

REPORT
TO THE UNITED STATES SECRETARY OF ENERGY
ON THE
WASTE ISOLATION PILOT PLANT

BY
Leonard C. Slosky
Member
WASTE ISOLATION PILOT PLANT
BLUE RIBBON PANEL

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I. BACKGROUND

The Waste Isolation Pilot Plant (WIPP), as established by Public Law 96-164, is being developed by the United States Department of Energy (DOE) to demonstrate the safe disposal of transuranic (TRU) waste from the nation's nuclear weapons program.

WIPP is a mined repository located 2,150 feet below the surface of southeastern New Mexico. The repository is within a 2,000 foot thick formation of 225 million year old bedded salt. WIPP is designed to dispose of nearly six million cubic feet of TRU wastes produced between 1970 and the year 2013. It is the only TRU waste disposal facility under development in the United States.

II. INTRODUCTION

The WIPP Blue Ribbon Panel (BRP) was established by the Secretary of the United States Department of Energy (DOE) on August 31, 1989. Each of the five Panel members was charged to independently report on the following issues related to WIPP:

- o The concept and timing of the draft plan for the WIPP test phase: the performance assessment (including the waste experiments) and the operations demonstration.
- o Whether the operations demonstration should be conducted at the same time as the waste experiments and the performance assessment.
- o The adequacy of plans to ensure that the TRU wastes generated by the Rocky Flats Plant (RFP) meet the waste acceptance criteria (WAC) for the WIPP.

The short amount of time allotted to the BRP, together with the complexity and extensive history of WIPP project, presented the BRP with a formidable task. Because of this, this report should be considered preliminary in nature. It also should be noted that the BRP was not charged and has not attempted to review all of the important issues concerning WIPP. In particular, the Panel has not addressed the operational readiness of WIPP.

III. BLUE RIBBON PANEL ASSESSMENT METHODOLOGY

The following methodology has been used by the BRP:

- o During September 11-14, 1989, the BRP toured the WIPP, portions of the Idaho National Engineering Laboratory (INEL), and portions of the RFP. During this period the BRP was briefed by numerous DOE officials and contractors; Dr. Peter B. Myers, Staff Director of the National Academy of Sciences/National Research Council Board on Radioactive Waste Management; Mr. Robert H. Neill, Director and Dr. Lokesh Chaturvedi, Deputy Director and Engineering Geologist of the Environmental Evaluation Group, New Mexico. Most of the people who briefed the Panel also provided written materials.
- o On September 25-26, 1989, the BRP convened a follow-up meeting in Denver, Colorado. At this meeting, a select group of DOE officials, DOE contractors, and a representative of the United States Environmental Protection Agency (EPA) were requested to respond to ten pages of questions prepared by the BRP.
- o The BRP has been provided an extensive number of DOE documents, including *Draft Plan For The Waste Isolation Pilot Plant Test Phase: Performance Assessment and Operations Demonstration*, April 1989 and June 1989 Addendum. DOE/WIPP 89-011; *TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, January 1989. WIPP/DOE-069, Revision 3.
- o The BRP and individual Panel members have requested and been provided additional documents from DOE. Individual Panel members have held discussions with a broad range of individuals knowledgeable about WIPP.

Throughout the process, officials from DOE have been quite informative, candid, and helpful to the BRP.

IV. EXECUTIVE SUMMARY

Following is a summary of the principal observations and recommendations.

1. The Waste Isolation Pilot Plant (WIPP) program is of major national importance even beyond the transuranic (TRU) waste management system. The success or failure of WIPP will have extensive impacts on the United States Department of Energy (DOE) as well as on civilian radioactive waste management programs.

2. DOE should implement an integrated management system for TRU waste and the WIPP program.

3. A considerable amount of work must be completed before WIPP can receive waste for the test phase. A number of potential legal challenges could impede the beginning of the test phase.

4. Rather than only including technical issues, the WIPP waste retrieval plan should address the regulatory and institutional actions required to store the waste if retrieval from WIPP becomes necessary.

5. Significant technical questions exist regarding the ability of WIPP to comply with the applicable regulatory requirements: the environmental radiation protection standards, the no migration exemption from the land disposal restrictions, and the hazardous waste facility standards. Despite the unresolved technical issues, bedded salt continues to offer outstanding qualities for the long-term isolation of TRU waste.

6. DOE should develop and publish within the next six months an integrated and coherent set of documents on the WIPP program:

First, a systematic assessment of the current understanding of the long-term performance of the WIPP repository, as recommended by the National Research Council. This document should include a sensitivity analysis and should clearly indicate existing uncertainties and the data needed to determine if WIPP complies with regulatory requirements.

Second, a generalized description of the laboratory, bin, and alcove experiments. This document should clearly indicate how the experiments address the data needs identified in the first document.

Third, a detailed technical description of the laboratory, bin, and alcove experiments.

7. Essential data from the bin and alcove experiments (particularly concerning gas generation) may not be available as soon as DOE expects. It is also very possible that the results from the planned tests will raise new issues that necessitate additional experiments. Thus, it may take longer than the three to five years DOE projects to determine WIPP's regulatory compliance.

8. It is imperative that the test phase not only obtain data on important technical issues such as gas generation, but also test solutions to these problems. Therefore, the alcove and particularly the bin tests should be expanded to include a broad range of: nonmetallic containers, treated waste forms, and additives to prevent gas build up.

