of RCRA Constituents: This procedure provides instructions on performing verification and validation of laboratory data containing the analytical results of groundwater monitoring samples. This procedure is applied only to the non-radiological analyses results for compliance data associated with the detection monitoring samples. The data reviewed for this procedure includes general chemistry parameters and RCRA constituents.
WP-02-RC.01	Hazardous and Universal Waste Management Plan: This plan describes the responsibilities and handling requirements for hazardous and universal wastes generated at the WIPP facility. It is meant to ensure that these wastes are properly handled, accumulated, and transported to an approved Treatment, Storage, Disposal Facility (TSDF) in accordance with applicable state and federal regulations, U.S. Department of Energy (DOE) Orders, and Washington TRU Solutions LLC (WTS) policies and procedures. This plan implements applicable sections of 20.4.1.100-1102 New Mexico Administrative Code (NMAC), *Hazardous Waste Management* (incorporating 40 *Code of Federal Regulations* [CFR] Parts 260-268 and 273).
WP 10-AD3029	Calibration and Control of Monitoring and Data Collection Equipment: This procedure provides direction for the control and calibration of Monitoring and Data Collection (M&DC) equipment at the WIPP facility, and ensures traceability to NIST (National Institute of Standards and Technology) standards, international standards, or intrinsic standards. This procedure also establishes requirements and responsibilities for identifying recall equipment, and for obtaining calibration services for WIPP facility M&DC equipment.
WP 13-1	Washington TRU Solutions LLC Quality Assurance Program Description: This document establishes the minimum quality requirements for Management and Operating Contractor (**MOC**) personnel and guidance for the development and implementation of QA programs by MOC

Number	Title/Description
	organizations.

Comment [r9]: Need help in fitting Table L-3 to one page.

Table L-4
January 2011 Culebra WLMP

WELL ID	WELL ID	WELL ID
AEC-7	H-17	SNL-15
C-2737	H-19 pad*	SNL-16
ERDA-9	I-461	SNL-17
H-02b2	SNL-01	SNL-18
H-03b2	SNL-02	SNL-19
H-04bR	SNL-03	WQSP-1
H-05b	SNL-05	WQSP-2
H-06bR	SNL-06	WQSP-3
H-07b1	SNL-08	WQSP-4
H-9bR	SNL-09	WQSP-5
H-10c	SNL-10	WQSP-6
H-11b4	SNL-12	WIPP-11
H-12	SNL-13	WIPP-13
H-15R	SNL-14	WIPP-19
H-16		

*H-19b0 monthly

Table L-5
Details of Construction for the Six Culebra Detection Monitoring Wells

NAME (Figure)	DATE DRILLED	TOTAL DEPTH feet (meters) bgs	DEPTH INTO LOS MEDAÑOS feet (meters)	DRILLING DEPTHS feet (meters) bgs		CASING feet (meters) bgs		PACKING feet (meters) bgs		CULEBRA INTERVAL feet (meters) bgs
				WITH AIR	CORING	DEPTH FOR 5 in. CASING	INTERVAL FOR SLOTTED SCREEN	SAND PACK INTERVAL	BRADY GRAVEL PACK INTERVAL	
WQSP-1 Figure L-7	September 13 throughand 16, 1994	737 (225)	15 (5-)	69~~63~~ (21~~2~~1)	69~~65.6~~ to 737 (21~~2~~1 to 22~~5~~24.6)	737 (22~~5~~4.6)	702 to 727 (214 to 222)	640 to 651 (195 to 198)	651 to 737 (198 to 22~~5~~4.6)	699 to 722 (213 to 22~~0~~1)
WQSP-2 Figure L-8	September 6 throughand 12, 1994	846 (258~~257.9~~)	12~~.3~~ (4~~3.7~~)	800 (244)	800 to 846 (244 to 258)	846 (258)	811 to 836 (247 to 255)	790 to 793 (241 to 242)	793 to 846 (242 to 258)	810.1 to 833.7 (247 to 254)
WQSP-3 Figure L-9	October 2~~0~~1 throughand 26, 1994	880 (268)	10 (3~~3.1~~)	83~~380~~ (25 4~~68~~)	833 to 88~~079~~ (254 to 268)	880 (268)	844 to 869 (257 to 265)	827 to 830 (252 to 253)	830 to 880 (253 to 268)	844 to 870 (257 to 265)
WQSP-4 Figure L-10	October 5 throughand 10, 1994,	800 (244)	~~9.2~~ (3~~2.8~~)	740 (226)	740~~.5~~ to 798 (22~~6~~5.7 to 243)	800 (244)	764 to 789 (233 to 24~~0~~1)	752 to 755 (229 to 230)	755 to 800 (230 to 244)	766 to 790.8 (233 to 241)
WQSP-5 Figure L-11	October 12 throughand 1~~8~~9, 1994,	681 (208)	7 ~~2.0~~(2~~0.61~~)	64~~876~~ (19 8~~206~~)	648 to 676 (198 to 206)	681 (208)	646 to 671 (197 to 205)	623 to 626 (190 to 191)	626 to 681 (191 to 208)	648 to 674.4 (198 to 205.~~6~~)
WQSP-6 Figure L-12	September 26 throughand October 3, 1994	616.6 (188~~18 7.9~~)	10~~9.7~~ (3)	568~~367~~ (1 73~~112~~)	568~~367~~ to 61~~7~~6 (173~~112~~ to 188)	61~~7~~6.6 (188)	581 to 606 (177 to 185)	567 to 570 (173 to 17~~43.7~~)	570 to 616.6 (174 to 188)	582 to 606.9 (177 to 185)

Table L-~~6~~4
Analytical Parameter and Sample Requirements

(10) PARAMETERS	(12) NO. OF BOTTLES	(13) VOLUME	(14) TYPE	(15) ACID WASH	(16) SAMPLE FILTER	(17) PRESERVATIVE	(18) HOLDING TIME
Indicator[1] Parameters:							
• pH	-	25 ml[2]	Glass	Field determined	No?	Field determined	None
• SC	-	100 ml[2]	Glass	Field determined	No	Field determined	None
• TOC	4	15 ml[2]	Glass	yes	No	HCl	28 days[2]
• ~~TOX~~	~~3~~	~~250 ml~~	~~Glass~~	~~yes~~	~~No~~	~~H_2SO_4, pH<2~~	~~7 days[2]~~
General Chemistry	1	1 Liter	Plastic	Yes	No	HNO_3,4pH<2	not specified in DMP
Phenolics	1	1 Liter	Amber Glass	Yes	No	H_2SO_4, pH<2	not specified in DMP
Metals/Cations	2	1 Liter	Plastic	Yes	No	HNO_3, pH<2	6 months[2,3]
VOC	4	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
VOC (Non-Purgable)	2	40 ml	Glass	No	No	HCL, ph<2	14 days[2]
BN/As	1	½ Gallon	Amber Glass	Yes	No	None	
TCLP	1	1 Liter	Plastic	Yes	No	HNO_3, pH<2	7 days[2]
Cyanide (Total)	1	1 Liter	Plastic	Yes	No	NaOH, pH>12	14 days[2]
Sulfide	1	250 ml	Amber Glass	Yes	No	NaOH + Zn Acetate	28 days[2]
Radionuclides	1	1 Gallon	Plastic Cube	Yes	Yes	HNO_3, pH<2	6 months[2]

1 = RCRA Detection Monitoring Analytes
2 = As specified in Table 4-1 of the RCRA TEGD
3 = Reduced holding time of 1 week for WIPP-specific Divalent cation 2 samples noted in the GMD
Note: Unless otherwise indicated, data are from DOE Procedure WP 02-EM1006 methods and are provided as information only.
Note: Deviations from this table are allowed with prior approval by the NMED.

Formatted: Left, Indent: Left: 0.46", No bullets or numbering, Tab stops: Not at 0.69"

Formatted: Left: 0.63"

(This page intentionally blank)

FIGURES

(This page intentionally blank)

Formatted Table

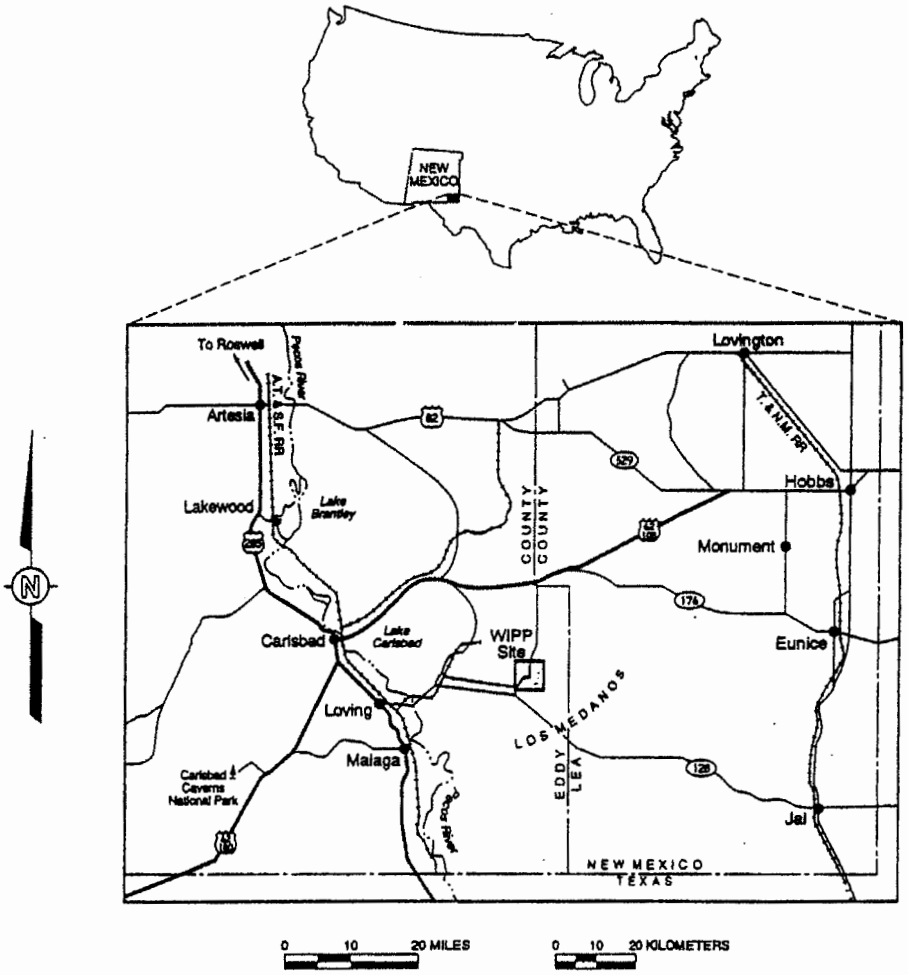
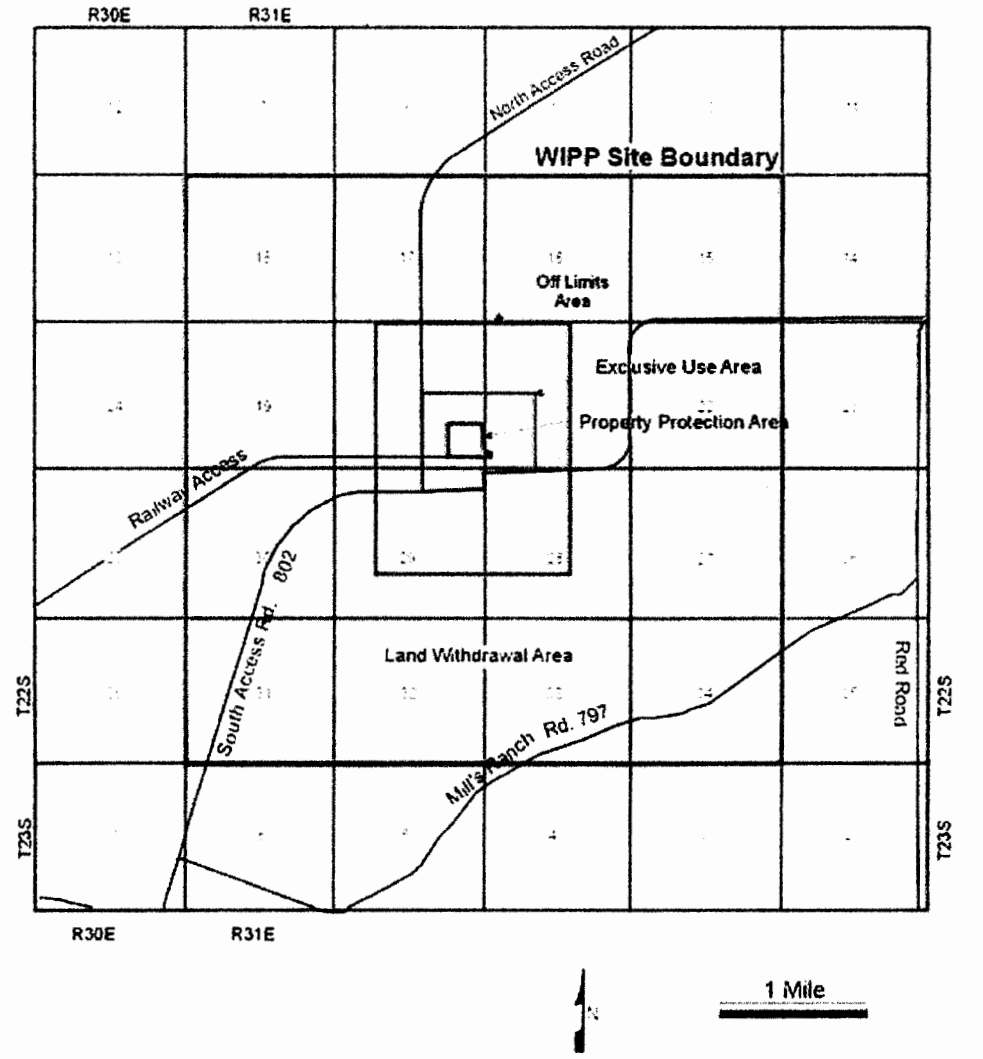


Figure L-1
General Location of the WIPP Facility

Formatted: Justified, Indent: Left: -0.13"



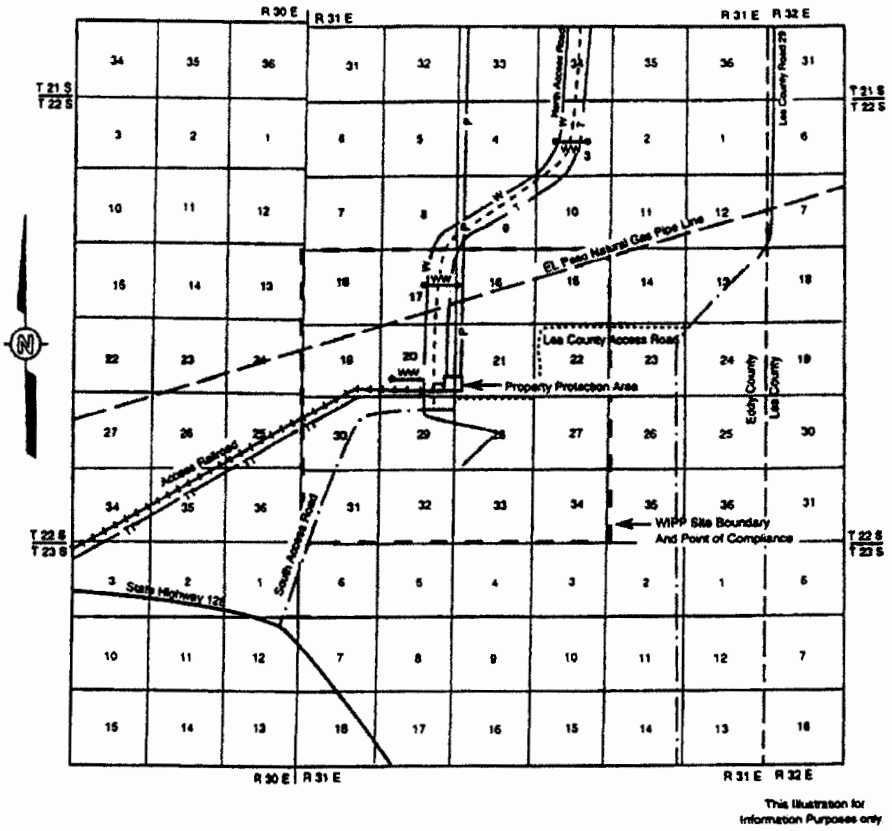


Figure L-2
WIPP Facility Boundaries Showing 16-square-Mile Land Withdrawal Boundary~~Figure L-2~~
~~WIPP Facility Boundaries Showing 16-Square-Mile Land Withdrawal Boundary~~

