EEG-70

EEG OBSERVATIONS OF THE MARCH 1998 WIPP OPERATIONAL READINESS REVIEW AUDIT

William T. Bartlett
Jim W. Kenney

Environmental Evaluation Group
New Mexico

May 1998

EEG-70
DOE/AL58309-70

EEG OBSERVATIONS OF THE MARCH 1998

WIPP OPERATIONAL READINESS REVIEW AUDIT

William T. Bartlett
Jim W. Kenney

Environmental Evaluation Group
7007 Wyoming Boulevard NE, Suite F-2
Albuquerque, New Mexico 87109

and

P. O. Box 3149, 505 North Main Street
Carlsbad, New Mexico 88221

May 1998

FOREWORD

The purpose of the New Mexico Environmental Evaluation Group (EEG) is to conduct an independent technical evaluation of the Waste Isolation Pilot Plant (WIPP) Project to ensure the protection of the public health and safety and the environment. The WIPP Project, located in southeastern New Mexico, is in the pre-operational phase as a repository for the disposal of transuranic (TRU) radioactive wastes generated by the national defense programs. The EEG was established in 1978 with funds provided by the U. S. Department of Energy (DOE) to the State of New Mexico. Public Law 100-456, the National Defense Authorization Act, Fiscal Year 1989, Section 1433, assigned EEG to the New Mexico Institute of Mining and Technology and continued the original contract DE-AC04-79AL10752 through DOE contract DE-ACO4-89AL58309. The National Defense Authorization Act for Fiscal Year 1994, Public Law 103-160, continues the authorization.

EEG performs independent technical analyses of the suitability of the proposed site; the design of the repository, its planned operation, and its long-term integrity; suitability and safety of the transportation systems; suitability of the Waste Acceptance Criteria and the generator sites' compliance with them; and related subjects. These analyses include assessments of reports issued by the DOE and its contractors, other federal agencies and organizations, as they relate to the potential health, safety and environmental impacts from WIPP. Another important function of EEG is the independent environmental monitoring of background radioactivity in air, water, and soil, both on-site and off-site.

Robert H. Neill
Director

EEG STAFF

Sally C. Ballard, B.S., Radiochemist

William T. Bartlett, Ph.D., Health Physicist

Radene Bradley, Secretary III

James K. Channell, Ph.D., Environmental Engineer/Health Physicist

Lokesh Chaturvedi, Ph.D., Deputy Director & Engineering Geologist

Patricia D. Fairchild, Secretary III

Donald H. Gray, M.A., Environmental Specialist

Jim W. Kenney, M.S., Environmental Scientist/Supervisor

Lanny King, Assistant Environmental Technician

Betsy J. Kraus, M.S., Technical Editor/Librarian

Robert H. Neill, M.S., Director

Dale Rucker, M.S., Performance Assessment Engineer

Jill Shortencarier, Executive Assistant

Matthew K. Silva, Ph.D., Chemical Engineer

Susan Stokum, Administrative Secretary

Ben A. Walker, B.A., Quality Assurance Specialist

Brenda J. West, B.A., Administrative Officer

ACKNOWLEDGMENTS

The authors appreciate the technical and editorial reviews by the EEG staff including Dr. James Channell, Dr. Lokesh Chaturvedi, Ms. Betsy Kraus, Mr. Dale Rucker, Dr. Matthew Silva, and Mr. Ben Walker. We also appreciate the timely and expert secretarial assistance of Mrs. Susan Stokum.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PICTURES

ACRONYMS

ALARA	As Low As Reasonably Achievable
CAMs	Continuous Air Monitors
CAO	Carlsbad Area Office
CH	Contact-Handled
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EEG	Environmental Evaluation Group
GET	General Employee Training
HEPA	High Efficiency Particulate Air
LWA	Land Withdrawal Act
MSHA	Mine Safety and Health Administration
NRC	Nuclear Regulatory Commission
ORR	Operational Readiness Review
RH	Remote-Handled
SAR	Safety Analysis Report
SPDV	Site and Preliminary Design Validation
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent Dosimeter
TRU	Transuranic
TSR	Technical Safety Requirements
WHB	Waste Handling Building
WID	Waste Isolation Division, Westinghouse Electric Corporation
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

The Manager of the Department of Energy Carlsbad Area Office (CAO) authorized an inspection of the Waste Isolation Pilot Plant (WIPP) from March 2 - 10, 1998, to confirm operational readiness for radiological waste disposal operations. There were important operational safety issues that were not reviewed by the audit team. Regardless, the audit team conclusion was that WIPP could begin operations when six “pre-start” findings concerning training, adherence to procedures and changes in operating defense-in-depth systems were completed. On April 1, 1998, the CAO declared the findings resolved and the facility ready for operations. The CAO plans to forward the recommendation to the Secretary of Energy for approval in May 1998.

The Environmental Evaluation Group (EEG) was allowed limited access to the audit and supporting technical information, even though the EEG is the only full-time WIPP oversight organization reviewing radiation related health and safety issues. Based on audit observations and previous EEG reviews of the site operations, the following should be resolved prior to radiological waste operations:

Recommendation 1: The EEG should be allowed independent access to inspection teams, meetings, contractor information, and preliminary reports in accordance with the WIPP Land Withdrawal Act.

Recommendation 2: An independent evaluation of mine safety should be completed annually as originally required by the Bureau of Mines in the WIPP Land Withdrawal Act.

Recommendation 3: A standard waste-room bulkhead should be designed and used to insure that waste-room exhaust airflow can be properly monitored and radiological confinement requirements can be satisfied. The WIPP Safety Analysis Report should be amended accordingly.

Recommendation 4: If there is a potential for an underground radiological release event, such as a fire anywhere in the repository, then the mine exhaust air should be immediately diverted to filtration mode. The WIPP Safety Analysis Report, procedures and worker training should be amended accordingly.

Recommendation 5: The underground radiation air monitors should be properly sited and tested.

Recommendation 6: Salt aerosol particulate concentrations should be established at underground radiation air monitoring locations.

Recommendation 7: Exhaust shaft water in-leakage should be minimized so that radiation compliance measurements are not compromised and hazardous waste water production is reduced or eliminated.

Recommendation 8: Routine radiological health and safety inspections should be conducted by DOE organizations other than the CAO or organizations reporting directly to the CAO.

Recommendation 9: Where possible, CAO staff should have technical qualifications equivalent to or greater than those required of contractor staff.

Recommendation 10: Radiation waste shipments should not be received at the public and non-radiation worker site access gate.

Recommendation 11: Waste handling procedures should be modified so that radiation waste containers do not remain unnecessarily suspended above the TRUPACT-II and waste handling dock.

Recommendation 12: The WIPP radiochemistry laboratory should be operational.

Recommendation 13: There should be a plan to systematically increase waste shipments from low to higher rates with appropriate operational, management and ALARA reviews.

1.0 INTRODUCTION

A Department of Energy (DOE) Operational Readiness Review (ORR) audit of the Waste Isolation Pilot Plant (WIPP) was conducted from March 2 - 10, 1998, to confirm readiness for radiological waste disposal operations. There were fifteen DOE ORR team members.

The Environmental Evaluation Group (EEG) was initially allowed two ORR observers, and on March 3, 1998, a third observer was permitted. The EEG was not allowed independent access to ORR inspectors or drills. DOE Carlsbad Area Office (CAO) staff escorted the EEG observers, although EEG staff were trained and badged for independent site access. The EEG was permitted to attend daily ORR briefings, but EEG staff were not allowed to ask questions and meeting minutes were not provided. EEG staff observers at the ORR audit were W. T. Bartlett (March 2-5), J. K. Channell (March 2 - 5), and J. W. Kenney (March 4 - 5).

The EEG requested a preliminary draft and final copies of the ORR report. On Friday, March 20, 1998, the CAO provided the final ORR report (Schepens 1998). The report was in three volumes. The first volume included an executive summary with abbreviated documentation of the audit process and findings. The second volume was a reproduction of the inspector's Assessment Forms. The third volume was in essence the DOE ORR Implementation Plan provided to the EEG on February 25, 1998.

This report includes a brief synopsis of the ORR objectives and findings. The EEG observations and recommendations regarding WIPP operations are also provided, and for the most part, the EEG observations are dissimilar to those of the ORR team.

2.0 CAO ORR PROCESS

The Manager of the CAO was delegated the authority within the DOE to determine readiness of the WIPP and to make a recommendation to the Secretary of Energy concerning the decision to operate the WIPP. In turn, the CAO Manager selected an ORR team leader, and a team was assembled to review operational readiness.

In general, the ORR team members had appropriate credentials, but there were no health physicists on the team. The team leader stated that the primary ORR objective was to audit the ability of the contractor and CAO to implement procedural requirements. There was a heavy representation of nuclear navy experience, and such professionals are usually well trained in the mechanics of radiation safety.

The ORR team evaluated WIPP's ability to meet the minimum core requirements for nuclear facility startup (US DOE 1995, Appendix 1). Each team member was assigned one or more of the core requirements for review. Information was gathered by reviewing WIPP documents and procedures, interviewing, and observing very formal, preconceived drill scenarios. The ORR audit did not evaluate the following:

Mine safety and operations
TRUPACT-II design and maintenance
Transportation
Radiation dosimetry
Facility design changes prior to September 1993

DOE Order 425.1, Item 4.d. allows exclusion of a review topic if there is a timely, independent review of the topic. Mine safety was not reviewed because routine inspections are performed by the Mine Safety and Health Administration (MSHA), but the Land Withdrawal Act (LWA) (US Congress 1996b) also required analyses by the Bureau of Mines. A subsequent Act by Congress eliminated the Bureau of Mines (US Congress 1996a), and equivalent analyses are not available (see Section 4.2 of this report). The TRUPACT-II shipping container design for contact-handled transuranic (CH-TRU) waste was certified by the U. S. Nuclear Regulatory Commission (NRC), but certification of the remote-handled transuranic (RH-TRU) waste shipping container is pending with the NRC. Transportation is audited by the U. S. Department of Transportation. Radiation dosimetry is certified by the DOE Laboratory Accreditation Program (10 CFR 835.402 (b)). The ORR team stated that DOE previously approved design changes prior to September 30, 1993, but these reviews were not referenced. Facility design is documented in the WIPP Safety Analysis Report (SAR) (Westinghouse 1997b).