9. Increased attention should be directed to evaluating potential waste treatment technologies. In contrast to other parameters affecting the performance of the repository (e.g., hydrogeologic processes), the waste form is one of the most controllable variables. Since about 90 percent of the total waste volume to be emplaced at WIPP is yet to be generated or will likely require repackaging, the opportunity exists to develop a more stable waste form that would moot a number of the unresolved technical issues and would dramatically improve the ability of WIPP to meet regulatory standards.

10. The bin experiments should begin as soon as possible. If WIPP cannot receive waste for experimental purposes by (or shortly after) mid-1990, the bin tests should be promptly initiated at another location.

11. The alcove tests are an important part of the WIPP test phase because they integrate important repository conditions that laboratory and bin tests cannot fully represent. However, current scheduling calls for the "final" performance assessment to be conducted before the majority of the alcove test results are likely to be available.

12. In total, about 5,900 drum-equivalents of waste are justified for the currently planned test program. This is equal to about 0.8 percent of total WIPP capacity. With the recommended expansion of the test program, about 8,800 drum-equivalents of waste (equal to about 1.2 percent of WIPP capacity) may be needed.

13. An operations demonstration is an important element in ensuring the operational readiness of a "production" facility. However, given the current degree of uncertainty regarding the ability of WIPP to meet regulatory requirements, it is not prudent to transport large quantities of waste (i.e., 2.5 percent of total capacity) to WIPP. In addition, since WIPP design and operational configurations are uncertain, an operations demonstration in the near-term would not be representative of actual repository conditions. If DOE wants to obtain more experience in the operation of the WIPP system at full-capacity, drums and standard waste boxes containing nonradioactive materials could be used. The Operations Demonstration should be separated from the Test Plan in order to avoid confusion.

14. It is not clear that a comprehensive assessment has been made of the applicability of federal and state hazardous waste regulations to the WIPP program. Considerably more attention to hazardous waste compliance issues is needed to prevent potentially serious delays in WIPP. DOE should aggressively work to resolve the applicability of the Safe Drinking Water Act's underground injection control requirements to WIPP.

15. DOE should expeditiously prepare a comprehensive hazardous waste compliance strategy. DOE should work closely with the State of New Mexico on the promulgation of mixed waste regulations and in the preparation of permit applications.

16. DOE should develop a comprehensive plan to characterize the hazardous (nonradioactive) components of TRU-mixed wastes being generated and in storage. The characterization plan must include substantial laboratory waste analyses.

17. DOE should take advantage of the opportunity to obtain hazardous waste characterization information when wastes are being processed for other purposes. This includes laboratory analyses when waste packages are opened and physically inspected for compliance with the waste acceptance criteria (WAC); head space gas analysis when waste packages are vented; and analysis of liquids resulting from the supercompaction of wastes.

18. Waste packages in the TRU waste inventory that are actually low-level wastes should be removed from the TRU waste inventory.

19. DOE needs to ensure that the databases being used for the performance assessment and other regulatory purposes are consistent with the WAC. It is not clear how the performance assessment will take into consideration the authority of the Waste Acceptance Criteria Certification Committee (WACCC) to exempt wastes from the WAC in the future.

20. DOE should integrate the WAC, the TRUPACT-II shipping requirements, and future hazardous waste restrictions into comprehensive criteria for certifying wastes for WIPP. Waste containers that are aspirated in non-humidity controlled environments should be subject to real-time radiography immediately prior to shipment to ensure that the criterion for liquids is not exceeded.

21. DOE should actively encourage and facilitate observers from the New Mexico Environmental Improvement Division, the Colorado Department of Health, the State of Idaho, and the Environmental Evaluation Group to accompany the DOE waste certification auditors.

22. Unannounced audits at each TRU waste generator facility should be conducted at least annually. The audits should include radiological assaying and real-time radiographic examination of a sufficient number of waste packages to ensure at least a 95 percent confidence level that wastes are being properly certified.

23. State representatives should be encouraged to observe the Rocky Flats waste recertification audits and inspections. The Rocky Flats waste recertification program should include the selection of waste packages by the audit team/state observers for radiological assaying and real-time radiographic examination under the audit team's review.

V. OBSERVATIONS, RECOMMENDATIONS, AND DISCUSSION

A. MANAGEMENT OF THE WIPP PROGRAM

Observation A.1:

The WIPP program is of major national importance even beyond the defense TRU waste management system. The success or failure of the WIPP program will have extensive impacts on the entire defense program of DOE, as well as on civilian radioactive waste management programs, both inside and outside of DOE. WIPP is an important test case for how the "DOE Culture" can adapt to the new environment of outside regulation and public scrutiny.

Observation A.2:

The DOE TRU waste management system is sufficiently complex as to necessitate a sophisticated systems management approach. Currently it appears that an adequate systems management approach is lacking.

Discussion:

It is acknowledged that integrating ten TRU waste generators (producing many different waste streams) with the first deep geological repository in the United States, while the regulatory environment is in flux, is far from a trivial matter. However, much greater emphasis on systems integration is needed for the DOE TRU waste management system to function effectively. The problem is not that individual elements of the program are inadequately managed. Many of the managers who briefed the BRP appeared to be doing an outstanding job with respect to their particular area of responsibility. Rather, the shortcoming is in the effective integration of the many elements comprising the DOE TRU waste management system.

