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REPLY TO ATTN OF: EH-332

SUBJECT: EH-30 Safety Evaluation Report (SER) for the Waste Isolation Pilot Plant (WIPP)

TO: Jack B. Tillman, Project Manager, DOE/WPO

The Office of the Deputy Assistant Secretary for Safety, Health and Quality Assurance (EH-30) has completed its review of the WIPP Final Safety Analysis Report and has documented the results of its review in the attached SER. As a result of the review, a number of open items remain outstanding and will require follow-up.

After you have reviewed the SER, we request that you schedule a meeting to discuss your proposed approach to resolve all open items and recommendations. This SER is based on material received through June 15, 1989. Material supplied after that date will likely be effective in resolving some of the open items reported in this SER and will be reviewed by EH-30 if received sufficiently prior to the meeting.

for James P. Knight, Director
Office of Safety Appraisals

Attachment

cc w/attachment:
Richard W. Starostecki, EH-30
Lewis G. Hulman, EH-32
Robert W. Barber, EH-34
Joseph E. Fitzgerald, EH-35
Oliver D. T. Lynch, Jr., EH-331
Harry J. Pettengill, EH-332
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Jill Lytle, DP-10
Dennis Krenz, AL
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WASTE ISOLATION PILOT PLANT

SAFETY EVALUATION REPORT

PREPARED UNDER
THE DIRECTION OF _____
Shirley J. Olinger
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REVIEWED BY _____
Harry J. Pettengill, Director
Nuclear Safety Technology Division

REVIEWED BY _____
James P. Knight, Director
Office of Safety Appraisals

APPROVED BY _____ 7/27/89
Richard W. Starostecki — Date
Deputy Assistant Secretary
Safety, Health and Quality Assurance

July 1989

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SUMMARY

Background

The Office of the Deputy Assistant Secretary for Safety, Health and Quality Assurance, EH-30 (hereinafter referred to as EH), has reviewed the Final Safety Analysis Report (FSAR) (December 1988 version as modified and supplemented through June 15, 1989) for the Waste Isolation Pilot Plant (WIPP) Facility located near Carlsbad, New Mexico. The purpose of EH's oversight review was to independently document in a Safety Evaluation Report (SER) the completeness and adequacy of the FSAR documentation in accordance with DOE Order 5481.1B. The principal programmatic responsibility for assuring the safety of operation of the WIPP Facility rests with DOE's Office of Defense Programs (DOE/DP) and DOE's Albuquerque Operations Office (DOE/AL).

The construction of the WIPP Facility has been completed and the facilities are being readied for operation in order to carry out an initial 5-year Pilot Plant Phase (Test Phase). The Test Phase is intended to demonstrate conformance to applicable environmental performance standards. Where complete, the EH review fully addressed the adequacy of the WIPP FSAR for the lifetime of the structures (i.e., design criteria for above ground structures and site characterization). Elsewhere, the EH review was limited to the Test Phase because of program uncertainties regarding the particulars of operation beyond the Test Phase. The review was further limited by the program decision to process and store only Contact Handled (CH) Transuranic (TRU) waste during initial operation. To completely access facility operations and safety beyond the Test Phase, and more specifically to evaluate those safety

procedures used for the processing and storing of Remote Handled (RH) TRU waste, will require addenda to this evaluation.

Scope

Principal areas reviewed by EH include: Site Characteristics; Principal Design Criteria; Plant Design; Process Description; Radiological Protection; Accident Analysis; Conduct of Operations; Operational Safety Requirements; Quality Assurance; and Decontamination and Decommissioning.

The EH initial review of the December 1988 FSAR concluded that additional information and clarification by the responsible program offices was required. Requests for this information were formally transmitted to DOE/WPO (Refs. 1 and 2). In order to expedite resolution of those comments and questions, meetings between DOE/EH, its DOE/WPO/AL counterpart and their respective contractors, were held at the WIPP site on April 24-28, 1989. Further discussions were held at the Bechtel offices in San Francisco, California, and during the DOE/EH Readiness Review Inspection (RRI) performed at the WIPP Site during May 8-15, 1989 (Refs. 3 and 4).

The actions noted above have resulted in numerous revisions and clarifications to the FSAR. Incorporated in this SER are EH's consideration of those revisions of the FSAR and supplemental information provided in formal responses to EH Requests for Additional Information (RAI). In general, DOE/WPO/AL has limited actual revision to the FSAR to those instances where the information is explicitly required by DOE Orders. In a number of other

instances DOE/WPO/AL has chosen to provide substantive information, including commitments EH considers essential to safe operation, in the formal responses to the RAIs but not to incorporate the information in the FSAR. It must be noted that the EH review and related concurrences are based on giving full weight to both the FSAR modifications and the supplemental information provided in the RAI responses. It is the EH position therefore that the formal RAI responses provided by DOE/WPO/AL have the same status and require the same control as the contents of the FSAR.

All statements and findings in this SER are provided in a format that parallels the FSAR for the WIPP Facility. For each FSAR chapter or section for which there were substantive issues, a complete description is presented. This description includes: (1) a summary description of the FSAR chapter or section; (2) the acceptance criteria used by EH to evaluate the chapter or section; (3) a complete statement of the issues and resolutions, as appropriate; requests for additional information if needed; and (5) the conclusions and open issues, if any. For those sections of the FSAR where there was no substantive technical information requiring a detailed safety review, there are no sections in the SER.

A complete compilation of all comments, questions, and requests for additional information, along with WIPP Project responses are included as Appendix B. In addition, Appendix A provides a cross reference of all the Appendix B requests for additional information to the SER text. The numbering system used to identify the questions, comments and issues, and the subsequent responses are consistent with the chapter/section numbers used in the FSAR, thus allowing

for rapid cross-referencing by the reader. Appendix C is a compilation of Readiness Review Inspection (RRI) findings that require modification of the FSAR and that are not tracked in the RRI report (Ref. 4). Appendix D lists the acronyms used in this report. Appendix E lists the principal participants in this review.

Findings

As a result of the FSAR review, 23 items were still outstanding as of June 15, 1989. Table 1 summarizes the open items, with appropriate references to chapters or sections of the SER that provide the detailed discussion for that open issue. The table does not include the Appendix C RRI findings that will require modification of the FSAR and the Appendix C findings will be tracked to closure by this report.

The more prominent open items identified in the SER include: Quality Assurance (staffing, qualifications, and authority); Structural and Systems Design (CH Area and electrical systems); Waste Monitoring and Retrievability (room closure and decontamination and decommissioning plan); and Accident Analysis (source term and scenarios).

EH intends to issue a supplement to the SER upon completion of all open items.

References for Summary

1. Memorandum from H. J. Pettengill (DOE/EH) to J. B. Tillman (DOE/WPO), March 29, 1989; Subject--Requests for Additional Information (RAI's) for Chapters 2, 8, 9, 10, 12, and 13 of the WIPP FSAR

2. Memorandum from H. J. Pettengill (DOE/EH) to J. B. Tillman (DOE/WPO), April 13, 1989; Subject--RAI's for Chapters 1, 3, 4, 5, 6, 7, and 11 of the WIPP FSAR

3. Memorandum, EH-332, S. Olinger (DOE/EH), to J. P. Knight and H. J. Pettengill (DOE/EH), May 4, 1989; Subject--Trip Report, WIPP Onsite Review of the FSAR, April 24-28, 1989

4. EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant: June 2, 1989

Table 1. Listing of Open Action Items from WIPP FSAR Review

Item No.	FSAR Chapter/ Section	Open Action Item
1	11	The DOE/WPO Quality Assurance (QA) Organization does not have sufficient resources and authority for adequate control of operations at WIPP. Also, the interface controls and responsibilities, both external and internal, between organizations of the three major participants are not clearly defined.
2	11	Engineering staff of DOE/WPO and the operating contractor lack technical understanding of the facility's design bases, design calculations and their related quality control.
3	11	The DOE/WPO Project Manager's authority to direct the work of project participants and to stop unsatisfactory work should be described and substantiated.
4	4.2	Four of the columns on Line F of the CH Area were found to be overstressed by about 13 percent. This was found for the dead load, live load, and design wind load combination.
5	4.4	The design bases for the electrical system (standards and guides) must be identified in the FSAR.
6	4.4	The description of the diesel generator start system should be included in the FSAR. This was removed in the June 1989 revision.
7	4.4	Uninterruptible Power Supply (UPS) loads must be less than the design capacity of that equipment.
8	4.4	Verification that the battery can supply 30 minutes of power at rated conditions is necessary through testing or analysis.
9	4.4	FSAR wording clarifying startup of diesel generator (local or remote) is necessary. Also, the FSAR wording should be changed to reflect actual operator actions required to restore power to the UPS within 30 minutes.
10	2.10	Monitoring of filled CH TRU waste storage rooms is required to ensure structural stability of these rooms and adequate performance of the installed rock bolts throughout the retrieval period, i.e., ten years. It is not as yet clear how such a program can be implemented in those CH TRU waste storage areas filled with containers.

Item No.	FSAR Chapter/ Section	Open Action Item
11	12	The Retrievability plan and the Decontamination and Decommissioning Plan for the Test Phase must be completed by the project and confirmed acceptable prior to emplacement of waste.
12	7	The source term assumptions are inconsistent with the WIPP Waste Acceptance criteria. Also, administrative controls are not sufficiently detailed and additional analyses should be done to calculate worker doses for maximum source term accident conditions with and without respirators, i.e., 1000 PE-Ci (Pu-239 equivalent curies) and 69 PE-Ci, respectively.
13	7	Doses for workers assumed to remain in the immediate accident area for accident scenarios C2 and C3 should be recalculated using assumptions consistent with previous accident analysis calculations.
14	7	The FSAR estimates 2×10^{-4} drum fires/year for accident C-7. Therefore, this accident requires analyses incorporating the fire suppression system impact on potential doses to workers.
15	7	A respiratory mask requirement for workers downstream from the active and open waste storage area is needed.
16	7	The potential for underground roof falls should be evaluated including the potential for releasing material from the stored CH TRU waste containers.
17	7	The catastrophic hoist accident (C8) requires calculations to verify that the probability is sufficiently low so that no accident analysis is required.
18	7	The waste drum fire propagation accident (C10) requires recalculation of probability values.
19	3.3.2	WIPP has not specified when and how often the valves used as isolation dampers in the air handling system are tested. Also, a copy of the test standards and procedures should be provided and permissible leakage rates specified.

Item No.	FSAR Chapter/ Section	Open Action Item
20	2.10	The specifications of the threshold values, i.e., ± 0.5 inches from the extrapolated data, to be used in the monitoring are not contained in Section 1.5 of the FSAR as committed at the April 24-28, 1989, FSAR meeting.
21	4.4	The description of the Failure Mode and Effects Analysis for the electrical system should specify that only single failures of the system were analyzed.
22	3.1	The flow chart implementing the component classification criteria (Figure 3.1-1 in the FSAR) was inconsistent with the stated criteria with respect to the differences between Class IIIA and Class IIIB. Although the figure was removed from the May 1989 FSAR, it should still be verified that the figure was correct in the Design Basis Document.
23	4.3	Modify Subsection 4.3.1.1.1 of the FSAR to indicate that the shaft linings did not in fact include a ground movement component in their design.

*This issue was discussed in the SER, its resolution and closure is also being tracked by the RRI process.

CHAPTER 1 - WIPP GENERAL DESCRIPTION

1.0 SUMMARY DESCRIPTION

This chapter was written as an introduction for the FSAR. It briefly describes the organization of the FSAR, the WIPP Facility's purpose and goals, and its operations and technical programs. The introductory chapter also identifies the agents and contractors participating in the WIPP Project.

Most of the sections of this introductory chapter contain information which either simply introduces the facility or summarizes information provided in much greater technical detail elsewhere in the FSAR. Notably, Section 1.5, entitled Technical Programs, does contain technical information that warranted EH review; however, for purposes of efficiency, the EH review of Section 1.5 has been incorporated in the review of Section 2.10 of the SER. Additionally, Chapter 1A of the FSAR summarizes the accident scenarios that were analyzed and these are covered in detail in Chapter 7 of the SER.

CHAPTER 2 - SITE CHARACTERISTICS

This chapter of the FSAR describes the site in the vicinity of the WIPP in terms of: Geography and Demography; Nearby Industrial, Transportation and Military Facilities; Meteorology; Surface Hydrology; Subsurface Hydrology; Regional Geology; Geology in the Vicinity of WIPP; Vibrating Ground Motion; Surface Faulting; Stability of Subsurface Materials and Foundations; and Slope Stability. It is to be noted that an important guideline for the review of this chapter was the assumption that the legislation pending in Congress and/or Administrative land withdrawal with the Department of Interior pertaining to the withdrawal of the entire 10,240-acre area within the WIPP Site boundary for DOE exclusive use would be approved.

SECTION 2.1 - GEOGRAPHY AND DEMOGRAPHY OF THE AREA AROUND THE WIPP FACILITY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the WIPP Facility location and configuration, exclusion areas, and nearby population distribution. The WIPP Facility is located within a site boundary which is defined by a square, four miles on a side, containing 10,240 acres committed to the WIPP Facility. Approximately centered within the square is a fenced area of about 35 acres which contains the WIPP surface structures and is designated as Zone I (FSAR Fig. 2.1-3). An area of about 1800 acres, which encompasses Zone I and overlies the existing and planned underground development is designated as Zone II. Most of Zone II lies within a chain link perimeter fence, called the Secured Area, with access restricted to authorized personnel. The WIPP site boundary is located at least one mile beyond any point on Zone II.

All land within the WIPP site boundary is federal land and is intended to remain under federal control during WIPP operation. Only mining and drilling associated with the WIPP Project is permitted in Zone I and in the Secured Area. Cattle grazing is permitted outside the Zone II area.

There are no communities within 10 miles of the WIPP Facility. The nearest community is Loving, with a population of 1,450, which is 18 miles from WIPP. The nearest significant population center is Carlsbad which is 26 miles west of the WIPP and has a population of 27,000. In 1976, there were about 94,000 people living within 50 miles of the WIPP Facility. The estimated population by the Year 2005 is 204,000.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used to review this section of the FSAR were taken primarily from USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants (Ref. 1).

Specific acceptance criteria used to evaluate Section 2.1 were demonstrated adequacy of:

1. Description of the location of the facility and a clear map for an area of at least a 50-mile radius around the facility.

2. Definition of site boundaries including distances from significant facility features to the site boundary.

3. Delineation of exclusion areas and description of legal rights with respect to the land ownership.

4. Identification of the boundaries for establishing effluent release limits.

5. Description of population distribution as a function of distance and direction.

6. Description of uses of nearby lands and waters within at least a five-mile radius.

7. Identification of activities conducted within the site boundary other than those directly related to the operation of the facility.

3.0 ISSUES

1. Section 2.1.2 of the FSAR states that "legislation is pending before Congress that will result in the permanent withdrawal of the entire 10,240-acre area within the WIPP Site boundary for DOE exclusive use." The SER review is based on the assumption that the legislative process is completed.

   Resolution:

   None required.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of the Geography and Demography of the Area provided that the precondition discussed in Paragraph 3.0 is met.

SECTION 2.2 - NEARBY INDUSTRIAL, TRANSPORTATION AND MILITARY FACILITIES

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the industrial and extraction activities, oil and gas pipelines, land and water transportation routes, airports and aviation routes, and military operations that could have a potential effect on operations at the WIPP Facility.

There are ranches and gas wells within five miles and three potash mines and two chemical processing plants within ten miles of the WIPP Facility. Sixteen gas pipelines are located within a five-mile radius of the WIPP Facility; the closest is 1.2 miles from the WIPP surface structures. Two airways pass within five miles of the WIPP Facility; however, the FSAR states that because of the low number of flights and the size of the facility the probability of an air disaster at the WIPP Facility is considered to be insignificant. The White Sands Missile Range (WSMR) is located about 160 miles west of the WIPP Facility. About six aircraft from WSMR fly over the WIPP Facility in a year. Missile and drone test activities are conducted at WSMR but none overfly the WIPP Facility.

An evaluation of potential accidents indicates that the risks due to nearby industrial, transportation and military activities, are small.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used to review this section of the FSAR were taken primarily from Subsection 2.1.3 of the USNRC Regulatory Guide 3.26 (Ref. 1).

Specific acceptance criteria used to evaluate FSAR Section 2.2 were demonstrated adequacy that there were no effects of:

1. Oil or gas pipelines which cross or pass close to the facility.

2. Nearby industrial, mining or agricultural activities.

3. Aircraft, missiles or drones, overflying the facility.

4. Land and water transportation routes which cross or pass close to the facility.

3.0 ISSUES

1. Missile and drones are tested around the WIPP Facility. Information was requested on the potential effects of a missile or drone impact.

   Resolution:

   The intent of the FSAR was clarified to indicate that there is a minimal potential that a missile or drone malfunction could affect the WIPP Facility, since all missiles and drones flown around the WIPP area are equipped with fail-safe devices that are initiated either automatically or by a flight safety officer. The response is considered acceptable and this issue is resolved.

2. Information was requested regarding the effects on WIPP of present and future mining activity in the vicinity of the WIPP Facility.

   Resolution:

   The FSAR will be modified to indicate that the minimum of one mile of intact salt surrounding the waste emplacement areas is adequate protection for the potential mining activities in the vicinity. This is based on recommendations made by the Oak Ridge National Laboratory and the Geological Characterization Report (Ref. 34). The response is considered acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable description of nearby industrial, transportation and military facilities.

SECTION 2.3 - METEOROLOGY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the regional climatology, local meteorology, the WIPP on-site meteorological measurement program, paleoclimatology and potential climatic changes. The primary focus of this section is to address the impact of meteorological issues on the design of the WIPP Facility, particularly the specification of wind and tornado design velocities as well as the determination of radiological doses at the WIPP Site boundaries.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used to review the on-site Meteorological Measurement Program included USNRC Regulatory Guide 1.23 (Ref. 9) and the ANSI Standard cited in Ref. 10.

Specific acceptance criteria used to evaluate Section 2.3 were demonstrated adequacy of:

1. Description of the general climate of the regions based on standard climatic summaries. Consideration of the relationships between regional synoptic-scale atmospheric processes and local (site) meteorological conditions based on appropriate meteorological data.

2. Data on severe weather phenomena based on standard meteorological records from a nearby representative National Weather Service Station (Roswell) and applicability of the data to local site conditions.

3. Operating basis tornado parameters as substantiated by two independent methods.

4. Operating basis wind velocity data.

5. Documents for other meteorological and air quality data used for safety related design and operating bases.

3.0 ISSUES

1. A series of questions were raised concerning the details of the AIRDOS calculations that were performed to assess potential wind borne radiation dosage. First, EH raised a concern on the use of the AIRDOS model, which is primarily an averaging calculation, to arrive at maximum exposure levels from an accidental release. Second, a question was raised concerning the frequency distribution of stability classes that is used as input to the AIRDOS calculation.

   Resolution:

   The response provided to comments in Subsection 7.2 (Appendix B) indicates that the AIRDOS model used a limited plume spread for the calculation of accidental release. Radionuclide concentrations were then calculated along the plume centerline at discrete distances downwind for each of seven stability classes. The case which resulted in the highest concentration for the selected receptor locations was chosen. This is considered an acceptable approach and this issue is resolved.

   The frequency distribution of stability classes used as input to the AIRDOS calculation is significantly different from that reported at the nearby Roswell Site. However, DOE/WPO indicated at the April FSAR review meeting that they are committed to recalculation of the AIRDOS predictions during the Test Phase, using site specific data taken with the currently placed instrumentation. On this basis the question associated with the frequency distribution used in the AIRDOS calculation will be eliminated.

2. The specification of the WIPP site-specific Design Based Tornado (DBT) is based on information (Ref. 8) using meteorological data for

the period 1916-1976. This yielded design wind velocities of 183 mph. Since it is known that some relatively large tornadoes have occurred in the WIPP vicinity in recent years, the validity of this information was questioned.

Resolution:

Dr. T.T. Fujita was contacted to discuss the adequacy of the design wind velocity in light of this new information. Based on his knowledge of the current state of the tornado data base, he indicated that updated design wind velocities would be close to those used in the original structural design. Since it was found from the structural evaluations that adequate safety margins exist in the design when subjected to tornado loadings, it is felt that the DBT used in the structural analysis is acceptable and this issue is resolved.

3. A question was raised as to the adequacy of the locations of the on-site meteorological sensors, and the impact of the buildings on these measurements. Since the AIRDOS model cannot include building wake effects in the calculations, such effects could negate the adequacy of the calculation.

Resolution:

In the on-site meteorological measurement program described in the FSAR, the sensors were originally located close enough to the structures to influence measured data. The May 1989 revision to the FSAR indicates that the instrument sensors have been relocated away from existing surface structures such that flows to the sensors are not influenced by the buildings. Such a relocation satisfies the conditions assumed for the AIRDOS calculations and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of the meteorology.

SECTION 2.4 - SURFACE HYDROLOGY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the surface hydrology in the vicinity of the WIPP Site. The WIPP lies in a 44,500 square mile basin that drains into the Pecos River. The river has headwaters close to Santa Fe, New Mexico and empties into the Rio Grande River after a course of about 500 miles. The WIPP Site is about 14 miles east of the Pecos at about midway along its course. The elevation of the WIPP surface structures is about 500 feet above the river elevation at its closest point to the WIPP.

There are no major drainage features east of the Pecos (the WIPP side). There is a topological depression (Nash Draw) about four miles northwest of the WIPP, but this drainage feature carries water only during very wet years. The bed elevation of Nash Draw is about 250 feet below the surface elevation of WIPP.

The WIPP area has an arid to semi-arid climate with average precipitation of 12 inches per year. The drainage systems at the WIPP were designed for "probable maximum precipitation" storms specified in a Corps of Engineers study (Ref. 11). The maximum precipitation for a six-hour period at the WIPP area is 25 inches. The normal drainage of areas north, south and west of the WIPP is to the west into Nash Draw and does not pass through the WIPP Site. A series of interceptors are provided east of WIPP to divert runoff from the area east of the WIPP.

The maximum flood stage on the Pecos River at the WIPP Site is 42.1 feet (corresponding to a flow of 120,000 cubic feet) and occurred on August 23, 1966. It is judged to be inconceivable that a flood could effect the WIPP Facility which is 500 feet above the river elevation.

Several dams exist along the Pecos River. Five of these dams are upstream of the WIPP Site and all together have a maximum storage capacity of about 900,000 acre-feet (4×10^{10} cubic feet). It is argued that this quantity

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

OCT - 8 1991

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

Dear Colleague:

Enclosed is a copy of the recently published Policy Statement addressing enforcement of RCRA Section 3004(J) storage prohibition at facilities generating mixed radioactive/hazardous wastes. EPA published this Policy Statement to address the present lack of treatment or disposal capacity for many such wastes. While EPA reserves the right to enforce all RCRA provisions at hazardous waste facilities, the Agency is conditionally identifying on-site storage of land disposal-prohibited mixed waste as a reduced priority among the Agency's civil enforcement actions.

This policy only applies to mixed waste generators that produce less than 1,000 cubic feet of land disposal prohibited mixed waste per year. The policy is limited in duration, terminating on December 31, 1993, although EPA may decide to renew it, in whole or in part, at that time. The reduced enforcement priority for section 3004(J) violations is, however, dependent on generators demonstrating that they are otherwise managing their mixed waste in an environmentally responsible manner. The notice provides examples of such responsible management, including full compliance with all other RCRA facility standards and record-keeping requirements and good faith efforts at limiting the amounts of mixed waste stored on-site.

If you have any additional questions on this policy statement or EPA's mixed waste program, please contact Richard LaShier at (202) 260-2210. For general questions about the RCRA program, or to order additional copies of the policy statement, please call the RCRA Hotline at (800) 424-9346, or (800) 553-7672 for the hearing impaired.

Sincerely,

Devereaux Barnes

Devereaux Barnes, Director
Permits and State Programs Division

Enclosure

FOR FURTHER INFORMATION:

Charles E. Blackburn, Office of Fuels Programs, Fossil Energy, U.S. Department of Energy, Forrestal Building, room 3F-094, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586-7751.

Lot Cooke, Office of Assistant General Counsel for Fossil Energy, U.S. Department of Energy, Forrestal Building, room 6E-042, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586-0503.

SUPPLEMENTARY INFORMATION: TGMI, a Delaware corporation with its principal place of business in Houston, Texas, is a wholly owned subsidiary of Texaco Exploration and Producing Inc., which in turn is wholly owned by Texaco Inc.

TGMI states that it will generally sell the requested natural gas volumes on a short-term basis, but some export agreements may extend for the term of the export authorization. The contractual arrangements will be the product of arms-length negotiations with an emphasis on competitive prices and contract flexibility. TGMI requests authorization to export for its own account as well as to act as agent for other U.S. suppliers and for Canadian purchasers.

The export application will be reviewed under section 3 of the NGA and the authority contained in DOE Delegation Order Nos. 0204-111 and 0204-127. In deciding whether the proposed export is in the public interest, domestic need for the natural gas will be considered, and any other issue determined to be appropriate, including whether the arrangement is consistent with DOE policy of promoting competition in the natural gas marketplace by allowing commercial parties to freely negotiate their own trade arrangements. Parties, especially those that may oppose this application, should comment on these matters as they relate to the requested export authority. The applicant asserts that there is no current need for the domestic gas that would be exported under the proposed arrangement. Parties opposing this arrangement bear the burden of overcoming this assertion.

NEPA compliance. The National Environmental Policy Act (NEPA), 42 U.S.C. 4321 *et seq.*, requires DOE to give appropriate consideration to the environmental effects of its proposed actions. No final decision will be issued in this proceeding until DOE has met its NEPA responsibilities.

Public comment procedure. In response to this notice, any person may file a protest, motion to intervene or notice of intervention, as applicable, and written comments. Any person wishing to become a party to the proceeding and to have the written comments considered as the basis for any decision on the application must, however, file a motion to intervene or notice of intervention, as applicable. The filing of a protest with respect to this application will not serve to make the protestant a party to the proceeding, although protests and comments received from persons who are not parties will be considered in determining the appropriate action to be taken on the application. All protests, motions to intervene, notices of intervention, and written comments must meet the requirements that are specified by the regulations in 10 CFR part 590. Protests, motions to intervene, notices of intervention, requests for additional procedures, and written comments should be filed with the Office of Fuels Programs at the address listed above.

It is intended that a decisional record on the application will be developed through responses to this notice by parties, including the parties' written comments and replies thereto. Additional procedures will be used as necessary to achieve a complete understanding of the facts and issues. A party seeking intervention may request that additional procedures be provided, such as additional written comments, an oral presentation, a conference, or trial-type hearing. Any request to file additional written comments should explain why they are necessary. Any request for an oral presentation should identify the substantial question of fact, law, or policy at issue, show that it is material and relevant to a decision in the proceeding, and demonstrate why an oral presentation is needed. Any request for a conference should demonstrate why the conference would materially advance the proceeding. Any request for a trial-type hearing must show that there are factual issues genuinely in dispute that are relevant and material to a decision and that a trial-type hearing is necessary for a full and true disclosure of the facts.

If an additional procedure is scheduled, notice will be provided to all parties. If no party requests additional procedures, a final opinion and order may be issued based on the official record, including the application and responses filed by parties pursuant to this notice, in accordance with 10 CFR 590.316.

A copy of TGMI's application is available for inspection and copying in the Office of Fuels Programs Docket Room, room 3F-056, at the above address. The docket room is open between the hours of 8 a.m. and 4:30 p.m., Monday through Friday, except Federal holidays.

Issued in Washington, DC on August 22, 1991.

Clifford P. Tomaszewski,

Acting Deputy Assistant Secretary for Fuels Programs, Office of Fossil Energy.

[FR Doc. 91-20753 Filed 8-28-91; 8:45 am]

BILLING CODE 6450-01-M

ENVIRONMENTAL PROTECTION AGENCY

F-91-PMPS-FFFFF

[FRL 3991-3]

Policy on Enforcement of RCRA Section 3004(J) Storage Prohibition at Facilities Generating Mixed Radioactive/Hazardous Wastes

AGENCY: Environmental Protection Agency (EPA).

ACTION: Policy statement.

SUMMARY: EPA is announcing its policy on the civil enforcement of the storage prohibition in section 3004(j) of the Resource Conservation and Recovery Act (RCRA) at facilities which generate "mixed wastes" regulated under both the RCRA subtitle C hazardous waste program and the Atomic Energy Act (AEA). The policy affects certain mixed wastes that are prohibited from land disposal under the RCRA Land Disposal Restrictions, and for which there are no available options for treatment or disposal. The policy explains how EPA considers violations of the section 3004(j) storage prohibition at such facilities to fit within the Agency's civil enforcement priorities.

EFFECTIVE DATE: August 29, 1991.

FOR FURTHER INFORMATION CONTACT: Richard LaShier, State and Regional Programs Branch, Office of Solid Waste; telephone (202) 260-2210.

SUPPLEMENTARY INFORMATION:

I. Overview

"Mixed wastes" are wastes that contain both a hazardous waste component regulated under subtitle C of RCRA and a radioactive component consisting of source, special nuclear, or byproduct material regulated under the AEA. In this document, EPA is announcing its policy on the civil enforcement of the storage prohibition in section 3004(j) of RCRA at certain facilities which generate mixed wastes. EPA reserves the right to enforce all RCRA provisions at hazardous waste facilities and against persons who handle hazardous waste. The intent of this policy is to explain how EPA considers section 3004(j) storage

violations involving certain mixed wastes to fit within the Agency's civil enforcement priorities. The affected wastes are land disposal prohibited mixed wastes for which there is no available treatment or disposal capacity. Generators and storers of these wastes may find it impossible to comply with the section 3004(j) storage prohibition if there are no available options for treatment or disposal of the wastes. Nevertheless, generators of these mixed wastes may, if they pursue prudent waste management practices, be capable of storing their mixed wastes for the limited duration of this policy in a manner that poses minimal risk to public health or the environment. Responsible management practices should minimize the environmental risks from these section 3004(j) storage violations.

For those mixed waste generators who are operating their storage facilities in an environmentally responsible manner as described in this policy, EPA considers the violations of section 3004(j) involving relatively small volumes of waste to be reduced priorities among EPA's potential civil enforcement actions. Any enforcement activity arising from violations of section 3004(j) at these facilities will generally focus on determining whether these generators are managing their mixed wastes in an environmentally responsible manner. EPA's primary concern is with the generally more significant violations of section 3004(j) committed by larger (>1,000 cubic ft/yr) mixed waste generators as well as by generators who are not pursuing environmentally responsible management of their stored mixed wastes.

The policy is limited in duration, and terminates on December 31, 1993. During the period that this policy is in effect, EPA will evaluate data that become available on generation, treatability, and treatment capacity for the mixed wastes affected by this policy. If sufficient, lawful treatment capacity becomes available before December 31, 1993, EPA will terminate this policy. If necessary, EPA may also renew this policy beyond 1993.

The policy applies to mixed waste facilities which generate no more than 1,000 cubic feet/year of land disposal prohibited mixed wastes. That is, the policy does not apply to any facility that generated more than 1,000 cubic feet of prohibited mixed wastes during the calendar year that ended December 31, 1989, or that does so during any succeeding calendar year that this policy is in effect. This amount relates only to the annual generation rate, and not to the mixed waste inventory in storage.

EPA will consider a variety of indicators of environmentally responsible operation in determining the civil enforcement priority of section 3004(j) storage violations at particular mixed waste generator facilities. These indicators include, but are not limited to:

- Whether the facility has conducted an inventory of its mixed waste storage areas to assess and assure its compliance with all other applicable RCRA storage facility standards.
- Whether the facility has identified and kept records of its mixed wastes, including sources, waste codes, generation rates and volumes in storage.
- Whether the facility has developed a mixed waste minimization plan, or can demonstrate (through documentation) that waste minimization is not technically feasible for its wastes.
- Whether the facility can document periodically that it has made good faith efforts to ascertain the availability of treatment capacity for its mixed wastes.
- Whether the facility (if contacted in connection with the ongoing joint EPA/NRC profile of mixed waste generators) has cooperated with the Agencies in providing complete and accurate information about their mixed wastes upon request.

II. Scope of Policy

A. Limitations on Scope

This policy affects only the civil judicial and administrative enforcement priorities that would arise solely from the act of storing prohibited mixed wastes in contravention of RCRA section 3004(j). The policy is also limited in scope to those mixed waste streams for which the effective dates of land disposal prohibitions have passed, and for which authorized treatment or disposal capacity is not available. The mixed wastes covered by this policy must be mixed wastes when generated; e.g., a generator may not commingle distinct hazardous and radioactive waste streams in order to come within the scope of this policy.

Wastes newly identified as hazardous, wastes currently subject to national capacity variances, and wastes which may be granted case-by-case extensions to the LDR effective dates are not covered by this policy unless EPA concludes that these wastes should also be governed by this policy.

EPA intends that this policy apply both to the mixed wastes generated during the term of the policy, and to existing inventories of mixed wastes already in storage. The policy does not cover other violations of RCRA storage requirements, such as the storage facility standards of subparts I through L of 40 CFR parts 264 or 265, or their State equivalents. EPA emphasizes that this policy does not affect any requirement under RCRA to obtain a storage permit, which is generally required if mixed wastes are stored for greater than 90 days. The policy does not extend to potential criminal violations of RCRA, for which prosecutorial discretion rests solely with the United States Attorney General.

B. Effect of Other Violations

This policy affects only the civil enforcement priority that EPA will generally assign to section 3004(j) storage violations. Allegations of another RCRA violation(s) should generally not affect that priority, as long as the generator is otherwise managing its mixed wastes in an environmentally responsible manner. If, however, a facility inspection or other information reveals significant RCRA violations (other than of section 3004(j)) or a pattern of violations which evidence a disregard for compliance with the RCRA hazardous waste regulations, EPA may attach a greater priority to all violations—including storage of mixed waste in violation of section 3004(j)—at that facility.

III. Applicability

This policy applies to EPA enforcement activities in all States in which mixed waste falls within the jurisdiction of RCRA. It is not relevant in States where mixed waste is not regulated under RCRA. In those States where the State as well as EPA has authority to enforce the LDRs, this policy affects only the EPA enforcement programs.

RCRA mixed waste jurisdiction applies in States which are unauthorized for the "base" RCRA program. As of April, 1991, there were 9 such States and Territories (Alaska, American Samoa, California, Hawaii, Iowa, Mariana Islands, Puerto Rico, Virgin Islands, and Wyoming). In these States and Territories, the EPA Regional Offices administer both the base RCRA mixed waste program and the Land Disposal Restrictions, so this policy applies in these States.

RCRA mixed waste jurisdiction extends to [illegible] States that have been authorized specifically for RCRA mixed waste programs. As of April 30, 1991, there were 24 States and Territories authorized to implement RCRA mixed waste programs. These States and Territories are: Arkansas,

Colorado, Connecticut, Florida, Georgia, Guam, Idaho, Illinois, Kansas, Kentucky, Michigan, Minnesota, Nebraska, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah, and Washington. The RCRA 3004(j) storage prohibition is an element of the Land Disposal Restrictions (LDRs) enacted in the Hazardous and Solid Waste Amendments (HSWA) of 1984. HSWA requires EPA to implement the LDR provisions as they apply to mixed waste until the authorized States receive approval from EPA to implement them in lieu of the Agency. EPA therefore implements the LDRs, and this policy applies, in the States with authorized RCRA mixed waste programs, until the States have also been authorized for their LDR programs.

As of April 30, 1991, 6 States (Georgia, Michigan, Minnesota, Texas, North Dakota, and Idaho) with mixed waste programs were also authorized to implement the solvent and "California List" LDRs in lieu of EPA. Since these States have independent authority to enforce the LDRs, EPA's enforcement policy affects EPA's enforcement of the LDRs, but is not binding on these 6 States. Therefore, facility owners and operators should consult with the responsible officials in these States for clarification on these States' policy with respect to storage of LDR prohibited mixed wastes.

During the term of this policy, additional States are likely to receive authorization for mixed waste and LDR programs. Facility owners and operators should track the authorization status of their State program in order to ascertain whether they are covered by this policy, or whether other restrictions based on State law might apply to mixed waste storage.

IV. Background

A. Regulatory Status of Mixed Wastes

"Mixed wastes" are a special category of wastes, because they contain a hazardous waste component regulated under Subtitle C of RCRA and a radioactive waste component regulated under the AEA. Although section 1004(27) of RCRA excludes "source," "special nuclear," and "byproduct material" from the definition of RCRA "solid waste," EPA issued a notice on July 3, 1986 (51 FR 24504) which clarified that RCRA applies to wastes which contain both a hazardous waste component and a component consisting of source, byproduct, or special nuclear material. The hazardous waste components of mixed wastes are subject to RCRA management standards for hazardous wastes, whereas the regulation of the radionuclides (and their radiological hazards) are addressed under AEA authority. The Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE) have concurred with the position that RCRA applies to the hazardous waste component of mixed wastes.

B. Applicability of LDRs

Like other hazardous wastes, mixed wastes are subject to the land disposal restrictions (LDRs). The LDRs currently apply to all the hazardous waste components of mixed wastes if those components were listed or identified by November 8, 1984. LDRs and corresponding treatment standards for mixed wastes containing solvents and dioxins went into effect on November 8, 19[illegible] and November 8, 1988. In addition, [illegible] disposal prohibitions on [illegible]ornia List" wastes were effective o[illegible]y 8, 1987. For the remaining listed or identified wasts, HSWA directed EPA to establish a 3-phased schedule for the effective date of LDR prohibitions and the promulgation of treatment standards by EPA. For the "scheduled wastes" that were also mixed wastes, EPA deferred issuing treatment standards until the issuance of the last phase (the "Third Third") of the HSWA-scheduled LDR regulations. The final Third Third Rule (55 FR 22520) was published on June 1, 1990. This rule established a national capacity variance for mixed wastes identified as hazardous because they contained a component that was a First Third, Second Third, or Third Third scheduled waste. The national variance for the scheduled mixed wastes was based on the finding that there was inadequate treatment capacity for these mixed wastes (55 FR 22532). The effect of the national capacity variance was to extend the effective date of the LDR prohibitions for these mixed wastes until May 8, 1992. This national capacity variance did not extend, however, to mixed wastes containing solvents, dioxins, or California List wastes. These wastes already received national capacity variances in earlier rulemakings, and HSWA precludes the Agency from issuing further national capacity variances in such cases. (RCRA 3004(h)(2). However, EPA is aware that there is inadequate treatment capacity for many mixed wastes containing solvents or California List components.