The ORR team results identified WIPP strengths as follows:

- A strong safety culture is in place.
- The management team is proactive and exhibits strong leadership qualities.
- Demonstrated strong, disciplined waste handling operations.
- Above average level of knowledge.
  - Waste handling operators
  - Maintenance workers
  - Engineering and environmental support personnel.
- Above average plant material condition.
- CAO oversight of Occurrence Reporting is effective.
- CAO observation program is extensive.

The weaknesses were stated as follows:

- No general weaknesses identified.
- Specific weaknesses identified in the following areas:
  - Procedure use policy not clearly defined,
  - HAZCOM emergency procedure knowledge,
  - Mode compliance procedures not always specific,
  - DOE facility specific training is lacking,
  - DOE knowledge of radiation fundamentals is weak.

Pre-start and post-start finding are reproduced in Appendix 2. On April 1, 1998, the CAO Manager announced that all pre-start findings were resolved. The ORR team and CAO Manager have concluded that waste handling operations can be safely started.

3.0 REVIEWS BY OTHER AGENCIES

The Defense Nuclear Facilities Safety Board (DNFSB) sent two staff observers to the ORR audit. No other organizations were represented.

The DNFSB has been conducting WIPP reviews since 1990. In 1997, the DNFSB staff attended waste characterization and certification audits at storage/generator sites and tracked other WIPP developments (Conway 1998). In April 1998, the DNFSB conducted a review of WIPP waste hoist operations as previously evaluated by the EEG (Greenfield 1990; Greenfield and Sargent 1993; Greenfield and Sargent 1995; Greenfield and Sargent 1998).

The ORR audit team apparently did not review the basis for requirements in the 1997 WIPP SAR (Westinghouse 1997b). The DNFSB staff addressed this issue in June 1997 (Winters and Roarty 1997). The DNFSB provided CAO miscellaneous comments on the 1996 WIPP SAR (Westinghouse 1997a), and the CAO responded to those comments in September 1997. The CAO did not provide the EEG copies of the DNFSB staff review and the CAO reply to the review until March 1998 (Hunter 1998b).

An important WIPP SAR criterion is the radiological accident dose criterion. If an accidental radiological dose could exceed an accident criterion, then a higher level of construction and maintenance may be required to reduce the likelihood of system failure. Those systems that must be designed to provide specific functions to protect operators, the public, or the environment are designated as safety class (US DOE 1989).

Joseph J. DiNunno, a DNFSB board member, suggested in the technical report DNFSB/TECH-16 on Integrated Safety Management[1] that the DOE has failed in attempts to reach consensus recommendations on numerical accident evaluation guidelines and a consistent application of the guidelines to safety evaluations (DNFSB 1997). DNFSB/TECH-16 suggested a 5 rem total

[1] The DNFSB publishes supporting technical reports that may not necessarily reflect consensus viewpoints of the DNFSB. DNFSB/TECH-16 was identified as the personal viewpoint of Board Member Joseph J. DiNunno.

effective dose equivalent (TEDE) criterion to be consistent with the NRC evaluation guidance found in 10 CFR 72 and 10 CFR 70 for non-reactor nuclear facilities. The WIPP uses evaluation guidelines varying from 2.5 rem to 100 rem depending on the likelihood of occurrence and location of the person at risk (Westinghouse 1997b, Tables 3.3-1 and 3.3-2). If inappropriate accident criteria are used, then a system may not be a safety class system, when in fact it should be.

The EEG requested better rationale for WIPP radiological accident criteria (Neill 1998). The 1997 SAR (Westinghouse 1997b, Section 3.3.5) gives the basis for radiological accident criteria (ANSI 1983), but these criteria are applicable to reactor facilities, not waste handling facilities. As mentioned above, the criteria are based on the probability and consequences of accidents. A simpler approach to accident criteria, such as suggested by the DNFSB/TECH-16, may be more appropriate for the WIPP. The DNFSB/TECH-16 report, written for the DOE nuclear complex-wide Integrated Safety Management, also suggests that contractors are reluctant to classify safety systems at a higher level because of the potential for noncompliance enforcement actions. The report states:

> There is evidence of contractor reluctance to establish control measures in the form of TSR's. Loosely structured administrative control measures are commonly preferred to Design Controls, with associated Limiting Condition of Operations (LCOs) or Operating Limits (OLs). This resistance to structuring robust and enforceable safety management control measures stems in part from the natural desire to avoid sanctions from enforcement actions, particularly those under provisions of the Price-Anderson Amendment Act.

This concern appears to be related to the recent DNFSB staff review of the WIPP hoist operations (Winters and Roarty 1997).

4.0 EEG OBSERVATIONS AND CONCERNS

The EEG recommendations and basis for the recommendations are addressed in the following topical subsections.

4.1 Health and Safety Oversight

Recommendation 1: The EEG should be allowed independent access to inspection teams, meetings, contractor information, and preliminary reports in accordance with the Land Withdrawal Act.

The DOE start-up requirement (6) states the following (US DOE 1995): "A process has been established to identify, evaluate, and resolve deficiencies and recommendations made by oversight groups, official review teams, audit organizations, and the operating contractor."

In the following sections of the report, there are a number of issues and recommendations that have not been resolved. During the ORR, restrictions were placed on the number and interactions of EEG observers. The EEG was not allowed independent access to ORR inspectors. Preliminary information about the ORR audit scheduling was not provided. These audit restrictions do not appear consistent with the DOE Order 425.1, requirement (6). The DOE is also required to provide EEG with free and timely access to WIPP health and safety data, preliminary reports and meetings (US Congress 1992).

The ORR team members received on-site training and familiarization in January 1998 and during this time prepared an audit plan. The EEG was not apprised of the preliminary ORR site visit. Each ORR team member documented findings on an assessment form, and if necessary filled out a deficiency form. The preliminary observations and findings were discussed at daily meetings. The EEG was allowed to observe the meetings, but not allowed to ask questions. The EEG requested, but did not receive the formal notes from these meetings. The ORR team identified weaknesses and strengths, but the EEG was not allowed to independently interact with the ORR team members.

4.2 Mine Safety

Recommendation 2: An independent evaluation of mine safety should be completed annually as originally required by the Bureau of Mines in the WIPP Land Withdrawal Act.

The ORR team perspective on mine safety was (Schepens 1998): "In view of the independent continuing audits by Mine Safety and Health Administration, mine safety and mining operations were not included in this evaluation."

The WIPP Land Withdrawal Act (U.S. Congress 1992, Section 11) requires both Mine Safety and Health Administration and the Bureau of Mines to evaluate the WIPP. These requirements were retained in the amended LWA (US Congress 1996b). MSHA is required to inspect the WIPP mines at least 4 times per year and has the authority to suspend operations to address health and safety deficiencies. The Bureau of Mines was tasked with preparing an annual safety evaluation of the WIPP, but the Bureau of Mines activities were reassigned (US Congress 1996a).

From 1982 to 1988, WIPP rooms and drifts were excavated as shown in Figure 1. Within a few years of the March/April 1983 excavation, Site and Preliminary Design Validation (SPDV) rooms in the experimental region began to show signs of deterioration, and within 8 to 9 years two major roof falls occurred in the northern experimental area. In addition, roof falls occurred in heated rooms A-1, A-2, and A-3 in the experimental region, designed to accelerate the closure process. By design, these rooms were not maintained as repository rooms, but rather were excavated for test purposes. Without remedial efforts, a geotechnical panel concluded that repository rooms would have an expected life of seven to eleven years.

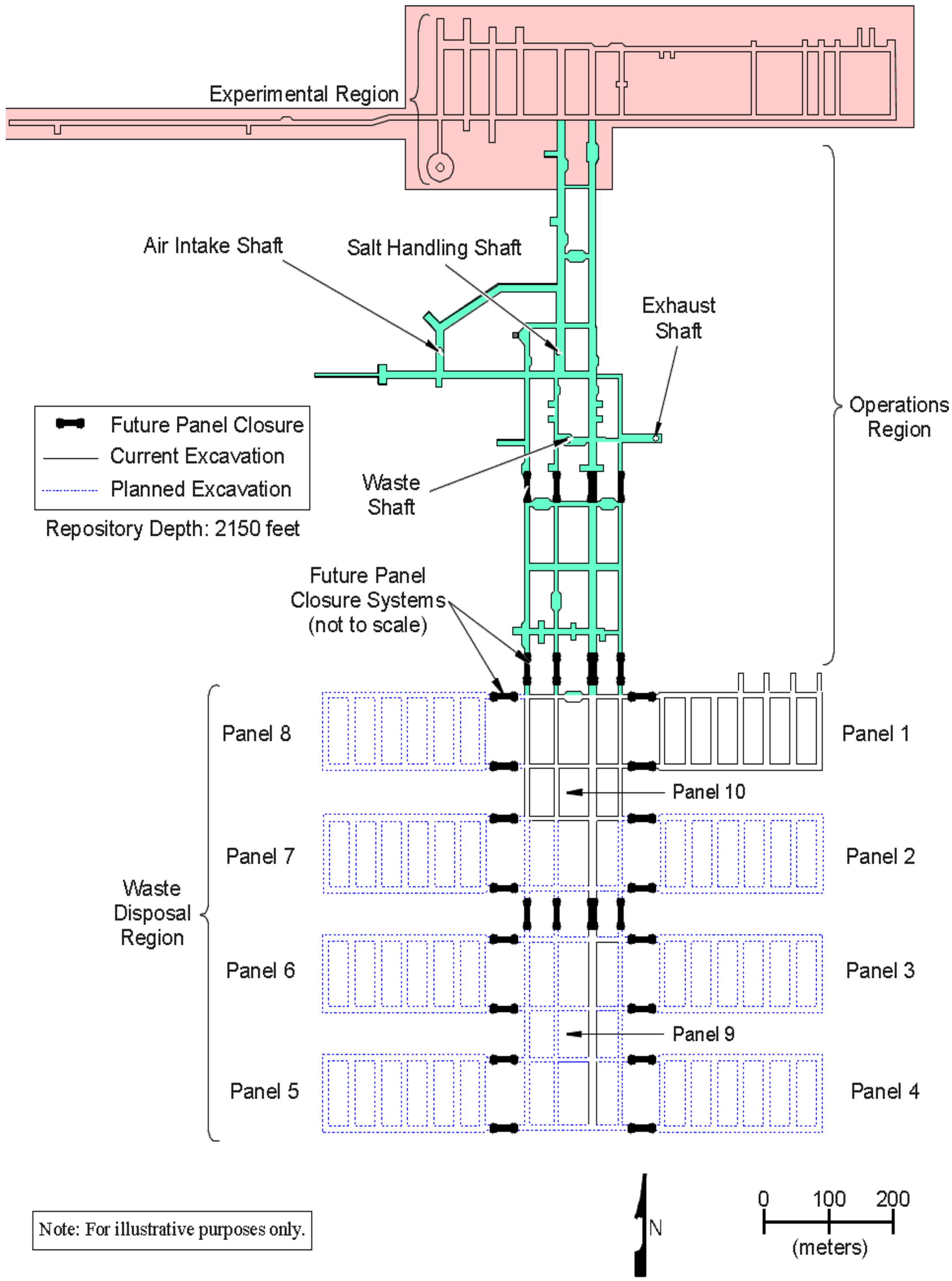


Figure 1. WIPP Disposal Horizon

Roof stability is insured by routine maintenance and roof-support systems. Unlike the experimental rooms, the repository rooms have been maintained and equipped with appropriate roof-support systems. Although panel 1 was excavated between 1986 and 1988 and is experiencing age-related closure, the WIPP plans to use this panel for initial waste emplacement. To insure worker safety, closure rate data are tracked and analyzed to predict unstable roof conditions. Increased closure rates may require that potentially unstable areas be abandoned.