Following are a few examples illustrating TRU waste management elements that do not appear to be adequately integrated:

- o There does not appear to be a direct linkage between TRU waste generators implementing new waste treatment technologies and the performance of the WIPP site. There does not appear to be a central management focus for assessing question such as: What impact does the supercompaction of waste from the RFP have on the performance of WIPP? Does supercompaction pose repository criticality concerns? How are plans for changes in waste forms communicated to the WIPP performance assessment team? Who has the authority and the responsibility to determine if a new waste form will be acceptable at WIPP?
- o The Waste Acceptance Criteria Certification Committee (WACCC) has the authority to approve wastes for disposal at WIPP that do not meet the WAC. How is this accounted for in the WIPP performance assessment? How can it be accounted for in the performance

assessment when the WACCC can exempt waste from the WAC years after the performance assessment is completed?

Recommendation A.1:

DOE should implement a comprehensive, integrated management system for TRU waste generation, treatment, transportation, storage, and disposal. The management system should encompass all DOE TRU waste generators and should include planning, research, and operational aspects of TRU waste management.

B. "DOE CULTURE"

Observation B.1

A number of the DOE managers who briefed the BRP exhibited a frustrated attitude, implying that WIPP is obviously an exemplary facility; why don't people just let us use it?

Discussion:

At a time when the preliminary performance assessments conducted by DOE indicate that WIPP does not comply with the Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes 40 CFR Part 191, Subpart B (EPA Standard) for human intrusion scenarios, such an attitude can easily be perceived as arrogant, sloppy, and unconcerned about safety and the environment. Such perceptions do not facilitate rational issue resolution.

Recommendation B.1:

DOE managers should recognize and exhibit in their attitudes that WIPP is being developed in a new era of external regulation. The mission of DOE is to carefully, scientifically, and systematically assess whether or not WIPP complies with the EPA Standard and other regulatory requirements. This means that all of the facts (and uncertainties), whether favorable or unfavorable to WIPP, need to be clearly presented and publicly debated.

C. PREREQUISITES TO THE RECEIPT OF WASTE AT WIPP FOR EXPERIMENTAL PURPOSES

Observation C.1:

A number of actions must be completed before waste can be received at WIPP, even for experimental purposes. The important milestones include, but may not be limited to:

- o Obtaining a Resource Conservation and Recovery Act (RCRA) Part A Interim Status Permit by filing a complete Part A application pursuant to 40 CFR Part 270. Before this can occur, the State of

New Mexico must receive authorization from EPA to regulate mixed wastes.

- o Receiving approval of the No Migration Petition from EPA to exempt WIPP from the Land Disposal Restrictions pursuant to 40 CFR Part 268.6.
- o Demonstrating compliance with the EPA regulations on Environmental Standards for Management and Storage of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste, 40 CFR Part 191, Subpart A.
- o Completing the Final Safety Analysis Report (FSAR).
- o Completing the Operational Readiness Review (ORR).
- o Complying with the Agreement for Consultation and Cooperation (C&C) between the United States Department of Energy and the State of New Mexico.
- o Obtaining Land Withdrawal approval.
- o Publishing the Final Supplement Environmental Impact Statement (FSEIS) on WIPP and issuing the Record of Decision (ROD).
- o Issuing the final WIPP waste retrieval plan. Successfully completing the bin and alcove retrieval tests.
- o Completing the Performance Assessment (PA) Plan.

Observation C.2:

Although the Secretary's Draft Decision Plan on WIPP (October 1989) identifies these actions, this list is provided to emphasize the considerable amount of work that must be completed for WIPP to receive waste for experiments, and to illustrate the numerous opportunities for legal challenges with which the WIPP program may have to contend.

Observation C.3:

DOE is currently developing a WIPP waste retrieval plan to address the technical aspects of waste retrieval, if WIPP is found unsuitable as a permanent repository.

Recommendation C.1:

The WIPP waste retrieval plan should address the regulatory and institutional requirements for implementing each waste retrieval alternative. Without consideration of such requirements, the institutional feasibility of the plan may be nil.

Observation C.4:

While many of the elements of the test program have been provided in various DOE documents, DOE has not adequately articulated the need for and design of the test program in an integrated manner.

Recommendation C.2:

DOE should develop and publish within the next six months a hierarchial, integrated, and coherent set of documents on the WIPP test phase. This set of documents should include:

- o Preliminary WIPP Performance Assessment 1989--A systematic assessment of the current understanding of the long-term performance of the WIPP repository, as recommended by the National Research Council. This document should include analyses of a range of scenarios (including human intrusion) and a comprehensive sensitivity analysis. The report should elucidate the critical issues, uncertainties in data and models, and the parameters for which additional data are needed.
- o Conceptual WIPP Test Phase Plan--A generalized description of the laboratory, bin-scale, and alcove-scale experiments already underway and planned for the test phase. This document should clearly indicate how the on-going and planned experiments address the data needs identified in the Preliminary Performance Assessment 1989, above. This document should replace the *Draft Plan For The Waste Isolation Pilot Plant Test Phase: Performance Assessment and Operations Demonstration*.
- o WIPP Experimental Design--A detailed technical description of the laboratory, bin-scale, and alcove-scale experiments to be conducted during the test phase. This document should be a more detailed technical version of the Conceptual WIPP Test Phase Plan, above. As with the Conceptual Plan, this document should indicate how the experiments will provide the data needs identified in the Preliminary Performance Assessment 1989.