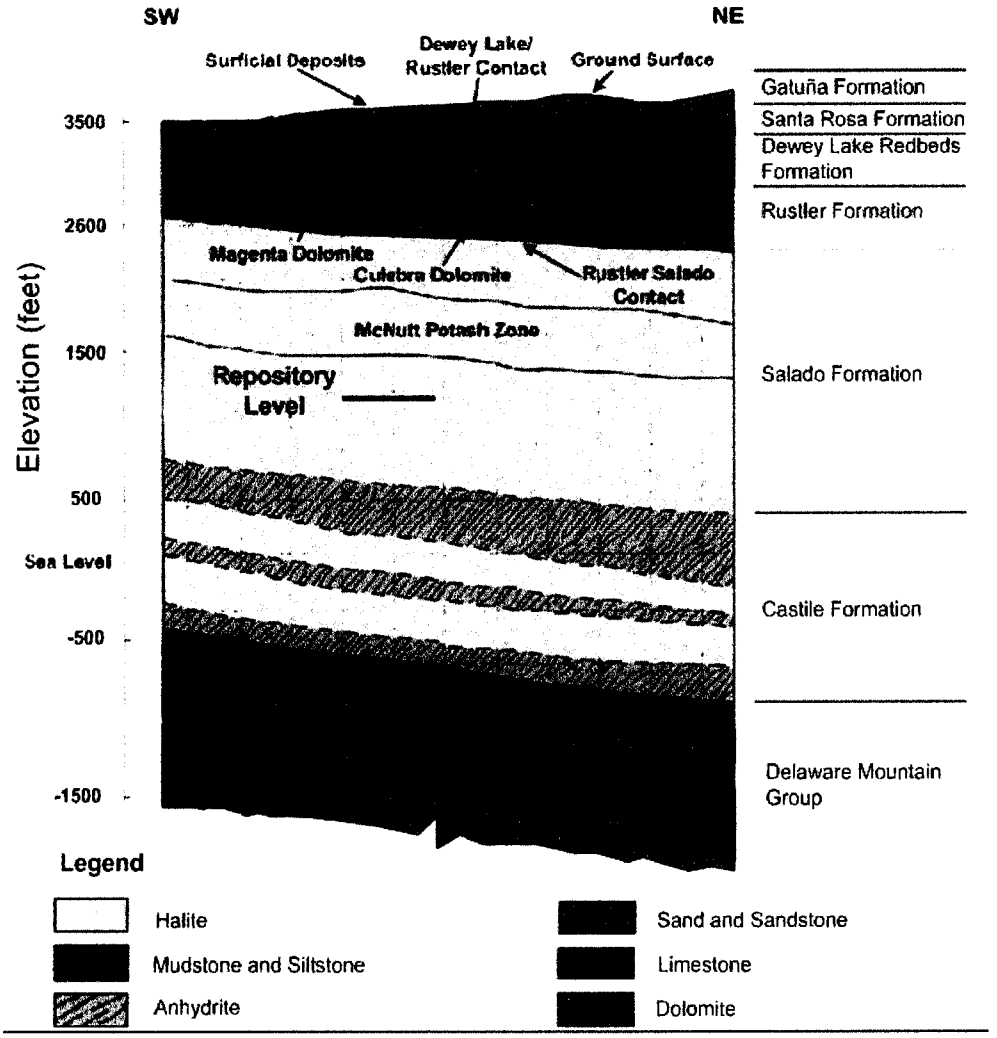
Formatted: Font: Bold
Formatted: Centered

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERNARY	PLEISTOCENE		MESCALERO CALICHE	
			GATUÑA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		**DEWEY LAKE**	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Los Medaños
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	**BELL CANYON**	
			CHERRY CANYON	
			BRUSHY CANYON	

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATERN-ARY	PLIESTO-CENE		MESCALERO CALICHE	
			GATUNA	
TERTIARY	MID-PLIOCENE		OGALLALA	
TRIASSIC		DOCKUM	SANTA ROSA	
PERMIAN	OCHOAN		DEWEY LAKE	
			RUSTLER	Forty-niner
				Magenta
				Tamarisk
				Culebra
				Unnamed
			SALADO	Upper
				McNutt Potash
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

Figure L-3
Site Geologic Column

Formatted: Indent: Left: -0.19", Right: -0.28"



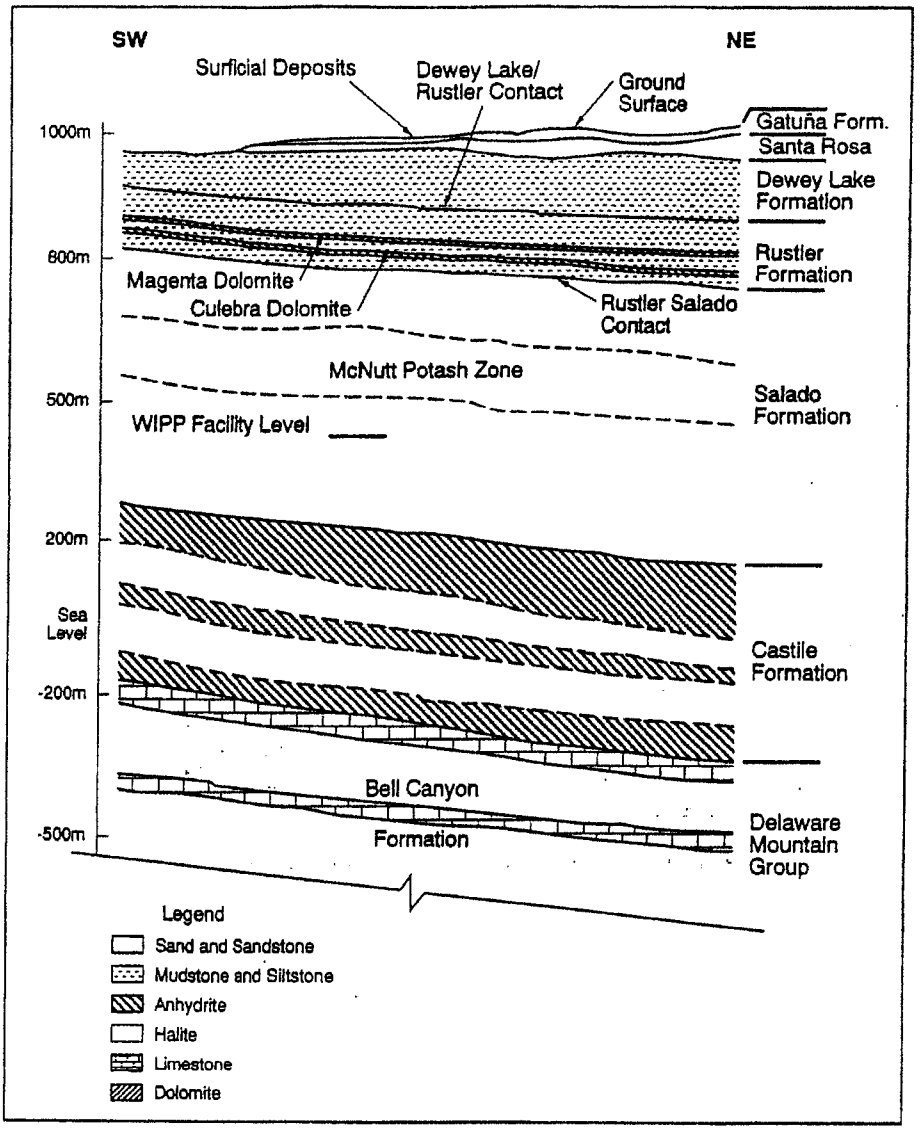
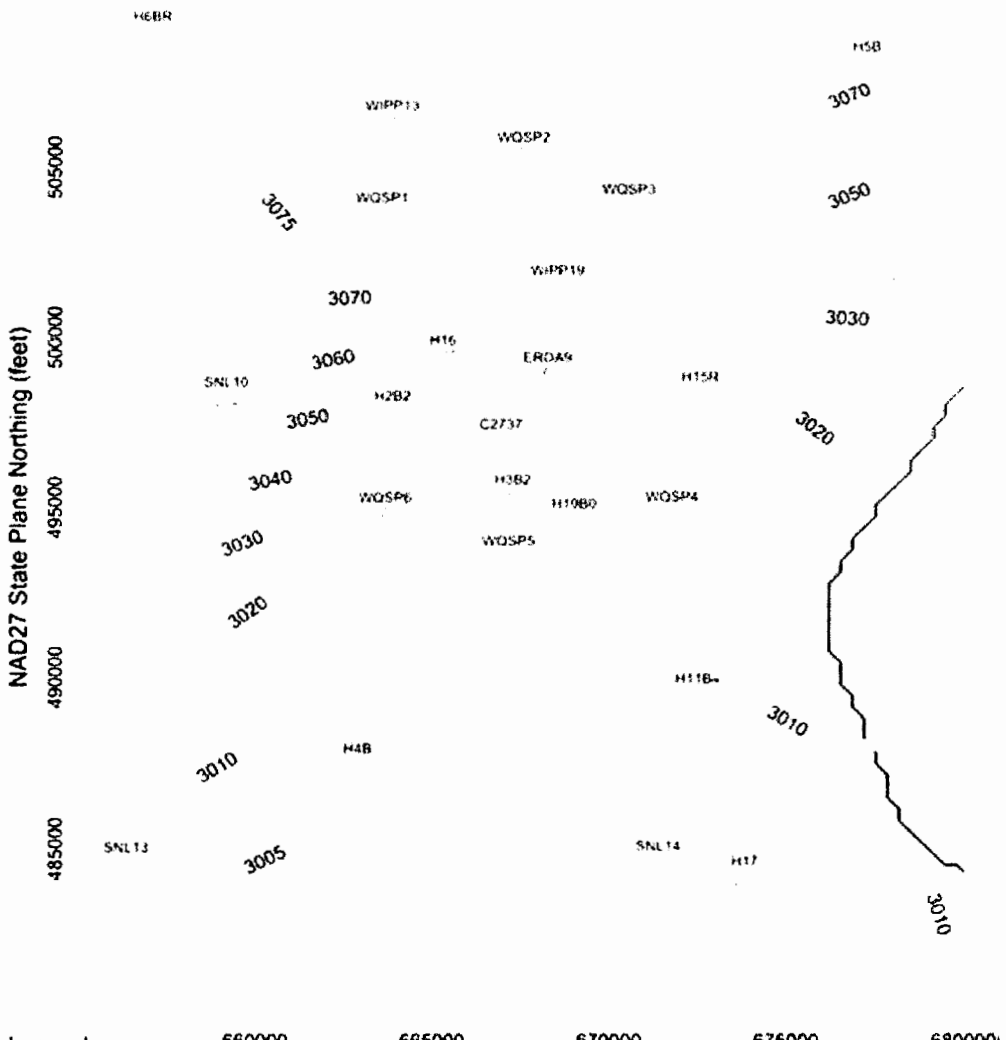


Figure L-4
Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site~~**Figure L-4**~~
~~**Generalized Stratigraphic Cross Section above Bell Canyon Formation at WIPP Site**~~



Legend
Units = Feet
Contour Interval = 5 feet

2009 Data

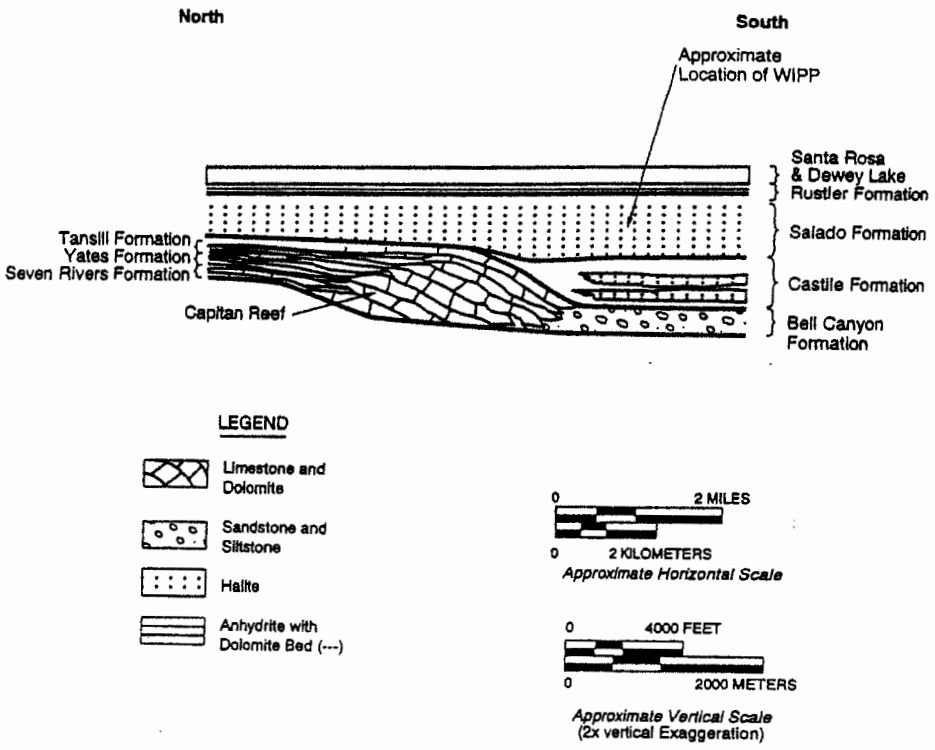
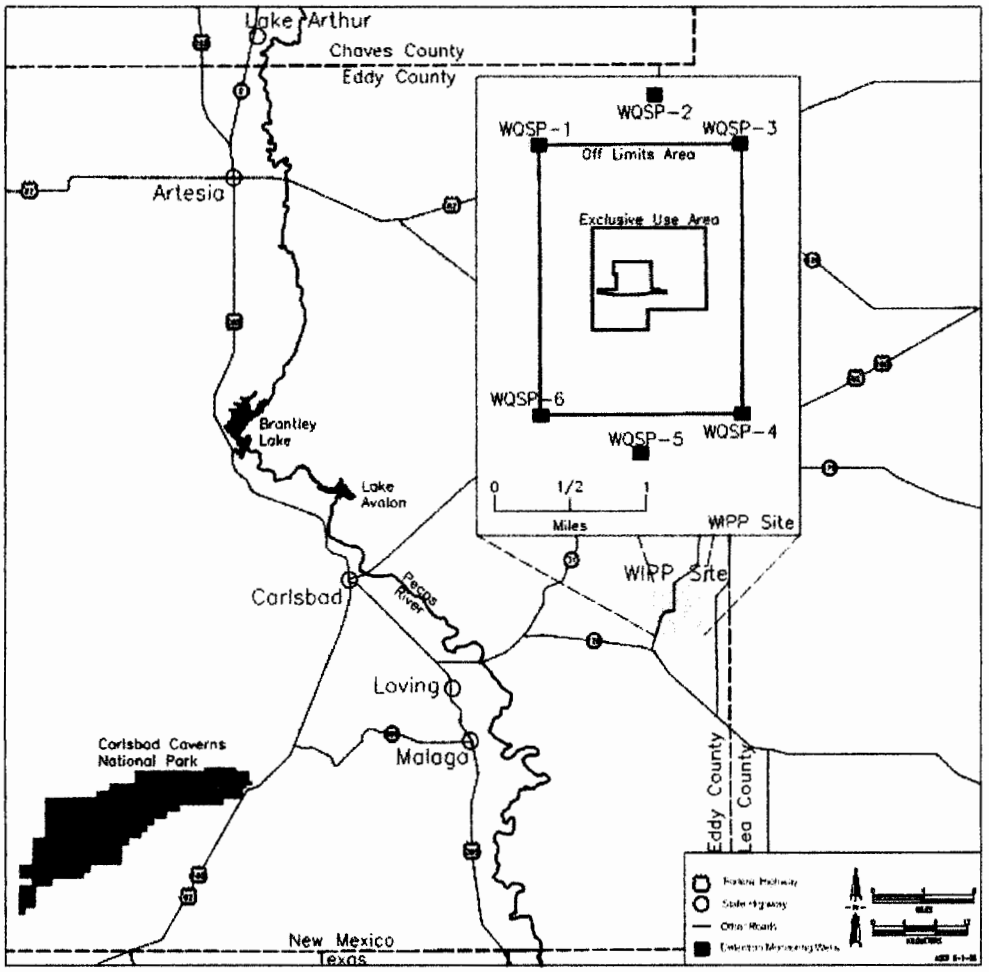
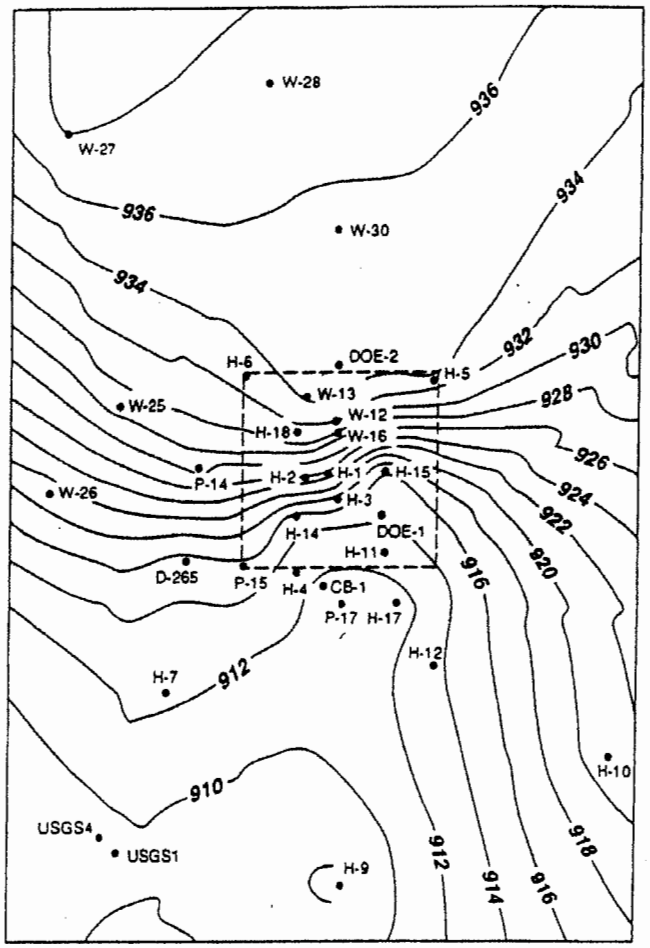