Assuring a high level of safety in panel 1 is not a straightforward process. Unlike newly excavated areas, the advanced stage of panel 1 salt creep requires constant stability monitoring and roof maintenance. It will take at least four years to fill panel 1 considering current CAO emplacement plans (US DOE/CAO 1997a). Once rooms or drifts are filled with waste, roof maintenance is not possible. Radiological confinement depends on containers surviving a roof collapse or brattice-cloth barriers remaining intact (Westinghouse 1997b, Section 5.2.3.11). If the anticipated delivery and emplacement schedules are further delayed, then the potential for roof falls will increase.

In 1996, the EEG reviewed roof stability in panel 1 rooms (Maleki and Chaturvedi 1996). The contractor recommended that:

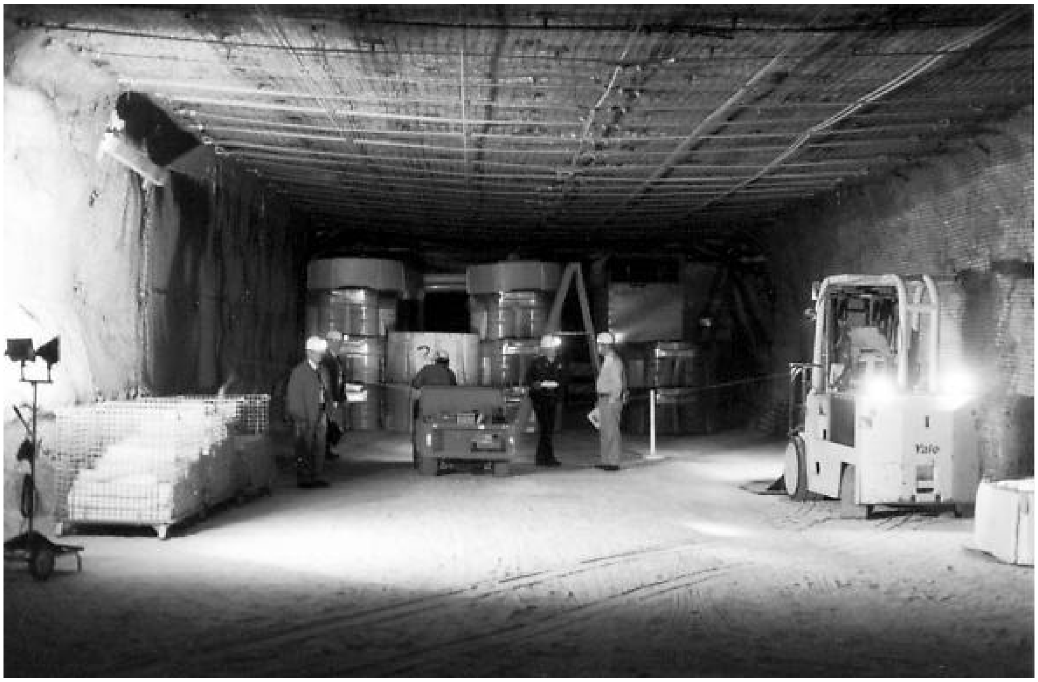
> To “assure stability” and safety, it is best to abandon panel 1 and mine a new panel as soon as all permitting processes are complete. The new panel should be positioned at a sufficient distance from panel 1 to minimize the detrimental effects associated with load transfer from panel 1 toward the new panel. To improve the long-term stability of E140, it is important to modify the excavation geometry and possibly to increase barrier pillar widths for future entries and panels.

The 1997 SAR suggests that panel 1 can be maintained by appropriate actions and documents the general methods needed to insure roof stability (Westinghouse 1997b). The EEG requested better definition of these plans (Neill 1998).

During the ORR, the EEG observed that panel 1, rooms 2 through 6 have restricted access. Room 7 has been reconditioned and additional roof support (roof bolts 12-feet long) are being added. Picture 1 was taken on March 4, 1998, in panel 1, room 1 and shows the north end of the specially-equipped roof support system with roof-bolt sensors. Picture 2 was taken on the same day and shows panel 1, room 7 with a cable and roof-bolt support system and the initial configuration for waste emplacement in the S1600 drift leading into room 7.

The WIPP contractor staff have a long and successful track record in WIPP mine safety. The mine is equipped with special detection systems and careful attention is paid to maintenance and mining. Regardless, the LWA requires annual independent reviews of mine safety, and the EEG expects to have a mine inspection completed by May 1998.

Picture 1. The north end of Room 1, Panel 1 on March 4, 1998. The roof has a specially designed support system and roof-bolt sensors. The ventilation barrier has two adjacent louvered exhaust openings.



Picture 2. The north end of Room 7, Panel 1 and S1600 drift on March 4, 1998. The roof support consists of roof-bolts, wire and cables. Behind the drum stacks is the ventilation barrier with two louvered exhaust openings separated by a large roll-up door.

4.3 Waste Room Ventilation Bulkheads

Recommendation 3: A standard waste-room bulkhead should be designed and used to insure that waste-room exhaust airflow can be properly monitored and radiological confinement requirements can be satisfied. The WIPP SAR should be amended accordingly.

Recommendation 4: If there is a potential for an underground radiological release event, such as a fire anywhere in the repository, then the mine exhaust air should be immediately diverted to filtration mode. The WIPP Safety Analysis Report, procedures and worker training should be amended accordingly.

Mine ventilation is an important safety concern. Use of diesel equipment in the underground necessitates a minimum airflow of 35,000 cubic feet per minute in each waste room (Hunter 1998a). Bulkheads with variable louvers will control airflow in each waste room of panel 1, and overall mine ventilation rate is controlled by surface exhaust fans above the exhaust ventilation shaft.

Radiological confinement is required in the 1997 SAR (Westinghouse 1997b, Sections 4.4.1 and 4.4.1.2) and DOE design criteria (US DOE 1989, Section 1300-7.1). Waste room radioactive releases can occur from handling accidents, roof falls, and spontaneous ignitions or explosions, and waste room exhaust air must be constantly monitored for radioactivity. The unfiltered air has the potential to be released to the surface and expose non-radiation workers (Nazarali et al. 1993; Bartlett 1993; Westinghouse 1997b, Section 5.2).

Initial waste emplacement is planned to occur in panel 1, room 7, and a bulkhead is located at the north end of this room in the S1600 drift. The bulkhead has a large, centrally located roll-up door and two sections of louvered openings for airflow control. The panel 1, room 7 design is not the same as panel 1, room 1 or the typical design shown in the 1997 WIPP SAR (Figure 2).

In January 1998, the EEG requested information on waste-room bulkhead configuration (Neill 1998). The CAO responded on February 27, 1998, by providing basic drawings of the ventilation scheme (Hunter 1998a) and arranging a March 3, 1998, meeting with Westinghouse Waste Isolation Division (WID). The conclusion of this meeting was that there is not a standard waste-room bulkhead design.

An ORR audit drill was conducted in panel 1, room 7 to simulate actual waste emplacement operating conditions and to determine the response of workers to a fire scenario. A simulated underground fire was staged in the upstream airflow from the emplacement activities and adjacent to the waste emplacement operations as workers were unloading waste containers.

