



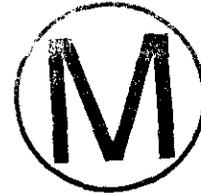
**PEER 15 - Advisory Committee on Nuclear Facility Safety
Review Reports**

Advisory Committee on Nuclear Facility Safety

to the

**United States Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585**

December 11, 1989

**Honorable James D. Watkins
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585**

Dear Admiral Watkins:

As you requested, the Advisory Committee on Nuclear Facility Safety has conducted a brief but comprehensive review of the Waste Isolation Pilot Plant (WIPP) Project. The purpose of this report is to provide our assessment of those elements of the project that relate to health and safety and to identify potential safety concerns.

The major observations and perspectives discussed below are derived from analyses of selected issues from several key areas. The key areas included unresolved technical problems, the Final Safety Analysis Report (FSAR), and WIPP management, organization and staffing policies and practices. Certain areas were not selected for review based on the nature of their separate resolution (i.e., Land Withdrawal, RCRA No Migration Petition, and certification of the TRUPACT shipping container) or lack of full program development (i.e., Remote Handled TRU waste).

The review involved the full committee. However, much of the detailed review was performed by the WIPP Subcommittee which was chaired by Paul Rice, and included committee members William Kastenber, James Martin, M. J. Ohanian, Robert Seale and Gerald Tape. In addition, Thomas Pigford and Konrad Krauskopf assisted us in the assessment of unresolved technical issues. Other expert consultants assisted in examining the adequacy of the FSAR and the conduct of operations. A complete list of consultants and staff is appended. The full committee visited WIPP in June 1989, and several members of the subcommittee made a follow-up visit to the WIPP site in August 1989. In addition, subcommittee members visited the Sandia National Laboratories, the Rocky Flats Plant, and the Idaho National Engineering Laboratory.

The committee commends the Department for its support and encouragement of reviews and analyses from organizations external to WIPP line management. Important input has been provided by the State of New Mexico Environmental Evaluation Group, the National Academy of Sciences, and the Department's own Environmental, Health and Safety reviewers. The committee has considered the inputs and recommendations from these sources.

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You have established requirements for the Department's nuclear activities that we found to be particularly relevant to our review of WIPP. These are (1) the long-term protection of public health and the environment and (2) a culture of management and operation that clearly demonstrates a commitment to excellence by agency and contractor managers and employees. Although we examined many details and could comment on numerous specifics (most of which have been identified in other reviews), we believe our best service to you is to provide comments and recommendations on the more important issues. We have organized our discussions and recommendations that follow into two major sections. First, we discuss the long-term environmental performance of WIPP. Second, we discuss issues which are more of a short-term nature and provide recommendations on actions necessary to assure safety in the day-to-day conduct of operations.

Long-Term Environmental Performance

Environmental Standards

The major issue for interment of TRU wastes in WIPP is whether reliable long-term isolation occurs. The Department acknowledges this requirement; however, it has not yet assembled and published in a suitable form the results of work it has done to show how WIPP is expected to perform against the Environmental Protection Agency (EPA) standards.

You have indicated that DOE will comply with 40 CFR Part 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Wastes. Here we consider only TRU waste. Subpart A applies specifically to management and storage, with the interest and capability to readily retrieve such wastes for subsequent use, processing or disposal. For the purpose of carrying out in situ tests and experiments and for gaining operations experience, Subpart A requirements are satisfactorily met. The ultimate objective of WIPP is to demonstrate and to become a "disposal" site, that is to provide for permanent isolation of TRU waste from the accessible environment with no intent of recovery. Subpart B, Sections 13 (containment) and 15 (individual protection) set forth the requirements directly applicable to WIPP. (Note that Subpart B is in the process of revision; for reference purposes, the draft revision is used here.)

The Department's scientific advisor for WIPP, Sandia National Laboratories, has prepared a systems analysis involving long-term radionuclide transport and dose assessment (SAND 89-0462), in which potential health effects to individuals are calculated for several hypothetical scenarios but not specifically compared with EPA standards. When the EPA default parameter values are used in the deterministic assessment, the results may, in some cases, be unnecessarily conservative. Nevertheless, except for human intrusion, all of the scenarios lead to limits that could be expected to satisfy EPA requirements. To be more specific:

- o If the expected results of the ongoing gas generation assessment and "representative" properties of waste, backfill, and borehole sealing can be confirmed, then the performance assessment should provide a high degree of



confidence that the undisturbed performance of the WIPP is not expected to result in any release of radionuclides to the Culebra Dolomite or to the surface for well over 10,000 years.