Figure L-5
Culebra Freshwater-Head Potentiometric Surface~~Schematic North-South Cross Section Through the North Delaware Basin~~



NOTE: Point of compliance is defined in Part 5.3.1.



Source: Jones et al. 1992, Figure 2-5

• Observation Well

Freshwater Heads in meters above mean sea level

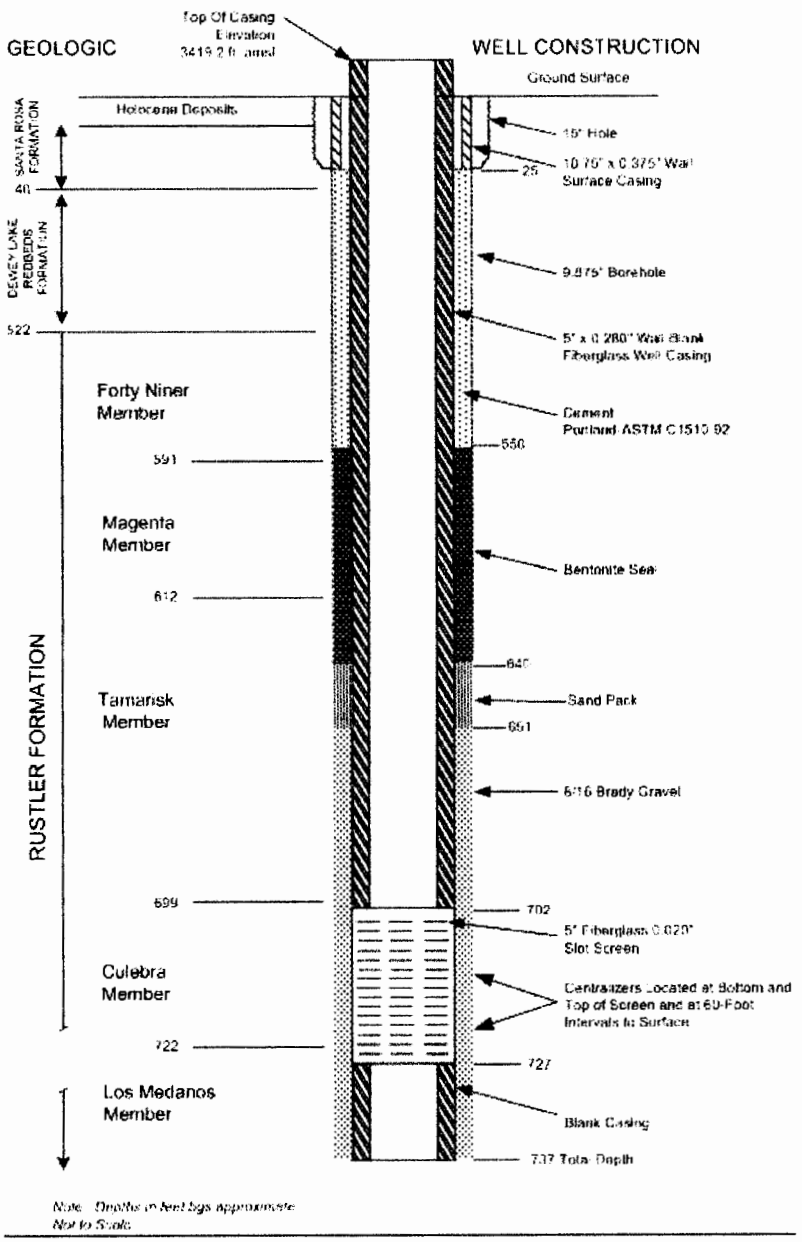
Contour Interval: 2 meters

0 4 8 kilometers

0 4 8 miles

SCALE

Figure L-6
Detection Monitoring Well Locations~~Culebra Freshwater Head Contour Surface~~


GEOLOGIC
WELL CONSTRUCTION
Top Of Casing
Elevation
3419.2 ft amsl
Ground Surface
Holocene Deposits
SANTA ROSA FORMATION
40
DEWEY LAKE REDBEDS FORMATION
522
Forty Niner Member
591
Magenta Member
612
Tamarisk Member
699
Culebra Member
722
Los Medanos Member
RUSTLER FORMATION
15" Hole
10.75" x 0.375" Wall Surface Casing
25
9.875" Borehole
5" x 0.280" Wall Blank Fiberglass Well Casing
Cement
Portland ASTM C1510-92
550
Bentonite Seal
640
Sand Pack
651
6/16 Brady Gravel
702
5" Fiberglass 0.020" Slot Screen
Centralizers Located at Bottom and Top of Screen and at 60-Foot Intervals to Surface
727
Blank Casing
737 Total Depth
Note: Depths in feet bgs approximate
Not to Scale

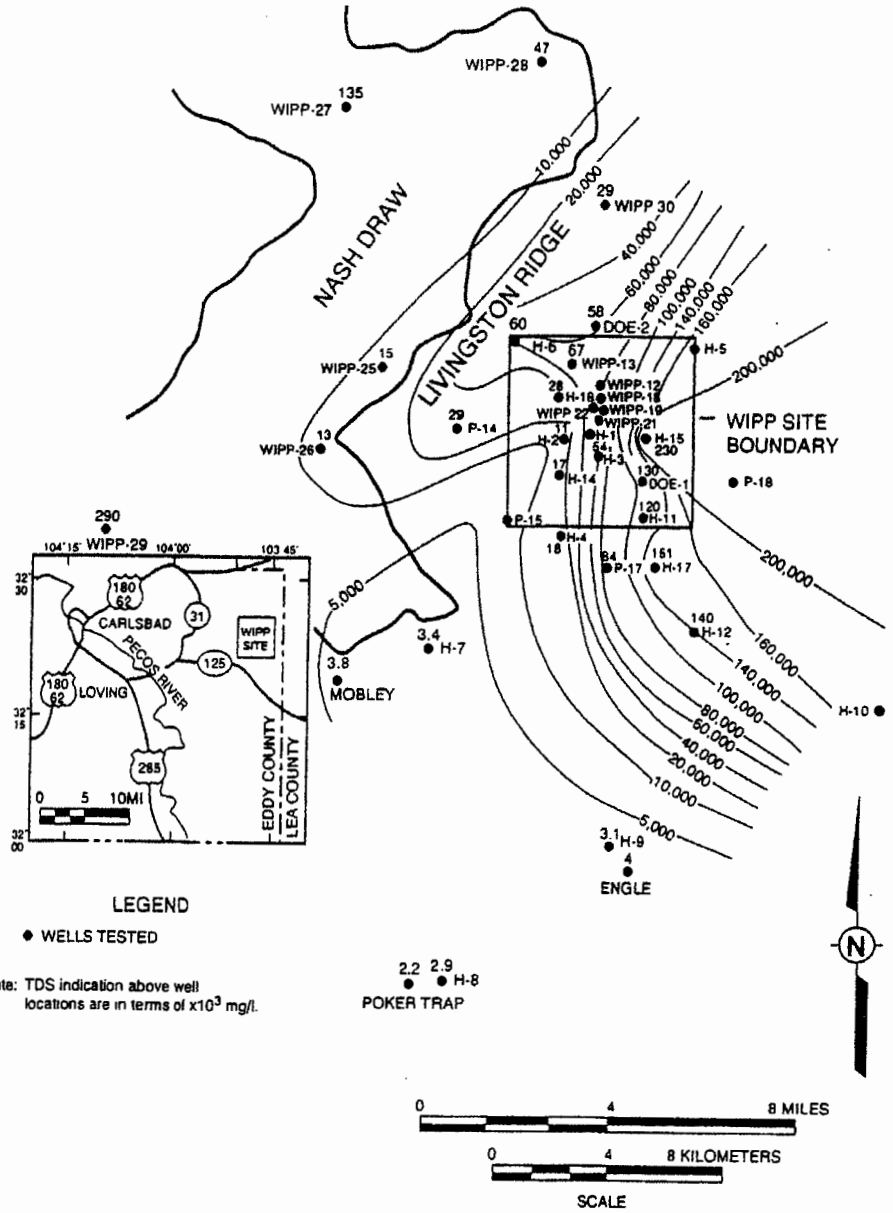
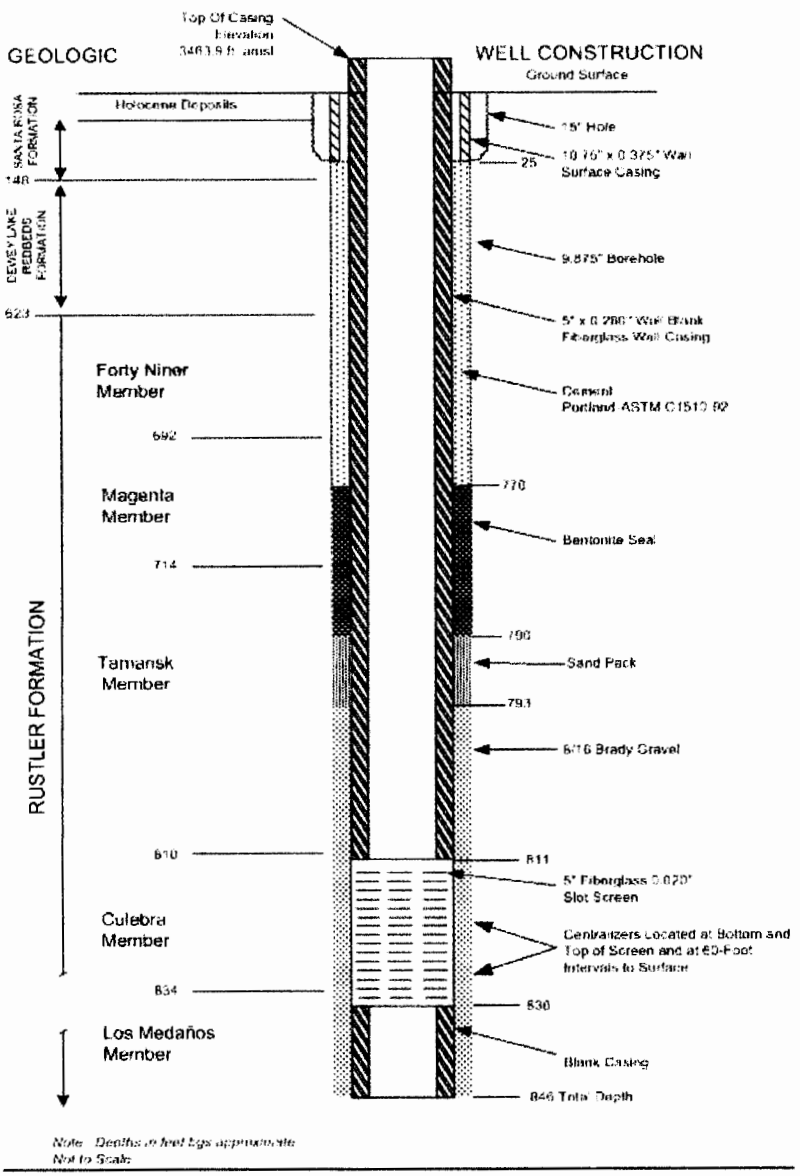


Figure L-7
As-Built Configuration of Well WQSP-1~~Total Dissolved Solids Distribution in the Culebra~~


GEOLOGIC
Top Of Casing
Elevation
3463.9 ft amsl
WELL CONSTRUCTION
Ground Surface
Holocene Deposits
SANTA ROSA FORMATION
148
DEWEY LAKE REDBEDS FORMATION
623
Forty Niner Member
692
Magenta Member
714
Tamarisk Member
610
Culebra Member
634
Los Medaños Member
RUSTLER FORMATION
15" Hole
10.75" x 0.375" Wall
Surface Casing
25
9.875" Borehole
5" x 0.280" Wall Blank
Fiberglass Wall Casing
Cement
Portland ASTM C150 92
770
Bentonite Seal
790
Sand Pack
793
6/16 Brady Gravel
811
5" Fiberglass 0.020"
Slot Screen
Centralizers Located at Bottom and
Top of Screen and at 60-Foot
Intervals to Surface
830
Blank Casing
846 Total Depth
Note: Depths in feet bgs approximate
Not to Scale