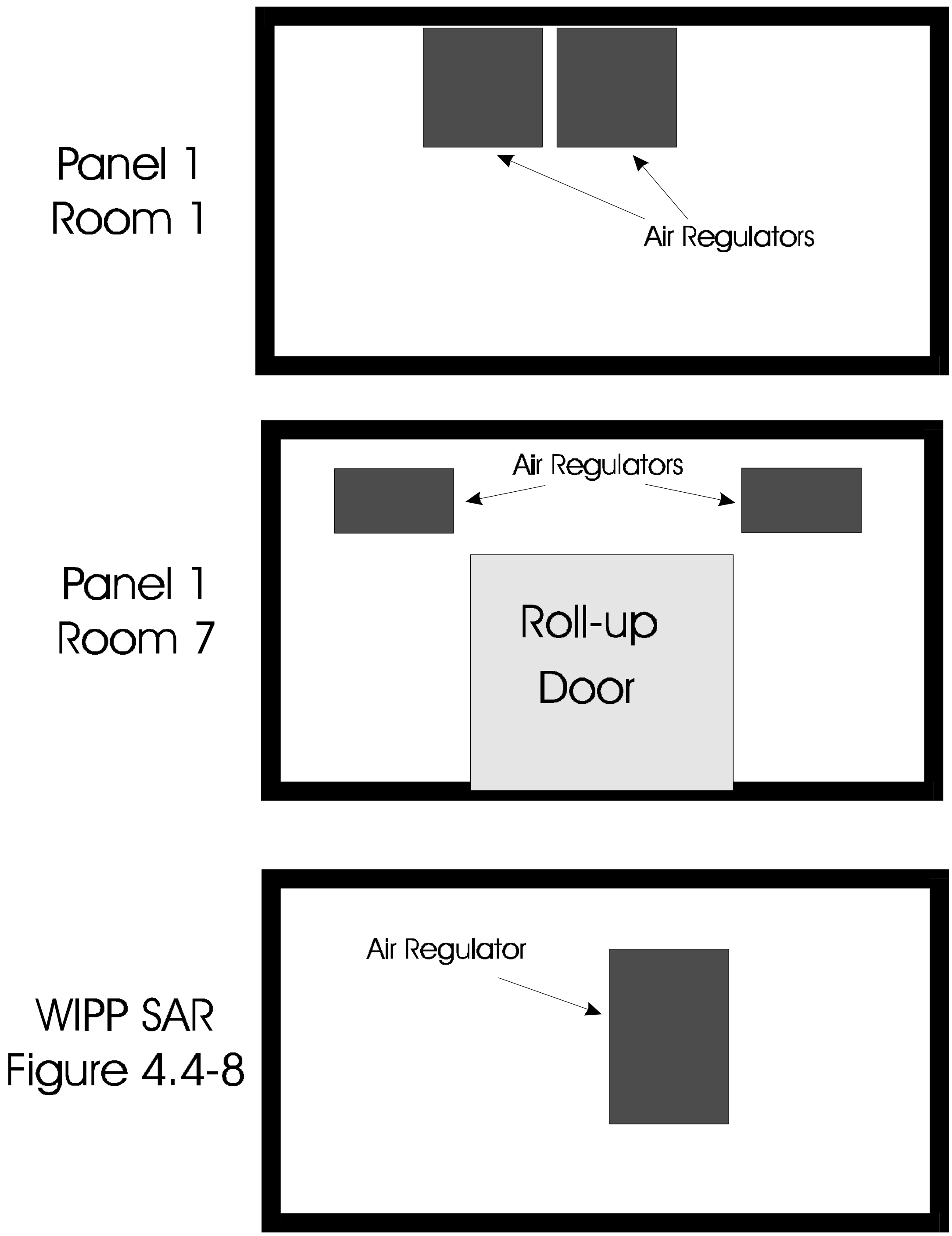


Figure 2. Relative Positions of Air Regulator Louvers in Waste Room Bulkheads

During the drill, the S1600 drift bulkhead roll-up door was inadvertently left open. In this configuration, the bulkhead could not control airflow and most of the airflow would by-pass the radiation effluent monitors located behind the exhaust louvers. This abnormal configuration was identified by the ORR team as a violation of the required facility configuration and classified as a "pre-start" finding. The ORR team considered the failure of workers to confirm the operational configuration as the root cause of the problem. The remedy was suggested to be adherence to the facility procedures.

Roll-up doors in a radiological confinement barrier increase the likelihood that room air flow will not be properly regulated and that radiation monitors may be by-passed. A simple solution is to remove the roll-up door and seal the opening, or perhaps permanently secure the door.

An additional concern is the non-standard airflow characteristics through bulkhead louvers where radiation monitors are located. For radiation monitors to function properly, the airflow characteristic around the monitor sampling probe must be carefully established (ANSI 1969). If the number or size of exhaust louvers is changed, then these airflow characteristic will change and necessitate additional radiation monitor operational testing. A standard bulkhead design without a roll-up door, and with standard location and sized exhaust louvers, would make airflow characteristics around the radiation monitor sampling probe more predictable.

Observation of the ORR drill also identified a concern with the potential confinement of radioactive airborne releases. The underground exhaust air effluent remained unfiltered during the drill, even though there was an identified fire in the radiation waste rooms. The 1997 SAR requires that the underground exhaust effluent be filtered only in the event of a waste container fire (Westinghouse 1997b, Section 4.4.2.3). During the drill, workers concluded that the simulated fire did not originate from the waste containers, and there was no request to filter underground exhaust air. <u>Any fire in a waste room should prompt a decision to filter the exhaust air</u>. When the fire is extinguished and there is confirmation that no radioactivity has been released, then normal unfiltered airflow can be resumed. The current procedure places heavy reliance on worker judgement, and workers may not be cognizant of the extent of the fire.

Considering the potential consequences of an airborne radioactive release, a more conservative reaction to waste room fires is important.

4.4 Radiation Effluent Monitoring

Recommendation 5: The underground radiation air monitors should be properly sited and tested.

Recommendation 6: Salt aerosol particulate concentrations should be established at underground radiation air monitoring locations.

Recommendation 7: Exhaust shaft water in-leakage should be minimized so that radiation compliance measurements are not compromised and hazardous waste water production is reduced or eliminated.

All underground air effluent is released via the exhaust ventilation shaft. Sampling of air effluent occurs at station A, located on the surface above the exhaust shaft. The EEG collects daily fixed air samples at station A to confirm compliance with 40 CFR 191 and 40 CFR 61 (Kenney et al. 1998).

The EEG noted that alpha continuous air monitors (CAMs) located at station A had reduced performance when sampling filters accumulated appreciable amounts of salt deposits (Bartlett 1993; Bartlett and Walker 1996). The station A CAMs were used to automatically cause diversion of unfiltered exhaust air to the high efficiency particulate air (HEPA) filtration building. The EEG recommended siting of alpha CAMs in the waste room areas below ground to minimize the consequences of salt aerosol and high airflow at station A (Bartlett and Walker 1996).

The underground radiation monitoring systems are now designed to automatically cause a shift to the filtration mode if radioactivity is detected. The waste room exit radiation monitors are required defense-in-depth equipment for waste operations and should be properly sited and tested as were station A monitors (Westinghouse 1997b, Section 5.1.8).

Exhaust Shaft Water. Video images of the exhaust shaft wall clearly shows the inflow of water from the strata. WID conducted a study (Duke 1996) that stated "...a water-saturated horizon is present in the lower Santa Rosa/upper Dewey Lake Formations in the depth range where water is leaking into the Exhaust Shaft capable of sustaining water production in the range of 0.3 to 0.6 gpm for a 24 hour period or longer." A second WID report (Duke 1997) states, "At present, there are two likely sources of this saline water. The first source is the North Salt Storage Area ... A second potential source of saline fluid could be attributable to residuum in the drilling and cuttings pit used during the drilling and excavation of the C&SH shaft in 1981."

During 1997 approximately 7% of the station A samples collected by the EEG were compromised due to the presence of water on the filter. A 1996 WID report noted that salt encrustations form on the station A sampling probes and that water droplets were the dominant source of probe moisture (Weaver et al. 1996). At higher airflow, water impacted the probes at higher velocity, and water flow rate could not be evaluated. A subsequent WID report suggested that wet salt deposition in the transport lines could significantly degrade the sampling performance and recommended cleaning or replacement when pressure drop exceeded 7.5 mm Hg (Chavez et al. 1997).

CAM Siting in the Underground. The CAO refused to provide the EEG with the preliminary test plan for siting CAMs in the underground drifts, although the test plan was available on March 4, 1998. The CAO stated the plan was *preliminary* and EEG was not entitled to such information (see Appendix 3). A final test plan was provided at 8:30 p.m. on March 23, 1998, the day before the test was initiated, and the EEG did not have sufficient time to review or comment on this important document.

The EEG was allowed to observe the radiation monitor testing, but the first day's testing (March 24, 1998) had to be postponed because of safety questions. Testing was resumed and completed on March 26, 1998. The EEG questioned both the test methodology and lack of information on the aerodynamic characteristics of the generated aerosol.

Underground Salt Aerosol. There are no available data to indicate the expected salt aerosol concentrations where radiation monitors are sited. During the ORR, roof bolting in E-140 drift caused significant visible salt aerosol in panel 1, room 7. Salt accumulations on CAM sampling filters will reduce radiation detection efficiency (Bartlett and Walker 1996; Bartlett and Walker 1997). Access to radiation monitors in the S1600 drift is difficult because panel 1, rooms 2 through 6 are restricted areas. The limited access further complicates CAM maintenance and the ability to frequently change sampling filters.

Exhaust Stack Configuration. Two exhaust stacks release unfiltered exhaust air from the underground. An additional stack and fan have been designed and will be added to the existing configuration. All three stacks are non-vertical and are short compared to the adjacent buildings and structures. The effluent air exhaust through these stacks is subject to backwash and fumigation conditions (Bartlett 1993; Nazarali et al. 1993). The design increases the likelihood that on-site workers will be exposed to radioactivity in the event of an accidental release.

Waste Handling Hoist Incident. On February 27, 1998, drums containing hazardous water from the exhaust shaft were being transported to the surface via the waste handling hoist. A cart loaded with the 6 water-filled 55-gallon drums rolled from the hoist and wedged on the side of the shaft during transport. A problem was recognized by the hoist operators, the hoist was secured, and a recovery plan developed. By the next day the problem was remedied, and no water was apparently lost from the drums. There was minor damage to the cart and the waste shaft lining material. The EEG was not notified of the incident until March 2, 1998.

In-leakage water is continuously collected from a trap located at the bottom of the exhaust shaft. Once nuclear operations begin, this area will be a part of a radiation zone, and worker access will be restricted accordingly. The exhaust shaft water in-leakage necessitates transport of hazardous material to an off-site repository.

4.5 Health Physics Operations

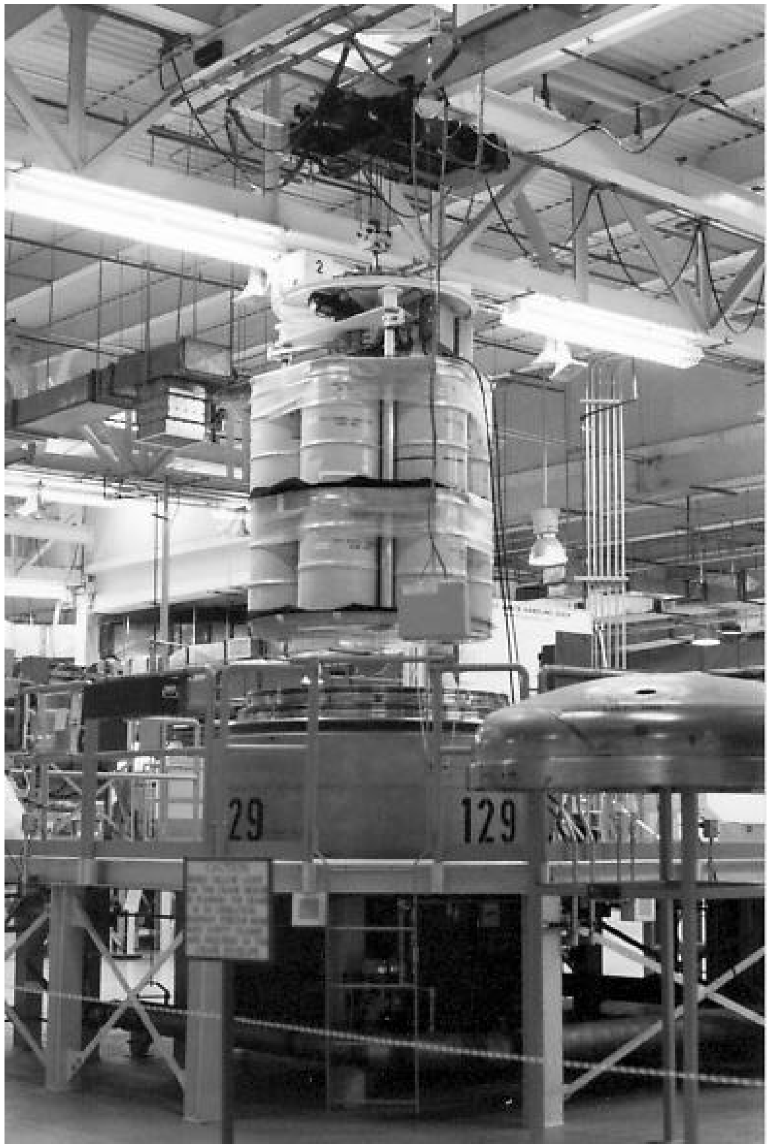
Recommendation 8: Routine radiological health and safety inspections should be conducted by DOE organizations other than the CAO or organizations reporting directly to the CAO.