C. The LDR Storage Prohibition

The aspect of the LDRs affected by this policy is the "storage prohibition" enacted in HSWA section 3004(j). This provision prohibits any storage of a land disposal prohibited waste (including mixed waste) except "for the purpose of the accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal." The provision has relevance to mixed waste management, since there are currently no facilities providing disposal capacity for commercially generated mixed wastes. Also, there are limited treatment options for much of the mixed waste generated by commercial generators (NRC fuel cycle and materials licensees) and by DOE.

EPA has previously concluded that storage of a waste pending development of treatment capacity does not constitute storage to accumulate sufficient quantities to facilitate proper treatment or disposal. Under section 3004(j), generators must rely on the capacity variances and case-by-case extensions authorized by section 3004(h) to deal with treatment capacity shortages. In enacting section 3004(j), Congress intended to eliminate the hazards associated with long-term storage. The "treat-as-you-go" approach is critical to the effectiveness of the LDRs, and the storage prohibition promotes expeditious development and use of treatment processes. *Hazardous Waste Treatment Council* v. *EPA*, 886 F.2d 355, 357 (D.C. Cir. 1989). During the development of the Third Third Rule, EPA solicited comment on alternative approaches that might have broadened the allowable bases for storing prohibited wastes. In the final rule, however, the Agency rejected the suggested alternatives and instead affirmed the strict interpretation of the storage prohibition, while leaving open the possibility of developing another position on the mixed waste storage issue (see 55 FR 22672–22673). This document announces the policy anticipated in the June 1, 1990 rule notice.

D. Mixed Waste Treatment Capacity Shortage

The shortage of treatment capacity for mixed wastes generated by DOE facilities is well documented, particularly in the data submitted to EPA to support the May 8, 1990 national capacity variance, and in the January, 1990 National Report on Prohibited Wastes and Treatment Options ("National Report") prepared by DOE as part of the Rocky Flats Federal Facilities Compliance Agreement. EPA believes that the mixed waste treatment capacity shortage documented by DOE is also affecting commercial generators. Indeed, for the waste volumes that remain after discounting liquid scintillation cocktail (LSC) volumes and "storage-for-decay"

volumes, the treatment prospects appear even more limited for commercial generators than for DOE sites. In addition, surveys conducted by States and regional low-level waste compacts indicate that the bulk of the commercially generated mixed wastes contain spent solvents and California List constituents for which the LDRs are already effective.

Without available treatment or disposal capacity for many mixed wastes, generators of these wastes are faced with little choice but to violate the LDR storage prohibition, since the development of treatment on-site is frequently not feasible. Also, in order to avoid continuing violations of the storage prohibition, generators could in some cases be forced to curtail the activities that generate these wastes. The latter could result in the cessation of such activities as facility and environmental monitoring with radioisotope levels, pharmaceutical manufacturing and testing, diagnostic testing, nuclear medicine, and the manufacture of the sealed sources and radioisotope formulations used in connection with the aforementioned activities.

E. Designation of Generation Rate

EPA is setting a generation rate of 1,000 cubic feet/year to define the class of mixed waste generators covered by this enforcement policy. This amount was selected on the basis of annual generation rate data reported in the DOE National Report and in commercial data contained in state surveys and reports submitted by states in connection with their 1990 Governors' Certifications under the Low-level Radioactive Waste Policy Amendments Act (LLRWPAA). EPA may subsequently adjust the amount upward or downward, once the Agency obtains better data on generation rates, waste treatability, and the effects of the amount set at this level.

EPA believes that the 1,000 cubic feet/yr amount will exclude from this policy only about 5% of the total number of mixed waste generators. However, the large generator facilities excluded by this amount may account for about 98% of the volume of LDR prohibited mixed wastes. The generation rate relates only to LDR-prohibited volumes of wastes for which there is no available treatment or disposal capacity. LSC fluids which are exempt from NRC-licensed disposal and "stored-for-decay" volumes (discussed below) will not be counted in calculating the generation rate, since they are currently treatable.

The generation rate future of this policy will focus the Agency's enforcement resources and the technology-forcing burdens of section 3004(j) on those larger mixed waste generators who are in a better position to procure and/or develop treatment capacity.

Only wastes that are LDR-prohibited are counted for this purpose, because wastes that are not currently prohibited (e.g., wastes subject to the national capacity variance issued May 8, 1990) are not prohibited from storage by section 3004(j). Currently, the mixed wastes that are LDR-prohibited contain hazardous components that are spent solvents (F001–F005), dioxins (F020–F023), or California List wastes.

Liquid Scintillation Cocktail (LSC) fluids are generally not to be included in the calcuation of the generation rate, except for those volumes that are not eligible for the NRC's medical waste exemption (i.e., they contain C–14 or H–3 in excess of the 0.05 uCi/g limits spelled out at 10 CFR 20.306). The LSC fluids that are exempted from NRC disposal requirements by 10 CFR 20.306 are typically burned for energy recovery in RCRA boilers or industrial furnaces, so they are not affected by this policy.

Stored-for-decay wastes are another class of mixed waste that should not be included in the calculation of the generation rate for eligible generators. For the purposes of this policy, the term "stored-for-decay" wastes is to be interpreted consistently with the NRC's definition of "decay-in-storage" at 10 CFR 35.92. That is, it refers to mixed wastes which contain radioisotopes (byproduct material) with physical half-lives of less than 65 days, so that storage for the period measured by at least 10 half-lives will cause their radioactivity to diminish to background levels. At the conclusion of the decay period, they may be managed solely as hazardous wastes, and not as mixed wastes. Therefore, these wastes are not at that time subject to the constraints on treatment and disposal that apply to other mixed wastes.

V. Steps To Ensure Environmentally Responsible Operation

In order to demonstrate that they are pursuing environmentally responsible management of their mixed wastes (and therefore should be accorded a reduced enforcement priority for section 3004(j) violations), persons and facilities managing mixed wastes should be undertaking at least the following steps.

A. Inventory and Compliance Assessment of Storage Areas

Generators should maintain a record identifying each physical location or unit where mixed waste is stored, and identifying the method of storage (i.e., container or tank). They should also perform regularly an assessment of these storage areas for compliance with applicable RCRA standards for storage methods, including an assessment of compliance with the storage facility standards of 40 CFR part 264 or part 265 (interim status), subparts I–J, or the State counterparts to these standards. The facility records should contain a certification that the assessment has been conducted, and a summary of the compliance status of each mixed waste storage area. EPA encourages facility owner/operators to take action promptly to correct any deficiencies, since EPA expects to focus its enforcement efforts regarding section 3004(j) violations on those situations where a subsequent inspection or other information reveals significant RCRA violation(s), or a pattern of violations that indicate a disregard for compliance with the RCRA Subtitle C requirements.

B. Identification of Mixed Wastes

Generators should record sufficient information to identify their mixed wastes. The identification should include the RCRA waste codes for the hazardous components, the source of the hazardous constituents and discussion of how the waste was generated (if known), the generation rate and volumes of mixed wastes in storage, and any process information relied upon to identify mixed wastes or make determinations that wastes are prohibited by the LDRs. The information on generation rates should include annual generation rates for all mixed wastes, as well as a separate calculation demonstrating that the facility's annual generation rate does not exceed 1,000 cubic ft/yr, based on the volumes and types of mixed wastes that this policy specifies should be counted in performing that calculation.

C. Waste Minimization Plans

EPA understands that many mixed waste generators are undertaking active measures to avoid the generation of mixed wastes. For example, "environmentally benign" liquids consisting of non-listed solvents are being substituted as LSC fluids, which operators of nuclear reactors have substituted trivalent chromates for the hexavalent chromate in corrosion inhibitors used in cooling systems. Each environmentally responsible mixed waste generator should develop a mixed waste minimization plan, and retain the plan at the facility. The plan should address process changes that can be made to reduce or eliminate mixed

wastes, methods to minimize the volume of regulated wastes through better segregation of materials, and substitution of non-hazardous materials. The plan should include a schedule for implementation, projections of volume reductions to be achieved, and assumptions that are critical to the accomplishment of the projected reductions.

EPA recognizes, however, that there may be cases where it is not technically feasible to minimize mixed waste generation. For example, a user of radioisotopes may be a "materials licensee" whose AEA license merely confers the rights to possess and use materials fabricated under another's specific license. Such a user may have little or no opportunity to substitute or segregate materials to avoid generating regulated wastes. In other instances, the benefits attributed to volume reduction may be offset by the greater radiological hazard associated with managing more concentrated waste forms. A generator's wastes may also be subject to a required treatment process (e.g., stabilization) which would inevitably increase the volume of the waste. In these and other such cases of technical infeasibility, the waste minimization plan should include a written explanation of the basis for the technical infeasibility.

D. Good Faith Efforts

This policy is limited in scope to those LDR-prohibited mixed wastes for which sufficient, lawful treatment capacity is not available. As stated earlier, EPA recognizes that commercial treatment and disposal capacity does not exist for many types of mixed wastes. However, since treatment or disposal capacity may become available in the future, generators should document periodically the good faith efforts they have undertaken to ascertain whether treatment capacity is available for their mixed wastes. EPA further recognizes that the availability of a process may not always translate into adequate capacity available to each generator, and such circumstances should be identified in the documentation.

E. Participation in EPA/NRC Profile

Both the management and regulation of mixed wastes have been hampered to a large extent by the lack of reliable data on the mixed waste universe. While some data have been collected recently by DOE, there has not been a corresponding aggregation of data describing the volumes, characteristics, inventories, and treatability of the wastes generated by the commercial sector. To rectify this situation, EPA and NRC are undertaking a "National Profile on Commercially Generated Low-level Radioactive Mixed Waste." After evaluating the adequacy of existing surveys and data collections, the two Agencies may determine that it is necessary to survey or study some subset of the more than 24,000 NRC and Agreement State fuel cycle and materials licensees. In that event, any generator selected for the EPA/NRC profile should cooperate fully with any study or other information request. The data compiled by the Agencies for the National Profile will contribute to EPA's determination whether to revise, revoke, or renew the policy at the end of the policy's term on December 31, 1993.

Dated: August 13, 1991.

Don R. Clay,

Assistant Administrator, Office of Solid Waste and Emergency Response.

Raymond B. Ludwiszewski,

Acting Assistant Administrator, Office of Enforcement.

[FR Doc. 91-20741 Filed 8-28-91; 8:45 am]

BILLING CODE 6560-50-M

[OPTS-51769; FRL 3943-1]

Toxic and Hazardous Substances; Certain Chemicals Premanufacture Notices

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: Section 5(a)(1) of the Toxic Substances Control Act (TSCA) requires any person who intends to manufacture or import a new chemical substance to submit a premanufacture notice (PMN) to EPA at least 90 days before manufacture or import commences. Statutory requirements for section 5(a)(1) premanufacture notices are discussed in the final rule published in the **Federal Register** of May 13, 1983 (48 FR 21722). This notice announces receipt of 22 such PMNs and provides a summary of each.

DATES: Close of review periods:

P 91-1297, 91-1298. November 6, 1991.

P 91-1300, 91-1301, 91-1302, 91-1303. November 9, 1991.

P 91-1304. October 29, 1991.

P 91-1305, 91-1306, 91-1307, 91-1308. November 10, 1991.

P 91-1309, 91-1310, 91-1311, 91-1312, 91-1313, 91-1314, 91-1315, 91-1316, 91-1317, 91-1318, 91-1319. November 11, 1991.

Written comments by:

P 91-1297, 91-1298. October 7, 1991.

P 91-1300, 91-1301, 91-1302, 91-1303. October 10, 1991.

P 91-1304. September 29, 1991.

P 91-1305, 91-1306, 91-1307, 91-1308. October 11, 1991.

P 91-1309, 91-1310, 91-1311, 91-1312, 91-1313, 91-1314, 91-1315, 91-1316, 91-1317, 91-1318, 91-1319. October 12, 1991.

ADDRESSES: Written comments, identified by the document control number "(OPTS-51769)" and the specific PMN number should be sent to: Document Processing Center (TS-790), Office of Toxic Substances, Environmental Protection Agency, 401 M St., SW., room L-100, Washington, DC 20460, (202) 382-3532.

FOR FURTHER INFORMATION CONTACT: Michael M. Stahl, Director, Environmental Assistance Division (TS-799), Office of Toxic Substances, Environmental Protection Agency, rm. EB-44, 401 M St., SW., Washington, DC 20460 (202) 554-1404, TDD (202) 554-0551.

SUPPLEMENTARY INFORMATION: The following notice contains information extracted from the nonconfidential version of the submission provided by the manufacturer on the PMNs received by EPA. The complete nonconfidential document is available in the Public Reading Room NE-G004 at the above address between 8 a.m. and 4 p.m., Monday through Friday, excluding legal holidays.

P 91-1297

Manufacturer. Donlar Corporation.

Chemical. (S) Potassium salt of polyaspartic acid.

Use/Production. (S) Anti-redeposition agent in detergent. Prod. range: Confidential.

Toxicity Data. Acute oral toxicity, LD50 5 g/kg species (rat).

P 91-1298

Manufacturer. Donlar Corporation.

Chemical. (S) Ammonium salt of polyaspartic acid.

Use/Production. (S) Anti-redeposition agent in detergent. Prod. range: Confidential.

P 91-1300

Importer. Ausimont USA, Inc.

Chemical. (G) Fluorinated polyurethane.

Use/Import. (S) Seals. Import range: Confidential.

P 91-1301

Manufacturer. E.I. Du Pont De Nemours Co., Inc.

Chemical. (G) Benzoic acid, 2-substituted-3-methyl-, methyl ester.

Persistent Spectral Hole-Burning: Science and Applications (Springer, Berlin, 1988); R. Jankowiak and G. J. Small, *Science* **237**, 618 (1987).
17. V. I. Goldanskii, Yu. F. Krupyanskii, V. N. Fleurov, *Dokl. Akad. Nauk SSSR* **272**, 23 (1983); G. P. Singh *et al.*, *Z. Phys. B* **55**, 23 (1984).
18. R. Zallen, *The Physics of Amorphous Solids* (Wiley, New York, 1983); W. A. Phillips, Ed., *Amorphous Solids* (Springer, Berlin, 1981); F. H. Stillinger and T. Weber, *Science* **225**, 983 (1984).
19. K. Binder and A. P. Young, *Rev. Mod. Phys.* **58**, 801 (1986); D. Stein, *Sci. Am.* **263**, 52 (July 1989); K. H. Fischer and J. A. Hertz, *Spin Glasses* (Cambridge Univ. Press, Cambridge, 1991).
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Perceived Risk, Trust, and the Politics of Nuclear Waste

PAUL SLOVIC, JAMES H. FLYNN, MARK LAYMAN

The Department of Energy's program for disposing of high-level radioactive wastes has been impeded by overwhelming political opposition fueled by public perceptions of risk. Analysis of these perceptions shows them to be deeply rooted in images of fear and dread that have been present since the discovery of radioactivity. The development and use of nuclear weapons linked these images to reality and the mishandling of radioactive wastes from the nation's military weapons facilities has contributed toward creating a profound state of distrust that cannot be erased quickly or easily. Postponing the permanent repository and employing dry-cask storage of wastes on site would provide the time necessary for difficult social and political issues to be resolved.

BY THE YEAR 2000, THE UNITED STATES WILL HAVE A projected 40,000 metric tons of spent nuclear fuel stored at some 70 sites and awaiting disposal. By 2035, after all existing nuclear plants have completed 40 years of operation, there will be approximately 85,000 metric tons (*1*). The U.S. Department of Energy (DOE) has been under intense pressure from Congress and the nuclear industry to dispose of this accumulating volume of high-level waste since the passage of the Nuclear Waste Policy Act in 1982 and its amendment in 1987, by which Yucca Mountain, Nevada, was selected as the only candidate site for the nation's first nuclear waste repository. The lack of a suitable solution to the waste problem is widely viewed as an obstacle to further development of nuclear power and a threat to the continued operation of existing reactors, besides being a safety hazard in its own right.

Yet, at this time, the DOE program has been brought nearly to a halt by overwhelming political opposition, fueled by perceptions of the public that the risks are immense (*2–7*). These perceptions stand in stark contrast to the prevailing view of the technical community, which argues that nuclear wastes can be disposed of safely, in deep underground isolation (*8–10*). Officials from DOE, the nuclear industry, and their technical experts are profoundly puzzled, frustrated, and disturbed by public and political opposition that many of them consider to be based on irrationality and ignorance. Lewis, for example, argued that the risk

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from a properly constructed repository "... is as negligible as it is possible to imagine. ... It is embarrassingly easy to solve the technical problems, yet impossible to solve the political problems. ... High-level nuclear waste disposal is a non-risk" (*9*, pp. 245–246).

A number of important events during the past several years underscore the seriousness of this problem.

1) Official opposition by the State of Nevada has increased substantially. In June 1989, the Nevada legislature passed Assembly Bill 222, making it unlawful for any person or governmental entity to store high-level radioactive waste in the state. The state attorney general subsequently issued an opinion that the Yucca Mountain site had been effectively vetoed under a provision of the Nuclear Waste Policy Act. The governor instructed state agencies to disregard DOE's applications for environmental permits necessary to investigate the site. The state and DOE initiated federal lawsuits over continuance of the program and issuance of the permits needed for on-site studies. In September 1990, the 9th U.S. Circuit Court of Appeals ruled that the state had acted improperly and ordered Nevada officials to issue the permits. Nevada appealed to the Supreme Court, which let stand the prior ruling. Although state officials have, under duress, begun to accept and process DOE permit applications, the governor and other elected officials have announced that their opposition to the repository will not diminish.

2) In November 1989, DOE, admitting dissatisfaction with its technical assessments of the Yucca Mountain site, announced that it would essentially start over with, "for the first time," an integrated, responsible plan. This plan would subject technical studies to close outside scrutiny to ensure that decisions about Yucca Mountain would be made "solely on the basis of solid scientific evidence" (*11*).

3) In July 1990, the National Research Council's Board on Radioactive Waste Management issued a strong critique of the DOE program, charging that DOE's insistence on doing everything right the first time has misled the public by promising unattainable levels of safety under a rigid schedule that is "... unrealistic, given the inherent uncertainties of this unprecedented undertaking," and thus vulnerable to " 'show stopping' problems and delays that could lead to a further deterioration of public and scientific trust" (*12*, p. 1). The board recommended, instead, a more flexible approach, permitting design and engineering changes as new information becomes available during repository construction and operation.

Perceptions of risk from radiation, nuclear power, and nuclear waste play a pivotal role in this story and need to be thoroughly understood if we are to make any progress in resolving the current impasse. In this article, we summarize research designed to penetrate the surface veneer of nuclear fear and opposition and provide insight into the nature of people's concerns, the origins of these concerns, the emotions that underlie them, and their implications for policy.

Attitude and Opinion Surveys

There have been more than a dozen surveys conducted during the past 5 years to assess public attitudes and opinions regarding the management of high-level radioactive wastes (*2, 5, 13–15*). The picture that emerges is uniformly negative.

One of the more extensive surveys was conducted in the fall of 1989 by Flynn *et al.* (*15*). More than 2500 respondents were questioned by telephone about their perceptions of the risks and benefits associated with a nuclear waste repository, their support of or opposition to the DOE repository program, their trust in the ability of DOE to manage the program, and their views on a variety of other issues pertaining to radioactive waste disposal. In addition to a national survey, data were collected from two other populations of special interest: residents of Nevada, the state selected as the site for the proposed national repository, and residents of Southern California, the major source of tourism and migration to Nevada.

When asked to indicate the closest distance they would be willing to live from each of ten facilities, the median distance from an underground nuclear waste repository was 200 miles in each of the three surveys, twice the distance from the next most undesirable facility, a chemical waste landfill, and three to eight times the distances from oil refineries, nuclear power plants, and pesticide manufacturing plants. In response to the statement, "Highway and rail accidents will occur in transporting the wastes to the repository site," the percentage of respondents who agreed or strongly agreed was 77.4% in Nevada, 69.2% in California, and 71.6% nationally. Similar expectations of problems were expressed with regard to future earthquake or volcanic activity at the site, contamination of underground water supplies, and accidents while handling the material during burial operations.

When asked whether a state that does not produce high-level nuclear wastes should serve as a site for a nuclear waste repository, 67.9% of the Southern California and 76.0% of the national respondents answered "no" (the question was not asked in Nevada). A majority of those polled in the Southern California and national surveys judged a single national repository to be the least fair of five disposal options (the other options were storage at each nuclear plant, in each state, in each of several regions, and dual repositories in the East and West).

Strong distrust of the DOE was evident from the responses to statements such as, "The U.S. Department of Energy can be trusted to provide prompt and full disclosure of any accidents or serious problems with their nuclear waste management programs." In Southern California, 67.5% either somewhat or strongly disagreed with this statement. The corresponding rate of disagreement in the national survey was 68.1%.

Nevadans were asked whether or not they would vote in favor of a repository at Yucca Mountain; 69.4% said they would vote against it, compared to 14.4% who would vote for it. About 68% of the Nevadans surveyed said they agreed strongly with the statement, "The State of Nevada should do all it can to stop the repository"; another 12.5% agreed somewhat with this statement; only 16.0% disagreed. When asked whether or not they favored Assembly Bill 222, making it illegal to dispose of high-level nuclear waste in Nevada, 74% were in favor and 18.4% were opposed. Finally, 73.6% of Nevadans said that the state should continue to do all it can to oppose the repository even if that means turning down benefits that may be offered by the federal government; 19.6% said the state should stop fighting and make a deal.

Follow-up surveys of Nevada residents in October 1990 and March 1991 suggest that opposition and distrust have risen (*16*). The percentage of Nevadans who would vote against a repository at Yucca Mountain increased from 69.4 to 80.2%. In response to a request to indicate "how much you trust each of the following to do what is right with regard to a nuclear waste repository at Yucca Mountain," the governor of Nevada topped the list of officials, agencies, and institutions. DOE, the Nuclear Regulatory Commission (NRC), and the U.S. Congress were the least trusted entities. Between 1989 and 1991, strong increases in trust were evident for the governor of Nevada and the Nevada state legislature. In contrast, trust in DOE and NRC declined between 1989 and 1991.

Imagery and Perception

Before answering any of the attitude or opinion questions, respondents in the national, Southern California, and Nevada surveys, along with respondents in a survey of 802 residents of Phoenix, were asked to associate freely about the concept of a nuclear waste repository (*7*). The method of continued associations (*17*) was used to evoke images, perceptions, and affective states

related to a repository. Respondents were asked to indicate the first thoughts or images that come to mind when they think of an underground nuclear waste repository.

The 3,334 respondents in the four surveys produced a combined total of exactly 10,000 word-association images to the repository stimulus. The associations were examined and assigned to 13 general categories (*18*). All but one general category contained subcategories. In all, there were 92 distinct subcategories. Many of these contained multiple associations, judged to have similar meanings. For example, the subcategory labeled "dangerous/toxic," within the general category labeled "negative consequences," included the terms "danger, dangerous, unsafe, disaster, hazardous, poisonous," and so on.

The two largest categories, "negative consequences" and "negative concepts," and their combined frequencies across all four samples are shown in Table 1. The subcategories are also shown, ordered by frequency within their superordinate category. The most arresting and most important result is the extreme negative quality of these images. These two largest categories accounted for more than 56% of the total number of images. The dominant subcategory, "dangerous/toxic," contained almost 17% of the total number of images. The five largest subordinate categories—"dangerous/toxic, death/sickness, environmental damage, bad/negative, and scary"—were thoroughly negative in affective quality and accounted for more than 42% of the total number of images. The four most frequent single associations were "dangerous" (n = 539), "danger" (n = 378), "death" (n = 306), and "pollution" (n = 276).

Positive imagery was rare. A general category labeled "positive" accounted for only 1% of the images. Other positive concepts, "necessary," "employment," and "money/income" combined to total only 2.5% of the images. The response "safe" was given only 37 times (0.37%). In addition, there were 232 associations pertaining to war, annihilation, weapons, and things military. The famous NIMBY position (not in my backyard) was expressed in 273 images.

Table 1. Dominant images of a nuclear waste repository: totals for four surveys.

Image categories	n
Negative consequences	
Dangerous/toxic	1683
Death/sickness	783
Environmental damage	692
Leakage	216
Destruction	133
Pain and suffering	18
Uninhabitable	7
Local repository area consequences	6
Negative consequences—other	8
Total	3546
Negative concepts	
Bad/negative	681
Scary	401
Unnecessary/opposed	296
Not near me	273
War/annihilation	126
Societally unpopular	41
Crime and corruption	40
Decay/slime/smell	39
Darkness/emptiness	37
Negative toward decision-makers and process	32
Commands to not build or to eliminate them	24
Wrong or bad solution	19
No nuclear, stop producing	15
Unjust	14
Violence	10
Prohibited	5
Negative—other	15
Total	2068

Associations indicative of distrust appeared in the category "negative toward decision-makers and process," and in another subcategory dealing with mistakes. A number of images in the "bad/negative" category also seemed to reflect lack of trust (for example, "stupid," "dumb," "illogical").

Jones *et al.* (*19*) have attempted to characterize the key dimensions of stigma. Two such defining characteristics are peril and negative aesthetic qualities (ugliness and repulsion). These qualities dominate the repository images. Peril is pervasive throughout the "negative consequences" category and negative aesthetics and repulsion form the bulk of "negative concepts" (Table 1). Indeed, the large subcategory "bad/negative" is remarkable in its reflection of antagonism and hostility toward the repository concept. Common responses in this category were "terrible," "ugly," "disgusting," "anger," "evil," "insane," "hate it," and, simply, "bad" (107 responses). Associations indicating locations ("desert," "Nevada," "underground") and concepts such as "radiation," "nuclear," and "chemicals" made up the bulk of the responses not covered in Table 1.

The images were similar in content and frequency from one survey to another. Demographic differences were also small. The negativity of repository images was remarkably consistent across men and women of different ages, incomes, education levels, and political persuasions.

After free-associating to the repository stimulus, each respondent in the Nevada survey rated the affective quality of his or her associations on a five-point scale ranging from extremely negative to extremely positive. These affective ratings were highly correlated with the respondent's attitudes and perceptions of risk. For example, more than 90% of the persons whose first image was judged very negative said they would vote against a repository at Yucca Mountain; more than half of the persons whose first image was judged positive would vote in favor of the repository. A similarly strong relationship was found between affective ratings of images and a person's judgment of the likelihood of accidents or other problems at a repository. Negativity of the image rating was also strongly related to support for the state of Nevada's opposition to the repository program.

What was learned by asking 3334 people to associate freely to the concept of a nuclear waste repository? The most obvious answer is that people do not like nuclear waste. However, these images (as well as the responses to the attitude and opinion questions) demonstrate an aversion so strong that to label it a "dislike" hardly does it justice. What these responses reveal are pervasive qualities of dread, revulsion, and anger—the raw materials of stigmatization and political opposition.

Because nuclear waste is a by-product of an impressive technology capable of producing massive amounts of energy without contributing to greenhouse gases, one might expect to find associations to energy and its benefits—electricity, light, heat, employment, health, progress, the good life—scattered among the images. Almost none were observed.

Moreover, people were not asked to reflect on nuclear waste; instead, they were asked about a storage facility or repository. One might expect, following the predominant view of experts in this field, to find a substantial number of repository images reflecting the qualities "necessary" and "safe." Few images of this kind were observed.

How Did It Get This Way?

Imagery and attitudes so negative and so impervious to influence from the assessments of technical experts must have very potent origins. Weart's (*20*) historical analysis shows that nuclear fears are deeply rooted in our social and cultural consciousness. He demonstrates that modern thinking about nuclear energy employs beliefs

and symbols that have been associated for centuries with the concept of transmutation—the passage through destruction to rebirth. In the early decades of the 20th century, transmutation images became centered on radioactivity, which was associated with "uncanny rays that brought hideous death or miraculous new life; with mad scientists and their ambiguous monsters; with cosmic secrets of death and life. . . . and with weapons great enough to destroy the world . . ." (*20*, p. 421).

This concept of transmutation has a duality that is hardly evident in the imagery observed in the surveys. Why has the destructive aspect predominated? The answer likely involves the bombings of Hiroshima and Nagasaki, which linked the frightening images of nuclear energy to reality. The sprouting of nuclear power in the aftermath of the atomic bombing led Smith (*21*) to observe: "Nuclear energy was conceived in secrecy, born in war, and first revealed to the world in horror. No matter how much proponents try to separate the peaceful from the weapons atom, the connection is firmly embedded in the minds of the public" (*21*, p. 62).

Research supports Smith's assertions. Fiske, Pratto, and Pavelchak (*22*) elicited people's images of nuclear war and obtained results that were similar to the repository images described above. A study by Slovic, Lichtenstein, and Fischhoff (*23*) found that, even before the accident at Three Mile Island, people expected nuclear reactor accidents to lead to disasters of immense proportions. When asked to describe the consequences of a "typical reactor accident," people's scenarios were found to resemble scenarios of the aftermath of nuclear war (*24*). The shared imagery of nuclear weapons, nuclear power, and nuclear waste may explain why a nuclear waste repository is judged by the public to pose risks at least as great as a nuclear power plant or a nuclear weapons test site (*5*).

Further insights into the special quality of nuclear fear are provided by Erikson (*26*), who describes the exceptionally dread quality of accidents that expose people to radiation. Unlike natural disasters, these accidents have no end. "Invisible contaminants remain a part of the surroundings—absorbed into the grain of the landscape, the tissues of the body and, worst of all, into the genetic material of the survivors. An 'all clear' is never sounded. The book of accounts is never closed" (*26*, p. 121).

Another strong determiner of public perceptions is the continuing story of decades of mishandling of wastes at the nation's military weapons facilities, now operated by DOE (*27*). Leakage from these facilities has resulted in widespread contamination, projected to require more than $150 billion for cleanup over the next 30 years. The recent revelation of unprecedented releases of radiation from the Hanford, Washington, weapons plant in the 1940s and 1950s (*28*) will certainly compound the negative imagery associated with a nuclear waste repository and further undermine public trust in government management of nuclear waste disposal.

A Crisis of Confidence

The fear and revulsion evoked in the general public by the thought of a nuclear waste repository stand in contrast to the confidence that most technical analysts and engineers have in their ability to dispose of radioactive materials safely. Even the report of the National Research Council (*12*), though highly concerned about the difficulties of predicting the long-term performance of a repository, conceded that "these uncertainties do not necessarily mean that the risks are significant, nor that the public should reject efforts to site the repository" (*12*, p. 13).

Starr has argued that "acceptance of any risk is more dependent on public confidence in risk management than on the quantitative estimates of risk. . . " (*29*, p. 98). Public fears and opposition to nuclear waste disposal plans can be seen as a "crisis of confidence," a profound breakdown of trust in the scientific, governmental, and industrial managers of nuclear technologies. The breakdown of trust was clearly evident at the time the Nuclear Waste Policy Act was signed (*30, 31*) and has been documented repeatedly in subsequent public opinion surveys (*2, 15, 32–34*).

Viewing the nuclear waste problem as one of distrust in risk management gives important insights into its intractability. Social psychological studies (*35*) have validated "folk wisdom" by demonstrating that trust is a quality that is quickly lost and slowly (if ever) regained. A single act of embezzlement is enough to convince us that our bookkeeper is untrustworthy. A subsequent opportunit to embezzle that is not taken would likely do little to reduce the degree of distrust. Indeed, 100 subsequent honest actions would probably do little to restore our trust in this individual.

In this light, the attempt by DOE to regain the confidence of the public, Congress, and the nuclear industry by rearranging its organizational chart and promising to do a better job of risk management and science in the future (*11*) was naive. Trust, once lost, cannot so easily be restored. Similarly naive is the aim professed by DOE officials and other nuclear industry leaders to change perceptions and gain support by letting people see firsthand the safety of nuclear waste management. The nature of any low-probability, high-consequence threat is such that adverse events will demonstrate riskiness but demonstrations of safety (or negligible risk) will require a very long time, free of damaging incidents. The intense scrutiny given to nuclear power and nuclear waste issues by the news media (*36, 37*) ensures that a stream of problems, occurring all over the world, will be brought to the public's attention, continually eroding trust.

Where Next for Nuclear Waste?

Although everyone recognizes the sophisticated engineering required to store nuclear wastes safely, the political requirements necessary to design and implement a repository have not similarly been appreciated. As a result, notes Jacob, "While vast resources have been expended on developing complex and sophisticated technologies, the equally sophisticated political processes and institutions required to develop a credible and legitimate strategy for nuclear waste management have not been developed" (*30*, p. 164).

In the absence of a trustworthy process for siting, developing, and operating a nuclear waste repository, the prospects for a short-term solution to the disposal problem seem remote. The report of the National Research Council (*12*) is quite sensitive to issues of risk perception and trust, but makes the strong assumption that trust can be restored by a process that openly recognizes the limits of technical understanding and does not aim to "get it right the first time." It seems likely that such open admission of uncertainty and refusal to guarantee safety might well have opposite effects from those intended—increased concern and further deterioration of trust. Moreover, the National Research Council statement also assumes that DOE will continue to manage the nuclear waste program, thus failing to come to grips with the difficulties that agency will face in restoring its tainted image.

The lack of a trustworthy process for siting, developing, and operating a nuclear waste repository has evoked numerous other comments and suggestions. Weinberg (*38*) draws an analogy between fear of witches during the 15th through 17th centuries and today's fear of harm from radiation. He hypothesizes that "rad-waste phobia" may dissipate if the intelligentsia (read environmentalists) say that such fears are unfounded, much as eventually happened with fears of witches. Carter argued that "trust will be gained by

building a record of sure, competent, open performance that gets good marks from independent technical peer reviewers and that shows decent respect for the public's sensibilities and common sense" (*39*, p. 416). Others have called for more radical changes, such as creating new organizations to take over DOE's management role (*40, 41*) and developing procedures to ensure that state, local, and tribal governments have a strong voice in siting decisions and oversight of actual repository operations (*30, 42, 43*). In this spirit, an official of the Canadian government has argued for making repository siting in that country voluntary by requiring public consent as an absolute prerequisite for confirming any decision (*44*).

Whatever steps are taken, it is unlikely that the current "crisis in confidence" will be ended quickly or easily. We must settle in for a long effort to restore the public trust. Krauskopf (*45*) has argued that postponing the repository to an indefinite future can be defended on a variety of technical grounds and points out that the choice between repository construction or postponement ultimately rests on the shoulders of the public and their elected representatives. The problems of perception and trust described above imply that postponement of a permanent repository may be the only politically viable option in the foreseeable future.

In an address to the National Association of Regulatory Utility Commissioners in November 1990, Joseph Rhodes, Jr., a commissioner from Pennsylvania, pointed out the implications of the polls indicating that most Nevadans oppose the siting of a repository anywhere in Nevada and want state leaders to oppose such siting with any means available (*46*). "I can't imagine," said Rhodes, "that there will ever be a usable Yucca Mountain Repository if the people of Nevada don't want it. . . . There are just too many ways to delay the program . . . (*46*, p. 6).

What are the options in the light of insurmountable public opposition to a permanent underground repository? Rhodes lists and rejects several: (i) Continuing on the present path in an attempt to site a permanent repository is a costly and doomed effort. (ii) Permanent on-site storage is unsafe. (iii) Deploying a monitored retrievable storage (MRS) program is also politically unacceptable. Without a viable program to develop a permanent repository, the MRS would be seen, in effect, as the permanent site. (iv) Reprocessing the spent nuclear fuel is also politically unacceptable because of concerns over nuclear weapons proliferation. Moreover, reprocessing reduces but does not eliminate high-level wastes, and the record of managing reprocessing residues at West Valley, Hanford, and other sites is hardly encouraging (*27, 39, 47*).

Rhodes concludes, and we concur, that the only viable option is to postpone the siting of a permanent repository and store the wastes on site in the interim—employing dry-cask storage that has been certified by NRC as being as safe as geological storage for 100 or more years (*48*). Should this course of action be followed, technical knowledge will undoubtedly advance greatly during this interim period. Perceptions of risk and trust in government and the nuclear industry may change greatly, too, if the problem of establishing and maintaining trust is taken seriously.

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of water is insufficient to cause any flooding that could raise the river level (420 feet above the probable maximum flood stage) by an amount required to affect the WIPP.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section were taken primarily from USNRC Regulatory Guide 3.26 (Ref. 1). Specific acceptance criteria were that:

1. Surface water could not drain into the WIPP Facility and thereby affect its operation.

2. Floods and dam failure would not affect the WIPP Facility.

3. The FSAR describes the hydrologically related design bases, performance requirements, and operating procedures important to safety.

3.0 ISSUES

1. The FSAR indicates that no liquid effluents are discharged from WIPP. This section of the FSAR does not contain a description of the process used to ensure that the containment waste (such as water used for decontamination) is not mixed with surface drainage effluent from the site.

   Resolution:

   The liquid effluent from the WIPP Site are separated so that potentially contaminated waste is collected, tested and stored at the site if found to be radioactive (see Section 5.4 of the FSAR). There is no mixing of water which is used for decontamination and normal rainfall at the site. It is therefore concluded that there is no

potential for mixing the contaminated and non contaminated wastes. This response is acceptable and this issue is resolved.

2. The FSAR refers to a system of drainage ditches used to collect surface runoff and to pass the runoff through the site. The FSAR indicated that the drainage ditches were described in Figure 2.4-3, but that figure contained no reference to the drainage system.

   Resolution:

   A system of drainage ditches (see Figure 2.4-3 of the May 1989 revision to the FSAR) is provided to divert the rainfall runoff at the site into natural drainage systems in the area. These ditches provide an acceptable drainage system for the rainfall at the site. This response is acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of Surface Hydrology. The WIPP Site is located in a dry area and is at a high elevation relative to the natural drainage features in the area. It is concluded that flooding and runoff problems are not expected to be significant at the site. The elevation of the WIPP surface facilities is 500 feet above the Pecos River and 250 feet above the Nash Draw, the only two prominent drainage features in the area. The vertical separation ensures that flooding in the area will not affect the WIPP Site. Failure of dams on the Pecos River would not release sufficient water to raise the river elevation by 500 feet. The region is arid and most precipitation in this area is lost through transpiration. This reduces the likelihood of surface runoff either entering the WIPP Site or of passing through the WIPP Site and potentially spreading contamination.

Provisions are made to collect local runoff so that it does not affect the operation of the facility and does not allow for contaminated water to enter the drainage features in the area.