- o If the results or properties are worse than those now assumed, it should be possible to gain the high degree of confidence of compliance by initiating engineering modifications to the waste or to the facility (e.g., backfill).

The results presented for the human-intrusion scenario are deterministic and may be physically unrealistic when taken as a whole "because each calculation assumes different repository and geosphere characteristics." (Sandia Report SAND89-0462, April 1989). Therefore, the parameters lead to projected releases that may exceed EPA standards. This scenario includes a drilling event with a probability of 1.0 for penetrating through a repository panel and connecting a brine pool in the lower Castille formation with an upper aquifer; a flow pattern of Castille brine within a panel that allows the emergent brine to have a radioactive concentration based on the solubility of the elements in brine; sealing of the borehole in a manner that results in porous material (a condition not consistent with predictions of current WIPP seal performance); and no credit given for passive markers and records. While we understand the desire to satisfy EPA requirements using conservative parameters, we believe that the assumptions used in the intrusion scenario, taken collectively, may lead to an overall condition that is more conservative than necessary.

The EPA standards and implementing guides recognize that determining expected performance of sites for long-term isolation of wastes involves "reasonable projections" using models and parameters that may require "qualitative judgments" (the quoted terms are from Appendix 3 of 40 CFR 191). In this regard, we believe that the Department should develop a carefully considered intrusion scenario that would include considerations such as expectations for future borehole sealing at least as good as the current state-of-the-art and the effects of Department actions to provide passive markers and records. Such a scenario should take into account what future humans can be expected to do, since we must believe they will exercise reasonable care about their environment and be aware that failure to take basic precautions in areas such as monitoring and borehole sealing could adversely affect their environment. If the intruder scenario is considered with such "reasonable projections" as we believe are allowed by EPA guidance, especially in the area of borehole sealing, we expect WIPP can be shown to meet EPA long-term performance requirements with satisfactory margins of safety.

However, if the Department prefers to address the intruder scenario using the default values in the EPA guidance, then we believe that insufficient margins exist to demonstrate compliance and it will be necessary to soon plan for engineering enhancements of the waste and/or repository configuration. Since the issue is more one of which methodology should be used for demonstrating compliance with EPA Subpart B standards, not whether WIPP is indeed safe, we recommend that the Department take the lead to develop "reasonable projections" of long-term per-

formance and interact with EPA on the adequacy of these important performance assessment inputs.

A "test phase" has been proposed in order to reduce the uncertainty in parameters such as brine inflow, solubility of waste forms, gas production rates, and gas/liquid two-phase flow, and to better confirm performance against EPA standards. The Department can use data from those experiments, to be obtained over the next few years while the waste is retrievable, to build additional confidence in the facility. However, it appears that these tests will not in-and-of-themselves provide the type of results that will significantly change performance assessment results currently being developed and scheduled for issue in December 1989. For this and other reasons discussed below, the Department should not delay its environmental performance assessment until such tests are done. Instead, the Department should proceed to prepare an assessment of the long-term environmental performance with the objective of laying out a basis for reasonable assurance that WIPP meets the EPA environmental standards and for obtaining a consensus among involved parties.

In our opinion, such a document is also essential to focus the "test phase" experiments and assure that they serve to reduce uncertainties in the performance assessment assumptions, to identify any engineering modifications that may be necessary to accommodate present TRU wastes, and to indicate whether justifiable improvements should be made in future waste forms to prevent or mitigate gas generation. The proposed tests could also be most useful in determining whether future waste forms can reasonably be improved (see below), a program we encourage.

We believe that, prior to your decision to allow emplacement of waste shipments underground at WIPP, it would be prudent for you to have a preliminary performance assessment that provides you with reasonable confidence that EPA Subpart B standards can eventually be shown to be met. This summary document should contain a carefully considered human-intrusion scenario and should clearly identify the key parameters and assumptions in the performance assessment that need to be addressed in the "test phase" to improve their certainty. When this has been done, we believe it would be proper to proceed immediately to the proposed in situ testing at WIPP when other ongoing prerequisite actions are complete. If the review of the performance assessment by involved parties provides a high degree of confidence that EPA standards will be met, as we suggest, then you could proceed with the operational performance phase as a gradual emplacement program to evaluate and work out operational issues identified in various reviews. Of course, any decision to go to production-oriented operation will require assurance that EPA Subpart B standards are satisfied.