Recommendation 9: Where possible, CAO staff should have technical qualifications equivalent to or greater than those required of contractor staff.

The WID health physics staff emphasized the WIPP "Start Clean, Stay Clean" philosophy. This philosophy is particularly important because of the facility design. The waste handling dock (Picture 3) is a complex structure that would be very difficult to decontaminate. In the mine, salt aerosol from mining and resuspension will also complicate decontamination efforts.

The contractor has devised methods to prevent spread of contamination. A vent-hood device surrounds the inner TRUPACT-II lid as the lid is opened. Exhaust air from the vent hood passes through HEPA filters. In addition, there are numerous radiation contamination surveys performed as the waste containers are withdrawn from the TRUPACT-II and transported to the underground. These are noteworthy and positive practices.

During the ORR drills, the EEG noted various questionable radiation safety practices that should have been considered by the CAO oversight and the ORR audit team. The individual observations are not necessarily significant problems, but the failure of the audit to consider or discuss any of these practices indicates a lack of appropriate oversight review. Some of the observations are discussed below.



Picture 3. A waste-handling-bay crane is lifting a 14-drum pack with simulated waste from the TRUPACT-II.

Contamination Control. On March 4, 1998, a drill was conducted in the waste handling building (WHB) to evaluate the training and methods used in waste handling. A 14-pack of drums with simulated waste was unloaded from a TRUPACT-II. A radiation smear from a waste drum was postulated to have measurable radioactivity, suggesting that the drum had removable contamination.

Once the positive smear was identified, the health physics technicians responded by informing workers. By procedure, the workers immediately left the WHB and assembled in an adjacent air lock. At this point each worker was checked for contamination using a hand-held radiation survey instrument.

The first concern of the workers was that airborne radioactivity might be present, although there was no CAM measurement or incident to suggest the potential for an airborne release. Because contamination was theoretically present, there was a potential that workers were contaminated, and if so, contamination could have been spread by the exiting workers. The actions of the workers seems contrary to the philosophy of Start Clean, Stay Clean. Typically, radiation workers should be required to perform a personal radiation survey prior to exiting a potentially contaminated area.

Use of Hand and Shoe Monitors. There were no hand and shoe monitors, or any whole-body radiation monitors in use at the WIPP facility. In the past, hand and shoe radiation monitoring equipment was used at radiation area exit points. Lack of appropriate monitoring equipment is a major programmatic concern. In the postulated drill scenario, hand and shoe monitors would have greatly facilitated contamination screening of exiting workers. If there were a reason to suspect airborne radioactivity, then immediate evacuation would have been prudent, but not in the postulated drill scenario.

The ORR team inspectors were preoccupied with the use of hand-held survey instruments, and the potential for contaminating the instruments. Although it is important to have properly calibrated instruments with an optimal sensitivity, whole-body surveys with hand-held instruments are time consuming and highly variable. In general, radiation workers tend to avoid self survey or take short cuts when not closely observed. The nuclear power industry places heavy reliance on automated whole-body survey instruments, and apart from the DOE, the use of automated whole-body survey techniques is accepted industry wide.

Automated whole-body survey instruments also have disadvantages, particularly when contamination is primarily from alpha emitting radionuclides. For beta emitting radionuclides, there is little debate on the efficacy of the whole-body survey instruments. Radiation workers should be familiar with the advantages and disadvantages of survey techniques and radiation survey equipment. A combination of survey methods and radiation equipment is necessary in a facility where both alpha and beta contamination are possible. This is particularly important if the facility is not easily decontaminated, which is the case for the WIPP.

Dosimetry. The WIPP thermoluminescent dosimetry (TLD) used for personnel radiation dose measurements is an albedo design. The WIPP requires the TLD dosimeter be worn on the outside of the clothing in close proximity to the body (Westinghouse 1998b). The albedo design measures neutrons reflected from the body surface. Improperly worn TLDs, such as those clipped to necklaces or in an improper orientation, will not adequately measure neutron doses.

During the ORR inspection, no radiation worker was observed to be properly wearing the dosimeter. Only one WIPP employee was observed wearing the dosimeter as prescribed by procedure. Improper wearing may be attributed to improper training. The ORR team claimed that dosimetry review was not necessary, but this was a poor health physics practice that should have been noted during the waste handling drills. The TLD is apparently the only neutron measurement device that will be routinely used at the WIPP.

Procedure Action Criteria. In the same drill described above, the participants were assembled to plan a recovery from the incident. This process appeared arbitrary and without appropriate procedural action criteria. There were no quantitative criteria to suggest the need for respiratory protection or to compare the relative risks of external gamma exposure to uptake of radioactive contamination. The recovery plan was dependent on available supervisory and managerial guidance, but action criteria should be part of radiation safety procedures. There were no ORR team questions about the adequacy of the WIPP procedures, but there was great attention to whether workers strictly complied with the available procedures.

CAO Oversight. Although the DOE has the responsibility and authority to self-regulate operational activities, it appears to be a conflict of interest for the CAO to be responsible for both WIPP contract administration and safety compliance inspections. Other than the ORR audit, there are apparently no plans for independent DOE compliance inspections of WIPP operations. The EEG and DNFSB are oversight organizations and can make recommendations. The CAO is an independent administrative organization within the DOE, and as such, is responsible for the contract administration, and health and safety reviews. The ORR audit team reviewed the training of CAO staff and reported the following:

> Some members of the CAO staff were assessed to determine their retention and understanding of some basic radiological fundamentals contained in the General Employee Training (GET) and Radiation Worker I training they had completed. Weaknesses were demonstrated in the following areas: types, characteristics, and sources of radioactive emissions; definitions of TRU; personnel exposure limits, surface contamination limits, radiation limits allowed external to the waste containers to be processed at WIPP; and average annual dose and major sources of that dose to the general public, etc. This lack of retention and understanding precludes these staff members from providing the effective oversight required with respect to radiological practices at WIPP.

The ORR team classified this finding as a “pre-start” recommendation. The DOE requires contractor radiation protection technical staff to have at least a Baccalaureate degree in science or engineering, including formal training in radiation protection (US DOE 1994). The individual shall have 4 years of relevant experience with the special requirement that nuclear experience be at the professional level. The EEG is not aware of any CAO staff member, responsible for radiation safety review, with these minimum qualifications.

4.6 Waste Handling Operations

Recommendation 10: Radiation waste shipments should not be received at the public and non-radiation worker site access gate.

Recommendation 11: Waste handling procedures should be modified so that radiation waste containers do not remain unnecessarily suspended above the TRUPACT-II and waste handling dock.

The waste handling system begins at the WIPP security gate with the receipt of the transport truck and TRUPACT-II shipping containers. The truck is examined, moved to a secured area, the trailer unloaded and shipping containers moved into the WHB. Once in the WHB, the waste containers are removed from the shipping container and transported to the underground repository. At present, only truck shipments are used. The site is also equipped for receipt of rail transport, and rail shipments have some potential transportation advantages.

There were ORR drills on March 3 - 5, 1998, demonstrating most of the waste handling sequence. The off-normal drills included scenarios with an incorrect inventory, contaminated drums, and an underground fire. The following observations were made.

Receipt of TRUPACT-IIs at Security Gate. Initial receipt of a truck loaded with three TRUPACT-II shipping containers occurred on Tuesday, March 3, 1998. Picture 4 indicates the relative position of a truck arriving at the security gate house. The security checks and radiation surveys can be lengthy (20 minutes or more), depending on the progress of inspections. WIPP anticipates receiving 500 to 900 shipments per year of CH-TRU waste, up to 500 RH-TRU shipments per year, for an average of about 1100 shipments per year for 35 years (US DOE/CAO 1997b).

Picture 4. Three TRUPACT-II shipping containers with simulated waste arrive at the WIPP security gate for inspection.

External dose rates from individual TRUPACT-II shipping containers can be as high as 200 mrem/hr at contact and 10 mrem/hr at two meters (US DOE/CAO 1996). The security gate entrance will likely have to be classified as at least a "Controlled Area" per WIPP procedures (Westinghouse 1998a). In addition, personnel TLDs are stored at the security gate building and radiation portal monitors are located in this area. It is likely that external radiation from shipping containers will interfere with TLD background measurements and operation of the portal monitor.

Use of WHB Crane. During the waste handling operations, a 14-drum load was observed to be suspended above the open TRUPACT II for approximately 20 minutes while smears of the accessible drum surfaces were counted (Picture 3). This drum package configuration has not been tested for a fall of approximately 10 feet, and the accident scenario (CH 2) was analyzed in the 1997 SAR (Westinghouse 1997b, Section 5.2.3.2). Leaving this payload suspended increases the probability of a CH 2 incident.

4.7 Radiochemistry Laboratory

Recommendation 12: The WIPP radiochemistry laboratory should be operational.

Currently WID has no on-site operational radiochemistry laboratory for rapid radiochemical analysis of workplace or environmental samples. This capability is an important part of the routine radiological operations. The on-site laboratory operations have been stopped pending resolution of vent-hood problems.

There should also be assurances that the on-site laboratory ventilation system air will be free from airborne radioactivity in the event of an accidental radiological release.

4.8 Start-up Phase of Operations

Recommendation 13: There should be a plan to systematically increase waste shipments from low to higher rates with appropriate operational, management and ALARA reviews (10 CFR 835.1002 (a)).

The Executive Summary in the ORR Report Volume I states that:

> "The WIPP is capable of receiving and emplacing CH TRU and TRU-mixed waste at a rate of up to 500,000 cubic feet per year, with an expected rate of 250,000 to 300,000 cubic feet per year."

There is no information or review supporting such a conclusion.