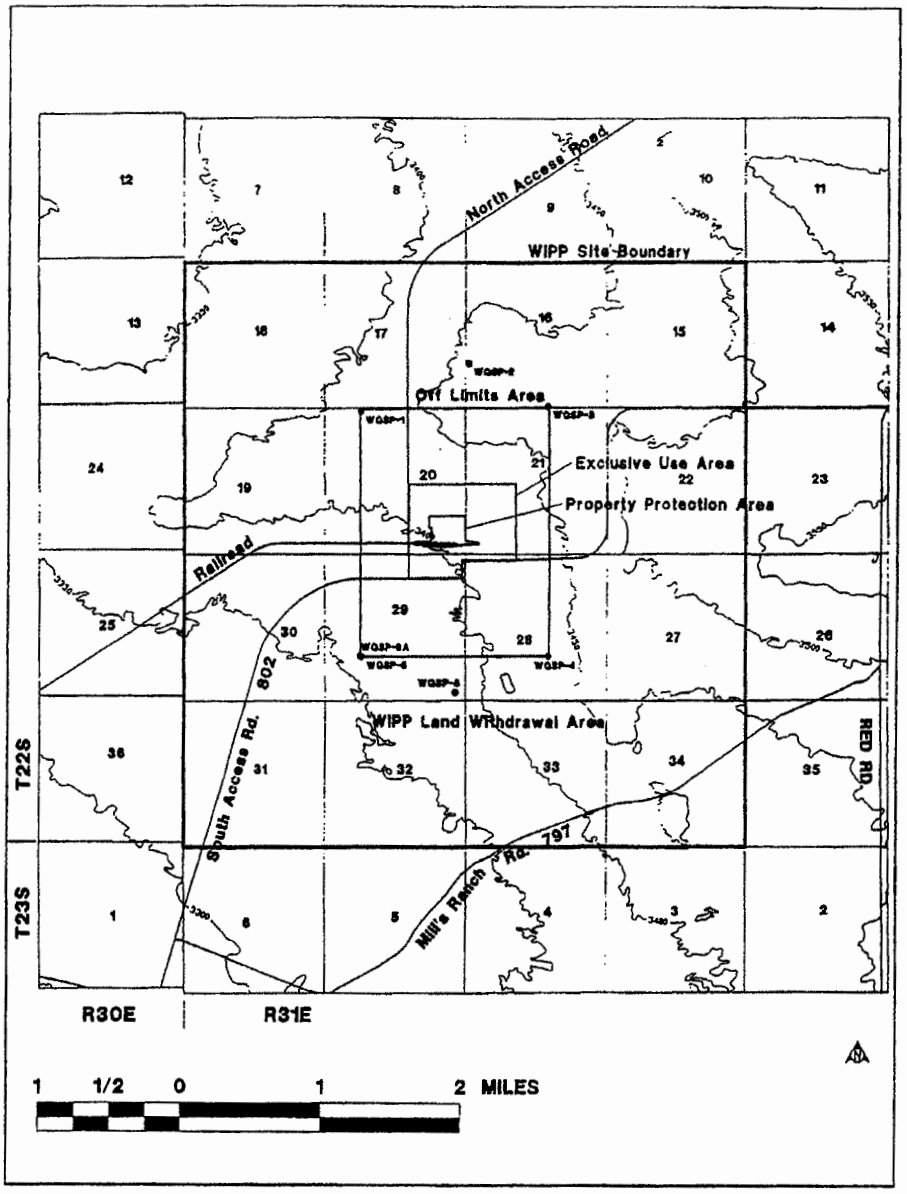
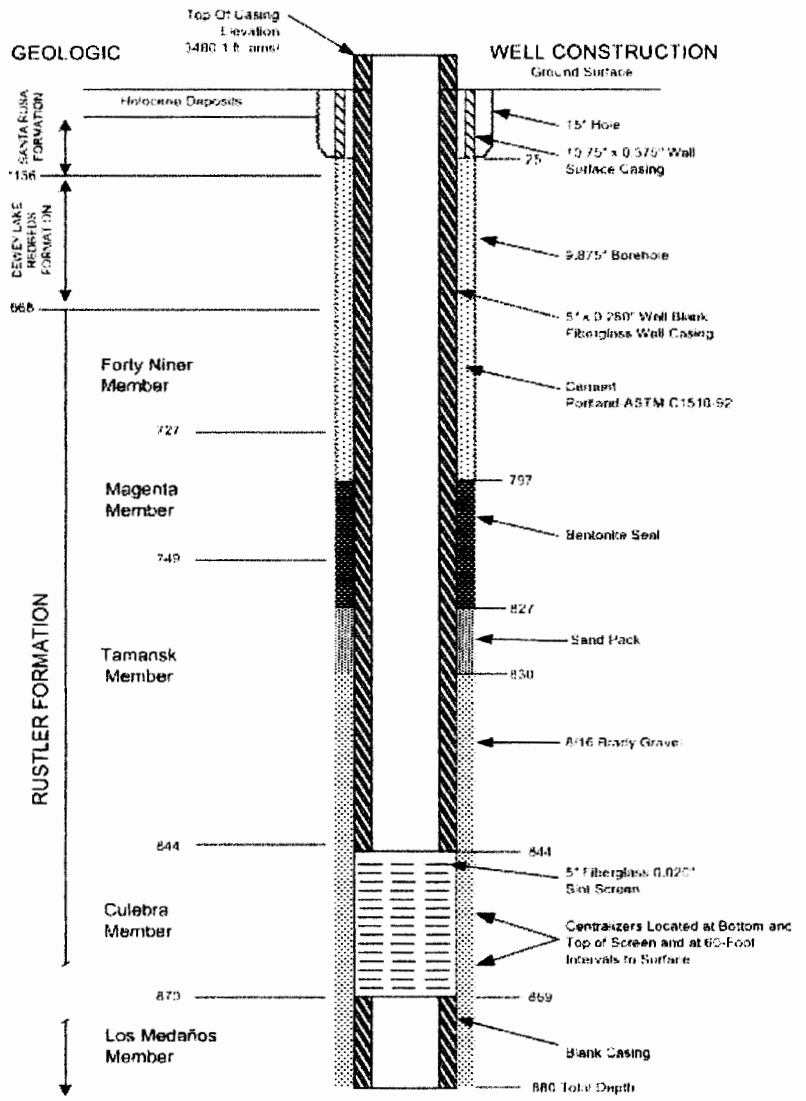
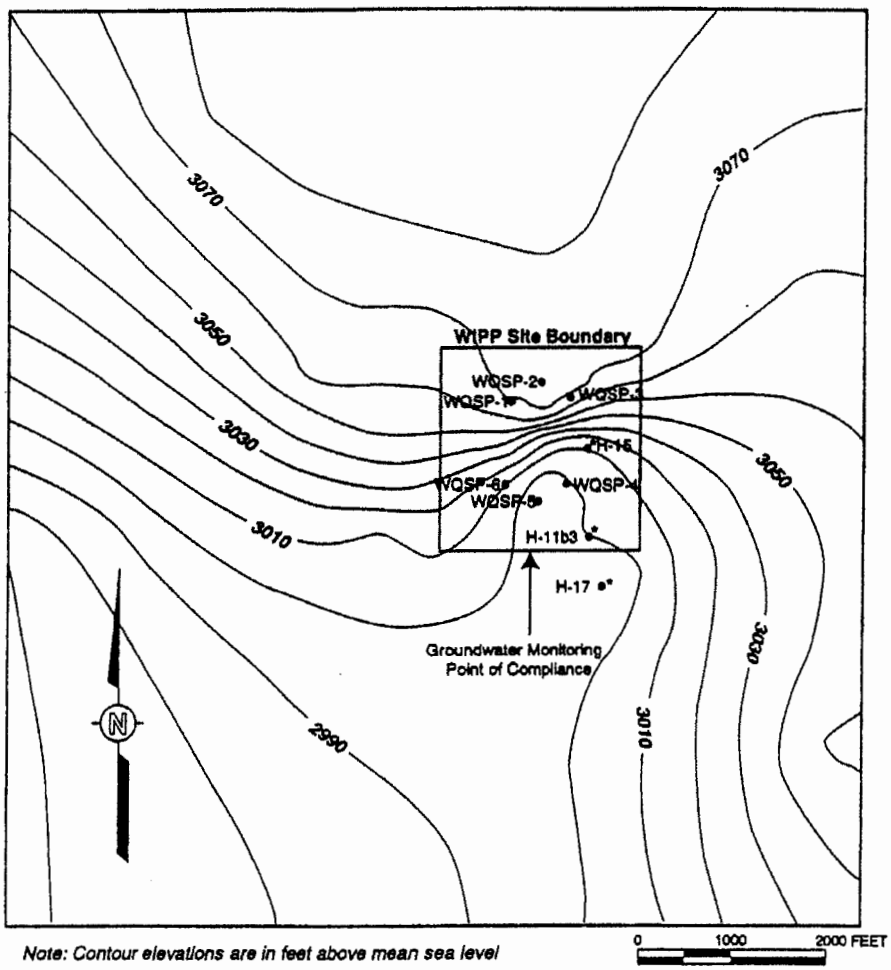


Figure L-8
As-Built Configuration of Well WQSP-2~~WQSP Monitor Well Locations~~

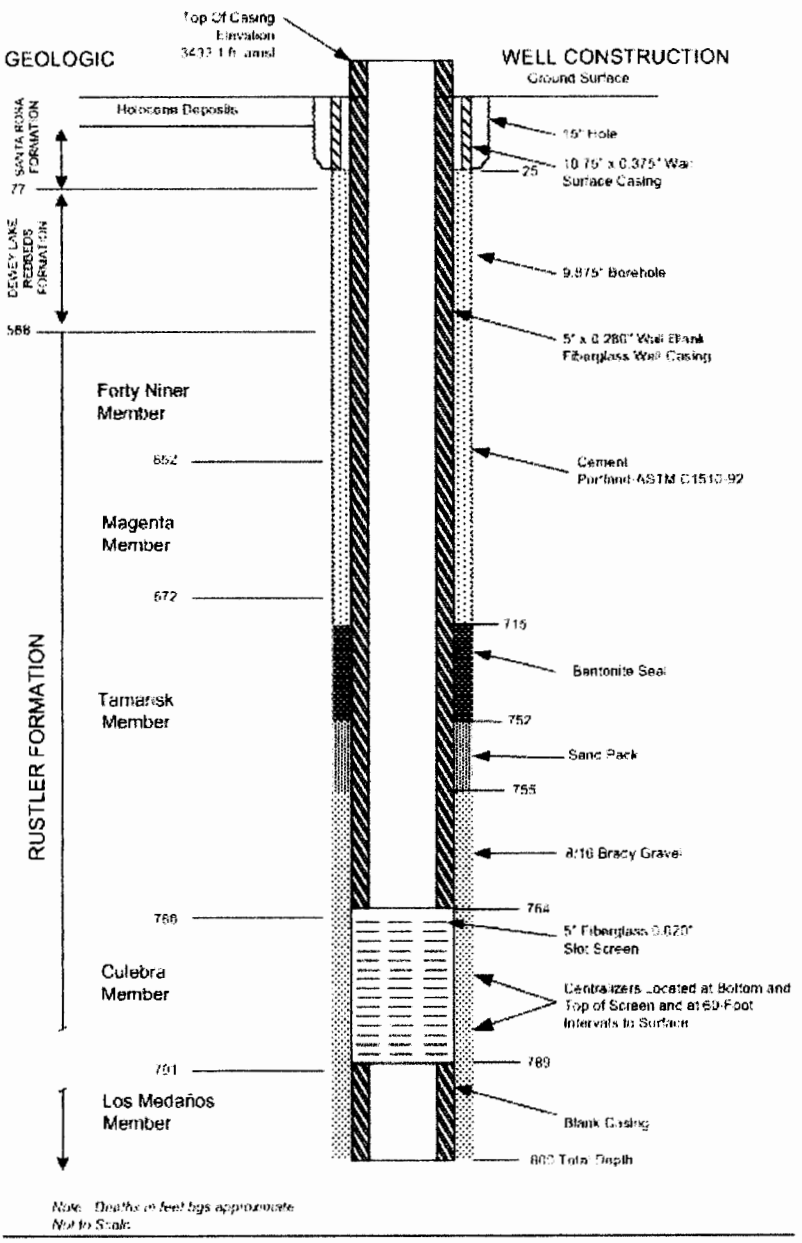

GEOLOGIC
WELL CONSTRUCTION
Ground Surface
Holocene Deposits
SANTA ROSA FORMATION
156
DEWEY LAKE REDBEDS FORMATION
668
Forty Niner Member
727
Magenta Member
749
Tamarisk Member
RUSTLER FORMATION
844
Culebra Member
870
Los Medaños Member
15" Hole
10.75" x 0.579" Wall Surface Casing
25
9.875" Borehole
5" x 0.280" Wall Blank Fiberglass Wall Casing
Cement
Portland ASTM C150-92
797
Bentonite Seal
827
Sand Pack
830
#16 Ready Gravel
844
5" Fiberglass 0.025" Slot Screen
Centralizers Located at Bottom and Top of Screen and at 60-Foot Intervals to Surface
869
Blank Casing
880 Total Depth
Note: Depths in feet bgs approximate
Not to Scale
*from DOE/WIPP-95-2154



Note: Contour elevations are in feet above mean sea level

*The Wells are included for reference only–they are not part of GMP

Figure L-9
As-Built Configuration of Well WQSP-3~~WIPP DMP Monitor Well Locations and Potentiometric Surface of the Culebra Near the WIPP~~


Top Of Casing
Elevation
GEOLOGIC
WELL CONSTRUCTION
Ground Surface
Holocene Deposits
SANTA ROSA FORMATION
77
DEWEY LAKE REDBEDS FORMATION
588
Forty Niner Member
652
Magenta Member
672
Tamarisk Member
766
Culebra Member
791
Los Medaños Member
RUSTLER FORMATION
15" Hole
10.75" x 0.375" Wall
Surface Casing
25
9.875" Borehole
5" x 0.280" Wall Blank
Fiberglass Well Casing
Cement
Portland ASTM C150-92
715
Bentonite Seal
752
Sand Pack
755
3/16 Bracy Gravel
764
5" Fiberglass 0.020"
Slot Screen
Centralizers Located at Bottom and
Top of Screen and at 60-Foot
Intervals to Surface
789
Blank Casing
800 Total Depth
Note: Depths in feet bgs approximate
Not to Scale

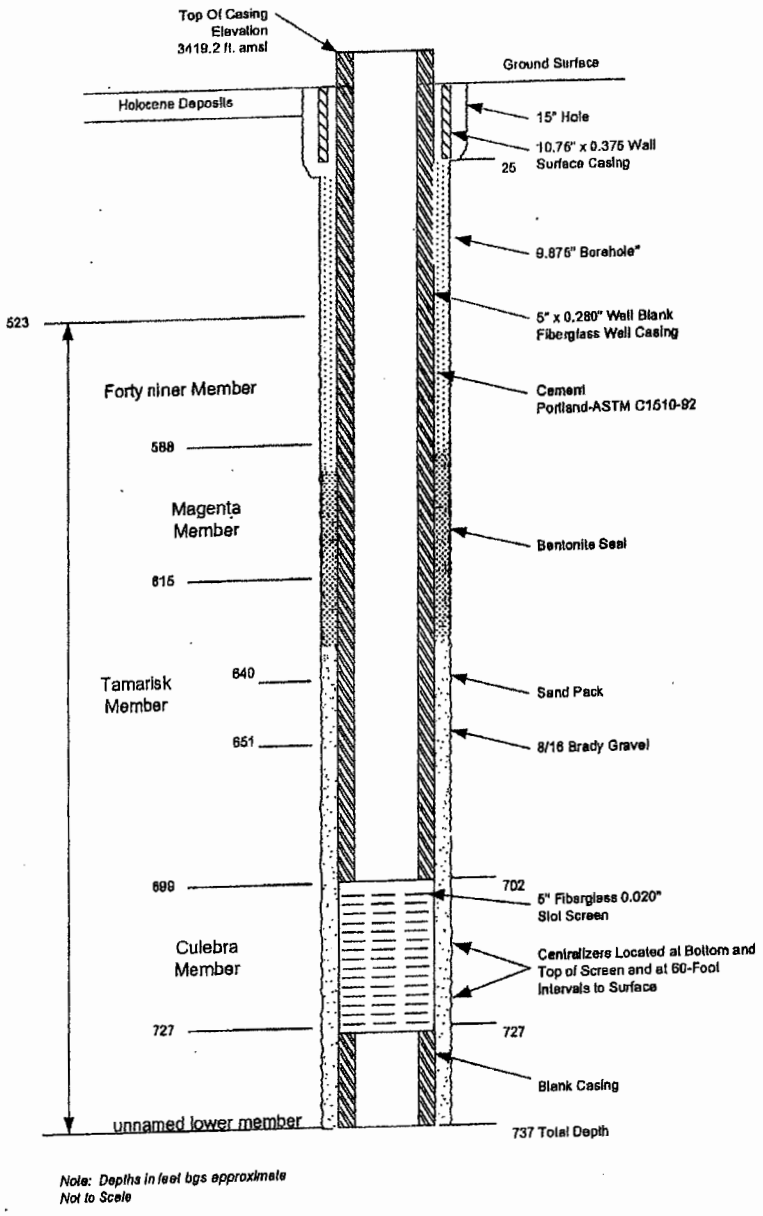
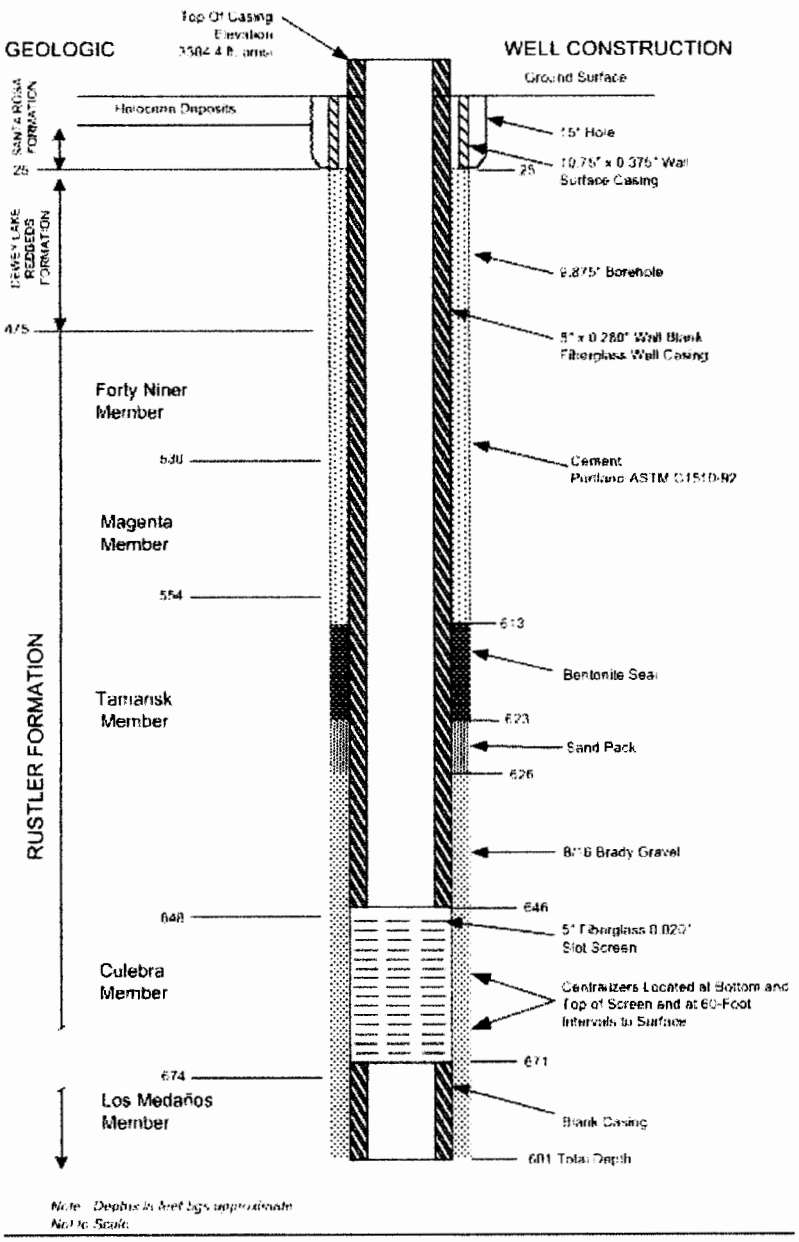