In summary, there appears to be acceptable confidence that the EPA requirements of Subpart A can be met to allow use of WIPP as a test facility and, therefore, to begin the emplacement of waste as part of the test program. The major technical issue facing WIPP is whether Subpart B can be met. From our review, we conclude that with the exception of the human-intrusion scenario, Subpart B requirements can be shown to be met using the work being completed by Sandia. The human-intrusion scenario, as developed by the DOE under its current application of EPA



guidelines, is not likely to meet the present Subpart B requirements. We see three major options:

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1. Plan that the test program will produce results that will enable Subpart B to be met. We believe this is unlikely because of the relatively short time for testing as compared to the time period for the key phenomena and the limited effect of the parameters tested on the human-intrusion scenario.
 2. Abandon WIPP. We do not believe this is necessary, prudent, or responsible.
 3. Further address the EPA Subpart B human-intrusion scenario requirements, an approach we recommend below. We see two basic parts for this approach:
 - a. Use more reasonable projections, for example, that future borehole seals would meet or exceed the current Sandia state-of-the-art form. DOE should take the lead to discuss these assumptions and approach with the EPA.
 - b. Examine what engineering modifications would be required to meet the Subpart B requirements without changing the current assumptions.

Recommendations:

The Department should promptly assemble the data necessary to provide reasonable confidence that WIPP can eventually be shown to meet the release quantities and undisturbed site doses as required by EPA Subpart B standards, including a carefully considered intrusion scenario based on "reasonable projections." Having established this confidence, initiate TRU waste emplacement in support of the performance assessment program.

The Department should, upon determination that a high degree of confidence exists that EPA Subpart B requirements will be met, initiate the operational test phase as a gradual emplacement program committed to deliberative steps to evaluate and work out various operational issues identified in various reviews.

Gas Generation

Evaluation of the brine inflow question identified that the permeability of the salt formation was much less than originally thought. As a result, gas generated by radiolysis of water and organic matter in the waste, by bacterial decomposition of organic matter, and by corrosion of metal in the waste and its containers may produce high pressures in the repository because its escape is slowed by the impermeability of the surrounding salt. Current efforts by Sandia are focused on analysis to show whether potential gas buildup could result in a failure mode that would release unacceptable amounts of radionuclides to the environment and on methods of ameliorating gas buildup, if necessary. Members and consultants reviewed this issue, and we are of the view that DOE's evaluation program is proceeding properly.

The potential problem of gas generation raises questions concerning the current waste form and future DOE management of TRU wastes that are worthy of further review. Specifically, a reduction in the amount of metals and organics or a change in the form of organic materials could reduce the gas generation. We do not believe that an attempt to change the form of existing TRU waste would be justified in view of the risks and cost it would entail. Therefore, to the extent necessary, efforts to ameliorate gas generation within the repository appear to be the most reasonable approach. For future TRU waste, however, a different form that would reduce significantly gas generation should be considered. The engineering enhancement study underway should explore practical measures for reducing the quantities of decomposable waste, of using nonmetallic containers, and of stabilizing the waste by incineration or vitrification. Such measures could be beneficial if they can be conducted at reasonable cost and without appreciable risk to the personnel involved. Such an effort would be consistent with recently stated goals of improved waste management throughout the Department.

Recommendation:

DOE should continue its studies of ways of mitigating any undesirable build-up of gas pressure from the disposal of existing TRU waste and should investigate justifiable improvements in future TRU waste forms that would greatly reduce gas generation.

Safety Issues Related to Conduct of Operations

Radiological Safety

Good radiological safety is perhaps the single most important aspect of day-to-day WIPP operations. Previous internal DOE reviews have identified numerous deficiencies and needed improvements which are being corrected. Critical action items remaining fall into the areas of equipment modifications, technician staffing, completion of training programs, and management personnel qualifications and attrition.

In the category of radiological equipment required for safe operation, the likely critical path for start-up involves the Continuous Air Monitors (CAMs). The CAMs have a long history of problems starting with poor designs, slow recognition and correction of the basic problems and questionable maintenance practices. Actions are in progress to resolve the CAMs issues. We also identified a design deficiency in the interlock system which, as currently installed, would allow the simultaneous opening of airlock doors that could expose the environment to potential or actual contaminated areas. Examples of other radiological equipment which must be completed for safe operation include the decontamination facility exhaust ventilation and contamination control equipment associated with unloading the TRUPACT shipping container.

Both Westinghouse and DOE WIPP management have identified that the current number of trained radiological technicians is not sufficient to start up without significant augmentation by the Westinghouse health physics professional staff

or outside contract radiological technicians. Close management attention will be required to complete technician staffing and associated training, including off-site hands-on training, in order to insure a safe start-up. Several actions relating to radiological programs development need to be completed to insure long-term safety and credibility. These include accreditation of the WIPP dosimetry program and demonstration of the planned capability of the internal dosimetry program.