D. CONCEPT AND TIMING OF THE WIPP TEST PHASE AND OPERATIONS DEMONSTRATION

1. Test Phase

Observation 1.D.1:

Significant technical questions regarding the ability of WIPP to meet the EPA Standard and other regulatory requirements remain to be resolved. A carefully planned, integrated, and implemented suite of tests--laboratory, bin-scale, and alcove-scale--is needed to provide additional data for the performance assessment (to determine compliance with the EPA Standard), the no migration

petition, and the RCRA Part B permit application. Despite the substantial unresolved technical issues, bedded salt continues to offer outstanding qualities for the long-term isolation of TRU waste.

Observation 1.D.2:

DOE plans call for a hold point after the first three years of the test phase to analyze the results of the performance assessment up to that point. If this review concludes that there is reasonable confidence that WIPP will meet the EPA Standard, then a decision will be made on the need for and the design of the second portion of the test phase. This approach has great merit. Because of the issues discussed below, it is likely that the second portion of the test phase will be required.

Observation 1.D.3:

Because of the complexity and interaction of the technical issues that must be resolved, it may take longer than five years for adequate test results to be available to determine compliance with the EPA Standard. It is also very possible that either the laboratory, bin-scale, or alcove-scale tests will raise new issues requiring additional experiments.

Observation 1.D.4:

One of the key questions the test phase needs to resolve is the net rate of gas generation/diffusion which results from at least five processes: chemical corrosion of the waste containers and metal within the wastes; biological decomposition of the organic matter in the wastes; radiolytic decomposition of waste materials; inflow of naturally occurring gas in the salt; and the diffusion of gas into the salt formation.

Because of the incomplete understanding of these processes and potential interactions among the processes, both the bin-scale and the alcove-scale tests may need to be conducted for a longer period of time than is anticipated in the test plan in order to obtain adequate data. This in turn means that the data needed for the "final" performance assessment may not be available in time to conduct the performance assessment on the current schedule.

Recommendation 1.D.1:

The bin-scale and the alcove-scale tests should be continued at least until the decision is made regarding the suitability of WIPP as a permanent disposal site, and probably as long as WIPP is operational (25 or more years).

Observation 1.D.5:

It is very important for the test phase not only to gather data on important technical issues such as gas generation, but also to test solutions to the potential technical problems. This means that the scope of the test phase experiments may need to be expanded. For example, it may be advisable to

include in the bin-scale tests nonmetallic containers (e.g. high integrity containers) and several different treated waste forms to address the gas generation issue. This means that an increased number of bins and a corresponding larger quantity of waste may be needed for the test phase. If such an approach is not taken, it is possible that following completion of the currently planned test phase, a subsequent test phase will be needed.

Recommendation 1.D.2:

The test phase and the bin-scale experiments in particular should be expanded to include a broad range of potential solutions to the gas generation problem such as: gas getters, preventers, and recombiners; several treated waste forms; nonmetallic containers; etc.

Observation 1.D.6:

Current plans call for the TRU waste to be emplaced in the WIPP repository in an essentially untreated form. In contrast with the other parameters affecting the performance of the repository (e.g., hydrogeologic processes), the waste form is one of the most controllable variables. Since about 90 percent of the total volume of contact-handled waste to be emplaced at WIPP is yet to be generated or is expected to require repackaging, the opportunity exists to develop a more stable waste form that would moot a number of the existing technical issues and would dramatically improve the ability of WIPP to meet the EPA Standard.

Recommendation 1.D.3:

The test phase and the bin-scale experiments in particular should be expanded to include a broad range of potential treated waste forms, such as drum grouting, shredded waste, thermal treatments, etc.

Recommendation 1.D.4:

On a periodic basis, DOE should assess the trade-offs between continuing to attempt to demonstrate compliance with the EPA Standard and other regulatory requirements using existing TRU waste forms versus committing to waste treatment(s) that would simplify and resolve many of the regulatory compliance issues.

Observation 1.D.7:

The inclusion of the Operations Demonstration (which is perceived by some as a pretext to ship large quantities of waste to WIPP before compliance with the EPA Standard has been demonstrated) has confused the purpose of the test phase and has undermined its credibility.

Bin-Scale Tests

Description:

The bin-scale tests are divided into three phases as described below.

Phase 1: Generally as-received waste, no backfill. Will utilize 40 bins containing about 210 drum-equivalents of uncompacted waste. In place 7/90.

Phase 2: As-received and compacted waste, backfill in drums. Will utilize 76 bins containing about 390 drum-equivalents of uncompacted waste. In place 4/91.

Phase 3: Largely undefined, but intended to incorporate contingencies and engineering modifications to waste and/or backfill. In place 12/91.

Phases 1 and 2 will require about 600 total drum-equivalents of waste. This is equal to about 0.08 percent of the total capacity of WIPP (for contact-handled waste).

Observation 1.D.8:

The bin-scale tests are an essential portion of the test program. The results of the bin-scale tests may be needed in order to obtain approval by EPA of the no migration petition. It is possible that regulatory or operational issues could delay the receipt of waste at WIPP for experimental purposes significantly beyond mid-1990.

Recommendation 1.D.5:

The bin-scale tests should begin as soon as possible. If WIPP cannot receive waste for experimental purposes by (or shortly after) mid-1990, the bin-scale tests should be promptly initiated at another location permitted for such purposes.

Observation 1.D.9:

Two important pieces of information are needed for the bin-scale tests that do not currently appear to be available: (1) chemical characterization of the Salado brine; and (2) characterization of the TRU waste inventory for hazardous waste components.