Figure L-10
As-Built Configuration of Well WQSP-4~~As-Built Configuration of Well WQSP-1~~



Note: Depths in feet bgs approximate
Not to Scale

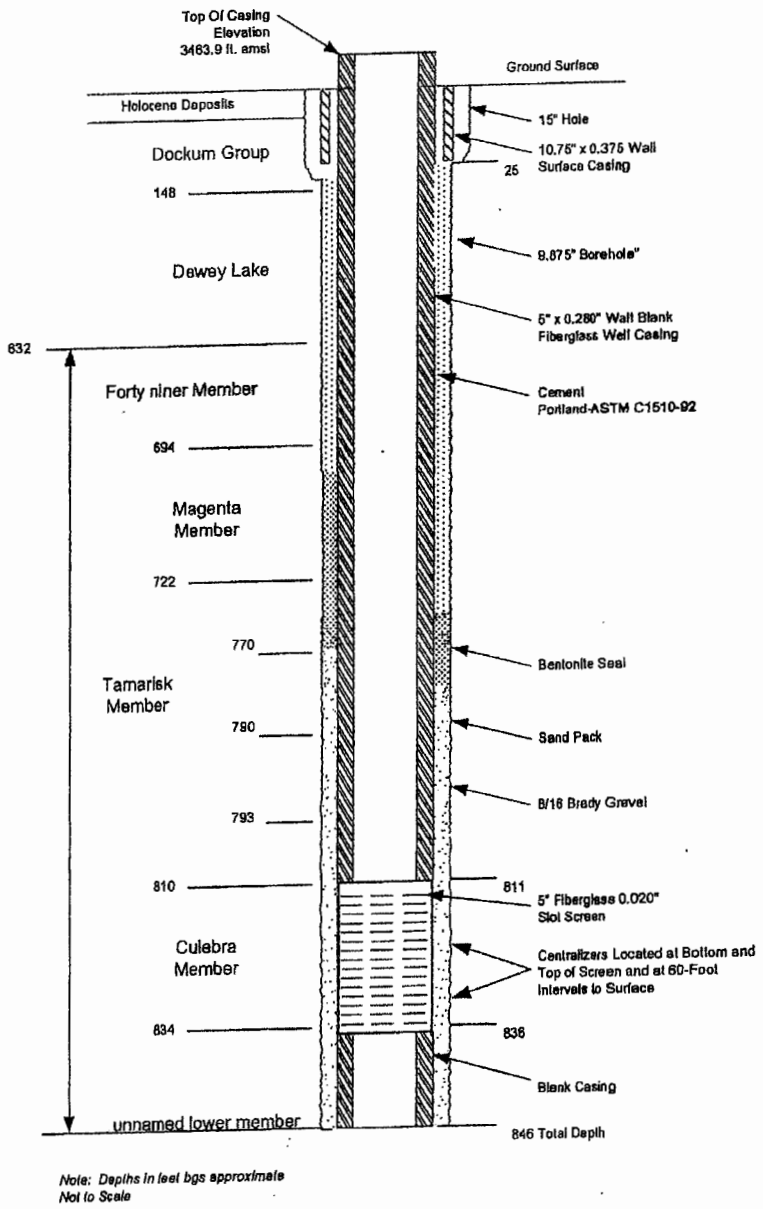
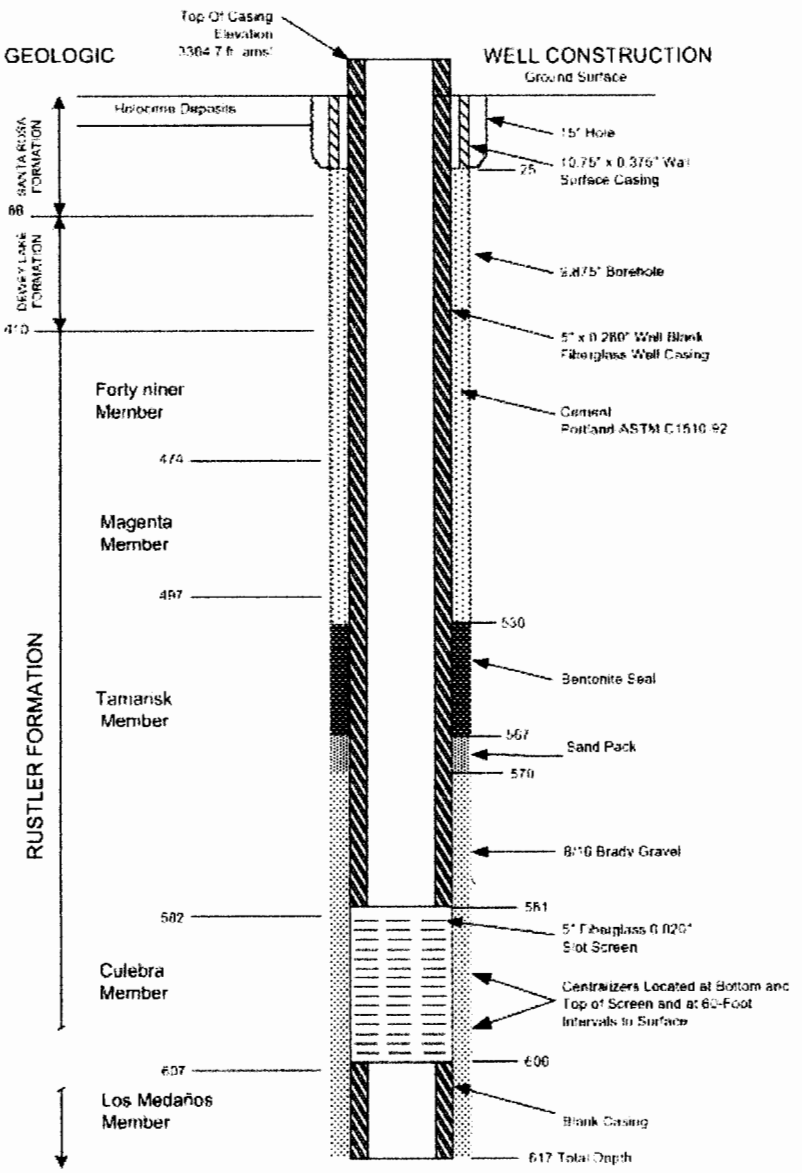


Figure L-11
As-Built Configuration of Well WQSP-5 ~~As-Built Configuration of Well WQSP-2~~


GEOLOGIC
Top Of Casing
Elevation
3384.7 ft amsl
WELL CONSTRUCTION
Ground Surface
Holocene Deposits
SANTA ROSA FORMATION
68
DEWEY LAKE FORMATION
410
Forty niner Member
474
Magenta Member
497
Tamarisk Member
502
Culebra Member
607
Los Medaños Member
RUSTLER FORMATION
15" Hole
10.75" x 0.375" Wall Surface Casing
25
9.875" Borehole
5" x 0.280" Wall Blank Fiberglass Well Casing
Cement
Portland ASTM C150-92
530
Bentonite Seal
567
Sand Pack
570
8/16 Brady Gravel
581
5" Fiberglass 0.020" Slot Screen
Centralizers Located at Bottom and Top of Screen and at 60-Foot Intervals to Surface
600
Blank Casing
617 Total Depth
Note: Depths in feet bgs approximate
Not to Scale

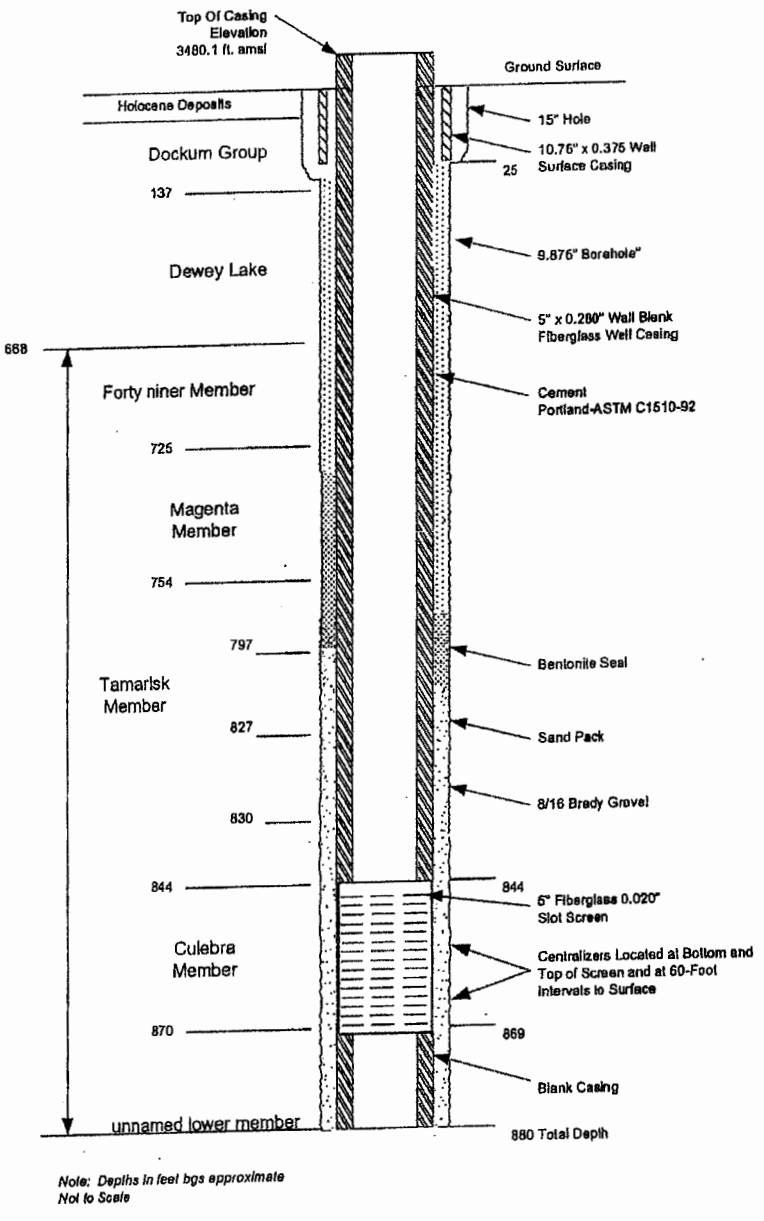


Figure L-12
As-Built Configuration of Well WQSP-6~~As-Built Configuration of Well WQSP-3~~

CHAIN OF CUSTODY RECORD

Page ___ of ___

Project Number	Project Name:	Total Number of Containers	Container Size / Request Analyses	Contract Laboratory
Samplers:	Date:			

Date	Time	Matrix	Sample Number

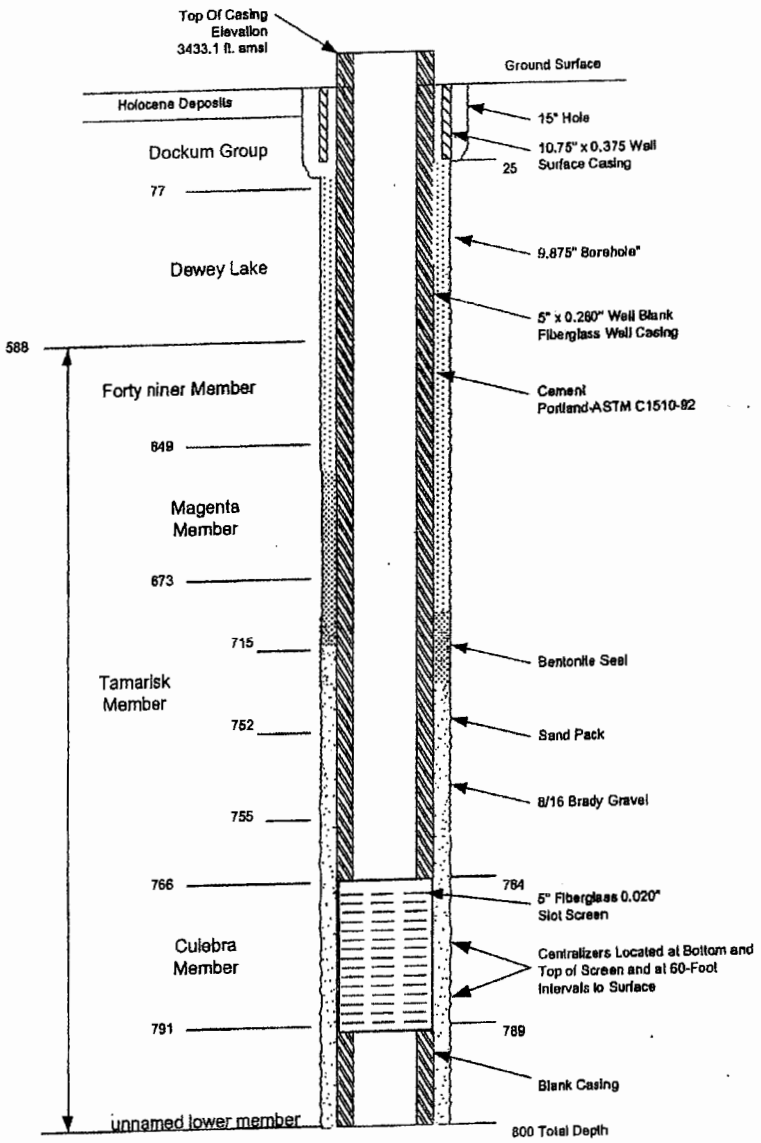
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