SECTION 2.5 - SUBSURFACE HYDROLOGY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the subsurface hydrogeologic conditions in the vicinity of the WIPP Site. The site is quite dry with a few formations that contain aquifers. The aquifer bearing formations are separated by rather thick layers of rock having very low permeabilities, thereby restricting any vertical migration of water from one aquifer to the other.

Several aquifers are located in the near surface formations (within about 150 feet of the surface). These aquifers again exhibit rather low permeability and are charged from and discharge into the Pecos River. Little use is made of the water contained in the aquifers.

The majority of the water used in the region is taken from the Capitan Reef aquifer. This aquifer is located in the Bell Canyon formation, which is about 2300 feet below the horizon of the WIPP storage area. The Capitan Reef aquifer is charged from and discharges into regions that are remote from the WIPP area. The low permeability of the Salado and Castile formations located above the Capitan Reef hydrologically isolate this aquifer from the WIPP Site.

In addition to the aquifers, pockets of entrapped brine are found in the halite and potash formations. These pockets are apparently stable, under reasonably high pressure equal to the lithostatic pressure, and can be quite large, that is, contain up to several hundred thousand gallons of brine.

The FSAR contains data describing the significant hydrologic properties (e.g., transmissivity, storage, etc.) in each of the host rock formations from the ground surface down to depths of about 2500 feet, which is below the WIPP storage horizon. These data were obtained from observations made at existing wells, exploratory wells drilled in support of the WIPP Project and data collected during the mining operations at WIPP.

2.0 ACCEPTANCE CRITERIA

The data in the FSAR include descriptive material for the geohydrology at the site. These data were reviewed to ensure that they were consistent with the conclusions deduced in the FSAR. The goal of the review was to develop confidence in the conclusion that the WIPP storage horizon is hydrologically isolated from the two aquifers (Dockum Group and Castile) in the region during the Test Phase. This would ensure that contaminated water from WIPP could not enter the groundwater systems and, in turn, that groundwater would not seep into the WIPP facilities during the Test Phase.

Specific acceptance criteria that were used to evaluate this section were taken from the following sections of Appendix IV of the 10 CFR 111 (Ref. 12):

1. 960.4-2-1 Geohydrology - this criteria requires that there is not potential for connection between aquifers in the area and the Facility.

2. 960.4-2-6 Dissolution - the rock types and water in the area will not lead to dissolution of material around the Facility.

3. 96-.5-2-10 Hydrology - the local hydrology, in terms of potentiometric surfaces, is compatible with the construction and operation of the site.

3.0 ISSUES

1. The FSAR referred to numerical modeling of the hydrologic system at WIPP but did not contain specific information regarding the models. Information on these models is required so that a better understanding of the hydrologic system at WIPP could be developed.

Resolution:

There is an extensive hydrologic experimental program that is ongoing and is a part of the long term assessment validation. Three ongoing modeling efforts are being conducted by the Sandia National Laboratories (SNL). Numerical simulation of groundwater flow in the Culebra initially used the three-dimensional finite element code SWIFT-II using variable fluid density and a single porosity formulation. This is presently being modified to a dual porosity formulation. The Second Interim Report on this simulation (Ref. 13) was released in March 1988, with the final report due later in 1989.

A second SNL modeling effort is under way to formulate a full 3-D model of potential release paths from the facility horizon to the surface aquifers. This will be completed in FY 1991. A third modeling effort is underway by the SNL Performance Assessment Team to formulate a regional Los Medanos hydrologic model from the surface through the Bell Canyon formation. This model is presently scheduled for completion in FY 1991.

These descriptions of the hydrologic modeling provide an acceptable basis for understanding the site hydrology and this issue is resolved.

2. The FSAR contained a reference to large cavities, filled with pressurized brine, in the vicinity of WIPP. There was a concern that these large cavities could create problems if they were breached during the mining operation.

Resolution:

The FSAR referred to the fact that some of the potash mines in the vicinity of WIPP contain large cavities that are filled with pressurized brine. The extent to which such cavities exist was investigated. It was determined that these are not open cavities but, rather interconnected porous zones. These pockets have not been observed in the WIPP shafts. All of the observed cavities are at least 5 miles laterally away from WIPP. These data are referenced in the May 1989 revision to the FSAR. This response is acceptable and this issue is resolved.

3. The FSAR referred to the difficulty and uncertainty in obtaining sorption data applicable to the WIPP Site. A concern was raised as to the planned program to resolve this uncertainty.

Resolution:

The May 1989 revision to the FSAR has referred to a SNL program (Ref. 14) to evaluate these data and to perform an assessment of long-term radionuclide transport. This was reviewed and found to be acceptable and this issued is resolved.

4. The FSAR refers to studies suggesting the possibility of salt dissolution at large depths and the evidence of such dissolution being manifested in "localized collapse features." The concern existed that such activity could create voids in the vicinity of WIPP.

Resolution:

The May 1989 revision to the FSAR used data contained in Refs. 15 and 16 to confirm that evidence of salt dissolution is not present near the WIPP Site. These references were reviewed and substantiate the

conclusion that salt dissolution has not occurred near the WIPP Site. This issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of the subsurface hydrology. The WIPP Site is located in a relatively impermeable salt formation where any fractures will tend to heal with time. The impermeable host material for the repository together with the rather large separation of the storage horizon from known water sources support the conclusion that water inflow or outflow from the facility should not present any safety issues. It is important to note that SNL has long range planned hydrologic experimental programs which are part of the long term assessment and should uncover any major problems, should they exist. It is also important to note that the EH review focused on the Test Phase. Therefore, no specific consideration was given to potential hydrologic problems which may occur during closure. The data required for this evaluation will be developed during the experimental program.

SECTION 2.6 - REGIONAL GEOLOGY

1.0 SUMMARY DESCRIPTION

The major geological features found within a radius of about 200 miles of the WIPP Facility are discussed in this section of the FSAR under the headings of (1) Regional Physiography and Geomorphology, (2) Regional Geologic and Structural History, (3) Regional Stratigraphy and Lithology, (4) Regional Structure and Tectonics, and (5) Pleistocene Climate of the WIPP Facility.

The WIPP Site is in the southwestern portion of the Great Plains physiographic province. This province is a broad highland belt, sloping gently eastward, and bordered on the north and west by the Rocky Mountains and Basin and Range province and on the east by the Central Lowlands province. The major permanent drainage of the area is the north-south flowing Pecos River located 14 miles west of the WIPP Facility. The Delaware Basin, in which the WIPP Facility is situated, is located in the Pecos Valley section of the Great Plains physiographic province. Much of the surface of the Pecos Valley Section exhibits karst topography pitted by numerous sinks and other karst features. The largest of these dissolution features are Nash Draw located four miles northwest of the WIPP Facility and San Simon Swale located 20 miles east. The WIPP Facility is situated on the western flank of a low drainage divide which separates these two features.

The geologic record of the region suggests a history of sedimentation upon a Precambrian basement and organic activity. This was followed by erosion and the onset of mild epeirogenic movement. The development of a shelf and basin setting in the late Paleozoic era resulted in an accumulation of clastics, carbonates, and evaporite reaching a maximum of 20,000 ft. Since that time the region has been mainly emergent and has undergone a slight east-south east tilt. The major geologic events of southeastern New Mexico subsequent to the development and filling of the Delaware Basin are a period of submergence and the Laramide Orogeny in the Mesozoic era, Basin and Range

uplift, erosion/dissolution and eolian activity and sedimentation in the Cenozoic era.

The underground WIPP Facility is located in the approximately 2000 ft. thick Salado formation which is part of the Ochoan sedimentary sequence.

Most of the large scale structures in the region were completely formed by the late Paleozoic. The remainder, including regional tilting, were formed as the result of mid to late Tertiary and Quaternary Basin and Range - related doming and faulting. The features are discussed according to structural type and time of formation. Major folds, flexures and faults in the WIPP Facility region are discussed separately.

Based on the type and location of the glacial and periglacial features of the region, the probability of future glacial disturbance to the WIPP Facility is minimal.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from 10 CFR 111, Part 960, Section 960.4-2-3, Rock Characteristics (Ref. 12).

Specific acceptance criteria that were used to evaluate Section 2.6 were:

1. The regional geology has been studied in depth, is well understood and described and illustrated.

2. The description includes geologic history, typography, stratigraphy and lithology, structure and tectonics, and igneous activity.

3. The regional geology allows for the identification of sites that contain geologic members that are massive, extensive, relatively homogeneous, and impermeable.

4. Maps, profiles, plots and cross sections are used to model the regional geology.

More specific criteria used to evaluate Section 2.6 are contained in Appendix D-1, biologic criterion and site-selection factors, FEIS, October 1980, (Ref. 17).

3.0 ISSUES

The geologic model used to predict the long term stability of the WIPP region and site is judgmental but is based on quantitative data developed from extensive site characterization studies. Much of the information in the geologic model is the result of extensive work done by the U.S. Geological Survey. Other information has been derived from core boring and geophysical investigations. The geologic model is judgmental in that it is based on information derived from sample points often far apart but generally not specified. The information on geologic conditions between sample points is based on geologic inference and/or extrapolations which is typically done for such geological investigations.

1. A request was made to obtain estimates of the level of subsidence which is anticipated due to the underground excavations at the WIPP Facility.

   Resolution:

   Based on additional information provided at the April 24-28, 1989 FSAR review meeting, using conservative assumptions regarding the extraction ratio for the WIPP Facility, the average subsidence was estimated at about 5 inches. An upper bound level of 15 inches was also conservatively estimated. These subsidence levels are considered to be acceptable. Another factor supporting this conclusion, is that the existing subsidence in the nearby potash mines has not caused any concern over the years. Note that the extraction ratios at the potash mines are much higher than that of

the WIPP. The response is considered acceptable and the issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of the regional geology.

SECTION 2.7 - GEOLOGY IN THE VICINITY OF THE WIPP FACILITY

1.0 SUMMARY DESCRIPTION

The local geological features in the vicinity of the WIPP Facility are discussed in this section of the FSAR under the headings of (1) Physiography and Geomorphology, (2) Stratigraphy and Lithology, (3) Structure and Tectonics, (4) Geologic Mapping, (5) Geologic History, (6) Plot Plans and Profiles, (7) Engineering Geology, (8) Geochemistry and Geophysics, (9) Analysis of Foundations.

The WIPP Facility is located near the eastern edge of the Pecos Valley section of the Great Plains physiographic province on the flank of a natural divide between Nash Draw and San Simon Swale. Much of the area is covered with eolian sand of very erratic distribution and thickness.

The rock formations of the WIPP Facility from the precambrian basement to the surface are described with respect to stratigraphy and lithology, and structure and tectonics. In particular the Ochoan series of sediments are discussed in detail. Subsurface information generated by drill hole logs, test pits, mapping of the shafts, and geophysical investigations is given in plot plans and geologic profiles.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from 10 CFR 111. Part 960 Section 960.5-2-9, Rock Characteristics (Ref. 12), and the validation of the criterion given in Chapter 2, USNRC Panel on WIPP report titled "Review of the Scientific and Technical Criteria for the Waste Isolation Pilot Plant" (Ref. 18).

Specific acceptance criteria used to evaluate Section 2.7 were:

1. The geology of the site is such that the repository will not be breached by natural phenomena.

2. The geology should permit the safe development and operation of the WIPP repository.

3. The geological data collected over the past 10 years has served to corroborate the anticipated geologic formations and structures and gives confidence in the geologic model of the repository.

3.0 ISSUES

None were identified.

4.0 REQUEST FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of the local geology. The related geomechanical behavior of the shafts, drifts, storage rooms and other appurtenances are addressed in Section 2.10.

The WIPP Facility horizon is taken to mean the level of underground drifts, rooms, waste experimental area plus 50 ft. above and below this level, thus encompassing strata found in the roof and floor of the storage horizon. Approximately 5.5 miles of drift have been excavated in the facility's horizon. Of this total, 2.8 miles have been geologically mapped. Map Unit 1 has been mapped or surveyed in all drifts to check for continuity of lithology and to check the geological structure throughout the facility's horizon. The underground drilling program, consisting of at least 126 vertical up and down

core holes, has demonstrated nearly identical stratigraphy throughout the facility's horizon. Individual map units vary slightly from sample point to sample point with respect to thickness, crystal size, and percentage of accessing constituents such as clay and polyhalite. Map units are considered to be fairly continuous. Surface mapping of the area around the WIPP Facility has been done by the U.S. Geological Survey. Underground mappings and geological characterization is an on going process and the data obtained thus far gave confidence in the geologic model of the WIPP.

The geologic model of the WIPP Facility as depicted on maps, cross sections, profiles and written information thoroughly portrays the known information concerning the geology of the site developed in the past 10 years. The information developed has served to corroborate the geologic model and the judgments upon which it is based. Based on the above discussion, the geological consequences given in Section 2.7.4 of the FSAR are considered acceptable.

It should be noted that forecasting the long term behavior of the underground openings at the storage horizon based on local geologic features only is insufficient. It needs to be supplemented by data obtained from continuous monitoring of the stability of the underground openings as discussed in Section 2.10 of this SER.

SECTION 2.8 - VIBRATORY GROUND MOTION

1.0 SUMMARY DESCRIPTION

Section 2.8 of the FSAR describes the procedures and the results associated with the definition of the Design Basis Earthquake (DBE) for the WIPP Facility. The DBE represents the design ground motion used in the seismic response evaluation of Class I and II structures and components of the facility. Its derivation is based on seismological and geological information pertinent to the site. The seismic hazard at the WIPP was evaluated through probabilistic techniques. The result of this evaluation was expressed in terms of seismic hazard curves which relate peak ground accelerations with annual probability of exceedance. On the basis of the WIPP hazard curves, it was concluded that the 1000 year acceleration (annual probability of exceedance 0.1%) corresponds to a 0.075g peak ground acceleration. In order to introduce additional conservatism, it was decided to set the peak acceleration of the DBE at 0.1 g. The latter peak acceleration together with the USNRC Regulatory Guide 1.60 design spectra (Ref. 19) define the DBE for the WIPP Facility.

The task for deriving the design earthquake for the WIPP Facility was primarily carried out by Bechtel National, Inc. (San Francisco, California) with significant contributions from Professor Allen R. Sanford of New Mexico Tech (Socorro, New Mexico). The general procedure employed in arriving at the DBE, consists of the following steps: (a) evaluation of the seismicity in the region; (b) evaluation of the geologic characteristics and tectonic activity in the region; (c) correlation of earthquake activity with geologic structures or tectonic provinces; and d) development of probabilistic estimates of the seismic hazard at the site. It should be noted that the above procedure follows the general guidelines given in Section 2.5 of the USNRC Standard Review Plan (Ref. 20). This reflects that an adequate level of detail was incorporated into the derivation of the DBE at the WIPP Facility. It should be kept in mind, however, that the seismic design of the WIPP Facility does not have to be based on seismic criteria as severe as that used for the seismic design of commercial nuclear plants that require significantly higher

performance levels. Thus, systematic application of all SRP acceptance criteria into the seismic design of the WIPP is judged by EH to be unnecessary.

The regional seismicity discussed in the FSAR concentrates on seismic data reported in New Mexico and particularly earthquakes in the WIPP region (area within 180 miles of the site). Both microseismic as well as regional seismographic data were considered in the development of the seismic data base. For convenience, the seismic data base was subdivided into two categories, namely pre- and post-1962 earthquake data. The pre-1962 data are primarily of the macroseismic nature whereas the post-1962 data (up to 1986) are primarily instrumental data and represent the major portion of the seismic data base. The largest earthquake considered in the data base of the region is the 1931 Valentine Texas Earthquake (estimated Richter magnitude about 6.4) which occurred approximately 120 miles southwest of the WIPP Facility. The seismic data base appears to be complete for earthquakes having magnitudes greater than or equal to 3 (MM intensities greater or equal to approximately IV).

Geologic evidence and recorded data associated with the WIPP region suggest that the region can be subdivided into two basic subregions, namely, the Permian Basin and the Basin and Range subregions. The Permian Basin subregion seems reasonably stable while the Basin and Range subregion is tectonically active with surface faults showing evidence of Quaternary movement. Earthquake activity in the Basin and Range subregion includes the 1931 Valentine, Texas Earthquake. The WIPP Facility is located in the relatively stable Permian Basin subregion. Seismicity studies of the WIPP region also indicate consistent seismic activity reported in the Central Basin Platform which is a small area located west of the WIPP Facility. This area, although a part of the Permian Basin subregion, has demonstrated a distinct seismicity pattern (magnitudes about 3-4). Seismological studies, however, have concluded that the earthquakes of the Central Basin Platform are due to

operations in oil fields (secondary recovery efforts) and are not related to tectonic activity.

The FSAR also describes the earthquakes of July 1972 (estimated magnitude about 2.8) and November 1974 (estimated magnitude about 3.8) which were associated with rockfall and considerable ground cracking at the National Potash Co. - Eddy County Mine. Based on an investigation of the origin of these two events the FSAR concludes that either of the above two earthquakes might have occurred at the rockfall site. Finally, based on the geologic and seismological evidence of the WIPP region, the FSAR concludes that no earthquake activity of interest to the WIPP region is known to be correlated to specific faults (see also Section 2.9 of the SER).

2.0 ACCEPTANCE CRITERIA

Acceptance criteria considered in the present review are primarily contained in several DOE and USNRC reports. Refs. 8, 21, and 22 are the primary DOE sources of acceptance criteria pertinent to the evaluation of the design earthquake of the WIPP Facility. Similar USNRC sources, including most recent modifications in seismic criteria, are given in Refs. 20, 23, 24, 25 and 26. Furthermore the review and acceptance process presented here by EH involves exercise of certain levels of engineering judgment which is an essential ingredient when dealing with predictions of earthquake response behavior. A balance of all of these aspects was maintained during the review process in order to reach a reasonable conclusion on the appropriateness of the seismic design input for the WIPP Facility.

3.0 ISSUES

The review of Section 2.8 of the WIPP FSAR resulted in a set of ten questions and/or clarifications, most of which were resolved after the April 24-28, 1989 FSAR review meeting (Ref. 27) held at the WIPP Facility. The resolutions required making changes to the FSAR and providing additional

information (Appendix B). The remaining questions concerning Section 2.8, Vibratory Ground Motion, are related to the following issues:

1. Potential mine induced seismic effects;
2. Seismic attenuation;
3. Definition of seismic hazard; and
4. Seismic evaluation of underground facility.

These issues are discussed below:

1. Potential mine induced seismicity from existing mines in the WIPP region could be important to the WIPP Facility. The WIPP Project was requested to address the possible impact of mine induced seismic effects on the facility.

   Resolution:

   This issue was primarily brought up because of the uncertainty associated with the origin of the July 1972 and November 1974 events which are reported in the FSAR. Based on studies conducted with the objective to locate these two events, it appears that their origin could have been related to a nearby potash mine (National Potash Co. - Eddy County) in which rockfall and considerable cracking was reported very close to the earthquake origin time (within one minute). The initial response (Appendix B) by the WIPP Project was that these two events "may or may not" have been mine related. Subsequent telephone discussions held during the April 24-28, 1989 FSAR meeting (Refs. 27) on this subject with J. Litehizer and H. Taylor of Bechtel National, Inc. did not resolve the possibility that recorded seismic activity in the WIPP region could have originated at a nearby potash mine (approximately located 30 miles northwest of WIPP). It was further concluded that additional analysis cannot be performed since insufficient recorded data is available from the above two events.

Given the uncertainty of the origin of the July 1972 and November 1974 events, the main question is what would be the possible impact of mine related dynamic activity on the WIPP Facility. The estimated magnitudes of the above events were 2.8 and 3.8 for the July 1972 and November 1974 earthquake, respectively. These magnitudes are considered low in the sense that they are not expected to produce ground accelerations at the WIPP Facility greater than those associated with the DBE. Accordingly, even if it is assumed that the largest of the above two seismic events originated at the potash mine, its impact on the WIPP Facility is judged to be less than that anticipated due to the occurrence of the DBE. This issue is resolved.

2. Adequacy of the seismic attenuation employed in the derivation of the DBE at the WIPP Facility in view of recent developments in the ground motions modeling area.

Resolution:

The attenuation law used by Bechtel in the seismic hazard study of the WIPP Facility is compared in the FSAR with that used in the 1976 work by Algermissen and Perkins (Ref. 28). In the latter study, attenuation relations from the western United States were considered with subsequent corrections to reflect a slower seismic attenuation which could be more representative for sites east of the Rocky Mountains. Such approach seems to be reasonable considering that (a) there are few strong ground motion data from earthquakes in the eastern United States while a large amount of such data are available from earthquakes in the western United States and (b) recorded data indicate that the seismic attenuation in the eastern United States is much different from that of the western United States.

Since the 1976 study by Algermissen and Perkins (Ref. 28), however, several ground motion models have been developed. Such models were

considered in a very recent study of the seismic hazard in the eastern United States (Ref. 25). In fact, the Algermissen and Perkins model was excluded from the latter study. Given the fact that the estimation of the seismic hazard is directly affected by the particular ground motion model employed in the analysis, it was decided to take a closer look at the seismic attenuation employed for the WIPP region.

After telephone discussions on this subject during the April 24-28, 1989 FSAR review meeting (Ref. 27), it was agreed that the forms of ground motion attenuation contained in the recent study by Bernreuter et al. (Ref. 25) be considered for comparison purposes. In the latter study, a set of seven models were considered by an expert ground motion panel as part of the most recent seismic hazard characterization of the eastern United States. Some of these models (Boore-Atkinson, Toro-McGuire and Veneziano) were used by Bechtel as a basis for comparison with the attenuation employed in the seismic hazard study of the WIPP Facility (Ref. 29).

In Figure 1, the WIPP seismic acceleration attenuation curves (solid) are plotted together with the corresponding curves obtained as a simple average of the above three models (dashed). The two results compare well. The differences shown for distances larger than about 200 Km are on the conservative side (distances of interest to WIPP region are up to 300 Km).

The conclusion reached from this review is that the attenuation employed in the seismic hazard estimation of the WIPP Facility discussed in the FSAR, correlates reasonably well with ground motion models considered in a recent study by Bernreuter et al. (Ref. 25). It should be mentioned, however, that the Electric Power Research Institute (EPRI) has independently conducted a similar study (Ref. 32) on the seismic hazard of the Eastern United States. EH recommends that the latter study be reviewed for possible

application to the WIPP Facility; however, for purposes of this SER, this issue is closed.

3. The estimate of the seismic hazard at the WIPP Facility was not adequately justified.

Resolution:

In order to demonstrate the conservatism in estimating the seismic hazard at the WIPP Facility, Bechtel indicated that their hazard study considered Richter magnitudes larger than 5.0. This argument was not quite clear since the main conclusion reached from the WIPP seismic hazard study was that the peak acceleration at the site is about 0.075 g which was subsequently raised to 0.1 g for defining the DBE. Specifically, it was suspected that the latter peak ground acceleration could be on the low side considering the magnitudes which were associated with it. This issue was further examined with the objective to resolve the question of how individual magnitudes affect the total hazard curve obtained for the WIPP. Subsequent investigation of this issue led to the conclusion that the main contribution to the total hazard is due to earthquake magnitudes in the range of about 3.75 to 5.0 (Ref. 29).

In order to further examine the adequacy of the total hazard curves of the WIPP Facility, EH considered the results of Ref. 21 dealing with seismic hazard models for DOE sites. In the latter study, hazard curves for two sites in New Mexico were obtained. Figures 2 and 3 show the hazard curves for the Sandia National Laboratory and the Los Alamos National Laboratory, respectively, that were derived from the study reported in Ref. 21. It may be noted that the 1000-year acceleration is associated with about 0.22 g which is much higher than that of the WIPP Facility. A closer examination of this difference, however, suggests that the proposed hazard curves of Ref. 21 for the above two sites may not be applicable to the WIPP. Specifically, by inspection of the Seismic Zone Map of the Uniform

Building Code (Figure 4) it can be concluded that the increase in peak ground accelerations in the Sandia and Los Alamos sites is essentially due to localized behavior. The WIPP Facility located in southeast New Mexico, is associated with a more seismically quiet zone. A closer site to the WIPP than those reported in Ref. 21, is the Pantex Plant located in northwest Texas. Hazard curves for the latter site that were obtained in Ref. 21 are shown in Figure 5. From the latter figure it can be seen that the (best estimate) 1000-year acceleration corresponds to about 0.1 g which is also the peak ground acceleration of the DBE for the WIPP site. Furthermore, the recent seismic hazard study by Berneuter et al. (Ref. 25) of 69 nuclear plant facilities located in the eastern United States was also considered by EH to further assess the adequacy of the WIPP hazard curves. Specifically, from the results obtained in the latter studies for the Comanche Peak nuclear plant (Figure 6) it can be seen that the 1000-year acceleration for this nuclear plant is less than 0.05 g by considering the 50th percentile of the constant percentile hazard curves. The corresponding acceleration at the 85th percentile is about 0.13 g. Finally, it may be noted that the seismic zone factor (equivalent to the peak ground acceleration) which is recommended by the Uniform Building Code (p. 168, 1988 Edition) for Zone 1 (of interest to WIPP) is 0.075.

The above discussion gives a qualitative appraisal of the hazard curves which were obtained in the seismic hazard study of the WIPP. From an overall prospective, it is concluded that the hazard curves (which form the basis for defining the peak acceleration for the DBE) were reasonably estimated based on the geologic and seismological data considered in the seismic hazard study. Finally, two additional items were considered by EH in judging the adequacy of the DBE. First, the design stresses in the structural members of the main structures of the WIPP such as the Waste Handling Building (Class II) are primarily dominated from tornado/wind loads. Second, the majority of these structures are steel frame structures which

are known for their inherent ductile behavior. The response is acceptable and this issue is closed.

4. FSAR descriptions related to the assessment of the underground facility were inconclusive. Clear descriptions of what was actually done as well as justification of the approach employed in the seismic evaluation of the underground facilities at WIPP was requested.

Resolution:

As a result of the initial FSAR review, the following comment and request for additional information was made (Ref. 2):

"The subject of underground seismic evaluation of the WIPP Facility is oversimplified in the FSAR (briefly mentioned in Section 2.8.6 which in turn refers to Subsection 3.2.6). Although a relatively considerable effort was made in the FSAR in order to address how the design basis earthquake was obtained at the site, the corresponding definition for the underground part of the facility is very limited. Specifically, it is claimed that no credit was taken due to attenuation with depth and consequently the 0.1 g peak seismic acceleration was also employed for underground structures. It is not clear if the one dimensional deconvolution approach (based on the SHAKE methodology) could be applicable at depths below the surface related to the WIPP site. Even if we reasonably assume that P or S waves attenuate with depth, this justification alone is insufficient. Address (within reasonable limits) the type of waves to be employed in the seismic analysis of underground facilities. Secondly, and more importantly, no seismic input were noted in any design calculations of underground facilities, (shafts, stability of rooms, etc.). Provide specific data to indicate where such seismic inputs were used in the design of the underground structures."

During a meeting held at Bechtel offices in San Francisco, May 3, 1989, Bechtel indicated that underground facilities at WIPP are Class IIIB and as such do not require seismic evaluation. Since there is an apparent discrepancy between this position and the descriptions given in the FSAR, WIPP agreed to change the FSAR to indicate that no seismic analysis was performed for the underground structures (June 1989 revision to the FSAR, p. 2.8-42). However, the question of what would be considered as an acceptable potential seismic risk with respect to the underground facility still required discussion. In attempting to quantify such potential risk at the WIPP, Bechtel has indicated that mine experience and available data (Ref. 31) show that no damage has been related to underground structures for cases in which the peak acceleration at the surface is below 0.2 g. In EH's opinion, although this is an encouraging factor, it is not completely sufficient to resolve the uncertainty in predicting earthquake effects in underground mines. This concern is indeed expressed in recent reviews on this subject sponsored by USNRC (Refs. 26 and 32). It is advisable to realize that the current state-of-the-art on dynamic response of underground facilities to earthquake loads still contains considerable uncertainty. On the other hand, there is a rather low level of excitation associated with the DBE at the WIPP, and there seems to be an absence of geological and seismological evidence that would support possible severe earthquake damage.

Even though there is insufficient evidence to indicate that severe damage of the underground facility due to earthquakes would occur, it is worthwhile to note that the vulnerability of the underground facility is expected to increase with time. The reason for this is the observed nonuniform creep behavior in the underground excavations, especially that associated with MB-139 that could substantially weaken the resistance of the underground structures when subjected to dynamic events. The effect of these events in causing potential accidents is discussed in Section 2.10 and Chapter 7 of the SER.

In conclusion, from the review of the seismic and/or dynamic aspects of the underground facility, it is unlikely that significant damage will occur during the Test Phase at the WIPP Facility due to seismic events. It is cautioned that with the passage of time there will be an increase in vulnerability of the underground structures, that are not backfilled, to dynamic excitations. This needs to be addressed by analyzing the effects of resulting potential accidents as discussed in Section 2.10 and Chapter 7 of this SER.

The issue is identified and will be tracked in Section 2.10 and Chapter 7.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of vibratory ground motion.

No significant issues remain to be completed. The overall approach employed in the derivation the seismic design input motion for the WIPP Facility is considered to be appropriate and within acceptable engineering bounds. The level of the DBE is judged to be generally consistent with the seismological and geological information pertinent to the WIPP region. In addition, the seismic hazard results obtained for the WIPP correlate reasonably with the seismic hazards of commercial nuclear plants and other DOE facilities closer to the WIPP Facility.

SECTION 2.9 - SURFACE FAULTING

1.0 SUMMARY DESCRIPTION

This section of the FSAR summarizes the state of surface faulting in the vicinity of the WIPP Facility, the effect of these faults on the geologic setting within which the facility resides, and the impact of such faulting on the definition of the seismic environment to which the facility is designed. This section of the FSAR provides a detailed summary of surface faulting at the site; that is, faulting which may be noted at the ground surface and which is associated with "displacements of a few centimeters to a few kilometers in scale." The conclusion of this section is that no such surface faulting exists within five miles of the site. This specific distance is relatively important if the siting procedures specified in Appendix A of 10 CFR 100 (Ref. 23) are to be followed when developing the design base earthquake (DBE). No corresponding discussion of faulting below or near the ground surface is presented.

A capable fault is defined in Ref. 23 as one in which movement of either recent vintage or of a recurring nature, has occurred; that is, one that can be associated with seismic events. The existence of such faults is clearly important in defining the procedures that must be used to quantitatively determine the seismic environment to be used for the facility design, that is the DBE.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used in this review include descriptions of the procedures used to develop the seismic hazard models summarized in UCRL-53582 (Ref. 21), and the design and evaluation guidelines associated with seismic hazards contained in UCRL-15910 (Ref. 8). In addition, criteria from Section 2.5.3 of the USNRC Standard Review Plan (Ref. 20), and the siting criteria outlined in Appendix A of 10 CFR 100 (Ref. 23) were utilized. This criteria describes procedures used to evaluate the suitability of the site for locating nuclear power reactors, and the impact of faulting on the procedures used in

the site evaluation. In meeting the requirements of the SRP, the subsection of the FSAR is deemed acceptable if sufficient surface and subsurface information is provided to assess the character of faulting in the area, as well as its age. The detailed site characterization presented in the Review of the Scientific and Technical Criteria (Ref. 18) of the National Academy of Sciences was used to assess fault descriptions presented in the FSAR.

3.0 ISSUES

1. Subsection 2.9.2 of the FSAR states that no surface faults have been mapped within five miles of the WIPP Facility. The term "surface faulting" is defined in Ref. 23 as "differential ground displacement at or near the surface caused directly by fault movement." Subsection 2.9.3 of the June 1989 revision to the FSAR refers to Section 2.7.3.4.2 stating that there are no capable faults within five miles of the site. The reference to Section 2.7.3.4.2 is incorrect, since no such section exists.

   Resolution:

   A review of Refs. 34 and 35 indicates that there is no evidence of any movement which may be associated with recent faulting. As indicated in Section 2.6 of the FSAR, and in Ref. 35, movements are restricted to the Castile formation below the Salado and these are associated with pre-Pliocene times (about five-million years ago). No evidence of movement of the Castile or Salado at the present time is indicated in these reports. Thus, the statement that no capable faults exist within five miles of the site seems reasonable. Subsection 2.9.3 of the June 1989 revision to the FSAR should be revised to give a correct reference; however, for purposes of the SER, this issue is resolved.

2. Subsection 2.9.4 indicates that two small earthquakes were located with epicenters near the Eddy County Mine, an existing mine, and are probably mining related; that is, were induced by the presence of the

mine itself or incidents which occurred within the mine. However, in Subsection 2.8.1.3, the FSAR apparently refers to the same events, but indicates that they cannot have been mining related.

Resolution:

After discussion of this anomaly with WIPP personnel, a revised description of these events has been inserted in Subsection 2.8.1.3 of the June 1989 revision to the FSAR. The references mentioned in Subsection 2.9.4 were modified to eliminate this concern and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable description of surface faulting.

SECTION 2.10 - STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS

1.0 SUMMARY DESCRIPTION

This section of the FSAR is concerned with the general topic of stability of subsurface facilities, foundations and materials. The term stability refers to the impact of engineering properties of the host soil/rock and foundation configuration parameters on the evaluation of the acceptability of the design of a particular foundation element under consideration. Specific areas of interest discussed in this section include potential subsidence of the ground surface due to extraction of salt rock at depth, residual stress states at depth in the salt, design bases for near surface foundations, shaft linings and shaft keys, specific properties of soils and rocks (strength, stiffness, creep, permeability, resistivity, groundwater conditions, etc.), description of the exploratory boring program conducted at the site, as well as description of the ongoing instrumentation programs being used to monitor response with time.

2.0 ACCEPTANCE CRITERIA

The acceptance criteria used in review of this section derive from the procedures outlined in Section 2.5.4 of the USNRC Standard Review Plan (Ref. 20).

3.0 ISSUES

1. Two different criteria for allowable subsidence were mentioned in the December 1988 FSAR and in the DVFR (Ref. 36), the first that subsidence should not exceed one inch within 500 feet of the Waste Shaft, and the second that subsidence should not exceed 15 inches over 35 years above the storage areas. The applicability of these to the design and the computations to support the criteria were not available.

Resolution:

The calculations shown in Appendix F were provided at the April FSAR review meeting (Ref. 27). The first criteria mentioned is the standard allowable settlement criteria for surface structures to minimize differential settlements while the second is a qualitative criteria to minimize the impact of the salt extraction from the storage area on the surrounding surface area. The calculations were reviewed and indicate that the low extraction ratios planned for the WIPP Facility leads to relatively low subsidence levels which satisfy the criteria mentioned above and this issue is resolved.

2. In the design of the underground rooms, empirical approaches were used in the selection of the room dimensions, and no specific indication was presented in the FSAR on how salt creep effects were included in the design. A detailed description of a threshold monitoring program was requested to ensure safe operations of the underground facility.

Resolution

The empirical design of the underground rooms was supported by the measured creep behavior determined during the Site and Preliminary Design Validation Test Program. These experiences include implicitly the effects of salt creep in an approximate fashion. To ensure the long term stability of the underground openings, a detailed description of the threshold monitoring program was verbally presented by DOE/WPO at the April 24-28, 1989, FSAR review meeting. The objective of the program is to monitor creep effects as well as the development and growth of fracture zones about the underground rooms.

The issue is resolved.

3. In evaluating the opening configurations used in the mined storage areas and access drifts, empirical mining criteria, together with specific experiences learned from the preliminary exploratory program carried out at the site (Ref. 38), have yielded the currently used configurations. No separate analytic evaluations of local stability of these openings, nor the impact of creep on the long term stability have been completed. There is evidence to indicate that rock fracturing, together with growth in separations along natural fault lines, will continue around these openings as creep in the host rocks occurs. Alternate approaches must be used to evaluate stability and safety.

Resolution:

A detailed monitoring program is being used to support these empirical designs. At the April FSAR meeting (Ref. 27), a specific threshold program was presented verbally. Normal mining procedures, such as floor, wall and roof drumming, together with closure measurements, must continually be used to monitor changes in behavior and, therefore, stability of these openings. The current criteria being used to monitor stability changes relies on extrapolating measured closure data. Whenever closure varies by 0.5 inches from the extrapolated data, more detailed investigations must be invoked to evaluate local separation effects on stability and safety. The response provided to the question (Appendix B) concerning threshold values refers to Section 1.5.3.3 of the FSAR. However, the June 1989 draft of the FSAR does not specify the $\pm$0.5 inch threshold committed at the April 24-28, 1989 FSAR meeting. This is an open issue.

The various numerical simulation programs that have been conducted, and are planned to be conducted in the future, should yield sufficient information on rock properties, which, in turn, may lead to a capability for prediction of future behavior. However, these analytic/numerical studies cannot include all the effects of local anomalies on stability and safety. The monitoring programs must

therefore be continued to provide suitable confidence in safety margins.

4. No discussion is presented in the June 1989 revision to the FSAR of the ability to perform monitoring of filled CH TRU waste storage rooms. Such monitoring is required to ensure structural stability of these rooms and adequate performance of the installed rock bolts throughout the retrieval period, i.e. ten years.

Resolution:

The potential for a roof collapse onto CH TRU waste canisters should be evaluated as a potential accident scenario of interest. Chapter 7 of the SER presents more details on this issue. However, since stability is to be evaluated by the long term monitoring program, the problem of monitoring within filled rooms remains an open issue.

5. In the design of the various shaft keys, the lateral pressure used in the designs indicates that these keys are not subjected to full lithostatic pressures. Generally, such rigid unyielding structures would be expected to sustain full overburden pressures due to the creeping salt foundation. The derivation of the design pressures used for the keys, described in the FSAR, was considered unsupported by traditionally used technical assumptions.

Resolution:

Existing long term empirical evidence available from existing mines in the area indicates that shaft keys are not subjected to full overburden lithostatic pressures. At the contact between the Salado and Rustler rocks, interface friction effects probably account for the significant reduction of the overburden loads on the keys. Traditional modeling calculations performed by BNL indicate that the projected pressure acting against the key over its lifetime, while less than full lithostatic, will be larger than the design pressures

assumed in the calculations. However, accepting the higher strengths for the existing concrete because of in-situ compression tests, together with the existing monitoring programs proposed for the Waste Shaft, leads to a conclusion that the shaft keys do not constitute a safety hazard throughout the Test Phase. This response is acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an adequate evaluation of the subsurface materials and foundations, with the caveats below.