There are a number of issues that should be considered in the progression to full operations. At this time, concurrent above ground and underground waste handling operations are not being attempted because of staffing limitations. Apparently, the WIPP plans to collect waste containers in the WHB in a staging area and transport these containers to the underground when unloading operations are completed. This plan could potentially increase worker risks in the WHB and be less efficient than a continuous process. Staffing and resource allocations need to be reviewed.

This report also notes some issues that need continuing consideration. For example:

- Effluent radiation monitoring is not well established (Recommendations 3, 5, 6, and 7).
- The exhaust ventilation shaft has water in-leakage (Recommendation 7).
- Independent radiological health and safety inspections are needed (Recommendation 8).
- There is a need for better waste shipment site access (Recommendation 10).
- Waste handling may need to be optimized (Recommendation 11).
- Systematic ALARA evaluations as waste handling experience is gained (10 CFR 835.1002).

Initial shipments should have the lowest risk from the expected inventory. As part of ALARA planning, the production rate should be increased in a step-wise fashion, with each step requiring operations and ALARA review.

No phased operational plans were recommended in the 1997 SAR or by the ORR team (Westinghouse 1997b; Schepens 1998). The TRU Waste Management Plan suggests 67 CH WIPP shipments in FY 1998, and 500 shipments are scheduled for FY 1999 (US DOE/CAO 1997a). The shipping rates do not appear to be based on WIPP operational considerations.

5.0 REFERENCES

10 CFR 70. 1994. Domestic Licensing of Special Nuclear Material.

10 CFR 72. 1994. Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-level Radioactive Waste.

10 CFR 835. 1997. Occupational Radiation Protection.

American National Standards Institute. 1969. Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities. La Grange Park, IL: American Nuclear Society, ANSI N13.1-1969.

American National Standards Institute. 1983. Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants. La Grange Park, IL: American Nuclear Society, ANSI/ANS-51.1-1983.

Bartlett, W. T. 1993. An Evaluation of the Air Effluent and Workplace Radioactivity Monitoring at the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group, EEG-52.

Bartlett, W. T. and B. A. Walker. 1996. The Influence of Salt Aerosol on Alpha Radiation Detection by WIPP Continuous Air Monitors. Albuquerque, NM: Environmental Evaluation Group, EEG-60.

Bartlett, W. T. and B. A. Walker. 1997. "The Influence of Salt Aerosol on Alpha Radiation Detection by WIPP Continuous Air Monitors," in the Proceedings of the 24th DOE/NRC Nuclear Air Cleaning and Treatment Conference, Portland, Oregon, July 15-18, 1996, edited by M. W. First. Boston, MA: Harvard School of Public Health, 188-201.

Chavez, M. C., D. L. O'Neal, A. McFarland, C. Ortiz. 1997. An Analysis of Salt Deposition on the Performance of the WIPP Station A Air Sampling System. Submitted to the Westinghouse Electric Corporation in August.

Conway, J. T. 1998. February 17 letter from J. T. Conway, Chairman DNFSB to the Congress of the United States, Annual Report for calendar year 1997.

Defense Nuclear Facilities Safety Board. 1997. Integrated Safety Management. Technical Report, DNFSB/TECH-16.

Duke Engineering and Services. 1996. Exhaust Shaft Hydraulic Assessment Data Report. Westinghouse Electric Corporation, Waste Isolation Division, DOE/WIPP 97-2219.

Duke Engineering and Services. 1997. Exhaust Shaft: Phase 2 Hydraulic Assessment Data Report Involving Drilling, Installation, Water-Quality Sampling, and Testing of Piezometers 1-12. Westinghouse Electric Corporation, Waste Isolation Division, DOE/WIPP 97-2278.

Greenfield, M. A. 1990. Probabilities of a Catastrophic Waste Hoist Accident at the Waste Isolation Pilot Plant. Albuquerque, NM: Environmental Evaluation Group, EEG-44.

Greenfield, M. A. and T. J. Sargent. 1993. A Probabilistic Analysis of a Catastrophic Waste Hoist Accident at the WIPP. Albuquerque, NM: Environmental Evaluation Group, EEG-53.

Greenfield, M. A. and T. J. Sargent. 1995. An Analysis of the Annual Probability of Failure of the Waste Hoist Brake System at the Waste Isolation Pilot Plant (WIPP). Albuquerque, NM: Environmental Evaluation Group, EEG-59.

Greenfield, M. A. and T. J. Sargent. 1998. Probability of Failure of the Waste Hoist Brake System at the Waste Isolation Pilot Plant (WIPP). Albuquerque, NM: Environmental Evaluation Group, EEG-65.

Hunter, E. K. 1998a. February 27 letter from E. Kent Hunter, DOE, Office of National TRU Waste Operations to Robert H. Neill, Director, EEG, on request for drawings underground ventilation system.

Hunter, E. K. 1998b. March 27 letter from E. Kent Hunter, DOE, Office of National TRU Waste Operations to Robert H. Neill, Director, EEG, on request for DNFSB's WIPP SAR comments and CAO reply.

Kenney, J. W., D. H. Gray, and S. C. Ballard. 1998. Preoperational Radiation Surveillance of the WIPP Project by EEG During 1993 through 1995. Albuquerque, NM: Environmental Evaluation Group, EEG-67.

Maleki, H. and L. Chaturvedi. 1996. Stability Evaluation of the E140 Drift and Panel 1 Rooms at WIPP. Albuquerque, NM: Environmental Evaluation Group, EEG-63.

Nazarali, A. M., M. W. Carter, G. E. Chabot, and K. W. Skrable. 1993. Analysis of the Underground Effluent Dispersion and Deposition for Off-site and On-site Radiation Dose Assessment at the Waste Isolation Pilot Plant (WIPP) Using Smoke Test Method. Westinghouse Electric Corporation, Waste Isolation Division, DOE/WIPP-92-051.

Neill, R. H. 1998. January 26 letter from R. H. Neill, Director, EEG to G. E. Dials, Manager, DOE/CAO, on the review of 1997 SAR.

Schepens, Roy. 1998. Department of Energy Operational Readiness Review for the Startup of the Waste Isolation Pilot Plant, March 10. U.S. Department of Energy.

U.S. Congress. 1992. Waste Isolation Pilot Plant Land Withdrawal Act, Public Law 102-579, October 23.

U.S. Congress. 1996a. Balanced Budget Downpayment Act, I. Public Law 104-99.

U.S. Congress. 1996b. Waste Isolation Pilot Plant Land Withdrawal Act, Public Law 102-579, October 23, 1992, as amended by Public Law 102-201, September 23.

U.S. Department of Energy. 1989. General Design Criteria. DOE Order 6430.1A.

U.S. Department of Energy. 1994. Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities. DOE Order 5480.20A.

U.S. Department of Energy. 1995. Startup and Restart of Nuclear Facilities. DOE Order 425.1, Chg 1.

U.S. Department of Energy, Carlsbad Area Office. 1996. Waste Acceptance Criteria for the Waste Isolation Pilot Plant. DOE/WIPP-069, Rev. 5.

U.S. Department of Energy, Carlsbad Area Office. 1997a. National TRU Waste Management Plan. DOE/NTP-96-1204, Rev. 1.

U.S. Department of Energy, Carlsbad Area Office. 1997b. Waste Isolation Pilot Plant Disposal Phase Final Supplemental Impact Statement. DOE/EIS-0026-S-2/V.1.

Weaver, G., D. L. O'Neal, A. McFarland, and C. Ortiz. 1996. Analysis of Salt and Moisture on the Air Sampling Probes at the Waste Isolation Pilot Plant. Submitted to the Westinghouse Electric Corporation in April. ESL/TR-W1.

Westinghouse Electric Corporation, Waste Isolation Division. 1997a. Waste Isolation Pilot Plant Safety Analysis Report. DOE/WIPP-95-2065, Rev. 1.

Westinghouse Electric Corporation, Waste Isolation Division. 1997b. Waste Isolation Pilot Plant Safety Analysis Report. DOE/WIPP-95-2065, Rev. 2.

Westinghouse Electric Corporation, Waste Isolation Division. 1998a. "Posting and Access," WP12-HP1500, Rev. 0, 3/27/97, in Control WIPP Operational Health Physics Procedures Manual. WP12-HP.

Westinghouse Electric Corporation, Waste Isolation Division. 1998b. "TLD Assignment, Issue and Retrieval," WP 12-DS3326, Rev. 0, Chg. 2, in Dosimetry Program Manual. WP12-3.

Winters, D. and J. Roarty. 1997. June 17 memorandum from D. Winters and J. Roarty to G. W. Cunningham, Technical Director of the DNFSB, on Review of Waste Isolation Pilot Plant (WIPP) Safety Authorization Basis Documentation.

APPENDIX 1

DOE Audit Requirements Specified in DOE O 425.1 Section d.

d. Minimum Core Requirements. Each of the minimum core requirements listed below shall be addressed when developing the breadth of an Operational Readiness Review. Justification shall be provided in the plan-of-action, prepared in accordance with paragraphs 4b(2) and (3), above, if it is determined that a particular core requirement will not be reviewed. The plan-of-action may reference a timely, independent review that addressed the requirements in a technically sound manner to justify not performing further evaluation of a core requirement during an Operational Readiness Review.

(1) There are adequate and correct procedures and safety limits for operating the process systems and utility systems.

(2) Training and qualification programs for operations and operations support personnel have been established, documented, and implemented. (The training and qualification program encompasses the range of duties and activities required to be performed.)

(3) Level of knowledge of operations and operations support personnel is adequate based on reviews of examinations and examination results and selected interviews of operating and operations support personnel.

(4) Facility safety documentation is in place that describes the "safety envelope" of the facility. The safety documentation should characterize the hazards/risks associated with the facility and should identify mitigating measures (systems, procedures, administrative controls, etc.) that protect workers and the public from those hazards/risks. Safety systems and systems essential to worker and public safety are defined and a system to maintain control over the design and modification of facilities and safety-related utility systems is established.

(5) A program is in place to confirm and periodically reconfirm the condition and operability of safety systems, including safety related process systems and safety related utility systems. This includes examinations of records of tests and calibration of safety system and other instruments that monitor limiting conditions of operation or that satisfy Technical Safety Requirements. All systems are currently operable and in a satisfactory condition.

(6) A process has been established to identify, evaluate, and resolve deficiencies and recommendations made by oversight groups, official review teams, audit organizations, and the operating contractor.

(7) A systematic review of the facility's conformance to applicable DOE Orders has been performed, any nonconformances have been identified, and schedules for gaining compliance have been justified in writing and formally approved.