The committee observed that the WIPP Project has demonstrated a significantly improved trend in attention-to-detail and facility preparations during the first half of 1989. These improvements are due, in part, to the addition of competent health physics professionals and managers to the WIPP Project staff. In this regard, the committee has two fundamental concerns.

First, three different people have held the senior Westinghouse health physics manager position during the past year. We believe that stability in management staffing is important to maintaining the recent improvements in radiological protection and providing the vitality necessary for safe operations.

Second, DOE needs to emphasize the importance and priority of radiological activities to the safe and successful operation of the WIPP facility. Although radioactivity is the unique factor that differentiates WIPP operations from other industrial operations, current organizational reporting relationships (both Westinghouse and the DOE) would indicate that radiation safety is just another set of requirements for routine operations (This is not peculiar in DOE to the WIPP project). For example, WIPP organization charts and the FSAR show the senior manager directly responsible for all radiation programs is positioned at three levels below the top manager and one level below the managers of Public Affairs, Human Resources, and Administrative Services. Neither the FSAR nor WIPP organization charts indicate a direct access line to the senior facility manager.

Recommendations:

Define an organizational structure that provides senior radiation program management with sufficient authority and with direct access to senior Westinghouse facility management.

Both Westinghouse and DOE management at WIPP provide close follow-up and attention to the completion of critical hardware actions and validation of equipment operation.

Expedite completion of radiological staffing and training plans. Define formal contingency plans for attrition and develop procedures for requalification and testing of technicians.

Fire Protection

The WIPP facility has a number of impressive fire protection features including a loop-type fire main system above ground with a dual water supply capability

including a diesel driven fire pump in case of loss of power. Underground areas are protected by a non-water fire protection system. The committee did have concerns regarding specific features in three areas.

First, the committee questions whether adequate risk analysis has been performed for the increased impact of a fire in the underground storage areas when a number of drums are exposed due to a lack of backfill. For example, the FSAR Waste Acceptance Criteria preclude packages that could sustain the propagation of fire from one drum or box to the next by limiting pyrophoric loading within drums and overpacking combustible boxes with metallic cladding. The basis of the FSAR exclusion is not clear, particularly in the area of characterizing the chemical source terms for combustion in old drums. Further, the apparent assumption that the only credible source for initiation of fires involving waste underground is the spontaneous combustion of a waste container falls short in view of other sources associated with normal and abnormal operations.

Second, the committee noted the lack of a smoke detection system in the high bay normal work area of the Waste Handling Building and questions whether this design feature is actually justified by administrative actions such as fire loading controls or routine watchstander inspection requirements.

Third, the committee is concerned that the water fire suppression system does not include the location of the Waste Handling Building exhaust high efficiency particulate air (HEPA) filters.

Recommendations:

A risk assessment of the pre-closure operations of WIPP, including a fire risk analysis addressing fires underground and the adequacy of fire detection and suppression systems, should be undertaken. This assessment should evaluate the acceptability of fire risks, should identify dominant contributors to this risk, and should evaluate and select among risk reduction tactics, if appropriate.

Until a fire risk assessment can be completed to evaluate the specifics and focus on any necessary corrective actions, stringent administrative controls may be required to control all combustibles and possible ignition sources during routine and non-routine operations.



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Final Safety Analysis Report

The committee was specifically requested to review the Final Safety Analysis Report (FSAR) and did so through extensive and detailed examinations by members, staff and consultants. Also considered were the results of reviews by other organizations (EH&S, EEG, etc.). These examinations identified a large number of specific concerns and weaknesses in the FSAR. These problems included (1) missing or incomplete commitments necessary to envelop safety criteria, (2) inconsistent information between FSAR sections, (3) questionable operational safety requirements, (4) lack of differentiation between descriptive matter and commitments, and (5) unacceptable application of certain quality assurance (QA) program requirements. These specific issues were discussed with WIPP management personnel in the DOE and Westinghouse organizations.

Subsequent reviews of actual practices being implemented showed that a majority of these concerns were either due to omissions or were editorial in nature, the likely result of lack of understanding of the management philosophy for the FSAR discussed above or inattention to detail by internal reviewers.

The fundamental issue with the FSAR concerns its basic purpose, its content and how it is handled, both in terms of initial approval and future approval of changes. Applicable DOE Orders, both at the Headquarters and field office levels, are not precise on this matter. To address this issue, committee members interviewed senior DOE managers that control WIPP policy, including the Headquarters program managers in the Office of Defense Programs, oversight managers in the Office of Environment, Safety and Health, the manager of the Albuquerque Field Office, and the manager of the WIPP Project Office. All of these managers agreed that the FSAR was intended to be the top level safety document for WIPP that would contain all of those commitments necessary to envelop the safety analysis to insure the safe operation of WIPP throughout its life. They further agreed that the FSAR is a living document that would be approved at a senior level of management and be maintained up-to-date, and, that future changes would be handled in the same manner as the original approval. The committee strongly supports the position of your managers and urges prompt revision to DOE policies to clarify FSAR requirements and define it as the top level commitments document.