It should be emphasized that to establish and maintain information on safety and stability of all underground openings, a detailed monitoring program must be maintained throughout the life of the facility. The specifications of the threshold values to be used in the monitoring are not contained in Section 1.5 of the FSAR as committed at the April 24-28, 1989 FSAR meeting. In addition, it is not as yet clear as to the program to be implemented in those CH TRU waste storage areas filled with drums. The impact of a potential roof collapse onto CH canisters should be an accident scenario of interest as noted in Chapter 7 of the SER.

SECTION 2.11 - SLOPE STABILITY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the condition of slopes, both permanent and temporary, in the vicinity of the site. The area around the WIPP Facility is relatively flat, with average slopes of less than 1%. No significant permanent cut slopes or embankments are planned within the area of interest. The excavation slopes planned within Control Zone I are temporary slopes.

2.0 ACCEPTANCE CRITERIA

The information presented in this section of the FSAR was reviewed to ensure that it substantiates the evaluations of stability of slopes at the site. The methods presented in Refs. 39 and 40 are those typically used for such evaluations. In addition, the information presented in the Geotechnical Field Data Reports (Ref. 37) as well as the site characterizations presented in the DVFR (Ref. 36) and the National Academy of Sciences (Ref. 18) were consulted to confirm the information presented in the FSAR. The criteria presented in Section 3.6.5 of the USNRC Regulatory Guide 3.26 (Ref. 1) were used to guide the evaluation.

3.0 ISSUES

1. The minimum acceptable safety factor used in the design of slopes in the area was selected as 1.1, a value lower than typically used in slope stability analysis.

   Resolution:

   The soils in the area, based on information in Ref. 39, as well as a physical inspection of the area, are granular and possess significant strength even without major compaction efforts used in placement.

The computed safety factors for these soils exceeded a value of 2, for embankments that are 20 feet high at a 2 over 1 slope. Most slopes, particularly temporary slopes, are designed with safety factors less than this value. Therefore, the design of these slopes is considered acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable analysis of slope stability.

The slopes in the vicinity of the WIPP Facility are temporary slopes composed primarily of granular fills. The safety factors for these slopes are larger than design recommendations.

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CHAPTER 3 - DESIGN CRITERIA

This chapter of the FSAR describes the principal design criteria used at WIPP: General Design Criteria; Structural and Mechanical Design Criteria; Safety Protection Criteria; Decommissioning and Decontamination Design Criteria; and Design Development Construction and Start-up of the WIPP Facility. Decommissioning and decontamination (Section 3.4) is dealt with in detail in Chapter 12.

SECTION 3.1 - GENERAL DESIGN CRITERIA

1.0 SUMMARY DESCRIPTION

This section of the FSAR presents the design criteria used at the WIPP. EH's review does not include the Remote Handled Transuranic (RH TRU) waste criteria. The review of this area will be done at a later date, prior to receipt of RH TRU waste. Criteria for Contact Handled Transuranic (CH TRU) waste are presented in each of the following areas:

1. Waste Characterization. The criteria which define TRU waste are described. TRU waste contains alpha emitting transuranic radionuclides with half lives greater than 20 years and in concentrations greater than 100 nCi/g. CH TRU waste can have surface dose rates of up to 200 mrem/hr but the average surface dose rate is expected to be about 14 mrem/hr.

2. CH TRU Waste Handling, Emplacement, and Retrieval. The criteria for handling, emplacement and retrieval of the CH TRU waste are described. This includes a description of the spatial and equipment requirements.

3. Underground Development. These criteria require that the mining operations be physically separated from the waste storage areas. The storage areas are also to be provided with entryways and ventilation passages permitting access for retrievability.

4. Monitoring and Surveillance. These criteria require that meteorological, groundwater, air quality, and seismic data are monitored at the site.

5. Facility Products and By-products. The criteria for handling of non-radioactive hazardous materials at the WIPP are in accordance with the codes and standards described in Reference 1. All radioactive by-products generated during operations will be emplaced underground.

6. Classification of Structures, Systems and Components. The criteria for determining the design classification of WIPP items are described. All of the structures, systems and components are classified as Classes I, II, IIIA, or IIIB. An item would be classified as either Class I if it was required to reduce the 50-year dose at the boundary to 25 rem for the whole body or to 75 rem to other organs. All of the accident scenarios result in lower dosages so that there are no Class I components at the WIPP.

   Items are Class II if they provide permanent shielding, provide permanent confinement, or monitor and control parameters essential to maintain the safety of the facility. There is another division within Class II. Class II components that provide the permanent confinement are designed to resist Design Basis Earthquake (DBE) and Tornado (DBT) while other Class II components are designed for Uniform Building Code (Ref. 2) wind and seismic criteria.

All other components are Class III. An item is Class IIIA if it monitors on-site radiation, its failure would cause a major work stoppage, its fabrication is very complex, its failure could lead to local contamination, or its failure could lead to WIPP operating personnel injuries.

All significant systems and structures are classified according to this system in FSAR Table 3.1-8. The applicable design codes for each type of component are given in Table 3.1-7.

2.0 ACCEPTANCE CRITERIA

The intent of the acceptance criteria for this section of the FSAR is to assure that the General Design Criteria specified in the section lead to designs that comply with applicable DOE orders (Ref. 6) and national standards (Refs 2, 9, 10, 14), and that the margins of safety reflect the safety importance of the component. Specifically EH required that the General Design Criteria assure that:

1. The characterization of the CH TRU waste conservatively represents the radioactivity that would be expected and consistent with data contained in the Final Environmental Impact Statement (Ref. 3) and in the WIPP Waste Acceptance Criteria (Ref. 4).

2. The operational (e.g. waste handling) criteria lead to procedures that minimize the risk of radioactive releases either within the facility or at the site boundary.

3. The codes specified to determine allowable limits (e.g., stresses, deformations) are national standards and are properly applied.

4. The criteria used to specify component classifications reflect the importance of the components.

5. The specific classification of components is consistent with the criteria specified in the FSAR.

3.0 ISSUES

1. The FSAR refers to the use of an average surface dose rate of 14 mrem/hr, rather than the maximum allowable surface dose rate of 200 mrem/hr, in analyzing the effects of "frequent" accidents. The validity of use of this average value was questioned.

   Resolution:

   The 14 mrem/hr represents the average radiation dose for CH TRU waste containers. This average is updated on an annual basis and the WIPP has committed to review the updated average values and to determine whether the 14 mrem/hr value should be changed during the five year Pilot Plant Phase (Test Phase). Since the average dose rate is updated yearly, the use of 14 mrem/hr is acceptable and this issue is resolved.

2. The FSAR refers to surge areas to be used as temporary holding areas for CH TRU containers that cannot be placed underground during each shift. Concerns were raised regarding the specific locations of these areas and the controls placed on containers stored in these areas.

   Resolution:

   The surge area is comprised of three components:

   An area for 12 parking spaces for trailers carrying TRUPACTS. This area is outside the radiologically controlled area. In the event of prolonged shutdown of the WIPP all shipping sites would be notified to cease shipments. These 12 spaces would accommodate

any shipments already in progress. Any TRUPACTS left in the area overnight will receive a more detailed radiological survey.

The normal CH waste handling areas. Any TRUPACTS in this area will be unopened. Any drums having surface dose rates in access of 100 mrem/h or that cannot be placed underground by the end of the a shift will be placed in a shielded storage area.

Shielded storage area. Any drums having surface dose rates exceeding 100 mrem/h are placed in this area. Containers will not be left in this area for more than one week.

The controls placed on the surge storage areas are acceptable and this issue is resolved.

3. Table 3.1-8 of the FSAR lists the classifications of all structure and component systems at WIPP and the seismic (DBE or UBC) design criteria. The table indicated that some Class II structures are designed for DBE seismic loadings while others are designed for UBC seismic loadings. There were no criteria given in the FSAR for deciding which seismic loading should be used.

   Resolution:

   The basis for the difference is given in Note 9 to Table 3.1-8 of the May 1989 revision to the FSAR. If a Class II component is contained wholly within another Class II building, the interior Class II components can be designed for UBC seismic loading and no tornado consideration. This is a reasonable approach since all primary containments are Class II. Any accident results in a "buttoning up" of the operation (e.g., no air flow to the outside except through the HEPA filters). Therefore, the failure of a structure or component contained within this outer containment would not result in the release of radioactivity to the atmosphere. The response is acceptable and this issue is resolved.

4. The FSAR listed the classification of the Exhaust Filter Building (EFB) as Class II and UBC seismic design. Since the EFB is not contained within another Class II structure, an issue was raised as to why it was not designed for DBE rather than UBC (see Issue 3).

   Resolution:

   The EFB classification has been changed to Class IIIA in the June 1989 revision to the FSAR since the HEPA filter system was assumed to be inoperative for all of the underground accident scenarios. Note that Class IIIA structures are designed for UBC seismic. Since no credit is taken for the HEPA filters in calculating the off-site doses to the public at the site boundaries during an accident, the EFB classification is adequate. The response is acceptable and this issue is resolved.

5. The FSAR contained a figure (3.1-1) that showed a flow chart formalizing the criteria for assigning a classification to a structure or component. A review of this figure indicated that it did not include all of the elements that would make a component Class IIIA rather than Class IIIB. Therefore, the application of this figure could result in components being classified IIIB rather than IIIA as required by the criteria contained in the FSAR.

   Resolution:

   The figure has been removed from the May 1989 revision to the FSAR. The figure was, however, also included in the WIPP Design Basis Document (Ref. 17). This figure must be modified to conform to the classification criteria in the FSAR. This issue is open.

6. The FSAR does not include a section comparing the actual criteria used for the design of the WIPP Facility with current design criteria as required by DOE Order 5481.1B (Ref. 5). In accordance with DOE

Order 6430.1A (Ref. 6), Section 0101-2, a determination must be made concerning whether or not any facility changes are necessary or desirable in order to comply with the current design criteria contained in 6430.1A. Such a determination must provide adequate documentation of the justification for any deviations from current Order 6430.1A that would require design or construction modifications.

Resolution:

The WIPP has agreed to complete this comparison within 18 months after startup and EH has concurred. This issue is resolved.

All RAIs for this section contained in Appendix B have been adequately answered except for the open item listed below.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide acceptable design criteria except as noted below. The criteria used to distinguish between Classes I, II, and III are reasonable and support the safety of the WIPP. The distinction between Class I and Class II is based on the potential magnitude of the long term radiation dosages at the WIPP boundary. The components are deemed Class II or Class III depending on whether they are required to control off-site or on-site radiation releases.

The findings discussed above support the conclusions that the FSAR satisfies the acceptance criteria stated in paragraph 2.0, above except for the following open item:

The flow chart implementing the component classification criteria (Figure 3.1-1 in the FSAR) was inconsistent with the stated criteria with respect to the differences between Class IIIA and Class IIIB. The figure was removed from the May 1989 revision to the FSAR but it should be verified that the figure was corrected in the Design Basis Document (Ref. 17).

SECTION 3.2 - STRUCTURAL AND MECHANICAL DESIGN CRITERIA

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the design criteria of the loads and load combinations that are applicable to the design of structures and mechanical equipment of the WIPP Project. It is divided into ten primary subsections: (1) wind loading, (2) tornado loading, (3) water level design, (4) groundwater design, (5) protection against dynamic effects, (6) seismic design, (7) snow loading, (8) equipment and material-derived loads, (9) thermal loading and (10) combined load criteria. For each loading, the occurrence, the intensity and the manner that it is applied on the structure or pertinent mechanical equipment are discussed. Tornado loadings are applicable to certain Design Class II surface facilities (referred to as DBE/DBT in the FSAR). Tornado effects on structures are described in Bechtel topical report BC-Top-3-A (Ref. 7). Likewise Design Basis Earthquake (DBE) is applied to Design Class II confinement structures and the analytical methods are described in Bechtel topical report BC-Top-4-A (Ref. 8). The combined load criteria for Design Class II structures are based on the requirement that all sections that provide strength must be at least equal to the combined load effects. For steel structures, the elastic method based on American Institute of Steel Construction (Ref. 9) specifications is used while for concrete structures, the strength design method based on American Concrete Institute Standard 318-77 (Ref. 10) is used. The Design Class III structures and mechanical equipment and those Design Class II structures not required for confinement are designed in accordance with the Uniform Building Code (Ref. 2).

2.0 ACCEPTANCE CRITERIA

The acceptance criteria used in this review include information provided in the USNRC Standard Review Plan (Ref. 11), USNRC Regulatory Guide 1.60 (Ref. 12), USNRC Regulatory Guide 1.92 (Ref. 13), the ANSI Standard A58.1 (Ref. 14), AISC Code (Ref. 9) and the ACI Standard (Ref. 10). The data contained in the

FSAR were reviewed in reference to the above information to assure its acceptability.

The specific acceptance criteria are developed from the following parts of Section 4.2 of the USNRC Regulatory Guide 3.26 (Ref. 15).

1. 4.2.1 Wind Loading - should be specified in accordance with ANSI Standard (Ref. 14).

2. 4.2.2 Tornado Loading - should be specified in accordance to the site specific data of Section 2.3 of the FSAR.

3. 4.2.5 Seismic Design - the loading should be specified in accordance with the requirements of Section 2.8 of the FSAR. The analyses should be conducted in accordance with the USNRC Standard Review Plan (Ref. 11) for Class II and the Uniform Building Code (Ref. 2) for Class III components.

4. 4.2.8 Load Combinations - the load combinations and load factors should be specified in accordance with the importance of the component and standard practice as reflected in the AISC (Ref. 9) and ACI Codes (Ref. 10).

3.0 ISSUES

1. The specified wind loading for Class III structures is 91 mph. However, the Support Building (SB) and Exhaust Filter Building (EFB) are designed for 99 mph winds even though they are Class III structures. The issue was raised regarding this apparent inconsistent application of the criteria (Ref. 16).

Resolution:

The Class III criteria wind loading depends on whether the items are Class IIIA or IIIB. Class IIIA items are designed for 99 mph while Class IIIB are designed for 91 mph. Both the EFB and SB are Class IIIA and are, therefore, designed for 99 mph wind velocity. The response is acceptable and this issue is resolved.

2. The FSAR did not contain a listing of the Class III structures that were designed for tornado loading.

Resolution:

The June 1989 revision to the FSAR states that the SB and the TRUPACT Maintenance Facility are designed for tornado loading since their collapse would influence Class II structures (Waste Handling Building). The response is acceptable and this issue is resolved.

3. The FSAR often refers to the Bechtel Topical Report BC-TOP-4-A (Ref. 8) in describing methods used for seismic response calculations at WIPP. This reference contains many alternative methods and the FSAR is not specific in specifying the method.

Resolution:

The FSAR was revised to include more material describing the methods of seismic analysis used for WIPP. The response is acceptable and this issue is resolved.

4. Several issues were raised regarding the methods of analysis used for Class II piping.

Resolution:

References to Class II piping were removed from the FSAR since there is no Class II piping at WIPP. The response is acceptable and this issue is resolved.

5. The load combinations contained in the FSAR include a load component due to salt creep for structures that abut the salt formations. These loads are to be included for all Class II structures. No data were included in the FSAR describing the magnitude of these loads or the methods to be used to determine the loads.

   Resolution:

   It was determined that there are no Class II structures subjected to salt creep loads. The response is acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides acceptable design criteria for the loads and load combinations that are applicable to the design of structures and mechanical equipment of the WIPP Project.

SECTION 3.3 - SAFETY PROTECTION CRITERIA

1.0 SUMMARY DESCRIPTION

SECTION 3.3.2 - AIR HANDLING

This section of the FSAR discusses the air handling systems designed to: (1) provide a suitable environment for personnel and equipment during normal plant operation, and (2) provide contamination control for anticipated operational occurrences and postulated waste handling accidents. This section also discusses certain components of the air handling systems used for functions related to space cooling and removal of heat generated by the equipment and waste.

The WIPP Facility air handling systems serve three major plant areas: the surface nuclear facilities, the surface support facilities, and the subsurface facilities.

SECTION 3.3.3 - FIRE AND EXPLOSION PROTECTION

The fire and explosion protection systems at the WIPP Facility are designed to ensure the safety of plant personnel, ensure the reliability and continuity of plant operations, and minimize property loss.

2.0 ACCEPTANCE CRITERIA

SECTION 3.3.2 - AIR HANDLING

The acceptance criteria used for the review of this section of the FSAR are those contained in the following documents:

The air handling systems are designed so that the emissions meet the limitations in DOE Order 5480.11 (Ref. 18).

Dampers are classified by function, configuration, construction and leak tightness in accordance with Tables 5.7 through 5.10 of ERDA 76-21 (Ref. 19). Damper selection is based on the requirements of ERDA 76-21, Table 5.12.

Other codes and standards used in the review of the air handling equipment design are as follows:

1. Fans conform to the Air Moving and Conditioning Association (AMCA) Application Guide No. 201 (Ref. 20).

2. Prefilters are rated in accordance with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 52-76 (Ref. 21).

3. High efficiency particulate air (HEPA) filters conform to the standards of U.S. Military Specification MIL-F-51068D (Ref. 22).

4. Installed air cleaning systems are tested in accordance with ANSI N510, Testing of Nuclear Air Cleaning Systems (Ref. 23).

5. Air handling systems installation conforms to National Fire Protection Association (NFPA) Standard No. 90A-1979 (Ref. 24).

6. DOE 6430.1A, General Design Criteria (Ref. 6): Section 1550-2.5, "Air Handling and Air Distribution Systems," and Section 1595-6, "Control of Air Handling Systems."

7. ANSI Standard N509 (Ref. 25).

SECTION 3.3.3 - FIRE AND EXPLOSION PROTECTION

The acceptance criteria for this section of the FSAR are based on designs that are safe as judged by national standards. The specific items that were considered in EH's review were:

1. Buildings and their support structures are protected by fixed, automatic fire suppression systems designed to the specific, individual hazards of each area.

2. Noncombustible construction, fireproof masonry construction, and fire resistant materials are used whenever possible.

3. Areas susceptible to fire are separated by fire walls and automatic fire doors to contain and isolate hazardous materials or operations. Fire separations are installed where required because of different occupancies per the Uniform Building Code (UBC) (Ref. 2).

4. All vertical openings in buildings are protected by enclosing stairways, elevators, pipeways, electrical penetrations, etc., to prevent fire from spreading to upper floors.

With one exception noted below, the safety protection criteria described in the WIPP FSAR for the air handling and the fire and explosion protection systems are adequate to provide assurance that the systems are designed to meet or exceed the acceptance criteria and that the systems are operable at all times or that suitable backup systems are provided. This is based on the following commitments:

a. The ventilation systems for the Waste Handling Building and Exhaust Filter Building provide dynamic confinement barriers to limit potential releases of airborne radioactive contaminants to levels ALARA, consistent with the requirement of DOE Order 5480.11 (Ref. 18).

b. The exhaust fans and controls are capable of being supplied by emergency power in the event that normal power is interrupted.

c. The Central Monitoring System (CMS) is manually switched to the emergency power supply to ensure continued operation monitoring and control of the HVAC systems if the normal power supply is lost.

d. The surface exhaust fans are capable of being connected to the emergency power supply in the event that normal power is lost.

e. The active components of the waste storage ventilation system (fans and motors) have 200 percent redundancy during emergency operations.

f. Air reversal capability during fire isolation mode is provided for all areas underground except the waste handling and waste storage areas.

g. The components of the electrical service and distribution systems are listed by Underwriters' Laboratory or approved by Factory Mutual Engineering Corporation.

h. Adequate provisions for the safe exit of personnel are ensured for all potential fire occurrences.

i. Evacuation alarm signals are provided throughout occupied areas.

3.0 ISSUES

SECTION 3.3.2 - AIR HANDLING

1. No information was provided regarding the testing and performance of the valves used as isolation dampers.

Resolution:

The DOE/WPO response indicated that this information is not available at the present time but would be provided for review when available.

This issue is open.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

Except as noted above, the May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides acceptable safety protection criteria for the Air Handling and the Fire/Explosion Protection systems. The criteria are in compliance with the acceptance criteria in Paragraph 2.0, except for one remaining open item relating to the testing of the valves used as isolation dampers. WIPP has agreed to furnish the test standards and procedures for the isolation dampers and to specify permissible leakage rates for EH review.

SECTION 3.3.6 - UNDERGROUND MINE SAFETY

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the layout of the underground facilities and the methods of providing physical separation and ventilation isolation between waste storage and mining operations. Personnel work upstream of stored CH TRU waste. Automatic alarm systems are installed to warn of hazardous radiological conditions. Air quantity and quality, fire monitoring and control, security (movement of personnel) and radiation levels are monitored at the Central Monitoring Room (CMR).

All underground equipment is painted with bright colors, equipped with lights, has audible alarms or flashing lights for operating in reverse, and give operators, where possible, a 360° field of vision. Reinforced canopy protection and fire extinguisher and/or extinguishing system are available. All electrical equipment is grounded. Underground mining areas are lighted where required.

2.0 ACCEPTANCE CRITERIA

This section was evaluated based on the requirements of federal and state regulations as prescribed in 30 CFR Part 57 (Ref. 26). Specific acceptance criteria used to evaluate this section were the following:

1. When rock bolts are used as a means of ground support, anchorage test procedures shall be established and tests shall be conducted to determine the anchorage capacity of rock-bolt installations.

2. Ground support shall be used if the operating experience of the mine, or any particular area of the mine, indicates that it is required.

3. Whenever self-propelled equipment is used underground, a fire extinguisher shall be on the equipment.

4. Ground conditions along haulageways and travelways shall be examined periodically and scaled or supported as necessary.

3.0 ISSUES

1. Information was requested regarding the safety checks performed in the underground areas (Ref 16).

Resolution:

The FSAR was revised in Section 3.3.6.3 to provide additional details of the underground safety inspections. Other details of the inspections were provided in the responses to the RAI. The responses are acceptable and the issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide acceptable underground mine safety criteria. The safety criteria comply with the Paragraph 2.0 acceptance criteria.

SECTION 3.5 - DESIGN DEVELOPMENT, CONSTRUCTION AND START-UP OF THE WIPP FACILITY

1.0 SUMMARY DESCRIPTION

This section of the FSAR presents a general description of the development of the WIPP Facility, progressing from the conceptual design, through preliminary design and to the final design period. Construction and turnover aspects of the process are also described.

2.0 ACCEPTANCE CRITERIA

The design criteria for the facility (loadings, analysis methodologies, and acceptable limits of response) are discussed in Sections 3.1 through 3.4 of the May 1989 revision to the FSAR. The application of these criteria to facility design is discussed in Chapter 4 of the May 1989 revision to the FSAR. This section of the FSAR describes the process used to complete the

facility development. As such, specific acceptance criteria are not applicable to this section.

3.0 ISSUES

1. Based on presentations made to EH during a number of site visits, it was indicated by Bechtel National, Inc. that a detailed finite element calculation was initially performed by Serata to investigate initial room layout and extraction ratios (Ref. 27). This analysis was not provided for review.

   Resolution:

   As indicated by the response to the inquiry concerning the Serata calculation (Appendix B), this analysis was applicable to a preliminary design concept which involved a second storage horizon approximately 600 feet deeper than the current horizon. On this basis, the details of the analysis are no longer of interest, and this issue is resolved.

2. Subsection 3.5.1.2 of the FSAR makes reference to calculations using laboratory test data as input to the finite element analyses performed by Bechtel. However, in descriptions made by Bechtel at various site visits, this was in fact not done.

   Resolution:

   As described by Bechtel, the primary input to these analyses is the data obtained from the studies associated with the Site Preliminary Design Validation (SPDV) Program. As described in Section 1.5 of this SER, the monitoring program implemented by the DOE/WPO is the primary basis for evaluating stability of the underground facility. Safety margin estimates inherent in the designs of the underground openings are not available, although one of the stated goals of the five year Pilot Plant Phase (Test Phase) is to develop such

estimates. Therefore, this is no longer considered an issue, although it is recommended that the wording of this subsection of the FSAR be revised to indicate that laboratory data did not play a significant role in the underground design; however, for purposes of this SER, this issue is closed.

3. During the review of the design calculations, several instances of inconsistencies (see Section 4.2 discussion) were found between the calculations, drawings, and field conditions. This finding led to a search for the QA/QC track for several selected structural and equipment components. The results of this review were:

   Inconsistencies do exist between the drawings, calculations, and field conditions.

   The QA construction documents are poorly organized making them difficult to locate. However, through various meetings and pursuits the required documentation was found indicating that the documentation is available but poorly organized.

   The WIPP should develop "as-built" drawings reflecting the field conditions.

   Resolution:

   EH performed an independent evaluation of some of the major Class II structures including the CH area of WHB, the Hoist Tower and the Hot Cell (see Section 4.2) and did not uncover any serious deficiencies that have not been resolved except for a small overstress in some of the columns of the WHB (as discussed in Section 4.2 of this SER). It is therefore concluded that the structures are generally adequate and the problem with the inconsistencies in the design calculations are QA related. This issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide an acceptable description of the design, development, construction and startup of WIPP.

REFERENCES FOR CHAPTER 3

1. Westinghouse Electric Corporation, "Operations Program Plan," DOE/WIPP-85-001, Rev. 3, July 1988.

2. Uniform Building Code, 1982 Edition.

3. U.S. Department of Energy, Final Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS 0026, U.S. Department of Energy, October 1980.

4. U.S. Department of Energy, "WIPP Waste Acceptance Criteria," WIPP/DOE-069, Rev. 3, January 1989.

5. U.S. Department of Energy, "Safety Analysis and Review System," DOE Order 5481.1B, September 23, 1986.

6. U.S. Department of Energy, "General Design Criteria," DOE Order 6430.1A, April 6, 1989.

7. Bechtel Power Corporation, "Tornado and Extreme Wind Design Criteria for Nuclear Power Plants," BC-Top-3-A, Rev. 3, Aug. 1974.

8. Bechtel Power Corporation, "Seismic Analysis of Structures and Equipment for Nuclear Power Plants," BC-Top-4-A, Rev. 3, Nov. 1974.

9. American Institute of Steel Construction, "Specification for Design, Fabrication, Erection of Structural Steel for Buildings," Nov. 1978.

10. American Concrete Institute, "Building Code Requirement for Reinforced Concrete," Standard 318-77, Dec. 1977.

11. U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," NUREG-0800, July 1981.

12. U.S. Nuclear Regulatory Commission, "Regulatory Guide 1.60, Design Response Spectra for Seismic Design of Nuclear Power Plants," Rev. 1, December 1973.

13. U.S. Nuclear Regulatory Commission, "Regulatory Guide 1.92 "Combining Modal Response and Spatial Components in Seismic Response Analysis," Rev. 1, February 1976.

14. American National Standard Institute, "Building Code Requirements for Minimum Design Loads in Building and other Structures," ANSI A58.1-1972.

15. U.S. Nuclear Regulatory Commission, "Regulatory Guide 3.26, "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plant," February 1975.

16. Memorandum, H.J. Pettengill (DOE/EH) to J.B. Tillman (DOE/WPO), April 13, 1989; Subject: Final Safety Analysis Report for the Waste Isolation Pilot Plant (transmitting EH comments on Chapters 1, 3, 4, 5, 6, 7, and 11).

17. Bechtel National, Inc., "Design Basis, Design Classification," D-76-K-03, Rev. 7, November 30, 1982.

18. U.S. Department of Energy "Radiation Protection for Occupational Workers," DOE Order 5480.11, December 21, 1988

19. U.S. Energy Research and Development Administration, Nuclear Air Cleaning Handbook, "Design, Construction and Testing or High Efficiency Air Cleaning System for Nuclear Applications," ERDA-76-21, 1976.

20. Air Moving and Conditioning Association (AMCA), "Fans and Systems," Application Guide No. 201, 1973.

21. American Society of Heating, Refrigerating, and Air Conditioning Engineers, ASHRAE, Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter, ASHRAE 52-76, 1976.

22. Department of Defense, Military Specification, Filter, Particulate, High Efficiency, Fire Resistant, MIL-F 51068D, August 1988.

23. American National Standards Institute, Testing of Nuclear Air Cleaning Systems, Standard N510, 1980.

24. National Fire Protection Association (NFPA), Standard for the Installation of Air Conditioning and Ventilating Systems, Standard No. 90A-1979.

25. American National Standards Institute, Nuclear Power Plant Air Cleaning Systems, Standard N509, 1976.

26. Mine Safety and Health Administration (MSHA), Federal Mining Code for Metal and Non-Metallic Underground Mines, Title 30, Code of Federal Regulations, Part 57, 1988.

27. Bechtel National, Inc., "Design Validation Final Report, Waste Isolation Pilot Plant," DOE-WIPP-86-010, 1986.

CHAPTER 4 - PLANT DESIGN

This section of the FSAR contains six sections describing the following aspects of the WIPP Facility: Summary Description of Facility; Surface Structures; Shafts and Subsurface Facilities; Service and Utility Systems; Waste Handling, Emplacement, and Retrieval Equipment; and Underground Mining Equipment. The SER does not review FSAR Section 4.1 since it is a general description of the facility and no RAI's pertaining to it appear in the Appendices.

SECTION 4.2 - SURFACE STRUCTURES

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the functions, the major design and construction features, and the design classification of the surface structures at the WIPP Facility. Surface structures are grouped under two general headings: (1) Waste Handling Building (WHB) and (2) Support Structures.

WASTE HANDLING BUILDING

For the WHB, the FSAR describes the following four functional areas and two systems:

Areas:

- CH TRU Waste Handling Area -- includes Air Locks, Inventory and Preparation Area, Overpack and Repair Room and support facilities.
- RH TRU Waste Handling Area -- includes Inventory and Preparation Area, Cask Receiving Area, Cask Preparation Area, Cask Maintenance Station, Hot Cell Complex and support facilities.
- TRUPACT Maintenance Facility Area
- WHB Support Areas

Systems

- Fire protection system
- Effluent monitoring system

Support Systems

The support structures are the following buildings which are required for support of the waste handling operations:

- Exhaust Filter Building
- Salt Handling Shaft Head Frame and Hoist House
- Air Intake Shaft Head Frame and Hoist House
- Main Warehouse Building
- Water Pumphouse
- Support Building
- Vehicle Service Building
- Guard and Security Building
- Main Gatehouse
- Armory Facility
- Safety and Emergency Services Building
- Compressor Building

The FSAR states that on the basis of the design classification definitions presented in Subsection 3.1.7, there are no Design Class I structures at the WIPP Facility. The WHB, which serves as a containment barrier to control the potential release of radioactive material, is the only surface structure designated as Design Class II and required to be designed to withstand the design basis earthquake (DBE) and the design basis tornado (DBT).

The primary focus of this review is the CH area. A complete review of the RH area will be performed at a later date prior to the receipt of RH waste. The RAIs (Ref. 11) associated with the RH area will be delayed until that time.

2.0 ACCEPTANCE CRITERIA

The acceptance criteria used for review of this section of the FSAR were the AISC Code (Ref. 3), the Uniform Building Code (Ref. 4), the ACI Code (Ref. 5), the Tornado Design Guide by McDonald, Mehta and Minor (Ref. 6), and the DOE Orders 6430.1A, 5480.5, and 5480.11 (Refs. 7-9).

The review included checks on the design calculations and as-built drawings of parts of the WHB, including the Hot Cell, the Hoist Tower, and the CH Area.

The following specific acceptance criteria were used in performing these reviews:

1. The loadings applied to the structures should be in accordance with the design analyses and the applicable building codes (Refs. 3, 4 and 5).

2. The methods of analysis used to evaluate structural responses (deformation and stresses) are in accordance with the applicable codes (Refs. 3, 4 and 5).

3. The allowable responses are within those specified in the design documents (Ref. 1 and 2).

3.0 ISSUES

1. The provided as-built drawings showed plate girders having 1/4-inch welds while the AISC code requires a 5/16-inch minimum size weld.

Resolution:

The shop drawing (Mosher Steel Fab Dwg. 265A) was examined during the April 24-28, 1989, FSAR review meeting at the site and the drawing indicated that a 5/16-inch weld was used as required. The shop drawings for these girders were not part of the documentation transmitted to EH for review. Based on the as-built drawings it is concluded that the welds are 5/16-inch as required. The issue is resolved.

2. The Hoist Tower floor, at elevation 185 ft-6 in., was designed as a composite system with shear studs connecting the steel beam and concrete slab. Confirmatory analysis by EH led to a concern that the shear studs were overstressed for Beam B-20.

   Resolution:

   Bechtel provided another calculation for the beam indicating that the studs were adequate provided the strength of the puddle welds was included with the studs. This additional calculation was reviewed during the April 24-28, 1989, FSAR meeting. It should be noted that the strength of the puddle welds would normally not be included in evaluating the strength of the connection between the concrete slab and steel during the design phase. Since the facility has already been constructed, it was determined that the inclusion of the puddle welds in the structural evaluation is acceptable and, therefore, the issue is resolved.

3. EH was not provided with calculations for the design of the girts and siding.

Resolution:

These calculations (CS-41-D-112, 113, and 116) were provided for review at the April 24-28, 1989, FSAR meeting and found to be acceptable. The issue is resolved.

4. EH questioned whether seismic restraints were provided for the crane. The drawings provided for review did not include these restraints.

Resolution:

The procurement specifications (1433L-014 and 1105-014) were examined during the April 24-28, 1989, FSAR meeting and found to require the restraints. The restraints were visually inspected during the RRI and found to be adequate. The issue is resolved.

5. EH questioned the seismic load calculations for some of the columns in the Hoist Tower. The correct calculation was not available when the report was prepared.

Resolution:

The calculation (CS-31-D-011) was provided for review during the April 24-28, 1989 FSAR review meeting and was found to be acceptable. The issue is resolved.

6. EH independently analyzed the seismic response of the Hoist Tower. The results of this study indicated that a seismic gap of at least 0.83 inches is required to prevent interference during the DBE. The size of the gap specified in the drawing was unclear.

Resolution:

The seismic gap was inspected during the RRI and found to be more than the 0.83-inch required. Thus, this issue is resolved.

7. A wall of the Hot Cell was analyzed as a T-beam and EH reviewers questioned the flange width used in the analysis.

Resolution:

This problem was evaluated during the April 24-28, 1989, FSAR review meeting. The flange of the T-beam in question is actually in the tension zone so that the wall behaves more as a rectangular beam than a T-beam. The Bechtel calculation assumed that the effective width of the flange was equal to one-quarter of the beam span on each side of the web. The ACI Code specification (Section 8.10.2) calls for the total flange width (not the overhang on one side) to be limited to one-quarter of the span. Actually, the ACI Code provision is for compressive flanges and the Code contains no provisions for tensile flanges. The Bechtel calculation uses the tensile flange width to determine the total reinforcement acting with the beams. The steel within the flange width assumed by Bechtel is required to satisfy the ACI minimum reinforcement ratios. If the reduced flange width (span/4) is used, the reinforcement available is about one-half of that used by Bechtel and violates the minimum reinforcement requirement in the ACI Code. A calculation was made by EH, and is included as Appendix G indicating that the reduced steel area results in a beam moment capacity of 10,290 kip-ft while the required moment is 10,100 kip-ft. Since this strength is adequate, the issue is resolved.

8. A question was raised regarding the adequate treatment of stresses around an opening in the Hot Cell roof.

Resolution:

A calculation was made by EH, and is included as Appendix H. This calculation indicates that the slab could carry the entire load acting as a one-way slab having the strength determined by omitting the cutout. This issue is, therefore, resolved.

9. The mat Hot Cell foundation was found to be slightly overstressed in shear in the Bechtel calculations which were reviewed.

Resolution:

This was found to be true but was based on a very conservative (uniform) distribution of soil pressure. A more realistic distribution of soil pressure (with the load concentrated near the supports) indicates that the foundation is adequate. This issue is resolved.

10. In addition to the above nine items, many instances were noted where the design calculations and "as-built" drawings were inconsistent. This problem was also considered during the RRI and amplified by the finding that the "as-built" drawings do not always reflect the field conditions.

Resolution:

This was also identified as a finding in the RRI and will be corrected by the WIPP when a correct set of as-built drawings are developed. The EH structural reviews have not indicated any serious concerns with structural adequacy at the WIPP. However, since there are discrepancies in the calculations due to changes made in the design (e.g., standardizing member sizes, resolving interferences, etc.), the design changes should be evaluated to determine if the original calculations are still valid. This will be tracked in the RRI follow-up. For purposes of the SER, this issue is resolved.

11. Four of the columns on Line F, supporting the roof trusses in the CH area, were found to be overstressed by about 13%. This was found for the dead load, live load, and design wind load combination. The Bechtel calculations were reviewed and found to contain the following errors leading to this overstress: the dead weight of the roof trusses was not included in the loads acting on the columns and the moment induced at the top of the columns by the horizontal reactions applied to the columns by the top and bottom chords of the roof trusses was not included.

    Resolution:

    This is an open issue.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, show that WIPP surface structures are designed in accordance with the applicable design bases and design criteria, with the exception of the 13% overstress that was found for four columns in Line F of the CH Area.

SECTION 4.3 - SHAFTS AND SUBSURFACE FACILITIES

1.0 SUMMARY DESCRIPTION

This section of the FSAR presents a general description of the four shafts and underground rooms currently in place or planned to be placed in the facility during the five year Pilot Plant Phase (Test Phase), together with a summary description of the design bases for these facilities. The four shafts (Waste, Salt Handling, Exhaust and Air Intake Shafts) connect the surface to the underground storage horizon within the salt (Salado) formation. All shafts, except the exhaust shaft, contain a hoist conveyance. Each shaft consists of a shaft collar, that extends from the surface through the upper granular soils, a shaft lining, that extends to the salt formation, a shaft key, that extends into the salt formation, and an unlined section within the salt formation that extends from the key to the shaft station at the depth of the storage horizon. The shaft lining is typically unreinforced concrete, except for that in the Salt Handling Shaft, which is steel. The function of the lining is to retain any loose rocks encountered in the upper rock formations above the salt, as well as to retain any water which may seep from aquifers penetrated by the shafts.

The underground facilities in the storage horizon consist of the shaft stations, the CH TRU and RH TRU storage areas and the experimental rooms. In addition, various support rooms are provided for these areas. EH's review does not include the RH TRU waste storage areas. The review of these areas will be done at a later date prior to the receipt of RH TRU wastes.

2.0 ACCEPTANCE CRITERIA

The acceptance criteria used for the review of this section of the FSAR are the ACI Code (Ref. 5) and the appropriate DOE Orders (Ref. 7-9) and as-built drawings. As part of this review, checks were performed on the design calculations and the as-built drawings of the shaft liners and shaft keys.