(8) Management programs are established, sufficient numbers of qualified personnel are provided, and adequate facilities and equipment are available to ensure operational support services (e.g., training, maintenance, waste management, environmental protection, industrial safety and hygiene, radiological protection and health physics, emergency preparedness, fire protection, quality assurance, criticality safety, and engineering) are adequate for operations.

(9) A routine and emergency operations drill program, including program records, has been established and implemented.

(10) An adequate startup or restart test program has been developed that includes adequate plans for graded operations testing to simultaneously confirm operability of equipment, the viability of procedures, and the training of operators.

(11) Functions, assignments, responsibilities, and reporting relationships are clearly defined, understood, and effectively implemented with line management responsibility for control of safety.

(12) The implementation status for DOE 5480.19, CONDUCT OF OPERATIONS REQUIREMENTS FOR DOE FACILITIES, of 7-9-90, is adequate for operations.

(13) There are sufficient numbers of qualified personnel to support safe operations.

(14) A program is established to promote a site-wide culture in which personnel exhibit an awareness of public and worker safety, health, and environmental protection requirements and, through their actions, demonstrate a high-priority commitment to comply with these requirements.

(15) The facility systems and procedures, as affected by facility modifications, are consistent with the description of the facility, procedures, and accident analysis included in the safety basis.

(16) The technical and managerial qualifications of those personnel at the DOE Field organization and at DOE Headquarters who have been assigned responsibilities for providing direction and guidance to the contractor, including the Facility Representatives, are adequate (DOE Operational Readiness Review only).

(17) The breadth, depth, and results of the responsible contractor Operational Readiness Review are adequate to verify the readiness of hardware, personnel, and management programs for operations (DOE Operational Readiness Review only).

(18) Modifications to the facility have been reviewed for potential impacts on procedures and training and qualification. Procedures have been revised to reflect these modifications and training has been performed to these revised procedures.

(19) The technical and management qualifications of contractor personnel responsible for facility operations are adequate.

(20) DOE Operations Office Oversight Programs, such as Occurrence Reporting, Facility Representative, Corrective Action, and Quality Assurance Programs, are adequate (DOE Operational Readiness Review only).

APPENDIX 2

ORR Findings

Pre-Start Findings

DOE1-1	FR Program document and FR Training and Qualification requirements are in draft form.
DOE1-2	Some CAO staff members did not demonstrate a satisfactory level of retention or understanding of radiological fundamentals.
EC1-1	Deficiencies were identified with the implementation of the Contingency Plan.
FP1-2	Validation of the layout of the emergency lighting systems to verify compliance with the Life Safety Code needs to be completed.
OP3-3	Two critical evolutions for operating Defense-in-Depth systems were observed to be conducted without using procedures in a step-by-step process.
SE2-1	Implementing Procedures for Mode Compliance do not ensure implementation of TSR requirements.

Post-Start Findings

DOE1-3	There is no CAO document describing CAO staff functions, responsibilities, and authorities as required by DOE M 411.1-1.
DOE1-4	Training and qualification requirements covering site specific systems and processes for appropriate CAO personnel are inadequate.
DOE1-5	Some responsibilities in the CAO Training Administrator position description are not being met.
DOE1-6	No CAO staff members are required to be Radiation Worker II qualified.
EC1-2	The site is not certified to dispose site-derived waste at WIPP.
EC1-3	No guidance is provided to the Waste Operations Data Administrator for the review and approval of data.

EP2-1 Not all significant observations contained in the evaluator notes were captured in the critique notes for inclusion in the site issues tracking system (STAR). As a result, not all significant deficiencies are being tracked to closure.

EP2-2 Controller's and evaluator's roles and responsibilities, as implemented during drills seemed to be interchangeable, even though they are separate and distinct functions as defined in WID Procedure 12-ES3004.

ES3-1 WP 02-AR3001 does not ensure that the contractor determines the existence of USQs following completion of safety evaluation. In addition, WP 02-AR3001 does not ensure prompt reporting of potential USQs as Off Normal or of USQs as Unusual Occurrences.

IS1-1 Deficiencies were found with proper chemical labeling, storage and acceptance of emergency eyewash stations.

MT1-2 Maintenance procedures for radiological work do not address the requirements for radiological hold points.

MT2-2 The Operator's Check List used to perform the daily pre-operational check on a fork lift did not contain all of the checks recommended in the fork lift Operator's and Owner's Manual.

RP1-3 Radiation Worker II practical exams are conducted in a manner such that each student is not individually evaluated.

SE1-2 An unauthorized modification to the NEMA 4X Cabinet of Local Processing Unit 807 (Mode Compliance Equipment) was made.

TR1-1 Documentation is not available to verify personnel in Training Implementation Matrix (TIM) Rev. 1 qualified positions meet all entry level requirements.

TR2-1 Several annual refresher safety courses have utilized a single examination with no changes for several years.

APPENDIX 3

EEG/CAO Communications on ORR Audit

October 29, 1997, EEG/CAO Quarterly Meeting. The EEG requested CAO to assign a contact person for the ORR audit participation. CAO designated person during meeting.

December 22, 1997, Email to CAO. The EEG requested information on the ORR schedule and scope, and a meeting in mid-January to discuss EEG participation.

January 8, 1998, Telephone call. Follow-up on December 22, 1997 request and was told a meeting was pointless because no information was available on the ORR audit process.

(By this time, the ORR audit team had apparently been on site, conducted a preliminary review of the facilities and prepared an audit plan.)

January 29, 1998, Telephone call to EEG. CAO contact stated ORR was selected. George Dials was delegated authority to open facility with concurrence of Secretary of Energy. Roy Schepens from Savannah River Plant would be team leader. ORR was scheduled for March 2, 1998 with opening session at 8:00 a.m. Non-concurrent drills scheduled for March 3 - 4, 1998 and inspector interviews to follow drills. No other information was available.

February 3, 1998, Telephone call to CAO. The EEG requested a meeting to discuss ORR plans and mechanism for the EEG's participation. The meeting was declined because no additional information was available. The EEG was told they would not have to participate in any special training because EEG staff GET training was up-to-date.

February 13, 1998, Email from CAO. CAO transmitted the ORR Implementation Plan. No audit schedule was included.

February 13, 1998, Telephone call to CAO. The EEG requested time to introduce EEG team members and give background on EEG oversight role.

February 16, 1998, FAX from CAO. The CAO requested more information on topics EEG intended to discuss.

February 17, 1998, Email to CAO. The EEG stated that 4 would participate in the audit. CAO acknowledges that Roy Schepens, ORR Team Leader, had no objections to the observers or an EEG opening statement.

February 18, 1998, Email to CAO. The EEG suggested that Bob Neill would not be present on March 2, 1998 because of scheduling conflict. Three EEG staff would be present at the initial meeting.

February 21, 1998, FAX to CAO Manager from Bob Neill. The proposed EEG presentation to the ORR team was outlined.

February 24, 1998, Email to CAO Contact. The EEG request that the EEG radiochemist and quality assurance expert be present during the audit when these special topics were to be discussed.

March 4, 1998, Bill Bartlett met with WID engineering per CAO February 27, 1998 letter. The WID engineers stated that the preliminary radiation effluent monitor test plan was available, but CAO would not allow WID to give EEG a copy of the plan for review.

March 12, 1998, Email to CAO. The EEG requested a copy of the WID underground CAM test plan or a reason the plan was not available to the EEG.

March 13, 1998, 10:54 AM, CAO Email to EEG. "The subject Test Plan is preliminary. This means that WID has not formally completed the draft, and it has not been provided to the CAO. Our February 11, 1998 letter (K. Hunter to R. Neill) said that the Test Plan would be provided to the EEG upon its completion. At this time, the preliminary information will not be provided to the EEG."

March 13, 1998, 11:25 AM, Email from EEG to CAO. "Our request stands. Please refer to the Land Withdrawal Act, Section 17 (a) (1) that <u>requires</u> the DOE to provide the EEG with free and timely access to data relating to health, safety, or environmental issues at WIPP, and (2) that <u>requires</u> the DOE to provide EEG with <u>preliminary</u> reports relating to health, safety, or environmental issues at WIPP."

(The CAO did not respond to the March 13, 1998 email.)

March 23, 1998, 8:30 PM. EEG received a copy of the <u>final</u> radiation monitor test plan. Testing began at 8:00 AM on March 24, 1998. There was no opportunity to review and comment on the test plan prior to testing. The EEG sent observers to watch the testing. The March 24, 1998, testing was postponed because of a safety concern. The testing was rescheduled to March 26, 1998, and completed on that date.

April 13, 1998, CAO letter to EEG. Required all EEG requests to be by formal letter.

April 15, 1998, EEG letter to CAO. Data and any reports on the underground radiation monitoring tests were requested.

LIST OF EEG REPORTS

EEG-1 Goad, Donna, A Compilation of Site Selection Criteria Considerations and Concerns Appearing in the Literature on the Deep Disposal of Radioactive Wastes, June 1979.

EEG-2 Review Comments on Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico SAND 78-1596, Volume I and II, December 1978.

EEG-3 Neill, Robert H., James K. Channell, Carla Wofsy, Moses A. Greenfield (eds.) Radiological Health Review of the Draft Environmental Impact Statement (DOE/EIS-0026-D) Waste Isolation Pilot Plant, U.S. Department of Energy, August 1979.

EEG-4 Little, Marshall S., Review Comments on the Report of the Steering Committee on Waste Acceptance Criteria for the Waste Isolation Pilot Plant, February 1980.

EEG-5 Channell, James K., Calculated Radiation Doses From Deposition of Material Released in Hypothetical Transportation Accidents Involving WIPP-Related Radioactive Wastes, October 1980.

EEG-6 Geotechnical Considerations for Radiological Hazard Assessment of WIPP. A Report of a Meeting Held on January 17-18, 1980, April 1980.

EEG-7 Chaturvedi, Lokesh, WIPP Site and Vicinity Geological Field Trip. A Report of a Field Trip to the Proposed Waste Isolation Pilot Plant Project in Southeastern New Mexico, June 16 to 18, 1980, October 1980.

EEG-8 Wofsy, Carla, The Significance of Certain Rustler Aquifer Parameters for Predicting Long-Term Radiation Doses from WIPP, September 1980.

EEG-9 Spiegler, Peter, An Approach to Calculating Upper Bounds on Maximum Individual Doses From the Use of Contaminated Well Water Following a WIPP Repository Breach, September 1981.