Requested Turnaround Time:	Sample Receipt Remarks:	Special Instructions:
☐ *Routine* ☐ *Rush* _____		
Sample Disposal: ☐ *Return to Client* ☐ *Disposal by Lab*	Results To:	
Carrier / Airbill No.:		

WHITE - Testing Laboratory
AF - Air Filter(s)
SE - Sediment
YELLOW - Field copy
AW - Aqueous
SO - Soil
PINK - Record Copy
DI - Deionized Water
SW - Surface Water
GW - Ground Water
VE - Vegetation

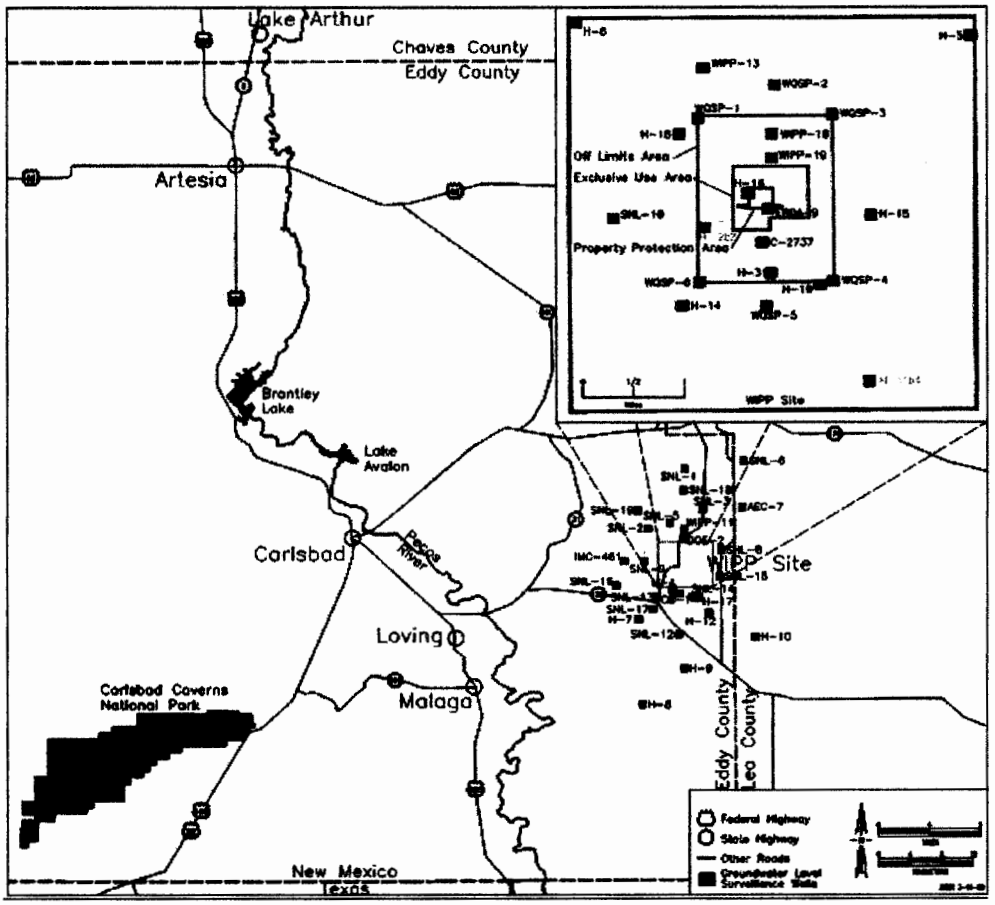
AP-02 EN/12/01, revision ++

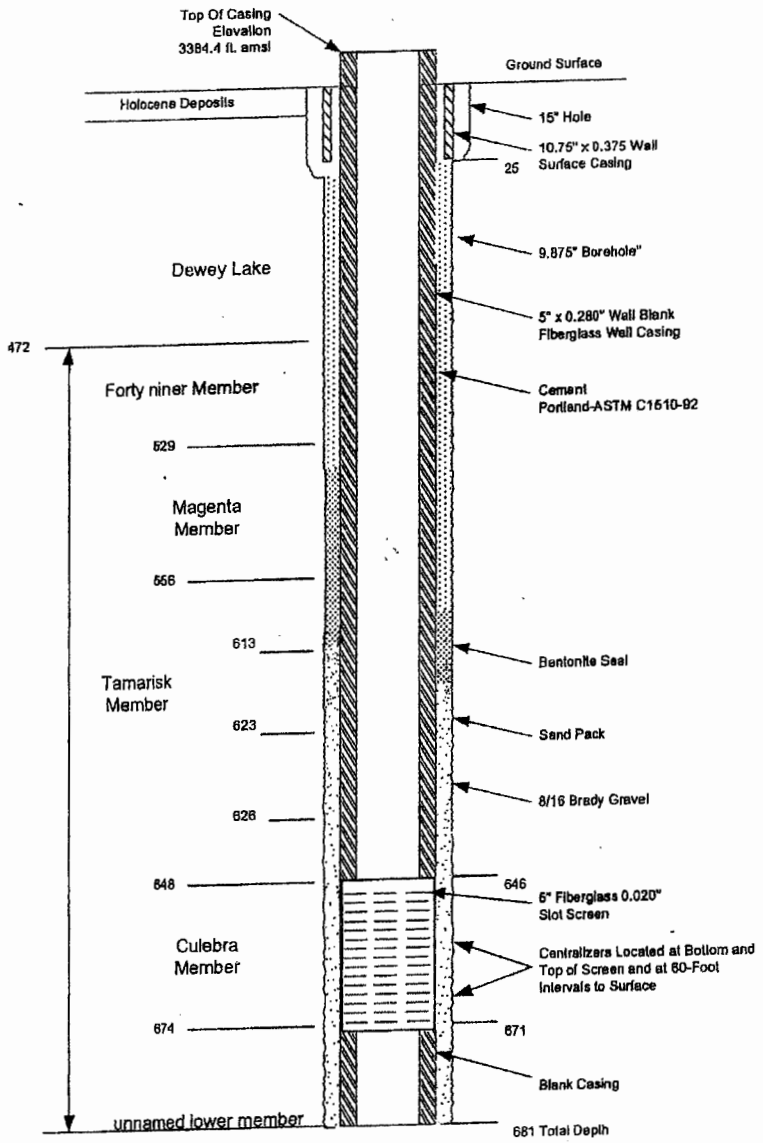
EXAMPLE



Note: Depths in feet bgs approximate
Not to Scale

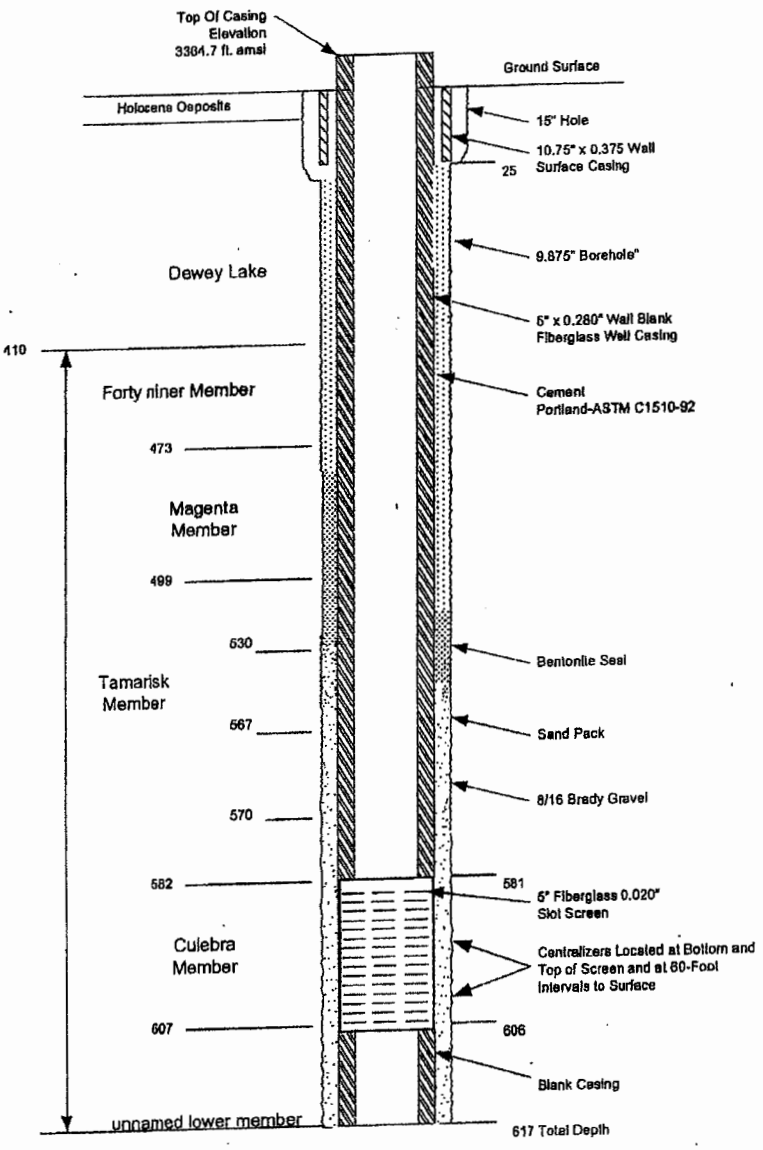
Figure L-13
Example Chain-of-Custody/Request for Analysis Form~~Figure L-13~~
~~As-Built Configuration of Well WQSP-4~~


Lake Arthur
Chaves County
Eddy County
Artesia
Brantley Lake
Lake Avalon
Carlsbad
Pecos River
Loving
Malaga
Carlsbad Caverns National Park
New Mexico
Texas
WIPP Site
Off Limits Area
Exclusive Use Area
Property Protection Area
Eddy County
Lea County
Federal Highway
State Highway
Other Roads
Groundwater Level Surveillance Wells



Note: Depths in feet bgs approximate
Not to Scale

Figure L-14
Groundwater Level Surveillance Wells
(inset represents the groundwater surveillance wells in WIPP Land Withdrawal Area)~~Figure L-14~~



Note: Depths in feet bgs approximate
Not to Scale

~~**Figure L-15**~~
~~**As-Built Configuration of Well WQSP-6**~~

~~**Figure L-16**~~
~~**Reserved**~~

Chain of Custody Record

{MOC Name and Address}

C of C Control No. _____

RFA Control No. _____

SAMPLING PROGRAM _____ LAB DESTINATION _____

SAMPLE TEAM MEMBERS _____ CARRIER/WAYBILL NO. _____

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.

Special Instructions _____

Possible Sample Hazards: _____

Signatures: (Name, Company, Date and Time: _____

1. Relinquished By: _____
   Received By: _____
2. Relinquished By: _____
   Received By: _____
3. Relinquished By: _____
   Received By: _____
4. Relinquished By: _____
   Received By: _____

WHITE - Original, to accompany samples YELLOW- Field Copy PINK- OTHER

~~Figure L-17a~~
~~Example Chain of Custody Record~~

REQUEST FOR ANALYSIS

{MOC Name and Address}

R/A Control _____
C/C Control No. _____
Date Sample Shipped _____
Lab Destination _____
Laboratory Contact _____
Send Lab Report To _____

VOC Monitoring Program _____

Date Report Required _____
Project Contact _____
Project Contact Phone No. _____

Purchase Order No. _____

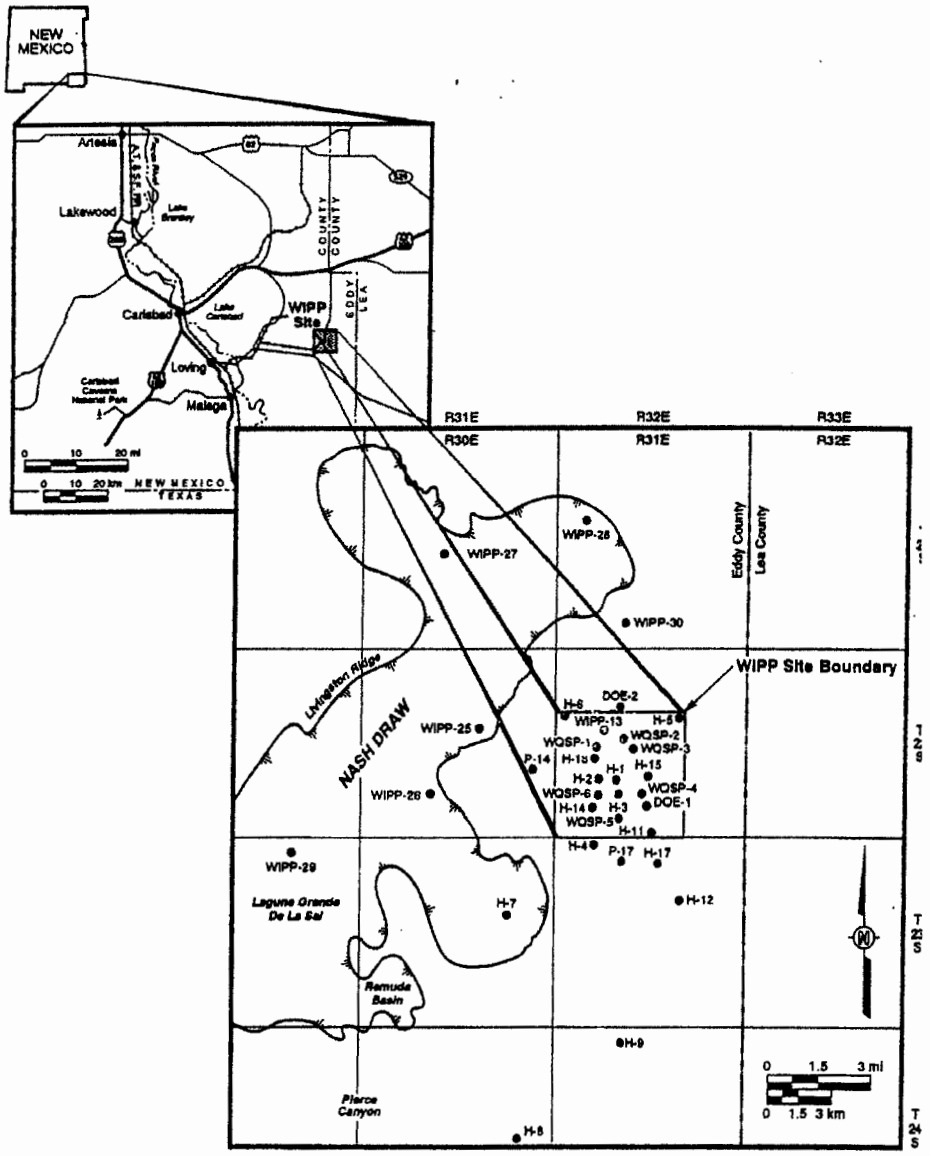
Serial No.	Sample No.	C-of-C No.	Sample Type	Sample Pressure	Preservative	Contract-Specific Testing	Special Instructions

TURNAROUND TIME REQUIRED: (Rush must be approved by appropriate Manager) NORMAL _____ RUSH ____ (Subject to rush surcharge)
POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or contain high levels of hazardous substances.)
NONHAZARD _____ FLAMMABLE _____ SKIN IRRITANT _____ HIGHLY TOXIC _____ BIOLOGICAL _____ OTHER

SAMPLE DISPOSAL (Please indicate disposition of sample following analysis.) RETURN TO CLIENT _____ DISPOSAL BY LAB _____ (Please Specify)