The following specific acceptance criteria were applied in performing these assessments:

1. The loadings applied to the structures should be in conformance with the definitions of Ref. 2 and the applicable building code (Ref. 5).

2. The methods of analysis used to evaluate the response of the liners and keys are in conformance with the requirements of the applicable codes (Ref. 5).

3. The allowable responses are within those specified in the design documents (Refs. 1 and 2).

4. The soil and rock property data used in the analyses conform with the measured data provided in the references (Refs. 13 and 14).

3.0 ISSUES

1. The first comment made in the review of the FSAR concerned the statement in Subsection 4.3.1.1.1 that indicated that the design bases used for shaft furnishings included a seismic load component while the design calculations did not.

   Resolution:

   This subsection was modified in the May 1989 revision to the FSAR to indicate that the shaft furnishings were designed to resist the dynamic forces associated with the hoisting system, and that these are larger than any forces associated with underground seismic effects. Considering the low level of seismic design input anticipated at the site, this revision is considered adequate and the issue is resolved.

2. It is stated in FSAR Subsection 4.3.1.1.1 that the shaft linings were designed to resist both water pressures from the aquifers above the salt formation as well as anticipated ground movement. The impact of any ground movement on the lining design was not indicated in the Design Validation Final Report (DVFR) (Ref. 15). In particular, the effects of any movements induced by seismic effects were not included in the design.

   Resolution:

   Independent calculations were performed by EH (see Appendix I) considering the level of ground shaking anticipated at the upper levels of the lining, using the seismic design motion as input at the ground surface. Assuming that the lining moves with the ground during the seismic event, the strains developed in the lining were found to be small indicating that they would not have a significant impact on the safety of the shaft lining. Thus, the design of the lining is controlled by water pressures and the impact of ground movement on the design is negligible. Unless other types of ground movement were considered in the design basis, this statement in the FSAR, Subsection 4.3.1.1.1, should be further revised to indicate that the shaft linings did not in fact include a ground movement component in their designs.

3. The lateral pressures used in the final design of the various shaft keys located at the interface between the salt and anhydride rock layers were considerably lower than the pressures originally described in the design calculations, with no justification. This apparently arbitrary reduction could not be duplicated by independent calculations performed by EH.

Resolution:

The description in Subsection 4.3.1.1.2 of the FSAR, referring to the design bases used for the shaft keys, was revised to indicate that the design was based primarily on empirical data available from existing potash mines in the vicinity of WIPP. This empirical data is essentially the qualitative observation that keys much thinner than those at WIPP have performed well. EH agrees that the empirical data from existing mines is one important element in evaluating current key designs. However, a valid analysis of record is necessary to link, insofar as possible, that experience with the final design as well as to confirm and document the actual margins of safety.

State of the art analyses were undertaken by both EH and the program in an effort to confirm the analysis supporting the as-built design of the key.

The results of the EH independent calculations performed by BNL indicate that the most highly stressed key (waste shaft) would remain within the code allowable stress when credit is taken for the actual measured concrete strength, in accordance with code provisions, rather than the original design strength (Ref. 26). Three separate calculations have been performed for WPO by Sandia, Bechtel and IT Corporation. These calculations each indicate lower loads and therefore lower key stresses than those resulting from the EH analysis due to the use of different, and held by WPO to be more appropriate, creep relationships as well as apparent computational differences. It must be noted that neither group has successfully demonstrated a good understanding of the actual phenomena controlling the loads on the shaft keys. Even the lower loads predicted by the WPO contractors would likely have caused distress in the relatively thin keys in the nearby mines, but, in fact, this has not occurred.

Although somewhat perplexing, it is clear that the best current computational techniques give a conservative characterization of the lateral pressure applied to the keys due to the creep of the salt. The shaft keys have been shown to meet code requirements when subjected to these conservative loads. In addition, the shaft keys will be subject to scheduled visual inspection as part of the normal mine maintenance program throughout the life of the WIPP Facility. This issue is resolved.

4. The design of the underground configuration of room and drift openings does not adequately account for long term creep effects nor separately address the evaluation of long term stability of these openings.

   Resolution:

   In the design of the underground rooms, empirical approaches were used in the selection of room dimensions together with the experiences gained from the Site and Preliminary Design Validation Test Room. These experiences include the effects of salt creep in an approximate fashion, with the current monitoring program being used to ensure that behavior of the openings follows a consistent path. The threshold monitoring program described in Section 2.10 will be used to monitor creep effects as well as potential impact of any fracturing which may develop around the openings. As mentioned in Section 2.10 of this SER, the ability to monitor rooms filled with CH containers is still an open issue.

   As indicated in Section 2.10 of this SER, there is evidence to indicate that rock fracturing, together with growth in separations along natural fault lines will continue around these openings as creep in the host rocks occurs. The monitoring programs must therefore be used to continually establish local stability and safety margins in the underground.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides acceptable criteria for shafts and subsurface facilities. A confirmatory two-dimensional axisymmetric analysis was performed by EH to support the key design for the waste shaft. Additional information on these issues associated with the key was received on June 15, 1989 and is under review. A minor modification is required in Subsection 4.3.1.1.1 of the FSAR to indicate that the shaft linings did not in fact include a ground movement component in their design.

Finally, it should be emphasized that to establish and maintain information on safety and stability of all underground openings, a detailed monitoring program must be maintained throughout the life of the facility. The ability to perform such monitoring in storage rooms filled with CH containers during the Test Phase has not been addressed and remains an open issue as addressed in SER Section 2.10.

SECTION 4.4 - SERVICE AND UTILITY SYSTEMS

SECTION 4.4.2 - ELECTRICAL SYSTEM

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the WIPP Facility electrical system, including normal power, that is supplied from off-site by a public utility company; backup power, provided by two (redundant) on-site 1100-kw diesel generators; and essential power, supplied by an 80-kva Uninterruptible Power Supply (UPS). This section summarizes the function of each of the power sources, and how they are integrated to assure reliable power to facility equipment and instrumentation. This section concludes that from the electrical perspective, the WIPP Facility design is fail-safe; essential systems are uninterruptible.

In addition, a Failure Mode and Effects Analysis (FMEA) has been provided for the surface and underground electrical system. This analysis concludes that a single failure of a component or system does not impose undue risk to the health and safety of the public or on-site personnel.

2.0 ACCEPTANCE CRITERIA

Division 16 of DOE Order 6430.1A (Ref. 7) and USNRC Regulatory Guide 3.26 (Ref. 17), provide the general design criteria for electrical systems. For the most part, the criteria are based on established industry standards including IEEE and NFPA standards. The appropriate standards were used for the review of the electrical system, particularly those portions of the description related to the diesel generators, the UPS, and protective relaying.

Specific criteria that were used to evaluate this section of the FSAR were:

1. Electrical systems shall be designed so that all components operate within their capacities for initial and projected loads.

2. Emergency power systems shall be capable of maintaining full operation of emergency load for a specified time period.

3. Batteries shall be kept fully charged.

4. The design of the primary and emergency power sources should be described.

5. The mechanics, sequence, and timing of events which will occur on a loss of offsite power should be presented.

3.0 ISSUES

1. The FSAR indicated that the diesel generators could be remotely started from the Central Monitoring Room (CMR). This was reflected in Subsections 4.4.2.1.2, 4.4.2.1.3, and in the second paragraph of Subsection 4.4.2.2.2. As identified by the Readiness Review Inspection (RRI) (Ref. 19, Finding B-3.6), the diesel generator controls are maintained in the 'LOCAL' mode, which precludes starting them from the CMR. This permits a controlled start of the diesel, including a five minute warm up period. Modifications to the FSAR partially address this concern.

   Resolution:

   a. The second paragraph of Subsection 4.4.2.1.2 states that the diesel generators can be remotely started from the CMR. In the FSAR, the wording was changed to indicate that it is standard practice to use the local start capability, however, the sentence goes on to state that the unit can be remotely started from the CMR. This is still not totally accurate. While the capability exists to start the diesels from the CMR the control switch

located at the diesel must be placed in 'REMOTE', which precludes starting the diesels in accordance with the operating procedure. The FSAR wording should clearly state that the controls permit starting the diesels either locally <u>or</u> remotely, and that the choice has been made to start the diesels locally. It should be noted that the additional time necessary to start the diesels locally does not significantly impact the acceptance criteria of establishing emergency power within 30 minutes.

b. The third paragraph of Subsection 4.4.2.1.3 states that AC power input to the UPS will be restored within 30 minutes via CMR operator action. However, a substantial number of field operator actions are necessary to manually start the diesels and perform the switching necessary to supply power to the UPS and other loads.

c. The second paragraph of Subsection 4.4.2.2.1 stated that the diesel generators would be started manually from the CMR. As previously noted, this is not consistent with the WIPP operating philosophy of closely monitoring the start-up of diesel generators. This was corrected in the June revision of the FSAR and is acceptable to EH.

Issues a. and b. above are open.

2. As documented in RAI comment #3(a) (Ref. 11), Subsection 4.4.2 of the FSAR should establish the design basis including the applicable standards, codes, and guides used for the design, procurement and installation of the electrical system.

Resolution:

DOE/WPO provided EH with information on 6/15/89 illustrating how the WIPP electrical design compares to DOE Order 6430.1 (Ref. 24) and 6430.1A (Ref. 7). DOE/WPO should review, summarize, and incorporate the information pertaining to DOE Order 6430.1 into the FSAR. EH has agreed that the design comparison to DOE Order 6430.1A may be completed within eighteen months after startup. This issue is open.

3. The third paragraph of Subsection 4.4.2.1.3 states that the dedicated batteries can supply power to a fully loaded UPS for 30 minutes. As identified during the RRI (Ref. 19, Finding B-3.5) verification, either through testing or analysis, that such capacity exists has not been demonstrated. As indicated in RAI comment #7(d), the battery testing or monitoring to assure 30 minutes of supply power was requested.

   Resolution:

   The response provided (Appendix B) was not adequate since it addressed the preventive maintenance program for the UPS. This issue is open.

4. The emergency diesel generator starting system is an important subsystem which should be described in the FSAR.

   Resolution:

   As agreed during the April 24-28, 1989 FSAR review meeting, the second paragraph of Subsection 4.4.2.1.2 in the May revision to the FSAR accurately responded to RAI comment #6(a) regarding the emergency diesel generator starting system. However, in a June revision to the FSAR, statements describing the diesel generator battery systems were deleted.

This finding raises concerns regarding agreements in this regard made during the April 24-28, 1989, meeting as reflected in the May 1989 revisions to the FSAR. DOE/WPO should revalidate the May 1989 revision to the FSAR responses to ensure other commitments were not inadvertently removed in the June revisions to the FSAR. This issue is open.

5. Subsection 4.4.2.1.3 describes the function of the 80 KVA UPS and refers to Table 4.4-9 for a list of essential loads. As identified during the RRI (Ref. 19, Finding B-3.3) this table contains more load (126.1 KVA) than the UPS is capable of delivering.

   Resolution:

   Information received on 6/15/89 indicates that the testing has been completed which demonstrates significantly lower loads exist. These results should be used to revise Table 4.4-9 of the FSAR. This issue is open for the RRI and will be tracked in the RRI report (Ref. 19).

6. A concern also existed regarding the loading of the 1100 KW diesel generator. As requested in RAI comment #16, the actual loads for the equipment listed in Table 4.4-8 were added in the April FSAR revision. It was subsequently noted, however, that the rated loads exceeded the capacity of the diesel.

   Resolution:

   This has been corrected in the June 1989 revisions to Table 4.4-8 of the FSAR. The response is acceptable and the issue is closed.

7. Subsection 4.4.2.2 describes the safety consideration of the electrical system. This system is classified as a Design Class III system based upon the fail-safe nature of the facility design. This analysis assumes a single failure criteria; i.e., the failure of only one component assumed for each scenario is fail safe.

Resolution:

This subsection should indicate that only single failures of the electrical system have been analyzed. This issue is open.

8. The description in the second paragraph of FSAR Subsection 4.4.2.1.1 was inconsistent with the referenced figure (Figure 4.1-4).

Resolution:

This paragraph was revised to more accurately reflect the offsite power grid as illustrated in Figure 4.1-4. The response is acceptable and the issue is resolved.

9. Additional information was requested regarding the time and sequence of events necessary to place the backup power source on line.

Resolution:

The first paragraph of FSAR Subsection 4.4.2.1.2 was revised to address this issue. The response is acceptable and the issue is resolved.

10. The protective relaying associated with the electrical system should be described.

Resolution:

Paragraph 3 of Subsection 4.4.2.1.4 was added to describe how load loss is minimized in a fault condition. The response is acceptable and the issue is resolved.

11. Information was requested regarding the preselected sequence of loading when power is restored. The concern was that the diesel generator could be subjected to overload conditions.

    Resolution:

    Subsection 4.4.2.1.5 was revised to accurately reflect the procedures addressing this issue. The response is acceptable and the issue is resolved.

12. Diesel generator testing should be described in the FSAR to assure the operational readiness of this important equipment.

    Resolution:

    Reference to the procedures associated with periodic testing of the diesel generators was added to Subsection 4.4.2.1.6. The response is acceptable and the issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR revisions, as supplemented by the responses in Appendix B, provides requirements for an acceptable electrical system that is in compliance with the acceptance criteria, except as indicated above.

SECTION 4.4.3 - FIRE PROTECTION SYSTEM

1.0 SUMMARY DESCRIPTION

The objectives for fire and explosion protection at the WIPP Facility are to ensure the safety of plant personnel, the reliability and continuity of plant operations, and to minimize property loss.

Items discussed in this section are: fire characteristics and protection; fire protection system description and evaluation; inspection and testing requirements; and, fire personnel qualification and training.

Operational Safety Requirements (OSRs) for the fire detection and alarm systems are described in detail in Subsection 10.3.4 of the WIPP FSAR; the fire suppression system OSR's are described in Subsection 10.3.5.

The WIPP Fire Protection System is designed to meet the criteria for an "improved risk" level of fire protection described in DOE Order 5480.7 (Ref. 20) and to comply with the regulations and criteria contained in Refs. 18-23. Document No. D-76-F-06, "Design Basis - Fire Protection," (Ref. 21) identifies the design requirements for fire protection at the WIPP.

2.0 ACCEPTANCE CRITERIA

The acceptance criteria were based primarily on Subsection 5.4.9 of USNRC Regulatory Guide 3.26 (Ref. 17). The specific acceptance criteria used to evaluate this section of the FSAR include:

1. Identifies the fires that could directly or indirectly affect safety-related structures, systems, and components.

2. Describes or discusses the bases for the design of the fire protection system.

3. Discusses fire characteristics.

4. Discusses the features of buildings and facility arrangements that provide fire prevention, fire extinguishing and fire control.

5. Lists the codes and standards considered and used for the design of the fire protection system.

In response to RAIs concerning life safety and building design features, modifications and additions were made to the FSAR to assure that the safety protection criteria for the fire protection system are adequate for life safety requirements and that the system is designed to meet or exceed the acceptance criteria. This is based on the following commitments which are contained in the revised FSAR and in responses to the RAIs.

a. All buildings and their support structures are protected by fixed, automatic fire suppression systems. (The shielded storage area in the WHB did not have an automatic fire suppression system at the time of the RRI (Ref. 19). DOE/WPO committed to install this system prior to waste receipt).

b. Noncombustible construction, fireproof masonry construction, and fire resistant materials are used whenever possible.

c. Areas susceptible to fire are separated by fire walls and automatic fire doors. Fire separations are installed where required per the Uniform Building Code (UBC, Ref. 4).

d. All vertical openings in buildings are protected by enclosing stairways, elevators, pipeways, electrical penetration, etc., to prevent fire from spreading to upper floors.

e. Adequate provisions for the safe exit of personnel are ensured for all potential fire occurrences. Evacuation alarm signals are provided throughout occupied areas.

3.0 ISSUES

1. Information was requested with regard to the design of the fire water system, specifically verification of the sufficiency of the fire water system's capacity and flow rate.

   Resolution:

   The following calculations were provided for review:

   a. Calculation CS-41-F-006, "To Analyze the Water Supply Requirements for each facility including Outside Protection, in Order to Determine Water Flow and Pressure Demands for Fire Protection."

   b. Calculation CS-41-F-002, "To Determine Firewater Demands and Firewater Collection Requirements for the WHB."

   c. Calculation CS-45-F-006, "To Determine the Fire Water Demand for the Support Building."

   It was found that these calculations adequately verify the sufficiency of the fire water system's capacity and flow rate and therefore the issue is closed.

2. Information was requested regarding pipe sizing for the fire water system.

Resolution:

Calculation CS-25-C-012, "Fire Water Distribution System," which calculates the flows and pressures in the fire water system and checks the correctness of the pipe sizes was provided for review. It was found that the calculation is acceptable and that the diameters of the fire loop pipes are adequate. The issue is closed.

3. Information was requested on the criteria used to locate the fire hydrants.

Resolution:

Document D-76-F-06, "Design Basis Fire Protection," (Ref. 21) was provided. Subsection 3.2.1.A of this document contains the criteria for fire hydrant location. The response is acceptable and the issue is closed.

4. Information was requested on the codes and standards used to design the fire detection and suppression systems.

Resolution:

Document D-76-F-06, "Design Basis Fire Protection," (Ref. 21) was provided. Subsection 3.2.1.C, of this document contains the criteria for fire or smoke detectors and is in accordance with NFPA 72E; suppression systems are designed in accordance with NFPA 10, 13 and 14. The response is acceptable and the issue is closed.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR as supplemented by the responses to Appendix B provide an acceptable Fire Protection System at WIPP that complies with the paragraph 2.0 acceptance criteria, and that has adequate administrative controls and safeguards in force to assure safe operation of the facility. The issue of the automatic fire suppression system for the shielded storage area is discussed in Section 5.1 of the SER and will be tracked in the RRI report (Ref. 19, Finding C-3.1).

SECTION 4.4.4 - WATER AND WASTE WATER SYSTEM
SECTION 4.4.5 - SALT HANDLING SYSTEM
SECTION 4.4.6 - RADIOACTIVE WASTE SYSTEMS
SECTION 4.4.7 - TRANSPORTATION
SECTION 4.4.8 - SAFETY COMMUNICATIONS AND ALARMS
SECTION 4.4.9 - MAINTENANCE PROVISIONS
SECTION 4.4.10 - COMPRESSED AIR SYSTEMS
SECTION 4.4.11 - UNDERGROUND FUEL SYSTEM

1.0 SUMMARY DESCRIPTION

The above subsections discuss various components of the WIPP service and utility systems:

1. Subsection 4.4.4: The water system supplies water for domestic use and fire protection. WIPP requires a maximum peak water supply of 375 gallons per minute; the average daily domestic demand is about 75,000 gallons per day.

2. Subsection 4.4.4: The sanitary sewage waste water system includes a buried sanitary collection system, a sewage treatment plant, and an effluent pond.

3. Subsection 4.4.5: Salt is transported from the excavating equipment to the salt handling system. This subsection describes the salt handling equipment, and the underground and surface salt handling controls.

4. Subsection 4.4.6: The solid, liquid, and airborne radwastes and radioactive mixed wastes that will be generated, collected and handled by the facility are described.

5. Subsection 4.4.7: Access to the WIPP Facility is provided by U.S. Highway 62/180 from the north and New Mexico State Highway 128 from the south. Roadways have been constructed within the secured area to

serve the surface facilities. Rail access is provided from a spur at the Western Ag Minerals Nash Draw Mine to the facility. Parking is provided outside the Zone 1 fence for employee vehicles and on-site for site maintenance and staff vehicles.

6. Subsection 4.4.8: Both intraplant and plant-to-off-site communications systems are available. This subsection describes the various components of each system.

7. Subsection 4.4.9: This subsection discusses the maintenance requirements on structures and equipment at the WIPP Facility.

8. Subsection 4.4.10: Three types of compressed air systems for the WIPP Facility are discussed: plant, instrument (dried and filtered plant air), and a single unit, high pressure breathing air compressor/bottle fill station.

9. Subsection 4.4.11: This subsection discusses the underground fuel system used to convey diesel fuel from the surface to a fuel depot on the storage horizon.

2.0 ACCEPTANCE CRITERIA

The acceptance criteria used to review these subsections of the FSAR were taken primarily from DOE Orders 5480.1B and 5820.2A and USNRC Regulatory Guide 3.26 (Refs. 18, 22 and 17 respectively). Specific acceptance criteria used to evaluate these subsections follow. The FSAR adequately:

1. Discusses the primary source of the water supply, alternate sources, storage facilities, the effects of loss of water supply, and power failure.

2. Describes the sanitary sewage handling system and shows that no radioactive material can be discharged in this effluent.

3. Presents the design bases for supplying the compressed air needs of the facility.

4. Discusses the systems to be used for internal and external communications.

5. Describes the functioning of the alarms and communication systems in response to normal and abnormal operations and under accident conditions.

3.0 ISSUES

1. WIPP was asked to describe the role that off-site agencies, such as fire control and rescue teams, would play in the event of an emergency situation.

   Resolution:

   Memorandums of understanding for assistance exist between WIPP and off-site agencies for ambulance, medical and fire support. This response is acceptable and the issue is closed.

2. WIPP was asked to specify the pressure drop levels and radiation limits which mandate filter change.

   Resolution:

   The WIPP criteria require changing HEPA filters at a differential pressure of three inches water gauge from new filter base reading. This response is acceptable and the issue is closed.

3. WIPP was asked to discuss any consideration of problems which may arise due to failure of a component resulting in the loss of compressed air. The FSAR does not appear to consider safety related

problems which may arise due to loss of compressed air systems for the Hoist brake, critical instrumentation and breathing air.

Resolution:

DOE/WPO supplied a description of the breathing air system, the plant air system and the instruments air system. In addition, a failure mode and effects analysis table was added to the June 1989 version of the FSAR. This table identifies each component and the associated failure effect. The response is acceptable and the issue is closed.

4. WIPP was requested to provide the design calculations verifying the sufficiency of the water supply system's flow rates and pipe sizes as described in Section 4.4.4.1 of the WIPP FSAR.

Resolution:

WIPP responded by providing the following design calculations and design basis documents:

a. D-23-F-01, "Design Basis Water Supply"

b. CS 23-C-028, "Water Pipeline - Hydraulic Analysis"

c. CS 23-C-031, "Water Pipeline Hydraulics"

d. CS 23-C-035, "Water Pipeline Hydraulics - New System"

e. CS 23-C-038, "Water Pipeline Hydraulics - Computer Runs"

f. CS 25-F-002, "Domestic Water Demand for WIPP"

These documents describe the flow capacity requirements of the water supply system and provide the calculations which verify the adequacy of the flow rates and pipe sizes. The response shows that the water supply system at WIPP is adequate and the issue is closed.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR as supplemented by the responses to Appendix B provide acceptable service and utility systems that comply with the acceptance criteria of paragraph 2.0, and also provides adequate controls and safeguards to assure safe and reliable operation of these systems at the WIPP Facility.

SECTION 4.5 - WASTE HANDLING EMPLACEMENT AND RETRIEVAL EQUIPMENT

SECTION 4.5.3 - UNDERGROUND HANDLING, EMPLACEMENT AND RETRIEVAL EQUIPMENT

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the major equipment used for transporting and storing CH TRU wastes underground. This function is accomplished by a CH TRU waste transporter and a CH TRU waste lift truck. The waste lift truck can handle seven packs of 55 gallon waste drums or four packs of 85 gallon drums. The retrieval operation is the emplacement operation in reverse and the same equipment is used.

2.0 ACCEPTANCE CRITERIA

General acceptance criteria were taken primarily from the Federal Mining Code for Metal and Non-metallic Underground Mines (Ref. 23). Specific acceptance criteria used to evaluate Subsection 4.5.3 were:

1. Provides a description of the underground handling, emplacement and retrieval equipment.

2. Demonstrates that the equipment is designed to eliminate accidents.

3. Demonstrates that the transport equipment performs its function and has been proof tested.

3.0 ISSUES

1. The major equipment used to transport and store CH TRU waste underground consists of the CH TRU transporter and diesel powered CH TRU waste lift trucks. The waste transporter is a commercially available diesel powered tractor-trailer designed for transporting CH TRU waste on pallets and is modified to comply with mine and other

safety codes. The waste lift truck handles seven packs of 55 gallon waste drums or four packs of 85 gallon drums. Since retrieval is the emplacement operation in reverse, the same equipment is required with provisions to overpack damaged waste packages and to supplement ventilation and control contamination if needed. CH TRU waste retrieval demonstrations were performed with non-radioactive "mock" waste forms. These demonstrations fully tested the handling equipment prior to commencement of waste receipts. For retrieval demonstrations, the expected conditions of the rooms at retrieval were simulated to the extent practical by contouring the room floor for the expected amount of floorheave and by undersizing the room to simulate creep closure. The details of this demonstration are reported in Westinghouse Electric Corp., Final Report for the Contact-Handled Transuranic Waste Mock Retrieval Demonstration, DOE/WIPP 88-006, January 1988, Ref. (25).

Resolution:

Based on the review of this section of the FSAR as well as the descriptions given in the Westinghouse report (Ref. 25), the equipment used in the underground waste storage area for handling, emplacement and retrieval of the wastes meet the acceptance criteria outlined above in Section 2.0. There is, however, an open issue related to the monitoring program in the CH TRU waste storage area. This issue is discussed in Section 2.10 of this SER.

4.0 REQUEST FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR as supplemented by the responses to Appendix B provide for acceptable underground handling and retrieval equipment for CH TRU waste. There are no open issues to be resolved.

SECTION 4.6 - UNDERGROUND MINING EQUIPMENT

1.0 SUMMARY DESCRIPTION

This section of the FSAR discusses the mining operations requiring three primary types of equipment: continuous miners, haulage vehicles, and auxiliary vehicles. Two types of continuous miners are used: drum type and boom type. Two types of haulage vehicles are used: diesel powered dump trucks and load-haul-dump units. A diesel powered scissor lift truck and a mobile sealer truck are available. Roof bolts are installed with two electric roof bolters and a crane equipped supply truck is used for heavy and bulky items.

A specialized self propelled, track mounted milling machine unit is used to maintain the underground haulageways. With a rear mounted cutting drum, it can cut the road surface to a smooth, even grade. The continuous miners and milling machines are equipped with laser control capability.

For safety, continuous miners are equipped with deflector shields for operator protection in case of a gas "blowout." Reinforced canopies will be used on mobile equipment when needed. Radiological considerations were not used in equipment selection.

2.0 ACCEPTANCE CRITERIA

General acceptance criteria were taken from the Federal Mining Code for Metal and Non-metallic Mines (Ref. 23). The specific acceptance criteria used to evaluate Section 4.6 were:

1. Provides an accurate description of the underground mining equipment.

2. Demonstrates that the equipment is designed to provide protection of both continuous miner operators and roof bolt installers.

3. Demonstrates that the equipment can perform its function.

4. Meets the standards of Mine Safety and Health Administration (MSHA).

3.0 ISSUES

1. With the exception of the specialized unit for maintaining the underground haulageways, the underground mining equipment is standard equipment for this type of mining operation. A number of equipment manufacturers produce similar equipment. The equipment types have been proof tested in many salt mining operations around the world. Provided it is operated and maintained according to manufacturer's recommendations and in accordance with state and federal regulations and standards, no problem should develop with mining equipment.

   Continuous miners are equipped with deflector shields for operator protection in case of a gas "blowout." In addition, laser control of the excavating equipment reduces the duration of operator exposure to the excavating activity. All roof bolters are equipped with an automatic temporary roof support system to protect the operator while drilling and installing rock bolts.

   Observations of the underground rooms show, in a number of instances, fracturing and cracking of the salt at the roof-rib junction and rib-floor junction. This is, in general, an indication of developing instability around the mined opening. (The issue of roof-rib-flow fracturing and cracking is dealt with further in Section 2.10 and Section 7.3). To inhibit or prevent this instability from developing further, scaling of the loose material and rock bolting is used. These functions require the need for various pieces of mining equipment to be used in the storage rooms.

   At the April 24-28, 1989 FSAR review meeting, the WIPP Project indicated that these rooms will be patterned rock bolted to provide additional assurance of ground control and that the need for mining equipment to re-enter a waste room would be an off normal or unusual

event. For removal of loose roof and rib materials, a small mobile scaler, rather than mining equipment, will be used.

Resolution:

The descriptions given in the FSAR regarding underground mining equipment are acceptable in that they satisfy the criteria described above in Section 2.0. This issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR as supplemented by the responses to Appendix B provide for acceptable underground mining equipment.

REFERENCES FOR CHAPTER 4

1. Bechtel National, Inc., "Design Basis, Structural (General)," Document No. D-76-D-01, December 1, 1982.

2. Bechtel National, Inc., "Design Basis, Design Classification," Document No. D-76-K-03, November 30, 1983.

3. American Institute of Steel Construction, Manual of Steel Construction, (AISC), Eighth Edition, 1980.

4. Uniform Building Code (UBC), 1982.

5. "Building Code Requirements for Reinforced Concrete," American Concrete Institute, ACI 318-83, 1983.

6. J. R. McDonald, K. C. Mehta and J. E. Minor, "Tornado Resistant Design of Nuclear Power Plant Structure," Nuclear Safety, Vol. 15, No. 4, July-August 1974.

7. U.S. Department of Energy, "General Design Criteria," DOE Order 6430.1A, December 25, 1987.

8. U.S. Department of Energy, "Safety of Nuclear Facilities," DOE Order 5480.5, September 23, 1986.

9. U.S. Department of Energy, "Requirements for Radiation Protection," DOE Order 5480.11, December 21, 1988.

10. Memorandum, H.J. Pettengill, (DOE/EH), to J. B. Tillman, (DOE/WPO), March 22, 1989; Subject: Waste Isolation Pilot Plant, Hoist Tower/Hot Cell Design Report.

11. Memorandum, H.J. Pettengill, (DOE/EH), to J.B. Tillman, (DOE/WPO), April 13, 1989; Subject: Final Safety Analysis Report for the Waste Isolation Pilot Plant (transmitting EH comments on Chapters 1, 3, 4, 5, 6, 7, and 11).

12. J. Xu, S.E. Pepper, P.C. Wang, and M. Reich, "BNL Structural Evaluation of the Contact-Handled (CH) Area of the Waste Handling Building of WIPP," Brookhaven National Laboratory, BNL-SAD-89-105, July 1989.

13. Westinghouse Electric Corporation, "Geotechnical Field Data and Analysis Report," DOE/WIPP 86-012, 1986.

14. D.J. Borns and J.C. Stormont, "An Interim Report on Excavation Effect Studies at WIPP: The Delineation of the Disturbed Rock Zone," Sandia National Laboratories, SAND 87-1375, 1987.

15. Bechtel National, Inc., "Design Validation Final Report, Waste Isolation Pilot Plant," DOE-WIPP-86-010, 1986.

16. Waste Isolation Pilot Plant, "Facility Operations Manual," WP-04-1.

17. U.S. Nuclear Regulatory Commission, Regulatory Guide 3.26, "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plant," February 1975.

18. U. S. Department of Energy, "Environmental Protection, Safety, and Health Protection Program for DOE Operations," DOE Order 5480.1B, January 23, 1989.

19. U.S. Department of Energy, EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant; June 2, 1989.

20. U.S. Department of Energy, "Fire Protection," DOE Order 5480.7, November 16, 1987.

21. Bechtel National Inc., "Design Basis, Fire Protection," Document No. D-76-F-06.

22. U.S. Department of Energy, "Radioactive Waste Management," DOE Order 5820.2A, September 26, 1988.

23. Mine Safety and Health Administration (MSHA), "Federal Mining Code for Metal and Non-metallic Underground Mines," Title 30, Code of Federal Regulations, Part 57, 1988.

24. U.S. Department of Energy, "General Design Criteria," DOE Order 6430.1, December 12, 1983.

25. Westinghouse Electric Corp., "Final Report for the Contact-Handled Transuranic Waste Mock Retrieval Demonstration," DOE/WIPP 88-006, January 1988.

26. N. Simos, "Design Loads of Waste Shaft Key due to Creep Effects of the Salt Rock," to be published.

CHAPTER 5 - PROCESS DESCRIPTION

This chapter describes the processes and systems in place for handling Contact Handled (CH) and Remote Handled (RH) Transuranic (TRU) wastes at the WIPP Facility. These processes include emplacement, retrieval, disposal of site generated radwaste and mining operations. Systems such as the Central Monitoring System (CMS) and the WIPP Waste Information System (WWIS) are also discussed.

It should be noted that the organization of Chapter 5 has been changed for the May 1989 revision to the FSAR. The subject matter of Section 5.3 of the December 1988 FSAR, "Radioactive Source Experiments," has been deleted. "Retrievability of Stored Waste," Section 5.8 in the December 1988 FSAR, is Section 5.3 in the May 1989 revision to the FSAR.

EH's review does not include the RH TRU waste. Therefore, Section 5.2 of the FSAR, which deals exclusively with the handling and emplacement of RH TRU, has not been reviewed for inclusion in the SER. Subsection 5.3.2, which describes plans for retrieval of RH TRU, has also not been reviewed. Review of these sections will be performed at a later date prior to the receipt of the RH TRU wastes.

SECTION 5.1 - CH TRU WASTE HANDLING SYSTEM

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the handling process for CH TRU wastes from receipt to emplacement. The CH Waste Handling System, which includes both above and below ground operations, was designed to handle 55-gallon waste drums in seven pack configurations, 85-gallon overpack waste drums in four pack configurations and standard waste boxes (SWBs). The anticipated average throughput is approximately 250,000 ft^3 per year as compared to the design basis throughput of 500,000 ft^3 per year. At various stages in the process, radiological surveys are made. When radiological limits are exceeded, waste

packages are decontaminated or overpacked to prevent the spread of contamination.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from DOE Orders 5480.5 and 5480.11 (Ref. 1 and 2). In addition EH required that the waste handling process as presented in the FSAR be feasible and that environmental, safety and health matters be adequately addressed to ensure radiological protection during normal plant operations and during abnormal conditions that can reasonably be expected to occur over the lifetime of the facility.

Specific acceptance criteria used to evaluate Section 5.1 were demonstrated adequacy of:

1. A formal, documented system for the control and traceability of records and documents associated with the CH waste containers.

2. Plans and procedures for receiving wastes into the facility and for inspecting the waste shipment upon arrival.

3. Plans and procedures for storing materials, including quantity, container descriptions and spacing between containers.

4. Commitment to maintain to personnel, site and environmental exposures to radiation resulting from operations within limiting values and as low as reasonable achievable (ALARA).

5. Proposed radiological surveys during the waste handling operations to ensure that the radwaste dose rates, contamination levels, and airborne activity are below the levels identified in the Radiation Safety Manual (Ref. 3) and Waste Acceptance Criteria (WAC) (Ref. 4).

6. Marks, labels and seals required for the waste packages in accordance with the WIPP Waste Acceptance Criteria (WAC) (Ref. 4).

3.0 ISSUES

1. Inventory and record keeping is considered to be important in the operation of this facility, yet no description of such activity is included in the FSAR. In addition, information is required which shows how the design basis throughput of 500,000 ft^3/yr is achieved compared to the anticipated average throughput of 250,000 ft^3/yr.

   Resolution:

   Inventory and record keeping is performed by use of the WIPP Waste Information System (WWIS). A description of the WWIS has been provided and is considered to be acceptable. This data base will store pertinent information about each container stored at WIPP.

   Increase in throughput would be achieved by extending plant operating hours. There would be no deviation from the current acceptable procedures. The response is acceptable and the issue is closed.

2. Information was requested to resolve some questions concerning the receipt of waste. Specifically, (a) how TRUPACTs with high radiation levels would be handled, (b) how shipments are logged in and verified, and (c) how waste containers are identified.

   Resolution:

   (a) Subsection 5.1.1.1 of the June 1989 revision to the FSAR, was revised to describe how TRUPACTs with high radiation levels are handled.

(b) Shipments are verified upon arrival at the facility by comparing the shipping manifest to the label on the waste packages. During routine operation, the WIPP Waste Tracking System (WWTS-a personal computer based system) will log in the receipt date for each shipment and determine whether the TRUPACTs and waste packages received match the data downloaded from the WWIS. When the shipment is emplaced, the emplacement date, emplacement location data, and overpack number (if overpacking was necessary) also will be entered into the WWTS for uploading to the WWIS.

(c) The requirements for labeling of waste packages are specified by the WIPP WAC (Ref. 4).

The responses are acceptable and the issue is closed.

3. Subsection 5.1.1.2 of the FSAR states that waste packages can be decontaminated at the unloading dock, but no levels or types of contamination that can be handled at the loading dock are specified. Nor is there any mention of changes in packing configuration when waste requires overpacking.

Resolution:

According to the WIPP Radiation Safety Manual (Ref. 3) an area no greater than 6 ft^2 and levels no greater than 300 dpm/100 cm^2 for alpha, or 1000 dpm/100 cm^2 for beta/gamma can reasonably be controlled at the unloading dock in the WHB. Due to the larger diameter of overpacked drums, they are assembled in a four pack versus the usual seven pack prior to transfer underground. These assemblies are always placed on the top row in the waste stack to ensure stability. The response is acceptable and the issue is closed.

4. The procedure for handling high radiation level containers including high radiation area controls, stay times, evaluation for extremity monitoring, and intermediate storage requirements was requested.

Resolution:

Time limits and storage requirements were included in Subsections 3.1.2.2 and 3.1.2.3 of the June 1989 revision to the FSAR and Procedure WP 05-106 is being modified to implement high radiation waste handling. Subsection 3.1.2.2 provides a commitment to a one week limit for storing high radiation level containers in the Shielded Storage Room (SSR). The FSAR also states that the SSR has a sprinkler system for fire suppression. This sprinkler system had not been installed at the time of the Readiness Review Inspection (RRI) (Appendix C, Finding C-3.1). DOE/WPO has committed to correct this deficiency prior to start-up. In addition Procedure WP 05-106 did not include the committed storage time limit requirements at the time of the RRI (Appendix C, Finding C-3.1). These issues remain open for the RRI and will be tracked by the RRI report (Ref. 6). For the purposes of this SER the issue is closed.

5. The design basis for the Overpack and Repair Room (OP&RR) assumes that 2% of the waste packages are contaminated or damaged. However, the decontamination enclosure is not adequate to accommodate this volume.

Resolution:

Based on the fact that operational experience shows that the receipt of breached containers or contaminated packages is unlikely under normal WIPP operational circumstances, the 2% number has been deleted from the June 1989 revision to the FSAR. However, accidental situations could arise, i.e., punctured or dropped drum, therefore, we recommend that WIPP reevaluate this position during the Test Phase. However, for purposes of this SER, this issue is closed.