EEG-10 Radiological Health Review of the Final Environmental Impact Statement (DOE/EIS-0026) Waste Isolation Pilot Plant, U. S. Department of Energy, January 1981.

EEG-11 Channell, James K., Calculated Radiation Doses From Radionuclides Brought to the Surface if Future Drilling Intercepts the WIPP Repository and Pressurized Brine, January 1982.

EEG-12 Little, Marshall S., Potential Release Scenario and Radiological Consequence Evaluation of Mineral Resources at WIPP, May 1982.

EEG-13 Spiegler, Peter, Analysis of the Potential Formation of a Breccia Chimney Beneath the WIPP Repository, May 1982.

EEG-14 Not published.

EEG-15 Bard, Stephen T., Estimated Radiation Doses Resulting if an Exploratory Borehole Penetrates a Pressurized Brine Reservoir Assumed to Exist Below the WIPP Repository Horizon - A Single Hole Scenario, March 1982.

EEG-16 Radionuclide Release, Transport and Consequence Modeling for WIPP. A Report of a Workshop Held on September 16-17, 1981, February 1982.

EEG-17 Spiegler, Peter, Hydrologic Analyses of Two Brine Encounters in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site, December 1982.

LIST OF EEG REPORTS (continued)

EEG-18 Spiegler, Peter and Dave Updegraff, Origin of the Brines Near WIPP from the Drill Holes ERDA-6 and WIPP-12 Based on Stable Isotope Concentration of Hydrogen and Oxygen, March 1983.

EEG-19 Channell, James K., Review Comments on Environmental Analysis Cost Reduction Proposals (WIPP/DOE-136) July 1982, November 1982.

EEG-20 Baca, Thomas E., An Evaluation of the Non-Radiological Environmental Problems Relating to the WIPP, February 1983.

EEG-21 Faith, Stuart, Peter Spiegler, Kenneth R. Rehfeldt, The Geochemistry of Two Pressurized Brines From the Castile Formation in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site, April 1983.

EEG-22 EEG Review Comments on the Geotechnical Reports Provided by DOE to EEG Under the Stipulated Agreement Through March 1, 1983, April 1983.

EEG-23 Neill, Robert H., James K. Channell, Lokesh Chaturvedi, Marshall S. Little, Kenneth Rehfeldt, Peter Spiegler, Evaluation of the Suitability of the WIPP Site, May 1983.

EEG-24 Neill, Robert H. and James K. Channell, Potential Problems From Shipment of High-Curie Content Contact-Handled Transuranic (CH-TRU) Waste to WIPP, August 1983.

EEG-25 Chaturvedi, Lokesh, Occurrence of Gases in the Salado Formation, March 1984.

EEG-26 Spiegler, Peter, Proposed Preoperational Environmental Monitoring Program for WIPP, November 1984.

EEG-27 Rehfeldt, Kenneth, Sensitivity Analysis of Solute Transport in Fractures and Determination of Anisotropy Within the Culebra Dolomite, September 1984.

EEG-28 Knowles, H. B., Radiation Shielding in the Hot Cell Facility at the Waste Isolation Pilot Plant: A Review, November 1984.

EEG-29 Little, Marshall S., Evaluation of the Safety Analysis Report for the Waste Isolation Pilot Plant Project, May 1985.

EEG-30 Dougherty, Frank, Tenera Corporation, Evaluation of the Waste Isolation Pilot Plant Classification of Systems, Structures and Components, July 1985.

EEG-31 Ramey, Dan, Chemistry of the Rustler Fluids, July 1985.

EEG-32 Chaturvedi, Lokesh and James K. Channell, The Rustler Formation as a Transport Medium for Contaminated Groundwater, December 1985.

EEG-33 Channell, James K., John C. Rodgers, Robert H. Neill, Adequacy of TRUPACT-I Design for Transporting Contact-Handled Transuranic Wastes to WIPP, June 1986.

EEG-34 Chaturvedi, Lokesh, (ed.), The Rustler Formation at the WIPP Site, Report of a Workshop on the Geology and Hydrology of the Rustler Formation as it Relates to the WIPP Project, February 1987.

EEG-35 Chapman, Jenny B., Stable Isotopes in Southeastern New Mexico Groundwater: Implications for Dating Recharge in the WIPP Area, October 1986.

EEG-36 Lowenstein, Tim K., Post Burial Alteration of the Permian Rustler Formation Evaporites, WIPP Site, New Mexico, April 1987.

LIST OF EEG REPORTS (continued)

EEG-37 Rodgers, John C., Exhaust Stack Monitoring Issues at the Waste Isolation Pilot Plant, November 1987.

EEG-38 Rodgers, John C. and Jim W. Kenney, A Critical Assessment of Continuous Air Monitoring Systems at the Waste Isolation Pilot Plant, March 1988.

EEG-39 Chapman, Jenny B., Chemical and Radiochemical Characteristics of Groundwater in the Culebra Dolomite, Southeastern New Mexico, March 1988.

EEG-40 Review of the Final Safety Analyses Report (Draft), DOE Waste Isolation Pilot Plant, December 1988, May 1989.

EEG-41 Review of the Draft Supplement Environmental Impact Statement, DOE Waste Isolation Pilot Plant, July 1989.

EEG-42 Chaturvedi, Lokesh, Evaluation of the DOE Plans for Radioactive Experiments and Operational Demonstration at WIPP, September 1989.

EEG-43 Kenney, Jim W., John Rodgers, Jenny Chapman, Kevin Shenk, Preoperational Radiation Surveillance of the WIPP Project by EEG 1985-1988, January 1990.

EEG-44 Greenfield, Moses A., Probabilities of a Catastrophic Waste Hoist Accident at the Waste Isolation Pilot Plant, January 1990.

EEG-45 Silva, Matthew K., Preliminary Investigation into the Explosion Potential of Volatile Organic Compounds in WIPP CH-TRU Waste, June 1990.

EEG-46 Gallegos, Anthony F. and James K. Channell, Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) Wastes to WIPP Along Selected Highway Routes in New Mexico Using RADTRAN IV, August 1990.

EEG-47 Kenney, Jim W. and Sally C. Ballard, Preoperational Radiation Surveillance of the WIPP Project by EEG During 1989, December 1990.

EEG-48 Silva, Matthew, An Assessment of the Flammability and Explosion Potential of Transuranic Waste, June 1991.

EEG-49 Kenney, Jim, Preoperational Radiation Surveillance of the WIPP Project by EEG During 1990, November 1991.

EEG-50 Silva, Matthew K. and James K. Channell, Implications of Oil and Gas Leases at the WIPP on Compliance with EPA TRU Waste Disposal Standards, June 1992.

EEG-51 Kenney, Jim W., Preoperational Radiation Surveillance of the WIPP Project by EEG During 1991, October 1992.

EEG-52 Bartlett, William T., An Evaluation of Air Effluent and Workplace Radioactivity Monitoring at the Waste Isolation Pilot Plant, February 1993.

EEG-53 Greenfield, Moses A. and Thomas J. Sargent, A Probabilistic Analysis of a Catastrophic Transuranic Waste Hoist Accident at the WIPP, June 1993.

EEG-54 Kenney, Jim W., Preoperational Radiation Surveillance of the WIPP Project by EEG During 1992, February 1994.

LIST OF EEG REPORTS (continued)

EEG-55 Silva, Matthew K., Implications of the Presence of Petroleum Resources on the Integrity of the WIPP, June 1994.

EEG-56 Silva, Matthew K. and Robert H. Neill, Unresolved Issues for the Disposal of Remote-Handled Transuranic Waste in the Waste isolation Pilot Plant, September 1994.

EEG-57 Lee, William W.-L, Lokesh Chaturvedi, Matthew K. Silva, Ruth Weiner, and Robert H. Neill, An Appraisal of the 1992 Preliminary Performance Assessment for the Waste Isolation Pilot Plant, September 1994.

EEG-58 Kenney, Jim W., Paula S. Downes, Donald H. Gray, Sally C. Ballard, Radionuclide Baseline in Soil Near Project Gnome and the Waste Isolation Pilot Plant, June 1995.

EEG-59 Greenfield, Moses A. and Thomas J. Sargent, An Analysis of the Annual Probability of Failure of the Waste Hoist Brake System at the Waste Isolation Pilot Plant (WIPP), November 1995.

EEG-60 Bartlett, William T. and Ben A. Walker, The Influence of Salt Aerosol on Alpha Radiation Detection by WIPP Continuous Air Monitors, January 1996.

EEG-61 Neill, Robert, Lokesh Chaturvedi, William W.-L. Lee, Thomas M. Clemo, Matthew K. Silva, Jim W. Kenney, William T. Bartlett, and Ben A. Walker, Review of the WIPP Draft Application to Show Compliance with EPA Transuranic Waste Disposal Standards, March 1996.

EEG-62 Silva, Matthew K., Fluid Injection for Salt Water Disposal and Enhanced Oil Recovery as a Potential Problem for the WIPP: Proceedings of a June 1995 Workshop and Analysis, August 1996.

EEG-63 Maleki, Hamid and Lokesh Chaturvedi, Stability Evaluation of the Panel 1 Rooms and the E140 Drift at WIPP, August 1996.

EEG-64 Neill, Robert H., James K. Channell, Peter Spiegler, Lokesh Chaturvedi, Review of the Draft Supplement to the WIPP Environmental Impact Statement, DOE/EIS-0026-S-2, April 1997.

EEG-65 Greenfield, Moses A. and Thomas J. Sargent, Probability of Failure of the Waste Hoist Brake System at the Waste Isolation Pilot Plant (WIPP), January 1998.

EEG-66 Channell, James K. and Robert H. Neill, Individual Radiation Doses From Transuranic Waste Brought to the Surface by Human Intrusion at the WIPP, February 1998.

EEG-67 Kenney, Jim W., Donald H. Gray, and Sally C. Ballard, Preoperational Radiation Surveillance of the WIPP Project by EEG During 1993 Though 1995, March 1998.

EEG-68 Neill, Robert H., Lokesh Chaturvedi, Dale F. Rucker, Matthew K. Silva, Ben A. Walker, James K. Channell, Thomas M. Clemo, Evaluation of the WIPP Project's Compliance with the EPA Radiation Protection Standards for Disposal of Transuranic Waste, March 1998.

EEG-69 Rucker, Dale, Sensitivity Analysis of Performance Parameters Used In Modeling the Waste Isolation Pilot Plant, May 1998.

EEG-70 Bartlett, William T. and Jim W. Kenney, EEG Observations of the March 1998 WIPP Operational Readiness Review Audit, May 1998.