Discussion:

If the bin-scale tests are initiated and it is then determined that the Salado brine (which will interact with the waste in the repository) is significantly different in chemical composition than the brine used in the bin-scale tests, the bin-scale tests may not be representative of repository conditions and may need to be repeated. Likewise if the hazardous waste components of the waste

used for the bin-scale tests are not known or if they are found to be significantly different from the overall TRU waste inventory, the bin-scale tests will not have addressed important issues concerning repository performance and regulatory compliance.

Recommendation 1.D.6:

The bin-scale tests should preferably use actual Salado brine or secondarily utilize simulated Salado brine developed after the Salado brine is adequately characterized. The wastes to be used for the bin-scale tests should be characterized for hazardous waste components. Further work is needed to determine how the hazardous waste characterization of TRU-mixed wastes can best be accomplished.

Alcove-Scale Tests

Description:

The alcove-scale tests consist of two phases as follows.

Phase 1: Intended to simulate the operational phase of WIPP; consists of two alcoves:

Alcove 1--empty (no waste) gas baseline-reference. Utilizes zero drums. In place 7/90.

Alcove 2--as received waste, no backfill. Utilizes 1,050 drum-equivalents. In place 7/90.

Phase 2: Intended to simulate the post-operational phase of WIPP; consists of four alcoves:

Alcove 3--specially prepared non-compacted waste with brine and backfill within drums. Will utilize 1,050 drum-equivalents. In place 5/91.

Alcove 4--specially prepared compacted waste with brine and backfill within drums. Will utilize 1,050 drum-equivalents. (Due to compaction, 350 drums will be shipped to WIPP.) In place 11/91.

Alcove 5--specially prepared, non-compacted waste with brine and backfill within drums. Also with external backfill in alcove. Will utilize 1,050 drum-equivalents. In place 11/91.

Alcove 6--specially prepared compacted waste with brine and backfill within drums. Also with external backfill in alcove. Will utilize 1,050 drum-equivalents. (Due to compaction, 350 drums will be shipped to WIPP.) In place 4/92.

In total, the alcove-scale test phases 1 and 2 will utilize about 5,250 drum-equivalents of waste. This is equal to about 0.7 percent of the total capacity of WIPP (for contact-handled waste).

Observation 1.D.10:

The alcove-scale tests are an important part of the WIPP test phase. The alcove-scale tests are needed to investigate important repository conditions that laboratory and bin-scale tests cannot fully represent. Alcove-scale tests have the advantage of being able to more realistically represent:

- o Potentially synergistic effects of the repository itself (i.e., gases and brines released from the host rock, mine biochemistry, etc.) on the rates and modes of waste degradation and gas generation.
- o The full-scale size of the repository.
- o The radiological and hazardous waste source terms included in the large number of TRU waste types intended for disposal at WIPP.

Observation 1.D.11:

While the experiments are planned to be conducted for a relatively short period of time (five years), the experiments are intended to provide information to allow prediction of repository behavior over the long-term (1,000 to 10,000 or even 100,000 years). The geohydrologic complexity of the WIPP repository makes the collection of meaningful and reliable experimental results extremely difficult. For example, will the disturbed rock zone interfere with measurements of the long-term salt permeability, as well as brine and gas inflow into the waste rooms? Will the disturbed rock zone have to be instrumented in order to determine its impact? Can the disturbed rock zone be instrumented without changing its properties.

Recommendation 1.D.7:

Since alcove 1 (gas baseline-reference) does not require any waste it should be initiated as soon as possible, preferably before 7/90.

Timing of the Test Phase

Following is a listing of key events in the WIPP test program and their scheduling, as presently understood or inferred from a number of DOE documents and presentations to the BRP. This timeline assumes that waste receipts at WIPP begin in July 1990. This listing is not intended to indicate all of the important (or even critical-path milestones); it has been prepared to illustrate apparent problems in the sequencing of test phase activities. Therefore, what is important are not the specific dates but the sequence of events. (The current DOE schedule for the test phase is unclear; written

materials presented to the BRP within the last several weeks have different dates for a number of these activities.)

<u>Activity</u>	<u>Date</u>
Phase 1 bin experiments initiated	7/90
Alcove 1 experiment initiated	7/90
Alcove 2 experiment initiated	7/90
Engineering enhancements report, preliminary	8/90
Backfill selection complete	10/90
Engineering enhancements report, final	12/90
Large-scale room seal experiments complete	1/91
Phase 2 bin experiments initiated	1/91
Alcove 3 experiment initiated	2/91
Phase 1 bin experiments initial results	3/91
Alcove 4 experiment initiated	7/91
Decision on engineering enhancements	9/91
Phase 2 bin experiments initial results	10/91
Phase 3 bin experiments (with engineering fixes) initiated	12/91
Alcove 5 experiment initiated	1/92
Alcove 1 reliable results available	6/92
Alcove 2 reliable results available	6/92
Alcove 6 experiment initiated	7/92
Phase 3 bin experiments initial results	9/92
Latest date that data from the experiments can be used in "final" performance assessment	9/92
Alcove 3 reliable results available	5/93
Hold point for review of performance assessment	7/93

Draft EPA compliance report released	9/93
Alcove 4 reliable results available	11/93
Alcove 5 reliable results available	1/94
Alcove 6 reliable results available	9/94
Final EPA compliance report released/ Decision on WIPP as a disposal facility	9/94

Observation 1.D.12:

The scheduling of the test phase assumes that useful data will be rapidly available from the experiments. It is not likely that obtaining adequate data on gas generation will require significantly longer time periods.