6. The following accidental fire scenarios (Ref. 5) were not adequately addressed.

   (a) Control of radioactive waste generated by the suppression of fires in the site-generated radwaste room, OP&RR, CH Waste Handling Area, and the waste storage area.

   (b) Control of the diesel fuel fire and waste drum fire with the fire extinguishing equipment available in the underground waste storage area.

   Resolution:

   (a) In the event of a waste drum fire in the site-generated radwaste room, OP&RR or the CH TRU waste handling area, automatic sprinklers as well as portable extinguishers are relied on to extinguish the fire. During any such fire, resulting smoke and aerosols will be handled by the roughing filters and HEPA filters. Any cleanup will become site generated radwaste. Fire water will collect in the sump and be handled using a qualified liquid waste process.

   (b) For suppression of fires in the underground, such as diesel fuel and waste drum fires, three suppression systems are available: (i) "on board" fixed dry chemical system with a capacity range of 20 at 120 sq ft, (ii) portable and wheeled dry chemical units rated to 120 sq ft and 1200 sq ft, respectively, and (iii) the underground emergency response vehicle (200 gallon capacity) with the ability to generate 1500 sq ft of fire suppressing foam. Diesel fuel fires will be suppressed using the "on board" fixed dry chemical system. If this is ineffective, the other methods of fire suppression will be employed. While a diesel fuel fire can reasonably be

expected to occur, engineering requirements and the underground vehicle design make the release of radioactivity due to an underground diesel fuel fire a non-credible event. Therefore, radioactive wastes will not be generated. A fire in a waste drum being transported can be suppressed using any of the three systems described above. Once drums are in the waste storage rooms, drum fires may be suppressed using these means only if the location of the drum makes it accessible. If a fire occurs in a drum which is located at the center of a storage room other drums will be moved until the drum is accessible. Then one of the three fire suppression methods will be utilized. Contamination resulting from a waste drum fire is unlikely as air flow will ensure that radioactivity is kept away from the clean areas. Radwastes generated by waste drum fire suppression are limited to liquid radwastes which are expected to evaporate into the ventilation system. A calculation was supplied showing the worst case fire, i.e., diesel fuel fire, to cover approximately 772 square feet. The fire truck fire suppression capacity is approximately two times the maximum expected fire size.

The responses are acceptable and the issue is closed.

7. Evaporation of the liquid radwastes into the ventilation system would cause an automatic switch to filtration by HEPA filters. Further review of Issue 6, above, led to the question of whether smoke generated by an underground fire could clog the HEPA filters.

Resolution:

Air passing through the HEPA filters is prefiltered by roughing filters. The roughing filters in combination with the considerable distance from a potential fire to the HEPA filters, and the nature of the particulate matter expected, indicates that clogging of HEPA

filters is not a major concern. In the event that the EFB HEPA filters become clogged, there is a HEPA filtration bypass mode which utilizes the smaller, 60,000 cfm fans. The response is acceptable and the issue is closed.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide for an acceptable CH TRU Waste Handling System that is in compliance with the acceptance criteria except for Issue 4 concerning the installation of a sprinkler system in the Shielded Storage Room and the maximum drum storage time in the SSR. This issue will be tracked by the RRI report.

SECTION 5.3 - RETRIEVABILITY OF STORED WASTE

1.0 SUMMARY DESCRIPTION

This section of the FSAR addresses the retrieval of CH and RH TRU waste. EH has not reviewed Subsection 5.3.2 as it discusses the retrieval of RH TRU waste.

This section describes the situations which may be encountered during CH TRU waste retrieval operations and how these situations will be handled to prevent the spread of any underground contamination. Facilities for over-packing and/or isolating breached containers will be installed near the storage rooms. Radiological surveying will identify radiation sources so that they can be decontaminated before being transported to the surface.

2.0 ACCEPTANCE CRITERIA

CH TRU waste retrieval operations must ensure protection of workers, site and environment from undue radiological exposure. Procedures must conform to DOE Orders 5480.5 and 5480.11 (Ref. 1 and 2) and provide guidance for handling normal and abnormal situations.

Specific acceptance criteria used to evaluate the adequacy of Section 5.3 were:

1. Personnel, site, and environmental exposures to radiation resulting from the release of hazardous materials under normal and abnormal operating conditions must be maintained within limiting values and as low as reasonably achievable (ALARA).

2. Plans and procedures for the retrieval of wastes are feasible and comprehensive.

3. Air monitoring capabilities shall be available during retrieval operations.

3.0 ISSUES

No requests for additional information (RAIs) were made for Section 5.3 during the initial FSAR review. The issue discussed below is a result of open issues in Chapter 7 and 12 concerning the accident evaluation of a roof collapse in the CH TRU waste storage rooms and the Retrievability Plan.

1. The surface storage of waste containers awaiting transport to "a DOE-assigned interim storage site and/or an approved repository," is not discussed. The WHB may not be able to accommodate the quantity of waste containers that will be received during the Test Phase (up to 3% of the total waste allowed). In addition, at this time administrative and technical procedures identifying the process proposed for repackaging and shipping the waste to the interim storage site have not been addressed by the FSAR.

   Resolution:

   Review of the Retrievability Plan that is identified as an issue in Chapter 12 of this SER should adequately resolve this issue. There are no further issues.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

Provide the Retrievability Plan for independent review.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide an acceptable system for retrieval of CH TRU waste except for two areas: (1) further details are necessary with regard to the timely

removal of waste containers from the facility once they reach the surface, and (2) an accident involving a roof collapse in a CH TRU waste storage room should be evaluated. An independent review of the Retrievability Plan will be required before this issue can be resolved.

SECTION 5.4 - PLANT-GENERATED RADWASTE SYSTEM

1.0 SUMMARY DESCRIPTION

Solid radwaste, the result of various activities such as decontamination and maintenance efforts, will be contact handled and will be collected in disposal containers. Liquid radwaste will be largely the result of fire suppression. All fire water will be collected and tested for radioactivity. Water which exceeds the limits for uncontrolled release will be processed and transferred to 55-gallon drums. Both solid and liquid radwaste will be disposed of in the underground waste storage area.

2.0 ACCEPTANCE CRITERIA

Site generated radwaste must be handled and disposed of responsibly such that radiological protection of workers, site and environment will be ensured. Such waste must also conform to the ALARA criterion as stated in DOE 5480.11 (Ref. 2). Procedures must be designed so that WIPP is capable of controlling all site generated radwastes. Specific acceptance criteria, also borrowed from DOE Orders 5480.5 and 5820.2A (Refs. 1 and 7, respectively), were:

1. The plant-generated radwaste system shall provide facilities, methods of disposal, and equipment to handle solid, liquid and gaseous wastes safely and effectively.

2. Technical and administrative controls shall be directed for reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal.

3.0 ISSUES

1. DOE Order 5820.2A (Ref. 7) requires that contaminated fire water be processed rather than solidified to reduce the volume of radioactive wastes.

   Resolution:

   DOE Order 5820.2A applies to storage facilities where radwaste has to be accumulated, stored and shipped elsewhere for disposal. As the WIPP has on-site disposal capacity, and the anticipated radwaste is sporadic if expected at all, processing the liquid radwaste to release limits is not economically feasible. The response is acceptable and the issue is closed.

2. DOE Order 5820.2A requires that solid radwaste be compacted to reduce the volumes of radwaste requiring disposal.

   Resolution:

   Compacting solid radwaste is not required unless the worst case volume estimates are exceeded, because the anticipated volume does not make compaction cost effective. Moreover, it is felt that compaction operations increase the risk for the spread of contamination. The committed response in Appendix B to modify Section 5.4.2 to reflect the proposed handling of solid radwastes was included in the June 1989 revision to the FSAR. The issue is closed.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, supplemented by the responses in Appendix B, provide an acceptable basis for concluding that the site generated radwaste will be handled and disposed of in a reasonable manner and in compliance with the acceptance criteria.

SECTION 5.5 - GENERAL PROCESS CONSIDERATIONS

1.0 SUMMARY DESCRIPTION

This section of the FSAR discusses general process considerations such as monitoring instrumentation, criticality safety, process interruption modes, and the WIPP Waste Information System (WWIS).

The WIPP monitoring instrumentation provides measurements and controls to ensure safe operation of the plant. Both local and remote monitoring of plant systems are possible. Certain instrumentation is safety related.

Studies have been performed to assess the possibility of accidental nuclear criticality. It was found that no credible criticality hazard exists.

Routine and emergency process interruptions are discussed. Routine interruptions would be those due to scheduled maintenance, unscheduled maintenance and plant inspection, and would be conducted according to established procedures. Emergency interruptions are those due to abnormal or accident conditions such as fire, earthquake or loss of electric power. Each of these instances requires that appropriate action be taken to correct the problem and to ensure that the facility can safely return to normal operations.

The WWIS is a computerized data base which stores important data on each waste container such as shipment number, identifying waste container numbers, date of shipment, maximum surface dose rate, radionuclide data, date of receipt, storage date and storage location. This information will be available in WWIS for CH TRU waste during the storage period and can be used for retrieval if necessary.

2.0 ACCEPTANCE CRITERIA

The WIPP must be designed to safely handle normal and abnormal situations which can reasonably be expected to occur during the lifetime of the facility. Safety systems and procedures must be on-line and available to avert the threat of accidents. The requirements of DOE Order 5480.5 (Ref. 1), with respect to nuclear criticality, notification and reporting of occurrences and emergency plans to handle potential accidents, must be satisfied.

Specific acceptance criteria used to evaluate Section 5.3 were the adequacy of:

1. Warning and alarm systems and central monitoring of these systems.

2. Assurances of nuclear criticality safety.

3.0 ISSUES

1. Subsection 5.5.1 of the FSAR generally discusses the functions, design and testing of the monitoring instrumentation. However, it does not discuss what specific instrumentation is used, where it is located, or what specifically is monitored.

   Resolution:

   In response to this comment, EH was supplied with a table listing each specific monitoring system and the location of associated components throughout the plant (Appendix B). The response is acceptable and the issue is closed.

2. Subsection 5.5.3.2, Emergency Interruptions, states: "If the earthquake is of sufficient magnitude, inspection of structures and equipment will be required." DOE/WPO was asked (a) to define

"sufficient magnitude" and (b) to provide a description of the inspection of structures and equipment that will be performed.

Resolution:

(a) "Sufficient magnitude" is defined as 0.1 g.

(b) A procedure identifying immediate inspections that may be required after a seismic event for critical structures or equipment (e.g., Hoist Tower and Waste Hoist) necessary for evacuation of personnel from the mine does not exist. A procedure must be available which defines, as a minimum, the purpose of inspection, what structural components and equipment require inspection, methods of damage assessment, and levels of acceptable damage. This item is an open issue of the Readiness Review Inspection (RRI) (Ref. 6, Finding C-6.2) and will be tracked by the RRI report, and thus is resolved for the SER.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide for acceptable safety related processes that are in place to maintain the overall integrity of the facility, with the exception of the one open issue, namely, to develop a procedure requiring structural inspections after an earthquake. This issue will be tracked through the RRI report.

SECTION 5.6 - UNDERGROUND MINING OPERATIONS

1.0 SUMMARY DESCRIPTION

Mining is performed by two continuous mining machines, one a boom type and the other a drum type continuous miner. Diesel powered underground trucks and load-haul-dumps (LHDs) are used for removal of mined salt. In virgin areas, probe holes to test for the presence of pressurized gas or brine are drilled prior to mining. After mining, vertical holes are drilled at the main intersections of the drifts and cross cuts. Safety checks during and immediately after mining are standard practice. Rock bolts are used extensively throughout the underground openings. They are used not only for remedial work, but also for safety. In addition, roofs in the first waste storage panel and many high traffic areas will be pattern bolted for extra safety and to provide greater assurance of the retrievability of waste. Both resin and mechanical bolts are used in most ground control activities. A qualification of bolts and bolting practices used in the WIPP Facility underground bolting program is described in Ref. 8. Specifications used in defining bolting requirements for the underground and used to guide the purchase of bolts are found in Refs. 9 and 10.

Separate ventilation circuits are maintained between the mining area and the storage area, with the air pressure maintained to ensure that any air leakage is from the clear mining area to the potentially contaminated storage area. Air quality and quantity are maintained at the levels required by the Mine Safety and Health Administration standard (Ref. 11).

2.0 ACCEPTANCE CRITERIA

Underground mining operations follow practices developed over the last 30 to 40 years for the use of continuous mining machines in horizon mining. Mining operations are inspected by federal and state authorities. Acceptance criteria were taken from the standards and regulations as given in 30 CFR Part 57, (Ref. 11).

3.0 ISSUES

1. Rock bolts are and will be used extensively throughout the underground openings. Information concerning (a) the adequacy of rock bolts determined through certification tests and (b) the effects of corrosion on rock bolts installed in the facility was not adequate.

   Resolution:

   (a) In addition to rock bolt certification tests performed in salt, Eddy County, New Mexico, certification of rock bolts is performed routinely by WIPP mine engineering personnel in compliance with 30 CFR Part 57.3203 b(2), h and i (Ref. 11).

   (b) The effects of corrosion on installed rock bolts have been studied by Sandia National Laboratory (Ref. 12) and Westinghouse (Ref. 9) resulting in the conclusion that environmental effects on rock bolts are insignificant.

The responses are acceptable and the issue is closed.

All RAIs have been adequately answered as documented in Appendix B. However, the effect of rock bolting in crack formation, propagation and total extent of the cracks as well as long term stability remains an open issue at this time. See Section 2.10 for a further discussion of this issue.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provide acceptable confidence that underground mining operations follow standard industry practice and meet federal and state regulations and standards.

SECTION 5.7 - CENTRAL MONITORING SYSTEM (CMS)

1.0 SUMMARY DESCRIPTION

The CMS monitors the fire alarm system, the security system, the radiation monitoring system, the electrical power status, the ventilation system, air quality, facility system and meteorological data.

The CMS computer and main consoles are located in the Central Monitoring Room (CMR) of the Support Building. The CMR was designed to allow its use during normal and emergency situations. Special features include two-hour fire walls, HEPA filtered air intake to allow occupancy during radiological release, uninterruptible power supply and linkage to the diesel generator. In the event that the CMR becomes uninhabitable, all plant systems can be monitored from the Guard and Security Building.

2.0 ACCEPTANCE CRITERIA

The requirements of Chapter 10, Operational Safety Requirements (OSRs), were used to evaluate this section of the FSAR. The CMS must be capable of alerting the WIPP staff to abnormal on-site conditions. Chapter 10 of the FSAR requires that the CMS monitor the fire alarm system, security systems, radiation monitoring systems, electrical power supply status, ventilation systems, air quality, personnel access, facility systems, effluent monitoring systems, and meteorological data.

DOE Order 5480.11 (Ref. 2) requires that air monitoring of workplaces be performed.

3.0 ISSUES

No issues were identified for this section.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides for acceptable functions and safety features for the CMS and complies with the acceptance criteria.

REFERENCES FOR CHAPTER 5

1. U.S. Department of Energy, "Safety of Nuclear Facilities," DOE Order 5480.5, September 23, 1986.

2. U.S. Department of Energy, "Radiation Protection for Occupational Workers," DOE Order 5480.11, December 21, 1988.

3. Waste Isolation Pilot Plant, "Radiation Safety Manual," WP 12-5, Revision 2, February 1989.

4. U.S. Department of Energy, "TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant," WIPP/DOE-069, Rev. 3, January 1989.

5. Memorandum, H.J. Pettengill (DOE/EH) to J.B. Tillman (DOE/WPO), April 13, 1989; Subject: EH comments on Chapters 1, 3, 4, 5, 6, 7 and 11 of the WIPP FSAR.

6. U.S. Department of Energy, EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant; June 2, 1989.

7. U.S. Department of Energy, "Radioactive Waste Management," DOE Order 5820.2A, September 26, 1988.

8. Westinghouse Electric Corp., Rock Bolt Certification Tests in Salt, Eddy County, New Mexico, TME 3135, November 1981.

9. Westinghouse Electric Corp., Shops Area Bolt and Mesh, Specification E404A56.

10. Westinghouse Electric Corp., Rock Bolts, Specification E404A48.

11. Mine Safety and Health Administration, "Federal Mining Code for Metal and Non-metallic Underground Mines," Title 30, Code of Federal Regulations, Part 57, 1988.

12. J.P. Lucas, Analysis of Rock Bolt Material Failures at the WIPP Site, SAND 84-0224, Sandia Laboratories, 1984.

CHAPTER 6 - ENVIRONMENTAL, SAFETY AND HEALTH PROTECTION

The principal areas of the EH review of Chapter 6 of the FSAR were contained in Section 6.1, "Radiological Protection." Although all sections of the FSAR were reviewed, only Section 6.1 is discussed below. Section 6.2, "Environmental Protection," was outside the scope of this review because it dealt with environmental matters, as opposed to safety issues. Section 6.3, "Safety," provided an overview of the safety philosophy for WIPP, and a brief summary of the safety program. Section 6.4, "Industrial Hygiene," provided general information regarding industrial hygiene. No requests for additional information were generated as a result of EH's review of Sections 6.3 and 6.4.

SECTION 6.1 - RADIOLOGICAL PROTECTION

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the Radiation Protection Program, procedures, and equipment that will be used to limit and control worker occupational radiation exposure. Principal areas discussed in this section included: (1) Measures to Assure that Occupational Radiation Exposure will be "as low as reasonably achievable" (ALARA); (2) Radiation Sources; (3) Radiation Protection Design Features; (4) On-Site Dose Assessment; (5) Radiological Control Program; (6) Off-Site Dose Assessment; and (7) Exposure to Hazardous Wastes. No requests for additional information were generated as a result of EH's review of Areas 6 and 7.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section were taken primarily from DOE Order 5480.11 (Ref. 1) and Chapter 8 "Radiation Protection," of USNRC Regulatory Guide 3.26 (Ref. 2). Specific acceptance criteria used to evaluate Section 6.1 were demonstrated adequacy of:

1. Methods, responsibilities, and programs to maintain occupational exposures ALARA.

2. Descriptions of direct and airborne radioactive material sources and predicted operational exposures.

3. Descriptions of area radiation and airborne radioactivity monitoring systems.

4. Identification of the radiation safety administrative organization and functional responsibilities.

5. Descriptions of the equipment, instrumentation, and facilities used to support the operation of the Radiation Safety Program.

3.0 ISSUES

The issues discussed in this section are a result of review of: (1) the December 1988 FSAR; (2) the May 1989 revision to the FSAR; (3) selected procedures from the WIPP Radiation Safety Manual (Ref. 3); and (4) the DOE/WPO responses to EH comments (Appendix B). Observations of the actual implementation of the Radiation Protection Program were made during the EH Readiness Review Inspection (RRI) conducted on May 8-15, 1989 (Ref. 4).

Review of Section 6.1 of the FSAR identified that descriptions of facility source terms, facility design relevant to radiation protection, and of the Radiation Protection Program itself were adequate, except as discussed below. In response to the EH comments, several revisions were incorporated into the May 1989 version of the FSAR. These are:

(a) The updating of the references and definitions included in Section 6.1 to reflect DOE Order 5480.11.

(b) The addition of specific information (detector type, range, alarm set points) relative to radiation protection instrumentation.

(c) The provision of clarifications as to respiratory protection program commitments to industry standards.

Several issues identified during the initial FSAR review were followed up during the EH RRI and are discussed below:

1. The information relative to the Radiation Safety Administrative Organization was deemed deficient in that it did not include: an organizational chart depicting all positions in the Radiation Safety Organization, minimum position qualification requirements for the Radiation Safety Organization, and a reference to the stop-work authority of the organization.

   Resolution:

   FSAR Subsection 6.1.5.2, Administrative Organization, and the accompanying Figure 6.1-14 were expanded to provide additional information related to the organization and managerial responsibilities of the Radiation Safety (RS) organization.

   Position qualification requirements for the RS manager are specified in FSAR Subsection 9.1.3; a specific reference to this subsection was added to Section 6.1. A commitment to specific position qualification requirements for other members of the RS staff was not included in the FSAR; however, these requirements are contained in RS position descriptions (see SER Section 9.1).

   A statement describing adequate stop-work authority for the RS staff was added to the FSAR.

   These responses are acceptable and the FSAR issue is closed.

During the RRI Review (Ref. 4), additional concerns with RS position vacancies and a lack of operational health physics experience among several members of the staff were identified (Ref. 4, Finding C-2.1, C-2.2). These items were evaluated as requiring resolution prior to waste receipt and will be tracked by the RRI report.

2. A concern was noted with the May 1989 revision to the FSAR Subsection 6.1.5.2, which discusses RS responsibilities in implementing the radiation worker training program. The December 1988 FSAR clearly specified biennial re-qualification for radiation workers, which meets DOE Order 5480.11 requirements. The May 1989 revision to the FSAR requires biennial re-qualification only for health physics technicians.

   Resolution:

   Westinghouse staff subsequently submitted a revised FSAR Subsection 6.1.5.2, dated June 1989, which re-institutes the biennial re-qualification requirement for radiation worker training. This response is acceptable and the issue is closed.

3. EH review of the locations of the Continuous Air Monitoring System (CAM) monitors raised a concern relative to the ability of the three CAMs in the large CH Receiving Area to effectively sample the air volume and whether additional portable air sampling in this area would be provided. During the EH RRI review of this area, more general concerns related to CAM system location, representativeness, sample collection efficiency, and effects of salt-loading were identified. The overall issue of CAM system adequacy was identified during the EH RRI as an item requiring resolution prior to TRU waste receipt.

Resolution:

Additional studies are being performed to validate CAM location, representativeness, collection efficiency and the effects of salt loading.

The issue of CAM system adequacy (which encompasses the specific EH FSAR review concern) remains open for the RRI and will be tracked by the RRI report (Ref. 4). As this issue will require onsite review as part of the RRI follow-up, it is considered closed for the SER. Final resolution of this issue will be reflected in the FSAR as necessary.

4. Review of FSAR Subsections 6.1.3.2, 6.1.5.3, and 6.1.5.4 found that the commitments contained in the FSAR relative to the respiratory protection and internal and external exposure monitoring programs are appropriate. Review of procedures referenced for implementation of these commitments, however, along with review of program and procedure status during the RRI, identified that formal, proceduralized programs for internal and external exposure monitoring are not in place and the existing respiratory protection procedures require upgrading.

   Resolution:

   Since these issues involve detailed implementation procedures, they are considered closed for the SER. They were, however, evaluated as requiring resolution prior to waste receipt and remain open for the RRI. They will be tracked by the RRI report (Ref. 4).

5. Justification was requested for the magnitude of the contamination levels assumed in the routine releases source term (FSAR Subsections 6.1.2.2, 6.1.6.1). The reference cited in the FSAR (Ref. 5) did not appear relevant and did not support the conclusions of the FSAR.

Resolution:

The DOE/WPO written response (Appendix B) to the subject comment provided several revisions to the FSAR Subsection 6.1.6.1 to provide additional justification. Reference 5 was deleted from the FSAR. In addition, EH reviewed FSAR Appendix 6A, titled "Calculation of Airborne Concentrations and Releases", which had not originally been provided. Review of the document confirmed that source term assumptions related to contamination levels are adequately conservative. The response is acceptable and this issue is closed.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSION

The revised May 1989 revision to the FSAR (in conjunction with the June 1989 revision noted in Issue 2 and the responses in Appendix B) provides an acceptable Radiological Protection Program. The description and commitments for the Radiation Protection Program are adequate to provide an appropriate level of radiological controls and protection for the worker. The concerns relative to implementation of this program noted in the RRI (i.e., Issues 1, 3 and 4 above) are being tracked and followed-up as part of the EH RRI process. With resolution of these issues modifications to the FSAR may be appropriate.

REFERENCES FOR CHAPTER 6

1. U.S. Department of Energy, "Radiation Protection for Occupational Workers," DOE Order 5480.11, December 1988.

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 3.26, "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants," February 1975.

3. Westinghouse Electric Corporation, WIPP Radiation Safety Manual (WP 12-5), February 1989.

4. EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant, June 2, 1989.

5. McKinley, K.B., and J.D. McKinney, "Initial Drum Retrieval - A Final Report," TREE-1286, Idaho National Engineering Laboratory, August 1978.

CHAPTER 7 - ACCIDENT ANALYSIS

1.0 SUMMARY DESCRIPTION

This chapter of the FSAR presents analyses of all credible accidents in terms of the potential exposure to workers and to members of the public. The accidents, involving CH TRU waste, that were analyzed are:

FSAR Accident Identification No.	Description
C0	Forklift knocks TRUPACT-II off trailer -- Radiological Control Area -- Outside of WHB
C1	Vehicle collision with a shipping container -- Offloading Area
C2	Drum drops from forklift -- Inventory/Preparation Area
C3	Drum punctured by forklift -- Inventory/Preparation Area
C4	Transporter hits pallet -- Underground Storage Area
C5	Drums drop from forklift -- Underground Storage Area
C6	Other equipment punctures drum -- Underground Storage Area
C7	Spontaneous ignition within a drum -- Inventory/Preparation Area
C8	A loaded hoist cage drops down waste handling shaft -- Hoist Loading Area
C9	Diesel fire in storage array underground -- Underground Storage Area
C10	Spontaneous ignition within a drum -- Underground Storage Area

Dose assessments are presented for each accident scenario. The maximum committed effective dose equivalent to a member of the public is given as 1.7

rem for Accident C10, and the maximum committed effective dose equivalent to a worker is given as 9.2 rem for Accident C6.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section were taken from DOE Orders 5480.11, AL5481.1B, 6430.1A, WIPP-DOE-069, WTSD-TME-063, DOE/WIPP-87-005 and "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" (Ref. 1-7)

Specific acceptance criteria used to evaluate Chapter 7 were adequacy of:

1. Identification of each accident and the location in the facility where it occurs.

2. Description of the sequence of events leading to the initiation of the accident.

3. Estimates of the probability of occurrence for each accident and their basis.

4. Description of the concentration of radioactive material released from the waste container(s) as a result of the accident.

5. Description of the conditions of meteorology, topography or other circumstances considered in the analyses.

6. Analysis of the radiological effects of each accident.

7. Assessment of the consequences of each accident to persons and property on-site and off-site.

8. Identification of the mathematical or physical models employed in the analysis and the assumptions that were used.

3.0 ISSUES

The December 1988 FSAR was reviewed and requests for additional information (RAIs) were issued on April 13, 1989 (Ref. 8). Responses to these comments were discussed at the April 24-28, 1989, FSAR review meeting and were documented in Appendix B received on May 4, 1989. All RAIs were satisfactorily resolved except for seven unresolved issues which are discussed below:

1. EH identified a concern (Appendix B, Section 7.2, Comment 1) regarding the use of the average value (12.9 PE-Ci) of waste package radioactivity rather than the maximum value (1000 PE-Ci) in the accident analyses. The DOE/WPO response was that an "administrative" limit would be placed on handling drums containing more than 70 PE-Ci. Drums above this limit would be handled under increased radiation safety control.

   Separate analysis is required, based on the assumption that an administrative procedure requiring that respirators will be worn whenever the quantity exceeds 70 PE-Ci. This additional analysis should evaluate resultant worker doses for the maximum source term conditions with and without respirators, i.e., for a 69 PE-Ci drum without respirators and for a 1000 PE-Ci drum with respirators. Further, the detailed application of this administrative procedure must be addressed in the FSAR for all of the potentially exposed workers (i.e., not just the waste handlers) and for as long as the potential for exposure exists (e.g., during waste handling operations above and below ground and during long term storage).

2. EH identified a concern with the assumptions made to calculate worker doses in several of the listed accident scenarios (Appendix B, Section 7.3, Comment 2). Specifically, dose calculations assumed workers in the immediate accident area avoided all intake by exiting

the area. Doses were calculated for nearby (approximately 20 feet away) workers who were assumed to be unaware of the accident. The approach was viewed as nonconservative.

The DOE/WPO response to the above comment (Appendix B) included revising the FSAR for the aboveground accidents (C2, C3) to include calculated doses for a worker assumed to remain in the immediate accident area for two minutes. Review of these doses identified them to be lower than the doses calculated for workers 20 feet away from the accident. Discussion with DOE/WPO personnel identified the newer doses were calculated using different assumptions than those used in the previous calculations. These dose values should be recalculated for consistency with the original calculations and the FSAR should be updated with the revised values.

DOE/WPO also indicated in their response to EH comments (Appendix B) and during subsequent conversation, that additional dose calculations for workers in the immediate area of underground accidents (i.e., C4) were not necessary, as waste emplacement work is done from the upstream direction of ventilation flow. Therefore, doses already calculated in the FSAR for individuals downstream of the waste drift were sufficient. As any additional dose calculations for hypothetical immediate-area workers are already bounded by those calculated in C3, the DOE/WPO position is acceptable.

3. In accident C-7, the FSAR estimates 2×10^{-4} drum fires/year. This accident should therefore be analyzed incorporating the fire suppression systems impact on potential doses to workers.

4. In the analysis of Accident C10, it is stated that the effects are mitigated due to plateout and to the relative location of the underground worker with respect to the ventilation flow pattern and the drum fire. In order to rely on the intent of the statement "waste is emplaced downstream of the worker" a commitment to adminis-

trative requirements for mandatory respiratory protection for workers downstream from the active and open waste storage area is needed.

5. Although Section 7.1 indicates no underground release is caused by earthquakes, the discussion in Subsection 2.10.3 suggests that roof falls may be anticipated due to the weakening of the underground structure resulting from the effects of long term creep of the salt formation. Additionally, effects from either seismic disturbances or any other dynamic external event (e.g., accidents in nearby mines, etc.) may further deteriorate the stability of the underground openings (which were subjected to creep) leading to roof collapse. Therefore, the potential for this accident should be analyzed in terms of the likelihood of destroying the integrity of the stored drums by a roof fall.

6. In accident C-8 (Appendix B, Section 7.3, Comment 4), the probability calculation of a catastrophic hoist accident required further clarification. After discussions at the April 24-28, 1989 FSAR review meeting DOE/WPO responded in Appendix B that additional calculations may be required to determine the accident probability due to the differences between MSHA and WIPP in the cable system static load safety factor. EH has not received these calculations.

7. In accident C-10 (Appendix B, Section 7.3, Comment 6c), the basis of the probability analysis of fire propagation to adjacent waste containers was questioned. As a result of the April 24-28, 1989 FSAR review meeting DOE/WPO responded in Appendix B that the final probability values will be recalculated. EH has not received these calculations.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

EH has reviewed the accident analyses described in Chapter 7 and the DOE/WPO's responses to the EH RAIs (Appendix B). The accident analyses contained in Chapter 7 of the May 1989 revision to the FSAR, as supplemented by the responses in Appendix B are adequate except for the seven outstanding issues discussed above which still require resolution and incorporation into the FSAR.

REFERENCES FOR CHAPTER 7

1. U.S. Department of Energy, "Radiation Protection for Occupational Workers," DOE Order 5480.11, December 21, 1988.

2. U.S. Department of Energy, "Safety Analysis and Review System, DOE Order," AL5481.1B, January 27, 1988.

3. U.S. Department of Energy, "General Design Criteria," DOE Order 6430.1A, (Draft), December 25, 1987.

4. U. S. Department of Energy, "TRU Waste Acceptance Criteria for the Waste Isolation Plant," WIPP-DOE-069, Rev. 3, January 1989.

5. Banz, Buchberger and Rasmussen, "Probability of a Catastrophic Hoist Accident at WIPP," WTSD-TME-063, July 1985.

6. Westinghouse Electric Corporation, "Waste Drum Fire Propagation at the Waste Isolation Pilot Plant," DOE/WIPP-87-005, April 1987.

7. "Radiation Protection Guidance to Federal Agencies for Occupational Exposure," Federal Register, Vol. 52, No. 17, January 27, 1987.

8. Memorandum from H.J. Pettengill, DOE/EH, to J.B. Tillman, DOE/WPO, April 13, 1989; Subject: Final Safety Analysis Report for the Waste Isolation Pilot Plant (transmitting EH comments on Chapters 1, 3, 4, 5, 6, 7 and 11 of the WIPP FSAR).

CHAPTER 8 - LONG TERM WASTE ISOLATION ASSESSMENTS

1.0 SUMMARY DESCRIPTION

This chapter of the FSAR discusses preliminary results of the long term isolation assessments that will be performed for the WIPP Facility. The assessments will not be completed until 1992. The assessments will provide input to the decision whether to make the WIPP Facility a permanent repository for the emplaced TRU wastes or remove them. Chapter 8 was included to satisfy commitments made to the State of New Mexico. No conclusions are presented in Chapter 8 as to the adequacy of WIPP's long term waste isolation capability.

Chapter 8, and supporting references, contained insufficient information to enable EH to judge the accuracy of the calculations and the results that are reported in Chapter 8. When the assessments are complete, i.e. 1992, FSAR Chapter 8 and supporting references will need to be independently reviewed.

CHAPTER 9 - CONDUCT OF OPERATIONS

SECTION 9.1 - ORGANIZATIONAL STRUCTURE

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the organizational structure, functions, responsibilities, and authorities of the Management and Operating Contractor (MOC), Westinghouse. It also describes the Westinghouse Corporate structure for managing the WIPP activity and specifies the minimum qualifications of the general manager, staff managers, and line managers with ES&H responsibilities.

Only the MOC will have an ongoing effect on day-to-day operation of the facility. Subsection 11.1.1 discusses the organizational functions, responsibilities, and authorities of the owner, the U.S. Department of Energy (DOE), the MOC, and the Scientific Advisor, Sandia National Laboratories.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used to review this section of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants, and from DOE Orders 5480.1B, 5480.4, 5480.5, 5481.1B, and 5482.1B (Refs. 1-6).

Specific acceptance criteria used to evaluate Section 9.1 were demonstrated adequacy of:

1. The process by which management provides and maintains a technically competent and safety-oriented staff.

2. The structure, functions, and responsibilities of the organizations responsible for operation, maintenance, and safety of the facility or operation.

3. The corporate organization, including the organization chart, management, engineering, and technical support organizations, and supported by organization charts. Also included are the corporation's technical staff supporting the engineering and operation of the WIPP.

4. The line of succession of authority and responsibility for overall facility operation.

5. The organizational arrangement for assessing safe operation and the interface between safety and operations.

6. An organizational chart which shows the titles, hierarchy of authority, and areas of responsibility.

7. The qualification requirements for the technical staff supporting design, construction, operation, and maintenance.

3.0 ISSUES

1. The December 1988 FSAR did not describe the corporate functions, responsibilities, and authorities with respect to plant engineering and design, construction, quality assurance, testing, and operation.

Resolution:

The May 1989 revision to the FSAR included a section describing the corporate management structure as it relates to the WIPP facility. The description in this section substantiates the substantive breadth and level of experience for management of the project as well as adequate technical and scientific manpower to implement project operation. The response is acceptable and the issue is resolved.

2. The December 1988 FSAR did not specify the minimum qualification requirements for all plant operating, technical, and maintenance support personnel.

   Resolution:

   The May 1989 revision to the FSAR specified the additional minimum qualifications for line managers with ES&H responsibilities and provides a commitment to develop position descriptions for all permanent staff positions within the MOC organization at WIPP. During the Readiness Review Inspection (RRI) EH reviewed a sample of the position descriptions and found them to be adequate. The issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable organizational structure to operate WIPP.

SECTION 9.2 - START-UP TESTING AND PREOPERATIONAL CHECKOUT

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the Start-up Testing and Preoperational Checkout Program and specifies: program objectives, administrative procedures for conducting the program, vendor testing, preoperational checkout, and the ongoing evaluation and testing.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants, and from DOE Orders 5480.1B, 5480.4, 5480.5, 5481.1B, and 5482.1B (Refs. 1-6).

Specific acceptance criteria used to evaluate Section 9.2 were demonstrated adequacy of:

1. The preoperational and operational inspection and testing program and that it provides assurance that equipment, components, and structures are capable of meeting safety requirements.

2. The organization and management system responsible for assuring that periodic testing of components related to safety is performed as required by Operational Safety Requirements (OSRs).

3. The system used for preparing, reviewing, approving, and executing all testing procedures and instructions and for evaluating, documenting, and approving the test results provide a reference to the document with this information.

4. The test objectives and the general methods for accomplishing these objectives. The acceptance criteria used to evaluate the test results enumerate general prerequisites for performing the tests, including special conditions to simulate normal and abnormal operating conditions of the tests listed.

5. The response and acceptance criteria expected in terms of design bases and criteria contained in the FSAR.

3.0 ISSUES

1. The December 1988 FSAR did not provide a list of all the equipment and systems designed for the WIPP facility with corresponding test procedures that will be used prior to receipt of CH TRU wastes.

   Resolution:

   The May 1989 revision to the FSAR referenced the revised Table 3.1-8 that includes a list of all the equipment and systems. A listing of the corresponding test procedures was provided and is included as Appendix J. The response is acceptable and this issue is resolved.

2. The December 1988 FSAR did not provide sufficient information to allow review against Acceptance Criteria No. 5.

Resolution:

Due to the number of official test procedures for CH systems (65) and corresponding test criteria and prerequisites, it was agreed by EH that providing a reference to the Start-up Program Procedures in the FSAR would be adequate. The required reference was made in the May 1989 revision to the FSAR, Additionally, the following nine procedures were reviewed by EH and found acceptable: TP-014-036, TP-017-004A, TP-017-004B, TP-019-008, TP-019-010, TP-019-017, TP-017-038, TP-019-011, TP-009/010-013 (Refs.9-17). The issue is resolved.

3. The December 1988 FSAR did not provide sufficient information to allow review against Acceptance Criteria No. 3.

Resolution:

The May 1989 revision to the FSAR, referenced the required Start-up Program Procedures, WP 03-001, WP 03-005, WP 03-006, and WP 03-007 (Refs. 18-21). EH has agreed that the references are adequate and the issue is resolved.

4. The December 1988 FSAR did not provide sufficient information to allow review against Acceptance Criteria No. 2.

Resolution:

Subsection 9.2.5 was added to the May 1989 revision to the FSAR, This section discusses the ongoing evaluation and testing program. The OSR equipment that is subjected to periodic operability checks to ensure that operating parameters are within the range allowed is discussed in the Operational Safety Requirements Administration Manual (Ref. 22). This Manual is referenced in the May 1989 revision to the FSAR, In addition, references to the preventive maintenance and calibration system are discussed in this new section. The

response is acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The revised May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable Start-up Testing and Preoperational Checkout Program for WIPP.