FOR LAB USE ONLY
RECEIVED BY _____ DATE/TIME _____

~~Figure L-17b~~
~~Example Request for Analysis~~



~~Figure L-18~~
~~Ground-water Surface Elevation Monitoring Locations~~

Formatted: Left
Field Code Changed
Field Code Changed

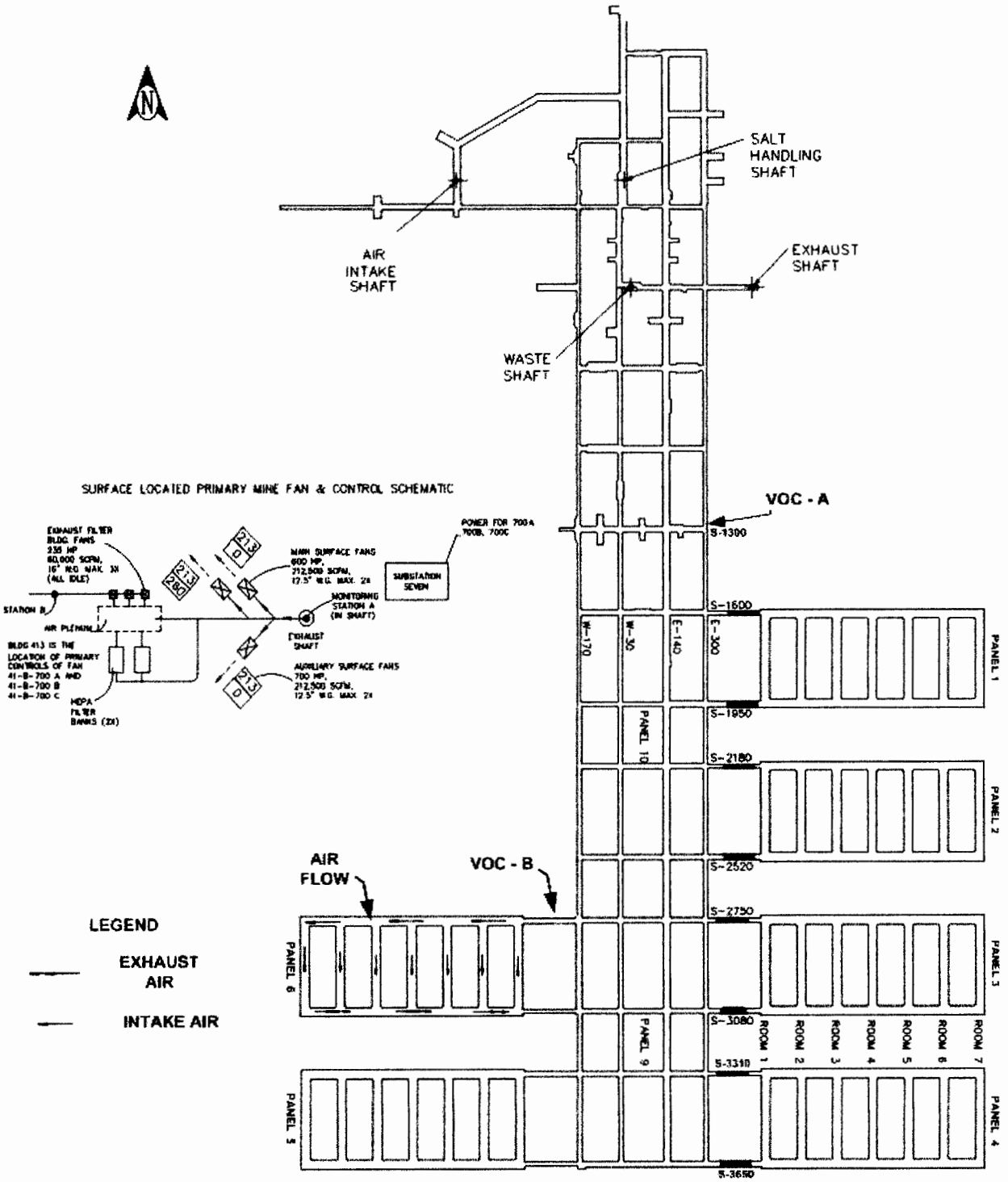
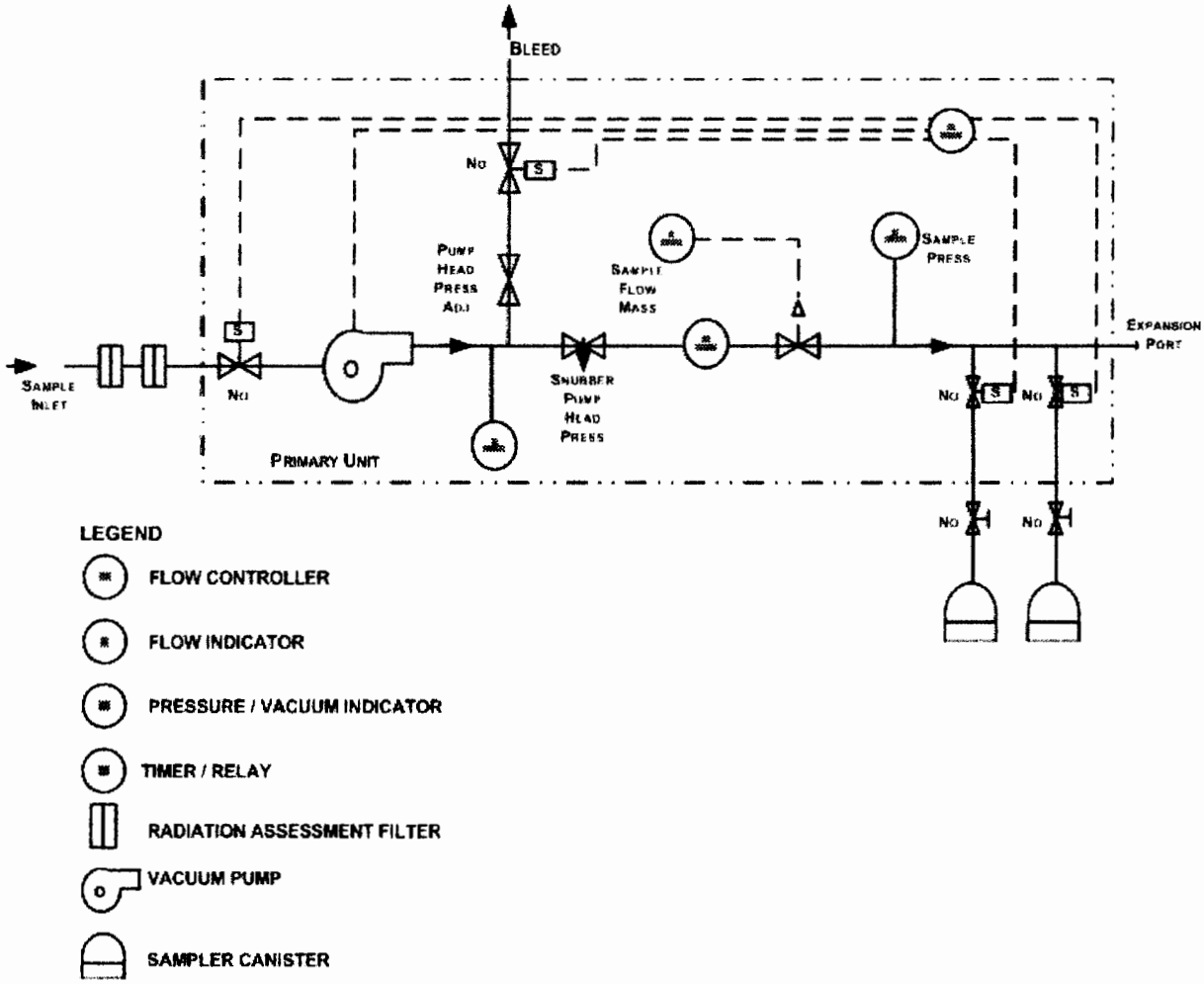


Figure N-1
Panel Area Flow

(This table changed)



NOTE: Number and Arrangement of Components May Vary Depending on Sampling Location (i.e., confirmatory vs. Room-Based) and Number of Samples To Be Collected.

Figure N-2
VOC Monitoring System Design

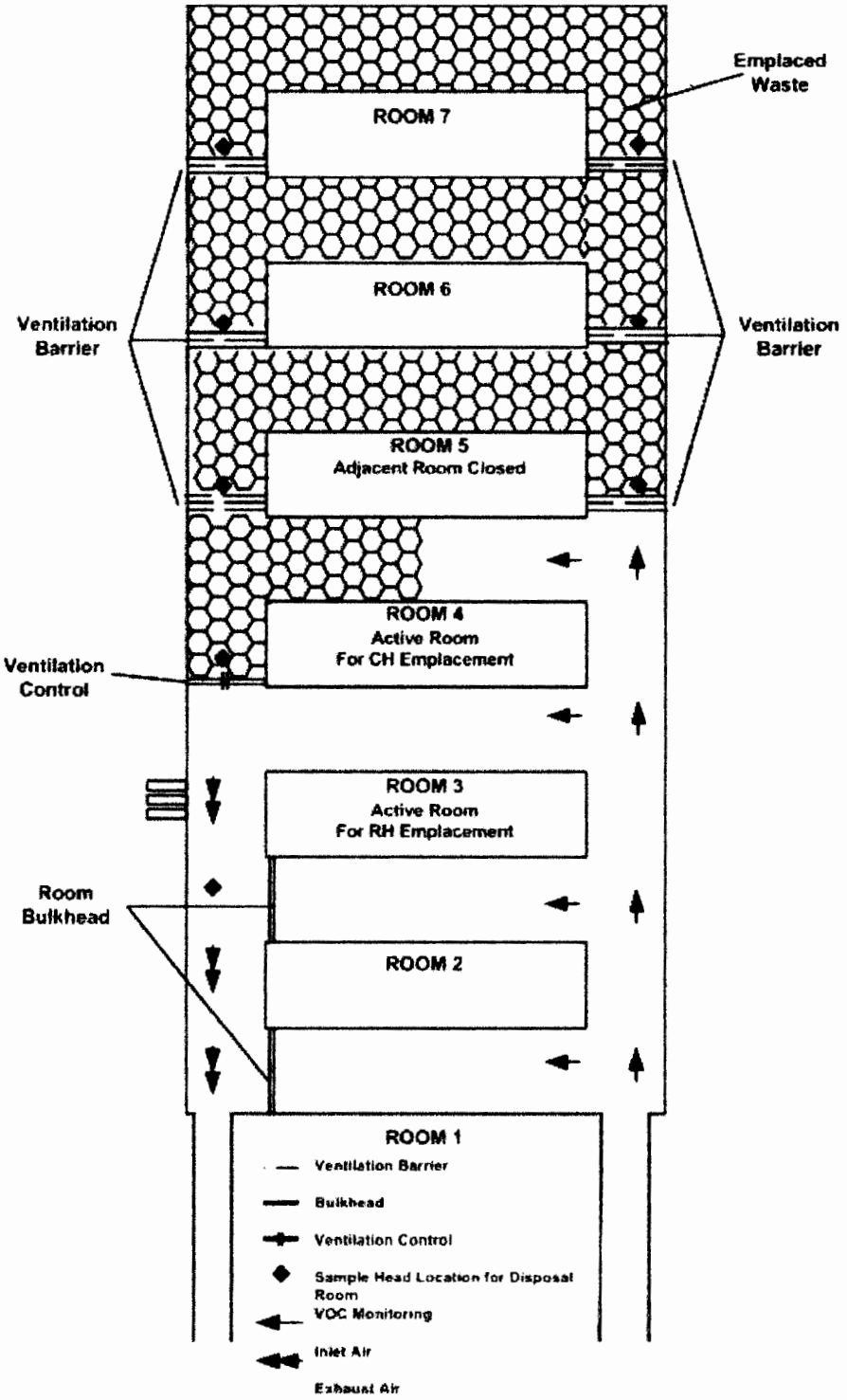


Figure N-3
Disposal Room VOC Monitoring

Field (

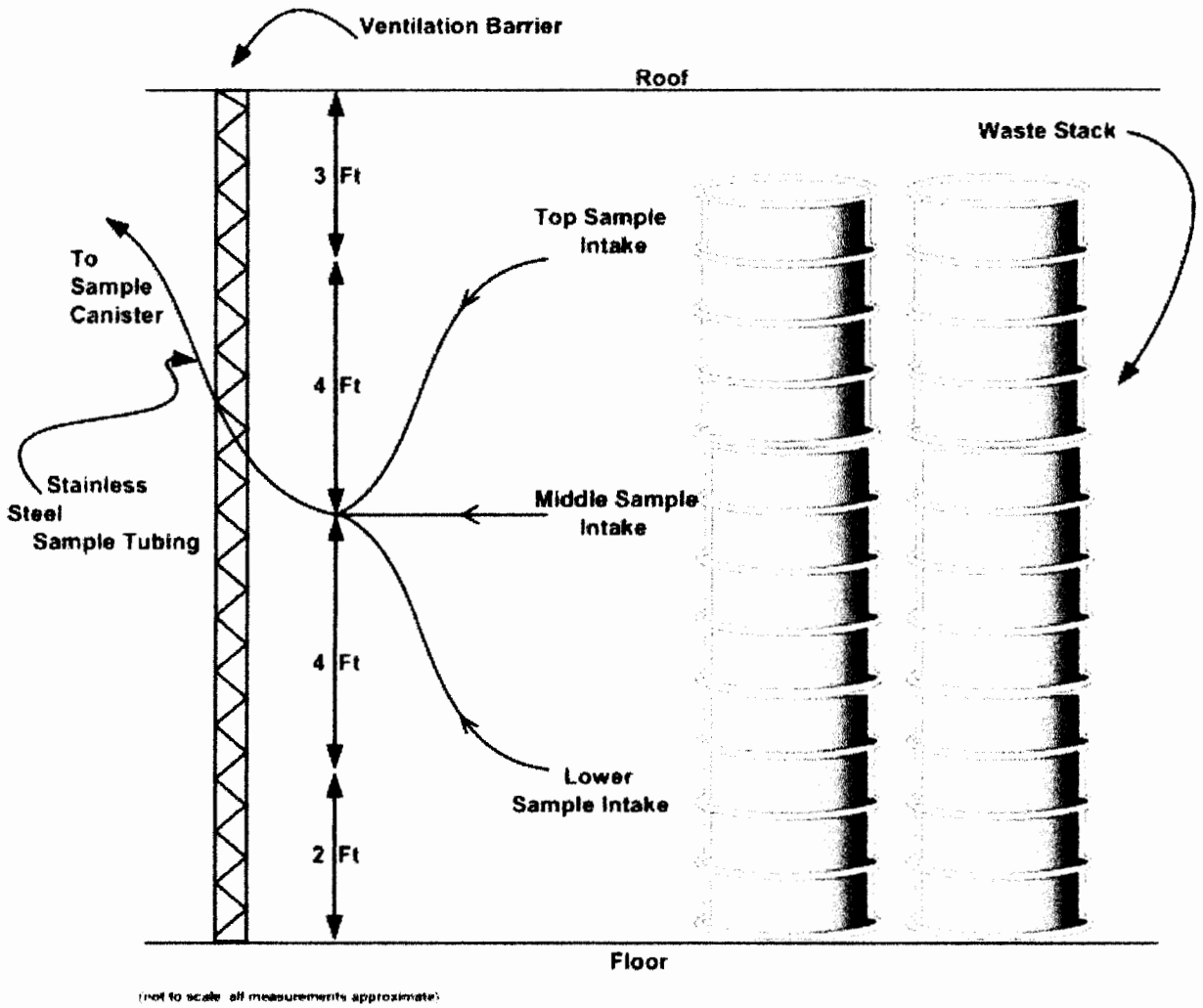


Figure N-4
VOC Sample Head Arrangement

ATTACHMENT N1

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N1-1 Introduction

This Permit Attachment describes the monitoring plan for hydrogen and methane generated in Underground Hazardous Waste Disposal Units (**HWDUs**) 3 through 8, also referred to as Panels 3 through 8.

Monitoring for hydrogen and methane in Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed, may be an effective way to gather data to establish realistic gas generation rates. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N1-2 Parameters to be Analyzed and Monitoring Design

The Permittees will monitor for hydrogen and methane in filled Panels 3 through 8 until final panel closure, unless an explosion-isolation wall is installed. A "filled panel" is an Underground HWDU that will no longer receive waste for emplacement.

Monitoring of a filled panel will commence after installation of the following items in each filled panel:

- substantial barriers
- bulkheads
- five additional monitoring locations.

The substantial barriers serve to protect the waste from events such as ground movement or vehicle impacts. The substantial barrier will be constructed from available non-flammable materials such as mined salt (Figure N1-1).

The bulkheads (Figure N1-2) serves to block ventilation at the intake and exhaust of the filled panel and prevent personnel access. The bulkhead is constructed as a typical WIPP bulkhead with no access doors or panels. The bulkhead will consist of a steel member frame covered with galvanized sheet metal, and will not allow personnel access. ~~Rubber conveyor belt~~Flexible flashing will be used as a gasket to attach the steel frame to the salt, thereby providing an effective yet flexible blockage to ventilation air. Over time, it is possible that the bulkhead may be damaged by creep closure around it. If the damage is such as to indicate a possible loss of functionality, then the bulkhead will be repaired or an additional bulkhead will be constructed outside of the original one.