Observation 1.D.13:

The scheduling of the test phase assumes that enough is known about the performance of TRU waste in salt to concurrently conduct the three scales of testing: laboratory, bin, and alcove. Given the current range of uncertainties and the complexity of the interactions, this assumption has a significant probability of turning out to be incorrect.

Observation 1.D.14:

Results from the engineering enhancements study will not be available until relatively late in the test phase. By the time decisions are made on engineering enhancements (9/92), all of the phase 1 and phase 2 bin tests will already be underway, as will alcove tests 1, 2, 3, and 4. This means only alcoves 5 and 6, and a third phase of bin-scale tests will be able to incorporate engineering enhancements that may be necessary for WIPP to comply with the EPA Standard.

Observation 1.D.15:

According to the existing schedule, the latest date that data can be input to the "final" performance assessment is 9/92. As of this date, reliable results from alcove tests 3, 4, 5, and 6 are unlikely to be available. In addition, if a third phase of bin-scale tests are needed, data from such tests are also unlikely to be available by 9/92. Thus, a significant portion of the data to be produced in the test phase will not be available in time to be used in the "final" performance assessment.

Recommendation 1.D.8:

Aside from delaying the "final" performance assessment, which may turn out to be inevitable, the primary action to increase the utility of the test phase is to increase the range of experiments conducted at the alcove-scale and particularly at the bin-scale.

Observation 1.D.16:

Alcoves 1 and 2 are scheduled to be sealed five months before the large-scale room seal experiments are scheduled to be complete. This is of concern because maintaining an airtight seal (to maintain anoxic conditions as will exist in the repository) is essential to the alcove tests.

Observation 1.D.17:

The alcove 3 experiment is scheduled to begin before significant data from the bin-scale experiments is likely to be available. This means that the backfill to be used in the drums in alcove 3 will be chosen before it is known if that backfill was effective in the bin-scale tests.

2. Operations Demonstration

Description:

The Operations Demonstration plan calls for the shipment of a large quantity (approximately 18,900 drums, which is equal to about 2.5 percent of the capacity of WIPP for contact-handled waste) of waste to WIPP essentially concurrently with the conduct of the bin-scale and alcove-scale experiments. This activity is intended to demonstrate the operational capability of the entire WIPP-related TRU waste management system including: generators' waste certification and TRUPACT-II loading, the transportation system, and waste receipt and emplacement at WIPP. The operations demonstration will not provide data useful in determining compliance with the EPA Standard.

Observation 2.D.1:

An operations demonstration is an important element in ensuring the operational readiness of a "production" facility. However, given the current degree of uncertainty regarding the ability of WIPP to meet the EPA Standard, it is not prudent to transport large quantities of waste to WIPP in the next several years. If WIPP is determined not to comply with the EPA Standard, all waste emplaced at WIPP would have to be removed and shipped elsewhere for storage, treatment, and/or disposal.

Observation 2.D.2:

Until a detailed study of engineering enhancements has been completed and reviewed, at least interim results are available from the bin-scale and alcove-scale experiments, and compliance with the EPA Standard has been demonstrated through performance assessment, the specific design and operational configuration of the WIPP underground will not be known. Thus, an operations demonstration prior to this point cannot demonstrate actual operational conditions. Therefore, a near-term operations demonstration will have limited value.

Observation 2.D.3:

The preparation of TRUPACT-II shipments by the generators, shipments along the transport routes, and emplacement of waste for the bin-scale and the alcove-scale experiments will provide significant operational experience. Assuming that 4,450 drums will be shipped to WIPP for waste experiments, about 106 TRUPACT-II shipments will be needed. If DOE believes that it is necessary, during the next few years, to obtain more experience or to demonstrate the operation of the WIPP system at full-capacity, nonradioactive simulated drums and standard waste boxes should be used.

Observation 2.D.4

The results of the test phase may necessitate the redesign of the waste rooms (e.g., smaller rooms to reduce the source term available for human intrusion) or treatment of the waste. If an operations demonstration is conducted prior to the resolution of such issues, it is possible that all of the waste emplaced for demonstration purposes would have to be moved to smaller rooms, removed for treatment at WIPP, or shipped elsewhere for treatment. This would result in significant additional radiation exposures to personnel, expense, and work effort.

Observation 2.D.5:

Plans for the Operations Demonstration appear to have been driven more by the need for additional TRU waste management capacity to serve defense program operational requirements than by the need for technical information related to WIPP. Regardless of the technical safety of storing wastes in WIPP, if DOE stores more waste in WIPP than is needed for waste performance experiments, DOE will be perceived as moving too fast, or of putting operational needs ahead of environmental and safety concerns.

Recommendation 2.D.1:

An operations demonstration with radioactive waste should be delayed until WIPP has been determined to comply with the EPA Standard and until the design and operational configuration of WIPP is resolved.

Recommendation 2.D.2:

The Operations Demonstration Plan should be separated from the Test Plan in order to avoid confusion. While the Operations Demonstration Plan and the Test Plan should be separated, it is important to recognize and maintain the interrelationships between these two programs.

E. REPROMULGATION OF THE ENVIRONMENTAL RADIATION PROTECTION STANDARD

Observation E.1:

It is not clear that the repromulgated EPA Standard (Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes 40 CFR Part 191, Subpart B) will satisfy the objections contained in the 1987 decision by the United States Court of Appeals For the First Circuit, or that the repromulgated standard will be able to withstand legal challenges on other grounds.