SECTION 9.3 - TRAINING PROGRAM

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the General Training, Radiation Worker Training, Miner Training and Qualification Training Programs. It also discusses the administration and record keeping requirements as they relate to the various training programs.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants, and from DOE Orders 5480.1B, 5480.4, 5480.5, 5481.1B, and 5482.1B (Refs. 1-6).

Specific acceptance criteria used to evaluate Section 9.3 were adequacy of:

1. The description of the proposed training program, including the scope of training in plant operations and design, instrumentation and control, methods of dealing with process malfunctions, decontamination procedures, and emergency procedures; in health physics, subjects such as nature and sources of radiation, methods of controlling contamination, interactions of radiation with matter, biological effects of radiation, and use of monitoring equipment.

2. The description of the program for continued training through presentation of additional materials and refresher training.

3. Identification of personnel in the organization responsible for the training programs and for maintaining up-to-date records on the status of trained personnel, training for new employees, and refresher or upgrading training of present personnel.

3.0 ISSUES

1. The radiation safety training elements are referenced in the December 1988 FSAR in Subsection 6.1.5.4 of the FSAR and Section 3 of the WIPP Radiation Safety Manual, Rev. 1, (Ref. 23). These training elements do not include an element on the use of monitoring equipment.

   Resolution:

   Subsection 6.1.5.4 of the May 1989 revision to the FSAR added a reference to the Radiation Worker Training that includes an acceptable training element on radiation survey instrumentation. The issue is resolved.

2. The December 1988 FSAR did not include a summary of the training requirements for visitors, subcontractors, etc., as required by DOE Order 5480.5 (Ref. 4).

   Resolution:

   In addition to employees at the WIPP Facility, the May 1989 revision to the FSAR included reference to visitors and subcontractors and specified the section of the WIPP Training Program Manual, WP 14-1 (Ref. 24) which meets the training requirements of DOE Order 5480.5 (Ref. 4). The response is acceptable and this issue is resolved.

3. The December 1988 FSAR did not include a summary description of the proposed retraining program.

   Resolution:

   The May 1989 revision to the FSAR referenced, in Subsection 9.3.4, the sections of the WIPP Training Program Manual (Subsections 3.4.6, 7 and 8) that details an acceptable retraining program. The issue is

resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides an acceptable training program for WIPP.

SECTION 9.4 - NORMAL OPERATIONS

1.0 SUMMARY DESCRIPTION

This section of the FSAR describes the operating procedures for operations involving radioactive material, hazardous operations, and system testing and inspection; operational occurrences; and plant records.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 (Ref. 1), DOE Orders 5480.1B, 5480.4, 5480.5, 5481.1B (Refs. 2-5), DOE Orders 1324.2, 5484.2 and 5000.3 (Refs. 25-27).

Specific acceptance criteria used to evaluate Section 9.4 were adequacy of the description of the:

1. Process in which operating, maintenance, and testing procedures are developed, reviewed, approved, implemented, and changed. Provide details for procedures relating to hazardous operations. Indicate organizational responsibility for developing, approving and updating procedures.

2. Management system for maintaining historical records associated with operation of the plant, maintenance, QA records, modifications, abnormal occurrences, radioactive releases and environmental surveys.

3.0 ISSUES

1. The December 1988 FSAR did not provide the necessary information to validate Acceptance Criteria No. 2.

   Resolution:

   The May 1989 revision to the FSAR references the Operations Administration Manual, WP 04-3 and the WIPP Procedures Manual, WP 15-030 (Refs. 28 and 29) in Subsection 9.4.5. These manuals describe the proper dispositioning of records associated with the areas identified in Acceptance Criteria No. 2 as identified by DOE Order 1324.2 (Ref. 25). The QA aspects of record keeping are discussed in Section 11.17 of the FSAR. The response is acceptable and this issue is resolved.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides acceptable operating procedures for operations involving radioactive material, hazardous operations, and system testing and inspection; operational occurrences; and plant records.

REFERENCES FOR CHAPTER 9

1. U.S. Nuclear Regulatory Commission, Regulatory Guide 3.26, "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants," February 1975.

2. U.S. Department of Energy, "Environment, Safety, and Health Program for Department of Energy Operations," DOE Order 5480.1B, January 23, 1989.

3. U.S. Department of Energy, "Environmental Protection, Safety, and Health Protection Standards," DOE Order 5480.4, May 15, 1984.

4. U.S. Department of Energy, "Safety of Nuclear Facilities," DOE Order 5480.5, September 23, 1986.

5. U.S. Department of Energy, "Safety Analysis and Review System," DOE Order 5481.1B, September 23, 1986.

6. U.S. Department of Energy, "Environment, Safety, and Health Appraisal Program," DOE Order 5482.1B, September 23, 1986.

7. Memorandum from H.J. Pettengill, (USDOE/EH) to J.B. Tillman, (DOE/WPO), "Final Safety Analysis Report (FSAR) for Waste Isolation Pilot Plant (WIPP)," (transmitting EH comments on Chapters 2, 8, 9, 10, and 12), March 29, 1989.

8. U.S. Department of Energy, "EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant," dated June 2, 1989.

9. Westinghouse Electric Corporation, WIPP Start-up Test Program, TP-014-036, Startup Test Procedure for: "Final CH Area HVAC Operations Test," Revision 0, May 27, 1988.

10. Westinghouse Electric Corporation, Start-up Test Procedure TP-017-004A, "Surface Facilities Seismic System," Revision 1, September 1988.

11. Westinghouse Electric Corporation, Startup Test Procedure TP-017-004B, "Underground Seismic System," Revision 1, September 1988.

12. Westinghouse Electric Corporation, Startup Test Procedure TP-019-008, "Underground Ventilation System Integrated Test," Revision 0, August 1988.

13. Westinghouse Electric Corporation, Startup Test Procedure TP-019-010, "Underground Booster Fan Interlocks and Controls," Revision 0, September 1988.

14. Westinghouse Electric Corporation, Startup Test Procedure TP-019-017, "Effluent Monitoring Skid Vacuum Pump Test," Revision 0, March 1989.

15. Westinghouse Electric Corporation, Startup Test Procedure TP-017-038, "Bulkhead Doors," Revision 0, September 1988.

16. Westinghouse Electric Corporation, Startup Test Procedure TP-019-011, "Underground Ventilation System Testing and Balancing," Revision 0, November 1988.

17. Westinghouse Electric Corporation, Startup Test Procedure TP-009/010-13, "Diesel Generator 1 & 2 (Load Test and Permissive Circuitry)," Revision 0, April 28, 1989.

18. Waste Isolation Pilot Plant Procedure WP 03-001, "Initiating, Executing, Revising and Cancelling Startup Test Procedures," Revision 4, March 31, 1989.

19. Waste Isolation Pilot Plant Procedure WP 03-005, "Startup Testing Documents/Records Control," Revision 1, April 28, 1989.

20. Waste Isolation Pilot Plant Procedure WP 03-006, "Qualification and Certification Requirements for Startup Testing Personnel," Revision 1, November 30, 1988.

21. Waste Isolation Pilot Plant Procedure WP-03-007, "Startup Testing: Open Items Tracking/Completion," Revision 1, March 22, 1989.

22. Waste Isolation Pilot Plant Procedure WP 04-7, "WIPP Operational Safety Requirements Administration Manual," Revision 0, March 2, 1989.

23. Waste Isolation Pilot Plant Procedure WP 12-5, "WIPP Radiation Safety Manual," Revision 2, February 1989.

24. Waste Isolation Pilot Plant, WP 14-1, "WIPP Training Program Manual," Revision 6, October 19, 1988.

25. U.S. Department of Energy, DOE Order 1324.2A, "Records Disposition," September 13, 1988.

26. U.S. Department of Energy, DOE Order 5484.2, "Unusual Occurrence Reporting," August 13, 1981.

27. U.S. Department of Energy, DOE Order 5000.3, "Unusual Occurrence Reporting System, November 7, 1984.

28. Waste Isolation Pilot Plant Procedure WP 04-3, "Operations Administration Manual," Revision 0, September 23, 1988.

29. Waste Isolation Pilot Plant Procedure WP 15-030, "Records Management," Revision 1, June 30, 1987."

CHAPTER 10 - OPERATIONAL SAFETY REQUIREMENTS

The principal results of EH's review of Chapter 10 of the FSAR (Ref. 7) are contained in Section 10.2 of this SER. Although all sections of the FSAR Chapter 10 were reviewed, only Section 10.2 of the May 1989 revision to the FSAR is discussed below (Section 10.2 of the December 1988 FSAR was deleted and Section 10.3 "Limiting Conditions for Operation," was renumbered to become Section 10.2). Section 10.1 contained an introduction which had no relevant technical information.

EH comments on Section 10.3, "Surveillance Requirements," were addressed by the WIPP, where appropriate, in Subsection 9.2.5 of Chapter 9. No changes to Section 10.3 were made as a result of EH comments, and none were deemed necessary.

EH comments on Sections 10.4, 10.5, and 10.6 were either minor in nature, or were requests for additional technical information. Such information was needed to enable a sufficient EH on-site Readiness Review Inspection, but did not require FSAR changes. No substantial changes to FSAR Sections 10.4, 10.5, and 10.6 were made by the WIPP as a result of EH comments and none were deemed necessary.

SECTION 10.2 - LIMITING CONDITIONS FOR OPERATION

1.0 SUMMARY DESCRIPTION

The purpose of this section of the FSAR is to specify the Limiting Conditions for Operation (LCOs) of WIPP equipment required to assure protection of employees, the environment, and the public. Each LCO contains a statement of the limiting condition and a required action statement (usually suspension of waste handling activities within 15 minutes). A violation is defined as exceeding the limiting condition and not accomplishing the required action.

Section 10.2 contains LCO's for: (1) Continuous Air Monitors (CAMs) (in five locations), (2) effluent monitors (in three locations), (3) Area Radiation Monitors (ARMs) (in 11 locations), (4) differential pressure monitors (in four above ground locations and one underground location), (5) filtration systems (two above ground areas and one underground), (6) backup electrical system, (7) fire detection and alarm systems (three areas), and (8) fire suppression systems (three areas).

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this section of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants, and from DOE Orders 5480.1B, 5480.4, 5480.5, 5481.1B and 5482.1B (Refs. 1-6).

Specific acceptance criteria used to evaluate Chapter 10 were adequacy of:

1. Monitoring equipment and local alarms for direct radiation exposure of personnel in areas where radioactive waste is stored or handled.

2. Monitoring equipment and local alarms for detection of airborne radiation in areas where radioactive waste is stored or handled.

3. Monitoring equipment and alarms for monitoring pressures within areas where radioactive waste is stored or handled to assure no leakage into the environment.

4. Monitors and alarms for airborne radioactive effluents released into the environment from areas where radioactive waste is stored or handled to assure releases are within limits.

5. Capability to monitor air flows through filtration systems to protect workers, the environment and the public.

6. Systems for fire detection, fire alarms, and fire suppression for worker and public safety, and for the protection of DOE's investment.

3.0 ISSUES

1. The December 1988 FSAR indicated that a satisfactory condition resulted even when a limiting condition was exceeded provided that the required action was taken. The required action was, in most cases, the suspension of waste handling operations. Thus, violations could nearly always be prevented by merely suspending waste handling operations. The FSAR was not specific about who could authorize resumption of waste handling activities. According to the operating procedures, waste handling operations could be suspended by the operating contractor for an indefinite time period whenever a limiting condition was encountered. However, DOE would not necessarily be notified of the resulting suspension of waste handling operations or involved in any way in the resumption of waste handling activities.

   Resolution:

   The May 1989 revision to the FSAR specified who has the authority to suspend and resume waste handling operations in response to exceeding a limiting condition. The FSAR also now requires that DOE (the DOE WIPP duty officer) be notified of such suspensions and resumptions. DOE does not routinely concur in the resumption of waste handling activities. The issue is resolved.

2. The December 1988 FSAR indicated that only one CAM was required to be operational at each of the five locations in the Waste Handling Building and remote monitoring was not required. EH was concerned

that sufficient consideration may not have been given to redundancy and central monitoring.

Resolution:

The May 1989 revision to the FSAR committed to CAMs at each location in the Waste Handling Building that are monitored at the Central Monitoring Station and to maintain operable backup equipment in the event of a CAM failure. This change adequately resolves the issue.

3. To assure that all leakage would be inward the pressures in various areas must be maintained negative. EH was concerned about the lack of commitment to central station monitoring of these pressures.

   Resolution:

   The May 1989 revision to the FSAR committed to remote monitoring of differential pressures in critical areas. This resolves the issue.

4. The December 1988 FSAR required set points of one atmosphere for several of the differential pressure monitors (Overpack and Repair Room, Hot Cell, RH High Bay, and CH Receiving Bay). EH expressed a concern in the request for additional information (Ref. 7) that it would not be possible to insure all leakage would be inward with such set points. The monitors have some inaccuracies and thus it would be possible for pressures in these areas to rise slightly above atmospheric, resulting in outleakage, without sounding an alarm.

CHAPTER 11 - QUALITY ASSURANCE

1.0 SUMMARY DESCRIPTION

This section of the FSAR summarizes the Quality Assurance Program for the WIPP Facility Operation. The Quality Assurance Program commits to compliance with ANSI/ASME NQA-1 1986 "Quality Assurance Program Requirements for Nuclear Power Facilities" (Ref. 8) as required by DOE Order 5700.6 (Ref. 3) and DOE-AL Order AL5700.6 (Ref 4).

Several revisions of the WIPP FSAR Quality Assurance chapter have been reviewed (November 1988, December 1988, and February 1989). The first two reviews generated a number of substantial comments which were transmitted to WIPP in Ref. 1. In order to resolve outstanding issues, a meeting was held on January 17, 1989 and most of the remaining issues were resolved. The meeting results are reported in Ref. 2. Subsequently, a revision of Chapter 11, received on February 13, 1989, incorporated the comment resolutions. Four key issues still remain and are discussed below.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used to review this section of the FSAR were taken from DOE Orders and recommended practices (Refs.3-5, 11).

Specific acceptance criteria used to evaluate this section of the FSAR were:

1. The Quality Assurance Organization is responsible for performing verification of work using persons who are not directly responsible for performing the work.

2. The responsible Quality Assurance authority shall have direct access to responsible management at a level where appropriate action can be effected for resolution of quality problems.

3. Those responsible for quality assurance shall report to a management level that will provide required authority and organizational freedom to resolve problems effectively and be independent of production and cost considerations.

4. External interfaces between organizations and internal interfaces between organization units are described to effect efficient management.

5. The Quality Assurance Program requires technical and quality assurance indoctrination, training and retraining programs to assure that persons involved in "important to safety" items and activities are knowledgeable in technical and quality assurance requirements and instructions and demonstrate a high level of competence and skill in the performance of their activities.

3.0 ISSUES

1. Review of Chapter 11 of the Draft FSAR dated November 15, 1988, version identified the following deficiencies: (1) a lack of sufficient independence for the QA Organization, (2) a lack of adherence to the intent of the ANSI/ASME NQA-1 Supplements, (3) a lack of an adequate design control program, (4) an inconsistent approach for the evaluation of "Important to Safety" items and services, (5) a lack of training, qualification and certification of audit, inspection, and test personnel and (6) no training and indoctrination programs.

Resolution:

DOE/WPO substantially revised the Draft and reissued it in December, 1988. The review of this revision revealed a lack of specific information as to "how" the policies of ANSI/ASME NQA-1 were to be

implemented. The requirements of ANSI/ASME NQA-1 were quoted but no description of how they would be implemented was provided. Although there was improvement in most areas, the Quality Assurance Program still lacked: (1) identification of the responsible Quality Assurance authority and its place in the WIPP Organization Structure, (2) interface requirements between the three major participants, (3) responsible authority and commitment for a Training and Indoctrination Program, (4) specific commitment(s) for review and approval of procurement documents, (5) a requirement for receipt inspection and the option of using source inspection to accept procured items or services, (6) the specifics for waste material receipt inspection at the site, (7) responsibilities for the processing and storage of radioactive waste materials, (8) test procedure requirements, (9) handling and storage requirements for radioactive waste materials, (10) responsibilities for nonconformance control, and (11) qualification and certification of audit personnel.

A meeting was held on January 17-18, 1989, with EH, DOE/WPO and BNL participants with the intended purpose to resolve the remaining open issues (Ref. 2). While most items were resolved at this meeting, the following key issues could not be resolved: (1) the inadequacy of the DOE/WPO Quality Assurance Organization in terms of the number of personnel and reporting level, and (2) the lack of clearly defined external and internal interface controls between the three project participants at the WIPP site.

These issues remain open.

2. A Quality Assurance issue that became apparent during the April 24-28, 1989, FSAR review meeting was the failure to adequately transfer knowledge of facility design bases (Ref. 13) to either DOE or the operating contractor.

DOE and operating contractor staff engineer(s) were not fully knowledgeable of the details of the WIPP designs, the design calculations, specifications and drawings (as-built, shop, etc.). It is therefore unlikely that issues pertaining to the design bases, design calculations, structures, etc., and related quality control can be adequately addressed.

Resolution:

This remains an open issue.

3. An additional Quality Assurance issue, which was confirmed during the Readiness Review Inspection, deals with the lack of contractual authority on the part of the DOE/WPO Project Manager to direct the work of project participants and to stop unsatisfactory work.

Resolution:

This remains an open issue.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides for an acceptable QA program with the exception of the three open issues discussed above.

6.0 REFERENCES

1. Memorandum, EH-332, E.F. Branagan, Jr. (DOE-EH) to J. Tillman (DOE/WPO), December 9, 1989; Subject: Review of Waste Isolation Pilot Plant Quality Assurance.

2. FSAR Chapter 11, Comment Resolutions, January 11, 1989 (with January 17 and 18 meeting results), 22 pages.

3. U. S. Department of Energy, "Quality Assurance," DOE Order 5700.6, September 23, 1986.

4. U. S. Department of Energy, "Quality Assurance," DOE/AL Order AL5700.6, September 23, 1986.

5. U. S. Department of Energy, "Records Disposition," DOE Order 1324.2, September 13, 1988.

6. U. S. Department of Energy, "Operation Quality Assurance Program Plan," DOE/WIPP 87-007, February 4, 1988.

7. U. S. Department of Energy, "Quality Assurance Requirement for Certification of TRU Waste for Shipment to the Waste Isolation Pilot Plant," DOE/WIPP-120.

8. American National Standards Institute, ANSI/ASME NQA-1-1986, Quality Assurance Program Requirements for Nuclear Power Facilities, 1986.

9. Sandia National Laboratories, Waste Management Technology Department, Waste Isolation Pilot Plant Quality Assurance Program Plan, February 1, 1988.

10. Westinghouse Waste Isolation Division, "Quality Program Manual," April April 29, 1988.

11. American Society of Nondestructive Testing, Recommended Practice SNT-TC-IA, (Intended for Certification of Nondestructive Testing Personnel), 1984.

12. Letter, M. Reich (BNL) to O. Thompson (DOE/EH), December 7, 1988; Subject: WIPP FSAR, Chapter 11.

13. Memorandum, S. Olinger (DOE/EH) to J.P. Knight and H.J. Pettengill (DOE/EH), May 4, 1989; Subject: Trip Report, WIPP Onsite Review of the FSAR, April 24-28, 1989.

CHAPTER 12 - DECONTAMINATION AND DECOMMISSIONING OF THE WIPP FACILITY

1.0 SUMMARY DESCRIPTION

This chapter of the FSAR describes the decontamination and decommissioning (D&D) commitments both at the end of the five year Pilot Plant Phase (Test Phase) and the operating life of 25 years. The chapter also discusses the D&D design features and activities, the closure, monuments, and records, and the post closure physical and environmental surveillance requirements.

At this time, EH's review is concerned only with the D&D commitments associated with the completion of the five year Test Phase. Additional safety analysis will be written if, at the end of the Test Phase, the WIPP is determined to be an acceptable waste repository and if the Test Phase period is extended.

2.0 ACCEPTANCE CRITERIA

Acceptance criteria used for review of this chapter of the FSAR were taken primarily from the USNRC Regulatory Guide 3.26 for nuclear fuel reprocessing plants, and from DOE Orders 5480.5, 5820.2, 6430.1A (Refs. 1-4).

Specific acceptance criteria used to evaluate Chapter 12 were the adequacy of:

1. Commitments to decontaminate and decommission (D&D) the WIPP Facility at the end of the Test Phase.

2. Consideration in the WIPP design and operations of the need to facilitate decontamination of structures and equipment, reduce radiation exposure to workers and the general public, minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials if the WIPP requires permanent decommissioning at the end

of the Test Phase.

3. The plan for retrieval of wastes at the end of the Test Phase that includes a review by independent peers.

3.0 ISSUES

1. The December 1988 FSAR did not discuss the commitment and provisions to D&D the WIPP Facility at the end of the Test Phase, if WIPP is determined to be unacceptable as a waste repository.

   Resolution:
   The response (Appendix B) to this item consists of a commitment to provide detailed information on D&D features in the D&D plan. In addition, the RAI item in Section 3.1 of Reference 6 requires a design criteria comparison of the WIPP design criteria to criteria in DOE Order 6430.1A (Ref. 4). The response is acceptable but until the D&D plan is completed and determined acceptable, this issue is open.

2. The December 1988 FSAR did not identify minimum elements of the conceptual D&D plan for the end of the Test Phase. Refer to Ref. 5, Question No. 1 in Section 12.3.

   Resolution:

   The response to Issue No. 1 above also applies to this issue in that WPO commits to a detailed D&D plan part of its overall waste retrieval plan. The response is acceptable but until the D&D plan is completed and determined to be acceptable, this issue is open.

3. The December 1988 FSAR did not include a commitment to issue a retrieval plan prior to start-up.

Resolution:

The May 1989 revision to the FSAR now includes Section 12.6 that describes DOE's commitment to maintaining retrieval for wastes emplaced during the Test Phase. The subsection describes specific measures to assure retrievability, however, this is not a detailed plan. WPO is preparing a detailed retrieval plan which will be completed prior to start of the Test Phase. A memorandum from Jack B. Tillman to Bill C. Moffitt is included in Appendix B and identifies the minimum characteristics to be included in the waste retrieval plan. The response is acceptable but until the retrieval plan is completed and determined to be acceptable, the issue is open.

4.0 REQUESTS FOR ADDITIONAL INFORMATION

There are no new or outstanding RAIs.

5.0 CONCLUSIONS

The May 1989 revision to the FSAR, as supplemented by the responses in Appendix B, provides acceptable D&D commitments, providing the retrieval and D&D plans are issued and confirmed to be acceptable prior to emplacement of waste.

REFERENCES FOR CHAPTER 12

1. U.S. Nuclear Regulatory Commission, Regulatory Guide 3.26, "Standard Format and Content of Safety Analysis Reports for Fuel Reprocessing Plants," February 1975.

2. U.S. Department of Energy, "Safety of Nuclear Facilities," DOE Order 5480.5, September 23, 1986.

3. U.S. Department of Energy, "Radioactive Waste Management," DOE Order 5820.2A, September 26, 1988.

4. U.S. Department of Energy, "General Design Criteria," DOE Order 6430.1A, April 6, 1989.

5. Memorandum, H.J. Pettengill, DOE-EH to J.B. Tillman, DOE-WPO, "Final Safety Analysis Report (FSAR) for Waste Isolation Pilot Plant (WIPP)," (transmitting EH comments on Chapters 2, 8, 9, 10, and 12), March 29, 1989.

6. Memorandum, H.J. Pettengill, DOE-EH to J.B. Tillman, DOE-WPO, "Final Safety Analysis Report for the Waste Isolation Pilot Plant (WIPP)," (transmitting EH comments on Chapters 1, 3, 4, 5, 6, 7 and 11), April 13, 1989.

ENCLOSURE 2

DOE F 1325.8 (8-89)

United States Government

Department of Ene

memorandum

RECEIVED JAN 26 1990

DATE: JAN 16 1990

REPLY TO ATTN OF: EH-332

SUBJECT: Supplement to Safety Evaluation Report for Waste Isolation Pilot Plant (WIPP)

TO: Jill Lytle, EM-30

The Office of the Deputy Assistant Secretary for Safety, Health and Quality Assurance (EH-30) has completed its review of the WIPP Project Office's responses to the 23 open items reported in our WIPP Safety Evaluation Report (SER) of July 27, 1989. As a result of the Project's commitments to change the WIPP Final Safety Analysis Report (FSAR), all 23 items are closed, subject to final documentation in the FSAR document.

As you know, the Project needs to issue the Experimental Plan for the Test Phase, the Retrieval Plan, and the Decontamination and Decommissioning Plan for WIPP. We consider each of these documents, and the corresponding amendments to the SAR to be important to safety. In our opinion, the review process for these documents and the corresponding SAR amendments should follow a process similar to that utilized by EH for the SAR review.

We also plan to complete a supplement to the Readiness Review Inspection (RRI) report in the near future. With completion of the FSAR review and RRI report by EH, it appears appropriate to begin the coordination necessary for transition to EM nuclear safety oversight of WIPP, in accord with SEN-6 directives. You should be aware that many of the EH staff active in WIPP review efforts to date have moved to other DOE elements as part of the overall realignment of nuclear safety responsibilities; others are likely to move in the not too distant future. Please let me know when you are ready to discuss these matters.

Attached is a copy of Supplement 1 to the SER.

Joseph E. Fitzgerald Jr.

Joseph E. Fitzgerald, Jr.
Acting Deputy Assistant Secretary
Safety, Health and Quality Assurance

Attachment

cc w/attachment: See List

SUPPLEMENT 1 TO SAFETY EVALUATION REPORT

FOR

WASTE ISOLATION PILOT PLANT

Prepared Under the Direction of — Edward F. Bonnagen Jr. for Carl Newton, EH-332

Reviewed By — Edward F. Bonnagen Jr. for Harry J. Pettengill, EH-332

Reviewed By — James P. Knight, EH-33

Approved By — Joseph E. Fitzgerald, Jr., EH-30 — Date

TABLE 1 - SUMMARY OF EH EVALUATION

ITEM NO.	DESCRIPTION OF ITEM	FSAR CHANGE REQUIRED*	FOLLOW-UP ACTION REQUIRED**
1	QA Resources and Authority & Organizational Interfaces	Yes	Yes
2	Operating Contractor Understanding of Facility Design	No	Yes
3	Project Manager's Stop Work Authority	Yes	No
4	Overstressed Columns in Waste Handling Building	No	No
5	Design Bases for Electrical System Not Specified	Yes	Yes
6	Diesel Generator Starting	Yes	No
7	UPS Loads	Yes	No
8	Battery Testing	No	Yes
9	Remote Diesel Startup	Yes	Yes
10	Room Monitoring for Structural Stability	Yes	Yes
11	Retrieval and D&D Plan	No	Yes
12	Additional Radiological Analyses Needed	Yes	No
13	Recalculation of Worker Doses	Yes	No
14	Re-evaluation of Drum Fires Accident	Yes	No
15	Respiratory Mask Requirement for Downstream Workers	Yes	Yes
16	Evaluate Underground Roof Falls	No	No

DOE F 1325.8
(8-89)
EFG (07-90)

ENCLOSURE 3

United States Government

Department of Energ

memorandum

DATE: MAR 08 1991

REPLY TO ATTN OF: EH-332

SUBJECT: Completion of the Office of Environment, Safety and Health (EH) Supplemental Safety Evaluation Report (SER) for the Waste Isolation Pilot Plant (WIPP) Final Safety Analysis Report (FSAR)

TO: Jill E. Lytle, EM-30

Attached is Supplement 2 to the EH Safety Evaluation Report for the WIPP FSAR (Revision 0, May 1990). Supplement 2 documents the resolution of the remaining outstanding items from the original FSAR review dated July 27, 1989, and Supplement 1 dated January 16, 1990. All issues have been closed and the EH review effort in this area has been completed.

EH safety evaluations of the WIPP Readiness Review Inspection and the FSAR Addendum will be provided separately.

This review was conducted by the Office of Safety Appraisals within the Office of Safety and Quality Assurance. Any questions concerning this report should be referred to Thomas McSpadden, Safety Technology Division, on extension (3-5656).

Joseph E. Fitzgerald, Jr.
Deputy Assistant Secretary
Safety and Quality Assurance

Attachment

cc w/attachment:
Paul L. Ziemer, EH-1
Peter N. Brush, EH-2
Mark Frei, EM-34
Robert W. Barber, EH-36
Oliver D. T. Lynch, Jr., EH-331
Harry J. Pettengill, EH-40
John J. Schinkle, AL/SPD
Arlen Hunt, WPO
Nolan Bailey, AL/SPD
Dennis Krenz, AL
Morris Reich, BNL
Wallace Kornack, ACNFS
Dan Gannon, SAIC
Robert Neill, EEG
Kirkland Jones, EID

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SUPPLEMENT 2 TO SAFETY EVALUATION REPORT

FOR THE

WASTE ISOLATION PILOT PLANT

Dated: MAR 4 1991

Prepared Under the Direction of _____ 2/28/91
Thomas McSpadden — Date
Safety Technology Division

Reviewed by _____ 2/28/91
Darrell Huff — Date
Safety Technology Division

Reviewed by _____ 2/28/91
Richard J. Serbu — Date
Acting Director
Safety Inspection Division

Approved by _____ 3/4/91
Oliver D. T. Lynch, Jr. — Date
Acting Director
Office of Safety Appraisals

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I. Introduction

The Waste Isolation Pilot Plant (WIPP) Safety Evaluation Report (SER) was issued on July 27, 1989, by the Office of the Deputy Assistant Secretary for Safety and Quality Assurance, EH-30 (Reference 1) of the Office of Environment, Safety and Health (EH). The purpose of the SER was to document EH-30's independent safety review of the WIPP Final Safety Analysis Report (FSAR) through Revision 0 (May 1990).

The EH-30 review was limited to the initial 5-year Pilot Plant phase of operation at WIPP. The Pilot Plant phase was to include the receipt, emplacement, and storage of Contact Handled Transuranic (CH TRU) waste over a 5-year period in order to demonstrate the safe disposal of defense wastes. Based on an evaluation at the end of the Pilot Plant phase, a decision was to have been made as to the acceptability of the WIPP site for disposal operations.

More recently, the Department of Energy (DOE) has decided to demonstrate safe disposal in compliance with relevant environmental regulatory requirements by using a phased approach. The first phase is the Dry Bin Scale Test Program during which waste will be packed into test bins, emplaced, and monitored for 5 years. Specific data to be obtained include the quantity, composition, and kinetic rate of gas production and consumption. The WIPP FSAR Addendum for the Dry Bin Scale Tests (Reference 17), which discusses the safety implications of this program, is under separate review.

EH will issue an additional SER supplement to address the WIPP FSAR Addendum.

Under current planning, subsequent test phases will include wet bin, leachability, and alcove tests. The consequences or safety aspects of these tests will be addressed in future safety analyses, probably in the form of additional addenda to the FSAR, to be prepared prior to the performance of these tests.

As a result of the EH-30 FSAR review, 23 open items were identified and documented in the SER. The more significant open items included Quality Assurance staffing and authority, design of the electrical system, waste retrieval concerns, and accident analysis source terms and scenarios.

EH-30 issued Supplement 1 to the Safety Evaluation Report (SSER No. 1) for the Waste Isolation Pilot Plant in January 1990 (Reference 7). The purpose of the SSER No. 1 was to document EH-30's evaluation of the WIPP Project Office's (WPOs) responses to each of the 23 items reported in the SER.

At the time the SSER No. 1 was issued, EH-30 and WPO agreed on requirements for resolution of each of the 23 findings. For 15 of the findings, resolution required a change to the text of the WIPP FSAR. Eleven findings required corrective action to be taken prior to closure. Corrective actions entail either design changes or

additional safety analyses. In four cases, the project response was sufficient to resolve the finding without requiring an FSAR text change or a corrective action. Table 1 summarizes the closure requirements for the 23 findings identified in the SER.

This report confirms and documents the final closeout of the SER findings. Section II discusses the 11 items which require corrective action for resolution. Section III discusses the 15 findings which require FSAR text changes for closure. The findings which require no corrective action or FSAR text changes are considered closed and are not addressed in this report.

ENCLOSURE

WIPP FSAR - BNL REVIEWERS

Reviewer	Degree	Professional Affiliation
Paul Bezler	Ph.D (Mech. Eng.)	PE; NY
Gerard Breidenbach	M.S. (Mech. Eng.)	
Carl Costantino	Ph.D. (Civil Eng.)	PE; NY
Walter Grossman	M.S. (Civil Eng.)	PE; NY, NJ, DE
William Gunther	M.S. (Electr. Eng.)	PE; NY
Andrew Hull	M.S. (Physics)	Certification-American Board of Health Physics
Donald Lamvermeyer	B.S. (Met. Eng.)	PE; California
Charles Meinhold	B.S. (Physics)	Certification-American Board of Health Physics
Charles Miller	Ph.D (Civil Eng.)	PE; NY
Young Park	Ph.D (Civil Eng.)	
Mike Philippacopoulos	Ph.D (Civil Eng.)	
Susan Pepper	M.S. (Civil Eng.)	
Morris Reich	Ph.D (Mech. Eng.)	
Nikolaos Simos	Ph.D (Mech. Eng.)	
Malcolm Wane	E.M. (Mining Eng.)	PE; Ontario
P.C. Wang	Ph.D (Eng.)	PE; NY, NJ

TABLE 1 - SUMMARY OF EH EVALUATION

ITEM NO.	DESCRIPTION OF ITEM	FSAR CHANGE REQUIRED*	CORRECTIVE ACTION REQUIRED**
1	QA Resources and Authority & Organizational Interfaces	Yes	Yes
2	Operating Contractor Understanding of Facility Design	No	Yes
3	Project Manager's Stop Work Authority	Yes	No
4	Overstressed Columns in Waste Handling Building	No	No
5	Design Bases for Electrical System Not Specified	Yes	Yes
6	Diesel Generator Starting	Yes	No
7	UPS Loads	Yes	No
8	Battery Testing	No	Yes
9	Remote Diesel Startup	Yes	Yes
10	Room Monitoring for Structural Stability	Yes	Yes
11	Retrieval and D&D Plan	Yes	Yes
12	Additional Radiological Analyses Needed	Yes	No
13	Recalculation of Worker Doses	Yes	No
14	Reevaluation of Drum Fires Accident	Yes	No
15	Respiratory Mask Requirement for Downstream Workers	Yes	Yes
16	Evaluate Underground Roof Falls	No	No

TABLE 1 - SUMMARY OF EH EVALUATION
(continued)

ITEM NO.	DESCRIPTION OF ITEM	FSAR CHANGE REQUIRED*	CORRECTIVE ACTION REQUIRED**
17	Catastrophic Hoist Accident Probability	No	Yes
18	Drum Fire Propagation Accident Probability	No	No
19	Testing of Isolation Damper Valves	No	Yes
20	Monitoring of Room Closure Threshold Values	Yes	Yes
21	Only Single Failures in Electrical System Were Analyzed	Yes	No
22	Inconsistent Flow Charts for Quality Level Assignments	No	No
23	No Ground Movement Considered in Shaft Lining Design	Yes	No

Note: This table lists outstanding requirements for closure as of January 1990.

* See Section III of this report
** See Section II of this report

II. Evaluation of Project Responses and Corrective Actions

Supplement No. 1 to the Safety Evaluation Report (SSER No. 1) identified 11 SER findings which required corrective action prior to startup of the WIPP facility. Reference 7 provides a list of recommended actions to be completed for resolution of these SER findings.

It should be noted that SSER No. 1 recommends corrective action for SER Item No. 17. This action involves reviewing documentation related to the failure of the waste hoist bearing to confirm that an accurate assessment of the cause of failure has been made and that appropriate corrective action has been taken. The failure of the waste hoist bearing is addressed in Reference 10 as Readiness Review Inspection Finding No. 76. The EH concerns identified in SER Item No. 17 are adequately addressed in Reference 10 and will not be addressed in this report.

EH-30 and WPO worked together to confirm that proper corrective action has been taken to resolve all 11 findings. Confirmation entailed the review of substantiating documentation and field verification. A summary description of the evaluation is provided for each of the findings requiring corrective action.

Item No. 1: QA Resources and Authority; Organizational Interfaces

EH's Original Concern:

(a) The DOE/WPO Quality Assurance (QA) Organization does not have sufficient resources and authority for adequate control of operations at WIPP.

(b) Also, the interface controls and responsibilities, both external and internal, among organizations of the three major participants are not clearly defined.

EH Evaluation of Project Response:

(a) The project has proposed a revised organization to address this EH concern. In the proposed organization, a new office, Quality and Regulatory Assurance (QRA), would be established. The manager of the new office would report directly to the project manager. The new office would be staffed by a manager, three engineers, and a secretary. The DOE/WPO QA Manager is responsible for monitoring the design, construction and operation of the facility, and identifying QA related problems (DOE/WIPP 103, Directive 4.1.1). In addition, the QA Manager is responsible for initiating, recommending, or approving solutions to quality-related problems.

The revised organization resolves EH's concerns regarding staffing level for QA and level of reporting. However, the new organization needs to be implemented, and this implementation documented in an FSAR revision.

The project's proposed FSAR changes are acceptable. (See Section III).

(b) Interface controls are clarified in a new project publication, Management Directive 103. In this document (Part II, Directives 2.2.1 and 2.3.1, dated May 18, 1989), the roles of the experimental contractor (Sandia) and the Management and Operating Contractor (Westinghouse) are clarified.

The description of interface controls and responsibilities provided in Management Directive 103 (Reference 2, Item 1) appear satisfactory and when fully implemented will resolve EH's concern with interface controls.

The FSAR changes committed to in the project's response are acceptable. (See Section III).

Item No.1, (continued)

Required Confirmatory Action:

(a) Before startup, confirm that a reasonable number of the positions in the new QRA Office have been filled and that the personnel are well qualified.

(b) Before startup, confirm that the new interface controls described in Management Directives 2.2.1 and 2.3.1 have been fully implemented and that they are effective.

EH Evaluation (9/30/90):

(a) This item was resolved in conjunction with Readiness Review Inspection (RRI) Finding Nos. 66, "Authority of QA Manager," and 73, "Inadequate QA Audits Performed" (References 8-10). An acting QRA Branch Chief has been appointed. This individual reports directly to the Assistant Project Manager for Compliance and has sufficient authority to initiate and verify corrective actions. In addition, three new positions in the QA organization were authorized. Resumes were provided to show these positions are filled by certified quality assurance professionals.