The existing VOC monitoring lines as specified in Attachment N, Section N-3a(2), "Sampling Locations for Disposal Room VOC Monitoring", will be used for sample collection in each disposal room for Panels 3 and 4. The sample lines and their construction are shown in Figure N1-3. In addition to the existing VOC monitoring lines, five more sampling locations will be used to monitor for hydrogen and methane. These additional locations include:

- the intake of room 1

- the waste side of the exhaust bulkhead,
- the accessible side of the exhaust bulkhead,
- the waste side of the intake bulkhead,
- the accessible side of the intake bulkhead.

These additional sampling locations (Figure N1-4) will use a single inlet sampling point placed near the back (roof) of the panel access drifts. This will maximize the sampling efficiency for these lighter compounds.

N1-3 Sampling Frequency

Sampling frequency will vary depending upon the levels of hydrogen and methane that are detected.

- If monitored concentrations are at or below Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted monthly.

- If monitored concentrations exceed Action Level 1 as specified in Permit Part 4, Table 4.6.5.3, monitoring will be conducted weekly in the affected filled panel.

N1-4 Sampling

Samples for hydrogen and methane will be collected using subatmospheric pressure grab sampling as described in Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling method uses passivated stainless-steel sample canisters to collect integrated air samples at each sample location. Flow rates and sampling duration may be modified as necessary to meet data quality objectives.

Sample lines shall be purged prior to sample collection.

N1-5 Sampling Equipment

N1-5a SUMMA® Canisters

Stainless-steel canisters with passivated or equivalent interior surfaces will be used to collect and store gas samples for hydrogen and methane analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use in a manner similar to that described by Compendium Method TO-15 (EPA, 1999). The vacuum of certified clean canisters will be verified upon initiation of a sample cycle. Sampling will be conducted using subatmospheric pressure grab sampling techniques as described in TO-15.

N1-5b Sample Tubing

Treated stainless steel tubing shall be used as a sample path and treatment shall prevent the inner walls from absorbing contaminants.

Any loss of the ability to purge a sample line will be evaluated. The criteria used for evaluation are shown in Figure N1-5.

ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

TABLE OF CONTENTS

O-1 Definitions ..... 2~~1~~
O-2 Objective ..... 3~~1~~
O-3 Design and Procedures ..... 3~~2~~
O-3a Test and Balance ..... 3~~2~~
O-3a(1) Test and Balance Process ..... 3~~2~~
O-3a(2) Test and Balance Schedule ..... 5~~3~~
O-3b Running Annual Average of the Total Mine Airflow ..... 5~~4~~
O-3b(1) Monitoring Total Mine Airflow ..... 5~~4~~
O-3b(2) Calculation of the Running Annual Average of Total Mine Airflow ..... 5~~4~~
O-3c Active Disposal Room Minimum Airflow ..... 6~~4~~
O-3c(1) Verification of Active Disposal Room Minimum Airflow ..... 6~~4~~
O-3c(2) Measurement and Calculation of the Active Waste Disposal Room Airflow ..... 6~~5~~
O-3d Quarterly Verification of Total Mine Airflow ..... 6~~5~~
O-4 Equipment Calibration and Maintenance ..... 6~~5~~
O-5 Reporting and Recordkeeping ..... 7~~5~~
O-5a Reporting ..... 7~~5~~
O-5b Recordkeeping ..... 7~~6~~
O-6 Quality Assurance ..... 7~~6~~

LIST OF TABLES

Table	Title
O-1	Ventilation Operating Modes and Associated Flow Rates
O-2	Mine Ventilation Rate Testing Equipment
O-3	Active Disposal Room Ventilation Rate Log Sheet (Example)

ATTACHMENT O

WIPP MINE VENTILATION RATE MONITORING PLAN

O-1 Definitions

Compliance with the mine ventilation requirements set forth in Permit Part 4 and Permit Attachment A2 requires the use and definition of the following terms:

Actual cubic feet per minute (**acfm**): The volume of air passing a fixed point in an excavation, normally determined as the product of the cross section of the excavation and the mean velocity of the air.

Standard cubic feet per minute (**scfm**): The actual cubic feet per minute passing a fixed point adjusted to standard conditions. In the Imperial measurement system, the standard condition for pressure is 14.7 pounds per square inch (**psi**) (sea level) and the standard condition for temperature is 492 degrees Rankine (freezing point of water or 32 degrees Fahrenheit). The greatest difference between acfm and scfm occurs in the summer when the pressure at the repository horizon is about 14.2 psi and the temperature is about 560 degrees Rankine (100 degrees Fahrenheit). Then

$$1 \text{ scfm} \times (560/492) \times (14.7/14.2) = 1.2 \text{ acfm}$$

A reasonably conservative conversion factor, therefore, is 1.2. Using this factor, 35,000 scfm is very nearly 35,000 x 1.2 or 42,000 acfm.

Restricted Access: If the required ventilation rate in an active ~~disposal~~ room where waste disposal is taking place cannot be achieved or cannot be supported due to operational needs, access is restricted by the use of barriers, signs and postings, or individuals stationed at the entrance to the active disposal room when ventilation rates are below 35,000 scfm. Note: As provided in O-3c(2) entry to restricted access active rooms for the purpose of establishing normal ventilation is allowed.

Shift: Those work shifts when there is normal access to the Waste Isolation Pilot Plant (**WIPP**) underground.

Worker: Anyone who has normal access to the WIPP underground.

O-2 Objective

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

- Maintaining an annual running average of 260,000 scfm through the underground repository
- Maintaining a minimum of 35,000 scfm of air through the active ~~disposal~~ rooms where waste disposal is taking place and when workers are present in the rooms

This plan contains the following elements: Objective; Design and Procedures; Equipment Calibration and Maintenance; Reporting and Record Keeping; Quality Assurance.

O-3 Design and Procedures

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

- Test and Balance, a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components
- Monitoring and calculation of the Running Annual Average of the Total Mine Airflow to verify achievement of the 260,000 scfm minimum requirement
- Monitoring of active ~~disposal~~ room(s) to ensure a minimum flow of 35,000 scfm whenever waste disposal is taking place and workers are present in the room
- Quarterly verification of the total mine airflow

O-3a Test and Balance

O-3a(1) Test and Balance Process

The WIPP ventilation system and the underground ventilation modes of operation are described in Permit Application A2-2a(3). The Permittees shall verify underground ventilation system performance by conducting a periodic Test and Balance. The Test and Balance is a comprehensive series of measurements and adjustments designed to ensure that the system is operating within acceptable design parameters. The Test and Balance is an appropriate method of verifying system flow because it provides consistent results based on good engineering practices. The testing of underground ventilation systems is described in McPherson, 1993. Once completed, the Test and Balance data become the baseline for underground ventilation system operation until the next Test and Balance is performed.

The "Test" portion of the process shall involve measuring the pressure drop and air quantity of every underground entry excluding alcoves or other dead end drifts. In addition, the tests shall verify resistance curves for each of the main regulators, measure shaft resistance, and measure main fan pressure and quantity. This is done at the highest achievable airflow to facilitate

accurate measurements. From these measurements the frictional resistance of the system is determined.

Pressure shall be measured using the gage and tube method, which measures the pressure drop between two points using a calibrated pressure recording device and pitot tubes. Pressure drops across the shafts shall be measured by either calibrated barometers at the top and bottom of shafts or the gage and tube method. Airflow shall be measured using a calibrated vane anemometer to take a full entry traverse between system junctions. Fan pressure shall be measured using a calibrated pressure recording device and pitot tube to determine both static and velocity pressure components.

Multiple measurements shall be taken at each field location to ensure accurate results. Consecutive field values must fall within ±5% to be acceptable. These data shall be verified during the testing process by checking that:

- the sum of airflows entering and leaving a junction is equal to zero; and,
- the sum of pressure drops around any closed loop is equal to zero.

Once the measurements are taken, data shall be used to calculate the resistance of every underground drift, as well as shafts and regulators using Atkinson's Square Law

$$P=R \times Q^2$$

where the pressure drop of an entry (P) is equal to a resistance (R) times the square of the quantity of air flowing (Q) through the circuit.

The "Balance" portion of the process shall involve adjusting the settings of the system fans and regulators to achieve the desired airflow distribution in all parts of the facility for each mode of operation. Particular emphasis shall be given to the active disposal room(s) in the Waste Disposal Circuit to ensure that a minimum airflow of 35,000 scfm is achieved. The system baseline settings for the current Balance shall be established from the previous Test and Balance. Adjustments shall then be made to account for changes in system resistance due to excavation convergence due to salt creep, approved system modifications, or operational changes.

The Permittees shall use a commercially available ventilation simulator to process Test and Balance field data. The simulator uses the Hardy-Cross Iteration Method (McPherson, 1993) to reduce field data into a balanced ventilation network, including the appropriate regulator settings necessary to achieve proper airflow distribution for the various operating modes. Once balanced, the same simulator shall be used to evaluate changes such as future repository development and potential system modification before they are implemented.

The Test and Balance process culminates in a final report which is retained on site. Following receipt of the Test and Balance Report, the Permittees shall revise the WIPP surface and underground ventilation system procedures to incorporate any required changes to the ventilation system configuration. The Test and Balance data shall be used to adjust the operating range of fan controls, waste tower pressure, auxiliary air intake tunnel regulator settings, underground regulator settings, and door configurations. The model data and procedure changes shall be used to establish normal configuration settings to achieve the desired airflow in the underground. These settings shall then be modified by operations

personnel throughout the year to compensate for system fluctuations caused by seasonal changes in psychrometric properties, and to meet specific operations needs. This ensures that the facility is operated at the design airflow rate for each ventilation mode.

O-3a(2) Test and Balance Schedule

The Test and Balance is generally conducted on a 12- to 18-month interval, but in no case shall the interval between consecutive Test and Balance performances exceed 18 months. This interval is sufficient to account for changes in the mine configuration since over this period the ventilated volume changes very little. The quality and maintenance of ventilation control structures (e.g., bulkheads) is excellent, so leakage is small and relatively constant. Historic test and balance results confirm that changes between test and balances fall within anticipated values.

O-3b Running Annual Average of the Total Mine Airflow

O-3b(1) Monitoring Total Mine Airflow

The Permittees shall use the Central Monitoring Room Operator's (**CMRO**) Log to monitor total mine airflow. Run-times for the various modes of operation shall be entered into the CMRO Log. For example, if the CMRO Log indicates that the ventilation system was configured for Alternate Mode (one main fan) at 8:00 am, and that this configuration was maintained until 11:30 am, a total of 3.5 hours of run-time in Alternate Mode would be recorded. Run times are recorded to the nearest quarter hour. The CMRO shall record each time when the ventilation system configuration is changed, including periods when there is no ventilation.

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

The Permittees shall calculate the running average flow rate on a monthly basis. The Permittees shall use the logged runtime data for various modes of operation (as described in O-3b(1)) and the nominal design flow-rates for the various modes presented in Table O-1 to calculate the average monthly flow rate for the facility.

The average monthly mine flow rate is computed monthly using the following formula:

Monthly Average Flow Rate = {[Normal Mode Run-time (hrs.) x 425,000 scfm]
+ [Alternate Mode Run-time (hrs.) x 260,000 scfm]
+ [Maintenance Bypass Run-time (hrs.) x 260,000 scfm]
+ [Reduced Mode Run-time (hrs.) x 120,000 scfm]
+ [Minimum Mode Run Time (hrs.) x 60,000 scfm]
+ [Filtration Mode Run-time (hrs.) x 60,000 scfm]}
/ 730 Hours per month.

The running annual average of total mine airflow annual average flow rate shall be calculated using the monthly averages and the following formula:

$$\text{Annual Average Flow Rate} = \sum \frac{\text{Monthly Average for Previous 12 Months}}{12}$$

The use of an average value of 730 hours per month in the monthly average calculation is reasonable, given that all the numbers involved are very large and that the final use of the

monthly average flow is in an annual calculation. ~~The Permittees will notify NMED within seven calendar days if either the minimum running annual average mine ventilation exhaust rate of 260,000 scfm or a minimum active room ventilation rate of 35,000 scfm when workers are present in the room are not achieved.~~

O-3c Active Disposal Room Minimum Airflow

O-3c(1) Verification of Active ~~Disposal~~ Room Minimum Airflow

Whenever workers are present, the Permittees shall verify the minimum airflow through active ~~disposal~~ room(s) where waste disposal is taking place of 35,000 scfm at the start of each shift, any time there is an operational mode change, or if there is a change in the ventilation system configuration.

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

The Permittees shall measure the airflow rate and use the room cross-sectional area to calculate the volume of air flowing through a disposal room. The measurement of airflow shall use a calibrated anemometer and a moving traverse (McPherson, 1993). Airflow measurements shall be collected at an appropriate location, chosen by the operator to minimize airflow disturbances, near the entrance of each active ~~disposal~~ room. The excavation dimensions at the measurement location are taken and the cross-sectional area is calculated. The flow rate is the product of the air velocity and the cross-section area. The value shall be entered on a log sheet (see Table O-3) and compared to the required minimum. The format and content of the log sheet may vary, but will always contain the data and information shown on Table O-3. Working values are in acfm and the conversion to scfm is described in section O-1 above. Measurements shall be collected, recorded, and verified by qualified operators.

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

O-3d Quarterly Verification of Total Mine Airflow

The Permittees shall perform a quarterly verification of the total mine airflow to ensure that rates established by the Test and Balance for various operational modes are reasonably maintained. These checks are identified in Permit Attachment E, Table E-1, and are performed as indicated in Table E-1.

O-4 Equipment Calibration and Maintenance

Equipment used for the periodic Test and Balance, quarterly flow verification checks, and daily verification of active disposal room flow rate shall be calibrated in accordance with appropriate

WIPP calibration and data collection procedures. Work performed by subcontractors shall also be calibrated to an equivalent standard. Equipment shall be inspected before each use to ensure that it is functioning properly and that the equipment calibration is current. Maintenance of equipment shall be completed by qualified individuals or by qualified off-site service vendors.

Equipment used to conduct the Test and Balance, Quarterly Verification of Total Mine Airflow, and to determine the airflow through the active disposal room(s) are provided in Table O-2.

O-5 Reporting and Recordkeeping

O-5a Reporting

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

The Permittees shall calculate the running annual average mine ventilation rate on a monthly basis and evaluate compliance with the minimum ventilation rate for an active room ~~ventilation rate~~ specified in ~~O-3b(2)~~Permit Section 4.5.3.2 on a monthly basis. ~~Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in O-3b(2) have not been achieved, t~~The Permittees ~~will notify~~shall report the Secretary in ~~writing within seven calendar days~~the annual report specified in Permit Section 4.6.4.2 whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit Section 4.5.3.2 have not been achieved..

O-5b Recordkeeping

The Permittees shall retain the following information in the Operating Record:

- The CMRO Log documenting the ventilation system operating mode.
- The underground facility running annual average mine ventilation rate on a monthly basis.
- Active disposal room ventilation flow rate readings as documented on the Active Disposal Room Ventilation Rate Log Sheet (Table O-3).
- The quarterly flow verification check and associated documentation.

These records will be maintained in the facility Operating Record until closure of the WIPP facility.

O-6 Quality Assurance

Quality assurance associated with the Mine Ventilation Rate Monitoring Plan shall comply with the requirements of the WIPP Quality Assurance Program Description (**QAPD**). The Permittees shall verify the qualification of personnel conducting ventilation flow measurements. The instrumentation used for monitoring both underground and active disposal shall be calibrated in accordance with the applicable provisions of the WIPP procedures. The software used to calculate the monthly and annual running averages and the ventilation simulation software

programs shall be controlled in accordance with the WIPP QAPD and WIPP computer software quality assurance plans.

Data generated by this plan, as well as records, and procedures to support this plan shall be maintained and managed in accordance with the WIPP QAPD. Nonconformance or conditions adverse to quality as identified in performance of this plan will be addressed and corrected as necessary in accordance with applicable WIPP Quality Assurance Procedures.