Although DOE is following the development of the new standard by EPA, until the standard is actually promulgated and any legal challenges resolved, it is not known what performance standard WIPP will be required to meet as a permanent disposal facility. This "moving target" subjects WIPP to a considerable amount of regulatory uncertainty.

Observation E.2:

One of the reasons the Court remanded the Standard to EPA in 1987 was that the Court believed WIPP to be an underground injection well and that the EPA Standard was less stringent than, and therefore inconsistent with the standard under the Safe Drinking Water Act to which underground injection wells are regulated.

Recommendation E.1:

DOE should explore options for resolving this issue, including determining if an underground injection control permit is needed for WIPP and statutorily clarifying the applicability of the Safe Drinking Water Act to WIPP.

F. COMPLIANCE WITH FEDERAL AND STATE HAZARDOUS WASTE REGULATIONS

Observation F.1:

It is not clear that a comprehensive and systematic assessment of the applicability of federal and state hazardous waste regulations to the WIPP program has been conducted. Without such planning, hazardous waste requirements have the potential to stall the WIPP program at numerous points.

It is not clear that all of the plans for WIPP are in compliance with applicable hazardous waste regulations. For example, the operational procedures for WIPP clearly state that waste containers will not be opened at WIPP. However, the federal regulations specifying Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR Part 264) appear to require that waste analyses be conducted at the disposal facility.

Discussion:

Planning by DOE is needed to minimize the chance that federal or State of New Mexico hazardous waste regulations do not catch the WIPP program by surprise. For example, there could be significant uncertainty in the RCRA Part B permitting process for WIPP. It is not uncommon for the RCRA Part B permitting process for land disposal facilities to take three or more years. Nationally, very few permits have been issued under the "Miscellaneous Units" provision to which WIPP is subject (40 CFR 264.600). No RCRA permit has ever been issued for a deep geologic repository.

Recommendation F.1:

DOE should promptly conduct a comprehensive and systematic assessment of the WIPP program's compliance with federal and State of New Mexico hazardous waste regulations. The assessment should identify each of the specific provisions of federal and state regulations that apply to the WIPP program. Following this assessment, a compliance strategy should be developed for each applicable provision. DOE should work closely with the State of New Mexico on the promulgation of mixed waste regulations and the preparation of hazardous waste permit applications.

Observation F.2:

Inadequate analytic data are available on the types and quantities of hazardous wastes in the TRU wastes intended to be disposed in WIPP.

Discussion:

Almost all existing waste characterization information is based on process knowledge. Process knowledge may provide a reasonably accurate characterization of hazardous wastes for the newly generated TRU-mixed waste. However, process knowledge may not provide sufficiently accurate characterizations for wastes generated nearly 20 years ago. Hazardous waste characterization data are needed for a number of purposes including: the performance assessment, the no migration petition, and the RCRA Part B permit application. Hazardous waste characterization data are also needed to comply with federal or state hazardous waste regulations at every site at which TRU-mixed wastes are generated and/or stored. Without actual measurements of the hazardous components in both old and newly generated TRU-mixed wastes, the WIPP program will continue to suffer a credibility problem and is also likely to encounter regulatory challenges.

It is recognized that conducting hazardous waste characterizations on TRU-mixed wastes presents formidable technical and personnel exposure problems that need to be addressed.

Recommendation F.2:

DOE should promptly develop a comprehensive, Department-wide plan to

characterize the hazardous (nonradioactive) components of TRU-mixed waste being generated and in storage.

When TRU wastes are being examined for other purposes, DOE should take advantage of the opportunity to obtain information on the hazardous components in the wastes. Several such opportunities are:

- o When waste packages are opened and physically inspected for compliance with the WAC.
- o When waste packages are vented.
- o When wastes are supercompacted.

Discussion:

Since all waste packages are required to be vented prior to shipment to WIPP (in TRUPACT-II), the opportunity is readily available to sample the head space gas from essentially all of the WIPP wastes. Analysis of the head space gas from, for example, ten percent of the waste packages (preferably at an elevated temperature) has the potential of producing a highly reliable database of the volatile organic compounds present. Some methods development would probably be needed, and the approach should be validated by more invasive analysis techniques.

The RFP plans to begin compacting all of its TRU wastes in 1990. It is likely that in the supercompacting process liquids will be pressed out of some of the packages being supercompacted. These liquids need to be removed for solidification or other treatment. Prior to treatment, these liquids could be sampled and analyzed for hazardous components.

Observation F.3:

Documents prepared by the RFP indicate that several types of hazardous materials used at the RFP and several hazardous wastes that are produced at the RFP do not end up in the TRU waste inventory. Further work by the BRP is needed to confirm that this is the case.

G. MANAGEMENT OF THE TRU WASTE INVENTORY

Observation G.1:

A significant percentage of the waste packages currently in the TRU waste inventory at the RFP and at INEL (the only two generator/storage sites reviewed to date by the BRP) are believed to be low-level waste and not TRU waste. RFP and INEL estimate that eight to ten percent and around 50 percent, respectively, of their TRU waste inventory is expected to be low-level waste. This "misclassification" has resulted from a change in the TRU waste criterion from 10 nCi/g to 100 nCi/g of TRU radionuclides, and the use of less sophisticated assay equipment.

Recommendation G.1:

All waste packages in the TRU waste inventory at all DOE facilities that may contain less than 100 nCi/g of TRU radionuclides should be reassayed as soon as possible and removed from the TRU waste inventory, if the TRU radionuclide content is less than 100 nCi/g.