(b) No information has been received.

EH Evaluation (12/20/90):

A transmittal concerning Item 1(b) was received on 12/7/90. The response reads:

"The interface controls described in Management Directive 2.2.1 and 2.3.1 have been fully implemented and DOE/WPO believes them to be effective. BNL is invited to field verify this item for closure."

EH discussed this with Westinghouse during a 12/10/90 conference call. Westinghouse agreed to provide EH with the Management Directives so that field verification would not be necessary.

EH Evaluation (1/4/91):

The Management Directives were received on 12/19/90 (Reference 15). The implementation of the interface controls described in the Management Directives requires field verification for closure of Item 1(b).

EH Evaluation (1/25/91):

EH met with representatives of DOE/WPO during the January 22-24, 1991, site visit to discuss Item 1(b). EH received documentation delineating the responsibilities of DOE, Westinghouse and Sandia.

Item No. 1, (continued)

In addition, DOE/WPO described weekly meetings which are held among the three organizations. Sandia has recently issued a management memorandum appointing a senior SNL employee to be responsible for all interactions with Westinghouse.

As part of the site verification, EH attended the weekly ES&H Interface Meeting. DOE/WPO and Westinghouse representatives of Quality and Regulatory Assurance, Radiation Safety, Dosimetry, Safety, Regulatory and Environmental Programs were present at the meeting. The group fully discussed a list of all outstanding commitments and upcoming events which will require cooperation among the organizations.

This item is closed.

Item No. 2: Operating Contractor Understanding of Facility Design

EH's Original Concern:

Engineering staff of DOE/WPO and the operating contractor lack technical understanding of the facility's design bases, design calculations and their related quality control.

EH Evaluation of Project Response:

The project has committed (Reference 2, Item 2) to training of key operating contractor personnel to enhance their knowledge of the technical details of the WIPP facility design. Specific training on Limiting Conditions for Operation and Operational Safety Requirements (LCO/OSR) was described in Reference 2. The project also committed to completing the as-built drawings for critical systems in the facility prior to startup and to implement configuration control procedures to assure drawings are maintained up-to-date. A description of critical systems and a proposed schedule was provided by the project (Reference 6).

Completion of as-built drawings, implementation of an adequate configuration control system, and the commitment to provide the proposed training resolve EH's concern in this area.

Required Confirmatory Action:

Confirm that as-built drawings of critical systems have been completed, that the required training has been completed, and that adequate configuration control procedures have been implemented.

EH Evaluation (8/31/90):

This item is being resolved in conjunction with Readiness Review Inspection (RRI) Finding No. 6 "Revise Electrical Drawings to `As-Built'" (References 8-10). The confirmatory action cannot be completed until RRI Finding No. 6 is closed. In addition, configuration control procedures and training documentation are required.

EH Evaluation (12/20/90):

A transmittal concerning this item was received on 12/7/90 (Reference 14). The configuration control procedure was reviewed along with the lesson plan and associated attendance sheets. These documents and the associated training satisfy the concerns expressed. Assuming that the as-built drawings are found to be complete, this item can be closed. Field verification of this item will be conducted in conjunction with RRI Finding No. 6.

Item No. 2, continued

EH Evaluation (1/25/91):

In response to this item and RRI Finding No. 6, the project identified 243 drawings that are critical to safety. Of the 19 plant systems, top priority was given to systems that are related to industrial safety or include LCO/OSR equipment. The 243 drawings represent the following systems:

- Plant Electrical Distribution System, Surface and Underground
- Effluent and Environmental Monitoring Systems
- Radiation Monitoring System
- Plant Communication System
- Fire Protection System
- Underground Ventilation System
- Underground Hoisting System

The project hired a contractor to field verify and update the existing site drawings. EH reviewed procedures, written by the project and the contractor, that adequately control the conduct of work.

The "As-Built Program" for the 243 critical drawings was completed on 9/14/90. An independent review of every drawing was conducted by a committee of Westinghouse personnel who found minor discrepancies in 72 of the 243 drawings. Engineering Change Orders (ECOs) were written to correct these errors. This part of the effort was completed in January 1991, prompting a followup visit by EH.

The goal of the January 22-24, 1991, site visit was to verify that the site had completed the "As-Built Program" in accordance with commitments made previously. To determine this, a sample of 20 drawings was reviewed by the team. The review consisted of the following attributes:

- The marked up drawings that were used to develop the as-built drawings were examined to determine the types of discrepancies found by the contractor's field walkdowns. These were compared with the final approved drawing to assure that observations were accurately recorded.

- The reviewers performed a walkdown of selected drawings.
- ECOs were reviewed to ensure that the changes were accurately made.
- Discussions were held with the cognizant engineers and the Westinghouse engineering management to better understand the resolution of apparent discrepancies.

The review team found minor discrepancies on six of the drawings. However, due to the complexity of the drawings reviewed and the insignificant nature of the errors, this number of errors is considered to be acceptable. The goal to achieve drawings for critical equipment and systems that are truly representative of field conditions has been satisfactorily achieved.

This item is closed.

Item No. 5: Design Bases for Electrical System Not Specified

EH's Original Concern:

The design bases for the electrical system (standards and guides) must be identified in the FSAR.

EH Evaluation of Project Response:

The project verified that WIPP meets the requirements of DOE Order 6430.1 and has committed (Reference 2, Item 5) to add a statement to the FSAR attesting to compliance of the WIPP electrical system with the design criteria.

In addition, the project agreed to evaluate the design against the requirements of DOE Order 6430.1A. This review is not required to be completed until 18 months after startup (Reference 1).

The project's proposed FSAR changes are acceptable and resolve EH's concern. (See Section III).

Required Confirmatory Action:

Confirm that the analysis of the WIPP electrical system against the requirements in DOE Order 6430.1A has been completed. Evaluate all areas that do not fully comply for potential retrofits.

EH Evaluation (8/31/90):

Despite the agreement that this item can be resolved after startup, EH discussed this item with Westinghouse during the August 14-16, 1990, site visit. Westinghouse Electrical Engineering provided information regarding the status of the review. Several items are still under review.

EH Evaluation (9/30/90):

A transmittal concerning this issue was received from the project on 9/18/90 (Reference 12). This transmittal addressed each relevant section of DOE 6430.1A. The reviewers conclude, on the basis of this document, that the critical safety issues related to the design bases have been resolved sufficiently to satisfy the pre-startup commitments. The remaining work is scheduled for completion by December 1990.* This remaining work is of a non-critical nature, allowing the item to be closed.

This item is closed.

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* As of January 1991, the remaining non-critical work is still in progress. A post-startup review (within 18 months) should be completed to verify full compliance with this issue.

Item No. 8: Battery Testing

EH's Original Concern:

Verification that the battery can supply 30 minutes of power at rated conditions is necessary through testing or analysis.

EH Evaluation of Project Response:

The project has provided copies of the revised startup test procedure and the results of the startup test conducted in June 1989. This procedure provides for a test of battery capacity that is consistent with FSAR requirements.

The response is adequate. No changes to the FSAR are required to resolve EH's concern.

Required Confirmatory Action:

Confirm that a comprehensive test has been satisfactorily completed.

EH Evaluation (8/31/90):

It was confirmed during the August 14-16, 1990, site visit that the battery testing has been completed.

This item is closed.

Item No. 9: Remote Diesel Startup

EH's Original Concern:

The section in the FSAR regarding startup of the diesel generators (local or remote) needs to be clarified. Also, the FSAR should be changed to reflect actual operator actions required to restore power to the Underground Power System (UPS) within 30 minutes.

EH Evaluation of Project Response:

The project has revised the startup procedure for the diesel generator (Reference 2, Item 9) so that it is now possible for an operator at the Central Monitoring Room (CMR) to remotely start the diesel generator without any action by personnel at the diesel generator location. Revised wording describing the startup procedure has been prepared. The project has committed to add this description of startup to the FSAR.

The project's proposed FSAR changes are acceptable and resolve EH's concern. (See Section III).

Required Confirmatory Action:

Confirm that a satisfactory test of remote startup capability has been performed.

EH Evaluation (8/31/90):

It was confirmed during the August 14-16, 1990, site visit that the diesel generator acceptance test included remote startup from the CMR.

This item is closed.

Item No. 10: Room Monitoring for Structural Stability

EH's Original Concern:

Monitoring of filled CH TRU waste storage rooms is required to ensure structural stability of these rooms and adequate performance of the installed rock bolts throughout the retrieval period, i.e., 10 years. It is not, as yet, clear how such a program can be implemented in those CH TRU waste storage areas filled with containers.

EH Evaluation of Project Response:

The project initially claimed that monitoring of filled waste storage rooms was not required to ensure structural stability and did not commit to monitoring in the FSAR (Reference 2). The project felt that "bolting experience, plus conservative extrapolation of Creep Data indicate that a minimum of 81/2 years is available, for emplacement and retrieval."

After reviewing the project's initial response to this item, EH reaffirmed the concerns about structural stability. EH requested that the project commit to a comprehensive monitoring system in underground rooms containing waste. Monitoring would be for the period waste is stored underground until it is either removed or a decision made to permanently dispose of it in WIPP, in which case the rooms would be backfilled and the monitoring function discontinued. EH restated its belief that such monitoring is essential to assure retrieval during the test phase. Effective monitoring could warn of impending roof falls, provide prompt detection of roof falls that occur, and assure that creep closure rates are not threatening container integrity before retrieval.

The project's revised response (Reference 6) committed to monitoring (both visually and with instruments) the rooms that contain waste. This commitment will be documented in several sections of the FSAR. The project noted that alcoves will not be monitored, but committed to additional roof control measures in alcoves (pattern bolting and wire mesh). The project also noted that the narrower width (25 feet for the alcoves versus 33 feet for the storage rooms) also greatly reduces the creep closure rate and the likelihood of roof fall events.

The project provided revised wording for several sections of the FSAR (Reference 6) that would implement the room monitoring commitment.

EH agrees that monitoring of the alcoves is not required, providing the roof bolt patterns and wire mesh commitments are adhered to and provided the mined width of the alcoves is limited to 25 feet.

Item No. 10, (continued)

The project's proposed FSAR changes are acceptable and resolve EH's concern.

Required Confirmatory Action:

Confirm that the monitoring program actually employed by the project is adequate to meet the FSAR requirements. Confirm that procedures for monitoring have been issued and review them for adequacy.

EH Evaluation (8/31/90):

The concerns initially raised are associated with two aspects of the underground monitoring program required to assure safe operation. The first has to do with development of threshold criteria for relative room closure beyond which serious concern for room stability and safety of operation develops. It was agreed during the FSAR review that in any storage areas, rock movements will be monitored on a relatively continuous basis. Predictions of future movements will be made based on these measurements, together with results obtained from the previous long history of operation at the site dating back to the Preliminary Design Verification studies and ongoing analytic studies of rock behavior. Whenever measurements exceed predictions by 0.5 inches in any 1 year, further storage operations will cease and detailed engineering investigations will be performed to evaluate the cause of the exceedances. This is considered to be acceptable.

The second aspect of the monitoring program makes use of continuous "drumming" procedures to uncover local wall and roof separations and to evaluate the potential for scabbing and rock falls. This "drumming" procedure is a standard mining practice to help ensure safe operation in mines. However, the "drumming" program obviously cannot be used to monitor potential scabbing effects at roof and wall locations in filled rooms.

It was learned during the August 14-16 1990, site visit that waste drums are no longer to be placed to fill the rooms during the five-year test phase. Therefore, it is assumed that the bin scale test program will not prevent access to the test rooms, the "drumming" procedure is acceptable and the monitoring program is adequate to meet the FSAR commitments. Monitoring procedures should be submitted for review and availability of room access for monitoring (including "drumming") should be assured.

EH Evaluation (12/20/90):

Procedure Nos. WP 07-301 to WP 07-207 are adequate for defining the procedures for installing various monitors. However, a specific statement should be provided to indicate that all storage rooms

Item No. 10, (continued)

will be monitored with some minimum number of instruments, that the data will be made part of the computerized data base to compare with the criteria, and that "drumming" will be utilized in these storage rooms. The confirmatory action cannot be completed without the additional information.

EH Evaluation (1/8/91):

EH received a transmittal regarding this finding on 12/31/90, which read in part:

> "All underground storage rooms will be monitored for stability with at least two redundant monitoring instruments...
>
> Ground control inspections will utilize sounding ("drumming") in accessible areas of storage rooms per the enclosed procedure, WP 04-220, WIPP Operations Ground Control Procedures."

EH discussed two concerns with this response with Westinghouse and DOE-EM in a conference call on 1/3/91. First, it is imperative that storage rooms be monitored with at least one horizontal instrument and one vertical instrument. Westinghouse informed EH that two horizontal and two vertical instruments (thus, "two redundant monitoring instruments") will be used. The response will be revised to clarify this point.

Second, it is necessary that all intersections of walls and ceilings be accessible for "drumming." On 1/17/91, EH received a revision to the response reading as follows:

> "Ground control inspections will utilize sounding ("drumming") in all areas of storage rooms per the enclosed procedure WP 04-220, WIPP Operations Ground Control Procedures. This ground control practice includes the back (roof), the ribs (wall), and the back/rib interface" (Reference 16).

This item is closed.

Item No. 11: Retrieval and D&D Plan

EH's Original Concern:

The Retrievability Plan and the Decontamination and Decommissioning Plan for the test phase must be completed by the project and confirmed acceptable prior to emplacement of waste.

EH Evaluation of Project Response:

The project has committed (Reference 3, Item 11) to issue final plans for retrieval and for decontamination and decommissioning prior to startup of the facility. In addition, the project has committed to revise the FSAR to include assurance that measures will be taken to prevent roof falls from complicating waste retrieval.

The response is adequate, provided a review and project response process, comparable to that used in the SAR review, is employed.

The project's proposed FSAR changes are acceptable and resolve EH's concern. (See Section III).

Required Confirmatory Action:

Confirm that final plans have been issued and that comments of reviewers have been appropriately considered.

EH Evaluation (8/31/90):

During the August 14-16, 1990, site visit, Westinghouse confirmed that they no longer plan to issue a separate document to discuss plant decontamination and decommissioning. Instead, this topic is discussed in Appendix C of the final Waste Retrieval Plan which was issued in May 1990 (Reference 11). EH reviewed this document for content, in connection with recommendations made by the Advisory Committee on Nuclear Facility Safety, and with regard to FSAR commitments.

As documented, the waste retrieval process appears adequate, in that it mirrors the waste emplacement process.

The Decontamination and Decommissioning (D&D) Plan, as presented in Appendix C of the Waste Retrieval Plan, does not provide details for the environmental surveillance monitoring or monument placement required by the FSAR. However, the FSAR (Section 12.3) states:

> "Actual D&D activities will be initiated prior to the cessation of WIPP facility operation and will proceed in a multi-phase approach which consists of three phases: (1) characterization of the facility; (2) development of a detailed decommissioning plan; and (3) implementation of the decommissioning plan and final report."

Item No. 11, (continued)

Therefore, while the Waste Retrieval Plan addresses decontamination and decommissioning only briefly, WIPP is committed to developing a detailed D&D Plan by the end of the test phase, if retrieval will be initiated.

EH agrees that this is a reasonable approach and confirms that the commitments of the Waste Retrieval Plan are acceptable when combined with those of the FSAR. It is unlikely that a detailed D&D Plan written this far in advance could accurately reflect plant conditions five years from now. A D&D Plan written towards the end of the test phase will more accurately address the critical issues.

This item is closed.

Item No. 15: Respiratory Mask Requirement for Downstream Workers

EH's Original Concern:

A respiratory mask requirement for workers downstream from the active and open waste storage area is needed.

EH Evaluation of Project Response:

The project has agreed to a respiratory mask requirement (Reference 2, item 15) for workers who are nonroutinely required to be downstream of active and open waste storage areas. Such workers are not expected to perform tasks downwind. Procedures to implement this requirement are being prepared. An FSAR commitment has been made to require respiratory protection. A commitment to post the entrances to such areas was also made.

The project's proposed FSAR changes are acceptable and resolve EH's concerns. (See Section III).

Required Confirmatory Action:

Confirm that implementing procedures are in place and that underground entry points are posted.

EH Evaluation (9/30/90):

The reviewers received a response addressing this item on 9/18/90 (Reference 12).

The reviewers agree that the respiratory protection requirements described in FSAR Sections 7.3 and 7.3.2 are adequate to meet EH's concerns.

The only question which remains is when the warning signs would be posted. The FSAR (page 7.3-5) states that "entries to these areas will be posted in accordance with the WIPP Radiation Protection Manual." The reviewers assume this to mean that the posting is done prior to waste handling operations and not after the fire (C10) has occurred as is implied in the project response.

Based on this assumption, this item is closed.

EH Evaluation (12/20/90):

The reviewers received a transmittal concerning this item on 12/7/90 (Reference 14). The response states the following:

> "In the event of a fire while moving a ≥ 70 PE-Ci drum, the underground area will be evacuated per WIPP Emergency Procedures. During recovery activities the areas downstream of the fire will be posted appropriately as contamination

Item No. 15, (continued)

areas and as airborne contamination areas per Radiation Safety Manual Section 8. In addition, recovery activities will be covered by radiation work permit (RWP)."

The reviewers are satisfied that respiratory protection is adequate.

This item is closed.

Item No. 19: Testing of Isolation Damper Valves

EH's Original Concern:

WIPP has not specified when and how often the valves used as isolation dampers in the air handling system are tested. Also, a copy of the test standards and procedures should be provided and permissible leakage rates specified.

EH Evaluation of Project Response:

The project provided a copy of the test procedure and the results of the testing conducted on June 14, 1989, and committed to inspect their operability daily. Justification for not specifying leakage rates was provided. Leakage rates are not specified for the dampers and leak rate testing was shown to be unnecessary.

The daily operability inspections are judged adequate by EH, as well as the results of the initial tests of the system. However, damper XD-38 could not be tested because of faulty fan control wiring. This damper should be retested after the repairs to the fan control wiring are complete. Leak rate testing is judged unnecessary since any excessive leaks would be detected during testing of the air handling system.

The response is adequate. No changes to the FSAR are required to resolve EH's concerns.

Required Confirmatory Action:

Review the results of the tests of the isolation damper valves.

EH Evaluation (8/31/90):

A review of the Tornado Damper Test results confirmed that damper XD-38 satisfied test requirements during the June 14, 1990, testing.

This item is closed.

Item No. 20: Monitoring of Room Closure Threshold Values

EH's Original Concern:

The specifications of the threshold values; i.e., ± 0.5 inches from the extrapolated data to be used in the monitoring, are not contained in Section 1.5 of the FSAR as committed at the April 24-28, 1989, FSAR meeting.

EH Evaluation of Project Response:

The project has committed to clarify in the FSAR the basis for the 0.5 inches and to specify in the FSAR the threshold limit. Proposed wording for the FSAR change was provided by the project (Reference 2, Item 20).

The project's proposed FSAR changes are acceptable and resolve EH's concern. (See Section III).

Required Confirmatory Action:

Confirm that the monitoring devices have been installed and are operational. Confirm that procedures have been issued and review them for adequacy.

EH Evaluation (8/31/90):

Underground monitoring devices were inspected by EH during the site visit of August 14-16, 1990. The areas inspected were the SPDV room area, test room areas, and new rooms in Panel 1 area to be used for bin scale tests.

The monitoring instrumentation in the various areas is considered to be acceptable. Most of the displacement measuring devices are digitally downloaded to the data base for use in the monitoring program. In some cases, the devices are manually read. If the rooms are not to be filled with waste drums during the 5-year test phase, as indicated to the reviewers during the site visit, the manual procedure is acceptable. In addition, "drumming" will be used based on the assumption that access to the walls and roof is available.

Monitoring procedures should be submitted for review, and assurance should be provided on room monitoring accessibility.

EH Evaluation (12/20/90):

See EH Evaluation for Item No. 10.

EH Evaluation (1/8/91):

See EH Evaluation for Item No. 10.

This item is closed.

III. Confirmation of Required FSAR Text Changes

Fifteen of the 23 SER items require FSAR text changes. Table 2 specifies text changes proposed by the project that would satisfactorily resolve the EH concerns. Alternate wording in the FSAR is acceptable, provided the intent is the same.

The May 1990 WIPP FSAR was reviewed to ensure that all required FSAR changes have been made in accordance with Tables 1 and 2. All required FSAR text changes as proposed by the project and accepted by EH have been incorporated into the text of the May 1990 FSAR with the following exceptions.

Proposed FSAR text changes for SER Item Nos. 12 and 13 reference an administrative radiological protection limit of 100 PE-Ci (plutonium equivalent-curies). In the text of the May 1990 FSAR, this limit is given as 70 PE-Ci. However, since the deviation leads to more conservative protection of the workers, the text change is acceptable.

The May 1990 FSAR was approved by the Office of Environmental Restoration and Waste Management on June ~~7~~ 12, 1990.

TABLE 2 - REQUIRED FSAR CHANGES

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
1a	**QA Resources and Authority** Add to 11.1.1: The Quality and Regulatory Assurance (QARA) Manager reports directly to the DOE/WPO Project Manager and shall have a sufficient qualified staff to implement the requirements and responsibilities identified herein. The QARA Manager has the authority and organizational freedom to: a. Identify and recommend solutions to quality problems, and b. Verify implementation of solutions.
1b	Organizational Interfaces Add to 9.1.1: Operating responsibility for the WIPP facility has been assigned to the MOC organization as depicted in Figure 9.1-1. Add to 11.1.2.1: DOE/WPO shall ensure that QA interface control measures between the Scientific Advisor (SA) and Management and Operating Contractor (MOC) are documented in their respective QA Programs.
2	Operating Contractor Understanding of Facility No changes are required.
3	Project Manager's Stop Work Authority DOE/WPO Project Manager has been assigned the contractual authority for the DOE contracts with the Major Project Participants (MPPs). As stated in Refs. 1 and 2, this includes the authority to stop work that is being performed by the Management and Operating Contractor and the Scientific Advisor.
4	Overstressed Columns in Waste Handling Building No changes are required.

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
5	**Design Bases for Electrical System Not Specified** Add to 3.0: The WIPP facility is designed to DOE Order 6430.1 entitled, "General Design Criteria Manual for Department of Energy Facilities," draft, dated June 10, 1981, as specified in Reference 15.
6	**Diesel Generator Starting** Add to 4.4.2.1.2: Although it is standard practice to start the diesel generators from the local control panel (per the Facility Operations Manual, WP 04-1), each unit can be remotely started from the Central Monitoring Room (CMR) via a local processing unit (LPU). This capability is maintained by leaving the generator start switch in the "remote" position. Monitoring of the diesel generators and associated breakers will be possible at the CMR, thus providing the ability to feed selected facility loads from the backup power source, in sequence, without exceeding generator capacity.
7	UPS Loads Replace Table 4.4-9 with: Table 4.4-9 UPS Loads 80 KVA Central UPS 28 KVA UPS Actual Measured Load Individual UPS 7 units - 2 KVA each — Local Processing Units (equipped with their own UPS) 5 units - 2.4 KVA each 2 units - 5 KVA each — Selected Radiation Monitoring Units None — Hydrogen Monitoring Units

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
8	**Battery Testing** No changes are required
9	**Remote Diesel Startup** Add to 4.4.2.1.2: Each of the diesel generators can carry all preselected monitoring loads (see Section 4.4.2.1.3 for a discussion of essential loads), plus operation of the Air Intake shaft hoist for personnel evacuation and other selected backup loads in accordance with procedures in the Facility Operations Manual. The diesel generator can be brought on line within 30 minutes. Upon loss of normal power, the generator(s) is started manually by the Facility Operator using the electric starter/batteries. The starter system is a 24 volt battery system with a 300 amp-hour capacity. The diesel automatically attempts four starts of 30 seconds each. Additional manual start capability exists after those automatic start attempts. Although it is standard practice to start the diesel generators from the local control panel (per the Facility Operations Manual, WP 04-1), each unit can be remotely started from the Central Monitoring Room (CMR) via a local processing unit (LPU). This capability is maintained by leaving the generator start switch in the "remote" position. Operations of emergency power supplies and the selection of loads is covered in the Facility Operations Manual, WP 04-1. Add to 4.4.2.1.3: In case of loss of AC power input to the UPS's, the dedicated batteries can supply power to a fully loaded UPS for 30 minutes. It is expected that the AC power input to the UPS will be restored within 30 minutes via operator action. Operations of the diesel generator is covered by the Facility Operations Manual, WP 04-1.

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
10	**Room Monitoring for Structural Stability** Add to 1.5.3.2: In addition, during the Pilot Plant phase, storage rooms will be monitored using both instrumentation and visual inspection in order to assure that wastes in these rooms will be readily retrievable.
11	**Retrieval and D&D Plan** Add to 7.1: These measures, in addition to monitoring using both instruments and visual inspections, should ensure that roof falls will not complicate retrieval. During the pilot plant phase, some rooms may not be readily accessible or available for monitoring. These sealed rooms will be reduced in width and be pattern bolted for greater safety.
12	Additional Radiological Analyses Needed Add to 7.3: In the event that packages are being handled which have the potential to result in accident doses much greater than 50 rem committed effective dose equivalent, any potentially exposed workers will wear full-face respirators as an added precaution. This limit will be based on the activity content of containers and will be specified in the Radiation Safety Manual. It is estimated that this limit will be 100 PE-Ci although it may vary depending on waste form, waste source, and waste packaging.

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE

12 (cont'd) Replace Table 7.3-2 with:

Table 7.3-2

DOSE COMMITMENTS TO EXPOSED WORKER

Accident *+	Committed Effective Dose Equivalent (CEDE) (REM)
C2**	0.7
C3**	1.3
C4	5.2
C6	9.2

* For the accidents not listed, the accident is considered to be either not credible, no release is expected, or no worker is present. See the text for details.

\+ Calculated CEDEs based on average contained loading if 12.9 PE-Ci.

** Calculated to worker located at 20 feet.

13 Recalculation of Worker Doses

Add to 7.3.1: Scenario C2: The total activity calculated to be inhaled by the worker is 1.4×10^{-9} PE-Ci with a calculated committed effective dose equivalent (CEDE) of 0.7 rem. Because workers are trained to leave the work area in the event of an accident which could damage a waste container, this quantity of inhaled activity is considered to be very conservative. If injury or other circumstances force a worker to remain in the area of the accident following the release, a potential CEDE of 8.0 rem can be calculated to workers within 6 feet of the accident.

Postulating higher activities in the containers, such as the administrative radiological protection limit of 100 PE-Ci and the maximum allowable limit of 1000 PE-Ci, then calculated CEDEs to the worker within 6 feet of the accident are estimated to be 62 rem for the 100 PE-Ci container and just over 12 rem for the 1000 PE-Ci container. The CEDE calculated for the 1000 PE-Ci is

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
13 cont'd	lower than that for the 100 PE-Ci container since respirators with a minimum protection factor of 50 are assumed to be in use when handling packages in excess of 100 PE-Ci. Add to 7.3.1: Scenario C3: Based on the exposure model described in C2, a worker in an adjacent area could inhale 2.5×10^{-9} PE-Ci with a resulting CEDE of 1.3 rem. Again, the worker's dose commitment is expected to be much smaller than that reported in Table 7.3-2 because workers are trained to evacuate the work area immediately as a result of any accident which could damage a waste container. As for C2, if a worker were to remain in the area of the accident following the release, a potential CEDE of 14 rem can be calculated. Furthermore, if the maximally affected container described in the above scenario (i.e., the container losing the lid), contains either 100 PE-Ci or 1000 PE-Ci, the calculated CEDEs to a worker at 6 feet would be 68 rem and 13 rem, respectively.
14	Reevaluation of Drum Fires Accident Add to 7.3.2: Scenario C7: The only spontaneous ignition in a waste drum occurred at the Idaho National Engineering Laboratory (INEL) in June 1970[6]. Using the estimated annual throughput rate of 19,000 drums and 1400 boxes, and an estimated average residence time for each container in the WHB of 4 hours based on the current operational timeline, then an overall residence time in the WHB of approximately 9 years may be calculated. From this residence time and the estimated frequency of occurrence, it can be calculated that WIPP could expect 5×10^{-6} drum fires per year in the WHB due to spontaneous ignition. The WIPP Waste Acceptance Criteria (WAC) have since been formulated to preclude this type of event by severely restricting the presence of pyrophoric materials which may be sent to WIPP. Due to the mitigating criteria of the WIPP WAC discussed above, it is felt that the accident scenario resulting from spontaneous ignition in a drum during its relatively short residence time in the WHB is unrealistic and, as such, the accident analysis is not presented in the FSAR.

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
	As a further means of mitigating the potential of the consequences of such an accident, an automatic sprinkler system has been added to the shielded storage room.
15	Respiratory Mask Requirements for Downstream Workers Add to 7.3.2: Waste is emplaced and stored downstream of workers and, therefore, no dose consequences to a waste handler is postulated for this event. Any workers that are required to be in waste storage area exhaust air streams will be in anticontamination clothing, wear full-face respirators, and will follow all applicable procedures in the WIPP Radiation Safety Manual. In addition, the entries to these areas will be posted in accordance with the WIPP Radiation Protection Manual.
16	Evaluate Underground Roof Falls No changes are required
17	Catastrophic Hoist Accident Probability No changes are required
18	Drum Fire Propagation Accident Probability No changes are required
19	Testing of Isolation Damper Valves No changes are required
20	Monitoring of Room Closure Threshold Values Add to 1.5.3.3: The threshold limit is established from statistical analyses of room closure data and is +0.5 inches above predicted levels. This analysis is updated on a regular basis and is reported in geotechnical data reports.

IV. SUMMARY

Table 3 is a listing of the final status of the 23 open items identified in the SER. As of January 1991, all project commitments made in response to EH concerns have been met and all SER open items have been resolved. The FSAR text changes and required followup actions listed in Table 1 have been completed. Therefore, the review of the WIPP FSAR is complete.

TABLE 2 - CONTINUED

ITEM NO.	DESCRIPTION OF CONCERN/REQUIRED FSAR CHANGE
20 cont'd	Once the threshold is crossed at an instrumented location, a study is initiated to determine the cause. If the cause cannot be related to operational considerations, such as mining activity, then additional field monitoring will be undertaken to characterize the ground response. Should the field data indicate that ground conditions are deteriorating, then corrective action will be taken as required.
21	Only Single Failures in Electrical System Were Analyzed Add to 4.4.1: A Failure Mode and Effects Analysis (FMEA) has been provided for the surface and underground electrical system to show the adequacy of the design and its effects on the operation and the safety of the public and operating personnel. The analysis assumes only single failures within components or systems as shown on the legend and presents the consequences of those failures. The results of this analysis are given in Table 4.4-6 for the surface electrical system and Table 4.4-7 for the underground electrical system.
22	Inconsistent Flow Charts for Quality Level Assignments No changes are required
23	No Ground Movement Considered in Shaft Lining Design Add to 4.3.1.1.1: The hoist systems are designated as Design Class III and are designed in accordance with the Uniform Building Code.[2] All the shaft furnishings are Design Class III and are designed to resist the dynamic forces of the hoisting system. Design studies were performed that indicated that ground movement was not significant for the design of the shaft linings, therefore, they are designed based on expected hydrostatic heads in the Rustler Formation.

TABLE 3

FINAL STATUS OF SER ITEMS

SER Item No.	Description	Follow Up Action Confirm that:	FSAR Change Required?	Status
1a	QA Responses and Authority	Positions in the new Quality and Regulatory Assurance Office have been filled by qualified personnel.	Yes	Resolved
1b	Organizational Interfaces	New interface controls are fully implemented and effective.	Yes	Resolved
2	Operating Contractor Understanding of Facility	As-builts of critical systems are complete, training is complete, configuration control procedures have been implemented.	No	Resolved
3	Project Managers Stop Work Authority	None	Yes	Resolved
4	Overstressed Columns in Waste Handling Building	None	No	Resolved
5	Design Bases for Electrical System Not Specified	WIPP electrical system evaluated against DOE Order 6430.1A	Yes	Resolved
6	Diesel Generator Starting	None	Yes	Resolved
7	UPS Loads	None	Yes	Resolved
8	Battery Testing	Comprehensive testing is complete.	No	Resolved

TABLE 3 (continued)

FINAL STATUS OF SER ITEMS

SER Item No.	Description	Follow Up Action Confirm that:	FSAR Change Required?	Status
9	Remote Diesel Startup	Testing of remote capability is complete.	Yes	Resolved
10	Room Monitoring for Structural Stability	Monitoring Program is adequate. Procedures for monitoring are adequate.	Yes	Resolved
11	Retrieval and D&D Plan	Final plans are issued and adequate.	No	Resolved
12	Additional Radiological Analyses Needed	None	Yes	Resolved
13	Recalculation of Worker Doses	None	Yes	Resolved
14	Reevaluation of Drum Fires Accident	None	Yes	Resolved
15	Respiratory Mask Requirements for Downstream Workers	Implementing procedures are in place and underground entry points are posted.	Yes	Resolved
16	Evaluate Underground Roof falls	None	No	Resolved
17	Catastrophic Hoist Accident Probability	An accurate assessment of the cause of failure of the waste hoist bearing has been made and appropriate action has been taken.*	No	Resolved
18	Drum Fire Propagation Accident Probability	None	No	Resolved

TABLE 3 (continued)

FINAL STATUS OF SER ITEMS

SER Item No.	Description	Follow Up Action Confirm that:	FSAR Change Required?	Status
19	Testing of Isolation Damper Valves	The results of the tests of the isolation damper valves are acceptable.	No	Resolved
20	Monitoring of Room Closure Threshold Values	Monitoring devices are installed and operational. Procedures are adequate.	Yes	Resolved
21	Only Single Failures in Electrical System Were Analyzed	None	Yes	Resolved
22	Inconsistent Flow Charts for Quality Level Assignments	None	No	Resolved
23	No ground movement Considered in Shaft Lining Design	None	Yes	Resolved

* Note: The January 1990, SSER (Reference 7) identifies required confirmatory action for SER Item No. 17. This action is reviewed as Readiness Review Inspection Finding No. 76 (Reference 10).

V. REFERENCES

1. U.S. Department of Energy, Office of Safety, Health and Quality Assurance, "Waste Isolation Pilot Plant - Safety Evaluation Report," July 27, 1989.

2. Memorandum, Jack B. Tillman (DOE-AL, WPO) to Mark Frei (DP-12), "Responses to DOE/HQ-EH Safety Evaluation Report" (Responses to Items 1, 10, 15, 16, and 19-51), September 21, 1989.

3. Memorandum, Jack B. Tillman (DOE-AL, WPO) to Mark Frei (DP-12), "Responses to DOE/HQ-EH Safety Evaluation Report" (Responses to Items 11, 12, 13, 14, 17, and 18), October 3, 1989.

4. Letter from H.G. Taylor (Bechtel) to R. J. Figlik, Manager, Management Support Staff (DOE-AL, WPO), "Bechtel Job No. 12484, WIPP Project, BNL WHB-CH-Area Design Review," August 10, 1989.

5. Memorandum, Mark Frei (DOE, DP-12) to James P. Knight (DOE, EH-33), "Final Response to DOE-HQ EH Safety Evaluation Report," October 11, 1989.

6. Memorandum, Mark Frei (DOE, EM-34) to James P. Knight (DOE, EH-33), "Revised Responses to WIPP SER Items 1, 2, 10, 16, and 17," December 1, 1989.

7. U.S. Department of Energy, Office of Safety, Health and Quality Assurance, "Supplement 1 to Safety Evaluation Report for Waste Isolation Pilot Plant," January 16, 1990.

8. U.S. Department of Energy, Office of Safety, Health and Quality Assurance, "EH-30 Readiness Review Inspection of the Waste Isolation Pilot Plant," June 2, 1989.

9. U.S. Department of Energy, Office of Safety, Health and Quality Assurance, "Supplement 1 to the EH Readiness Review Inspection of the Waste Isolation Pilot Plant," January 22, 1990.

10. U.S. Department of Energy, Office of Safety, Health and Quality Assurance, "Supplement 2 to EH Readiness Review Inspection of the Waste Isolation Pilot Plant," February 1991.

11. DOE/WIPP 89-022, "Waste Retrieval Plan," May 1990.

References, continued

12. Memorandum, Mark W. Frei (DOE, EM-34) to R. Serbu (DOE, EH-332), "Transmittal of Waste Isolation Pilot Plant Responses to EH-30 Readiness Review Inspection Findings and Safety Evaluation Report Items," (Responses to RRI Finding Nos. 66, 73, 74, 76, and 77 and SER Item Nos. 5 and 15), September 13, 1990.

13. Memorandum, E.K. Hunter (WIPP) to Mark Frei (DOE, EM-34), "Transmittal of Additional Information Required to Close EH-30 Critical Audit Findings C-1.02.1 (#18), C-1.02.2 (#19), C-2.10.1 (#37), C-6.03 (#50) and C-6.08 (#55)," October 29, 1990.

14. Letter, L.L. Reed (Westinghouse/WIPP) to J.A. Mewhinney (DOE/WPO), "Additional Information Required in Brookhaven National Laboratory Safety Evaluation Report for the closure of the Readiness Review Inspection Critical Open Items and the Open WIPP FSAR concerns, " (Responses to SER Item Nos. 1b, 2, 10, 15, and 20 and RRI Finding Nos. 6, 9, 18, 19, 37, 50, 55, 59, 75, 76, and 77), December 5, 1990.

15. Letter, L.L. Reed (Westinghouse/WIPP) to J.A. Mewhinney (DOE/WPO), "Additional Information Requested by Brookhaven National Laboratory Draft Safety Evaluation Report and the December 10, 1990 conference call for the closure of the Readiness Review Inspection Critical Open Items and the Open WIPP FSAR Concerns," (Responses to RRI Finding Nos. 6, 9, 19, 37, 50, 55, 59, 75, 76, and 77 and SER Item Nos. 1b, 10, 15, and 20), December 17, 1990.

16. Letter, L.L. Reed (Westinghouse/WIPP) to J.A. Mewhinney (DOE/WPO), "Revised Response Requested by Brookhaven National Laboratory in the January 3, 1991, Conference Call," (Response to SER Item Nos. 10 and 20), January 11, 1991.

17. WP 02-9, "Waste Isolation Pilot Plant Final Safety Analysis Report Addendum Dry Bin Scale Test," draft, Westinghouse Electric Corporation, December 1990.