Discussion:

The retention of low-level waste in the TRU waste inventory has the potential to needlessly consume significant resources through "over management" of such waste. This misallocation of resources can occur in the consumption of valuable TRU waste storage space, certification of waste packages that need not go to WIPP, and the misuse of expensive disposal capacity at WIPP.

H. WASTE ACCEPTANCE CRITERIA FOR WIPP

To date there has been insufficient time to fully assess the WAC for WIPP. While further time is needed to complete this assessment, some initial and preliminary thoughts are provided below.

Observation H.1:

It is not clear that the WAC are consistent with the source term databases being used for the performance assessment, the no migration petition, and the RCRA Part B permit application.

Recommendation H.1:

DOE needs to ensure that the databases being used for the performance assessment, the no migration petition, and the RCRA Part B permit application are consistent with the WAC. The databases should not assume that the WAC are controlling elements of the source term that the WAC in reality are not.

Observation H.2:

It is not clear how the performance assessment, the no migration petition, and the RCRA Part B permit application will take into consideration the authority of the WACCC to exempt wastes from the WAC in the future.

Recommendation H.2:

The WACCC should not grant any exemptions from the WAC until after WIPP has been demonstrated to comply with the EPA Standard. Exemptions to the WAC should be granted only if a technical assessment indicates that the performance of the repository will not be materially affected.

Observation H.3:

It is not clear that adequate methods are being used to ensure that the WAC for corrosives, pyrophorics, explosives, and RCRA constituents are being met. The BRP should pursue this matter further.

Observation H.4:

It is possible that waste containers that are vented and then allowed to aspirate in a high humidity environment (such as out-of-doors) may accumulate a significant amount of liquid.

Recommendation H.3:

Waste containers that are aspirated in non-humidity controlled environments should be subject to real-time radiography immediately prior to shipment to ensure that the criterion for liquids is not exceeded.

Observation H.5:

In addition to the WAC, wastes to be shipped to WIPP in TRUPACT-II must also comply with the conditions specified in the United States Nuclear Regulatory Commission's Certificate of Compliance, some of which are more restrictive than the WAC. In the future, the RCRA Part B permit for WIPP may impose additional restrictions on the wastes that can be received at WIPP.

Recommendation H.4:

DOE should develop comprehensive, integrated criteria and a unified certification process for determining what wastes can be shipped to WIPP. The WACCC should audit waste generators for compliance with this integrated set of criteria.

I. AUDITING COMPLIANCE WITH THE WASTE ACCEPTANCE CRITERIA

Observation I.1:

The audit program conducted by the WACCC is a vital mechanism for ensuring that the TRU waste generators are properly certifying waste according to the WAC. While the existing audit approach has significant merit, additional steps would increase the effectiveness and credibility of the WAC and the auditing program.

Recommendation I.1:

DOE should actively encourage and facilitate observers from the New Mexico Environmental Improvement Division, the Colorado Department of Health, the State of Idaho, and the Environmental Evaluation Group to accompany the WACCC auditors.

Recommendation I.2:

The WACCC should conduct an unannounced audit at each TRU waste generator facility at least annually. In addition to reviewing the waste generators' certification records, the audit team should randomly select drums from the generators' inventory for radiological assaying and examination by real-time radiography under the audit team's observation. Audits of each generator should include enough waste packages to ensure at least a 95 percent confidence level that wastes are being properly certified.

J. ROCKY FLATS WASTE RECERTIFICATION PROGRAM

A revised draft of the Rocky Flats Waste Recertification Program Plan (DOE/WIPP 89-025) was not received for review by the BRP until October 18, 1989. This revised plan was prepared in response to questions raised by the BRP. While this responsiveness is appreciated, the recent receipt of this document has not permitted thorough review nor has it allowed opportunity for discussion with DOE officials. Therefore, the following comments are very preliminary.

Observation J.1:

The recertification plan appears to be generally headed in the correct direction.

Discussion:

An important change from prior plans is the exclusion of low-level waste (waste having less than 100 nCi/g. of TRU radionuclides) prior to recertification. Inclusion of state observers on the audit teams will improve public confidence in the recertification program. For the plan to have credibility, the level of observation/inspection needs to be very nearly full-time. The plan calls for the audit team to review each of the drums to be reassayed at the RFP. Given the on-going criminal investigation, limiting the audit team reviews to only the drums to be reassayed does not seem adequate. The plan does not include unannounced audits of RFP waste being recertified at INEL. The plan includes the opening of a number of waste containers and the physical inspection of contents, both at the RFP and at INEL. This presents an opportunity to collect data on the hazardous components in the wastes that will be useful in the performance assessment, the no migration petition, the RCRA Part B application, and other hazardous waste compliance issues regarding WIPP.

Recommendation J.1:

DOE should actively encourage and facilitate observers from the New Mexico Environmental Improvement Division, the Colorado Department of Health, and the Environmental Evaluation Group in the recertification audits/inspections.

Recommendation J.2:

In addition to the recertification procedure to be conducted by RFP personnel, the audit team should, on an unannounced basis, randomly select drums from each of major waste types in the RFP inventory for radiological assaying and real-time radiographic examination under the audit team's observation

Recommendation J.3:

Because the RFP and INEL will have the same contractor during the recertification program (and because of the on-going criminal investigation), unannounced audits of the recertification activities at INEL should be conducted to increase public credibility.

Recommendation J.4:

Since the recertification plan involves the opening of waste containers and the inspection of their contents, serious consideration should be given to obtaining data on the hazardous constituents of the wastes.