Both DOE and Westinghouse WIPP managements have not been aggressive enough in promptly resolving issues raised in external reviews of the FSAR (and other areas) such as those raised by the Office of Environment, Safety and Health and the State of New Mexico Environmental Evaluation Group.

The committee believes that a thorough review and revision of the FSAR, based on updated DOE policies and on the various external reviews, is a key step to insure long term consistent application of commitments and eliminate deficiencies that could adversely affect long-term safe operation.

Recommendations:

Revise applicable DOE policies and orders to define the FSAR as the top level safety document that will be:

- a compilation of all commitments necessary to ensure safe operation of the facility,**
- approved at a senior level of management, and**
- kept up-to-date as a living document with future changes handled in the same manner as the original approval.**

Review and revise the WIPP FSAR based on the revised DOE policies and on existing critiques. Give priority to resolving all open issues.

Quality Assurance

As a result of initial reviews of policy documents such as the FSAR, the committee had serious reservations about the structure and adequacy of the quality assurance program. However, subsequent reviews of actual program practices showed that most of the concerns were unfounded and had resulted from poor descriptions and other inadequacies in the FSAR. The committee reviewed a number of different aspects of the actual WIPP quality assurance program being implemented and found it to contain most of the features one would expect at a more complex facility such as a reactor. WIPP has obtained quality assurance professionals with previous experience who understand both the technical and administrative aspects of a full featured quality assurance program. Previous DOE reviews have identified a number of quality assurance program deficiencies, most of which have been corrected.

The committee did observe several areas which require further management attention and corrective action. While some of these issues do not relate to the Quality Assurance Department, they are discussed below within the broader definition of the WIPP quality assurance program.

The committee considers that the General Criteria for Quality Assurance defined in the FSAR forms a sound basis for both the operation of the facility and for associated experimental activities. However, the application of the General Criteria is inconsistent between the operational and experimental activities and could degrade the overall performance of important experimental efforts.

Many organizations are involved in the resolution of outstanding safety related technical and procedural problems requisite to the start-up of WIPP. The committee was satisfied that most of these outstanding issues were identified on one or more of the work off schedules. However, the committee was concerned that there is no simple master tracking system to insure that relatively straightforward safety issues do not become "lost" or needlessly become the critical path. Further, lack



of such a system deprives management of a tool to detect early adverse trends and imbalanced work loads.

Training programs have been initiated and a significant amount of training has been accomplished. However, the committee is concerned that too much emphasis has been placed on "self-study" to the detriment of formal presentations. In the commercial nuclear power industry, the use of self-paced study is very limited and is used in conjunction with evaluation methods to assure the intent of the self-study is realized. Also, it appeared to the committee that the training department does not have sufficient input to senior WIPP management to resolve training problems, particularly as the work pace increases and there is less time for ongoing training.

Recommendation:

WIPP management should complete open quality assurance related corrective actions, correct inconsistencies in the application of Quality Assurance General Criteria, consolidate and upgrade current tracking systems, and insure that Training Department management has access to senior management.

Organization and Management

The committee found that the DOE, Westinghouse, and Sandia National Laboratories have each established organizations that should be capable of performing WIPP operations in a safe and coordinated manner. This, of course, assumes that open issues in the areas of staffing and training are properly resolved. However, the committee has concerns regarding the lack of clear definition of certain reporting relationships that could result in confusion as to "who's in charge". In particular, the FSAR defines the Management and Operating Contractor (MOC) and the Scientific Advisor (Sandia) as holding equal levels of authority under the DOE WIPP Project Office Manager (WPO). This leads to the conclusion that the WPO manager will provide day-to-day line direction and coordination for facility operation. In actual practice, most of the hands-on experimental work in the facility will be carried out by an experimental division within the MOC organization. It appears to the committee that simple but important changes should be made to the FSAR to eliminate any confusion that the MOC is singularly responsible and accountable to the DOE for the safe and proper operation of WIPP.

Your recently announced policy is to establish a clear, straight line reporting relationship from operating facilities to the Headquarters program official and then to you. The current situation at WIPP appears to have two reporting chains to Headquarters. One of these runs from WIPP to the Operations Office to the Under Secretary while the other runs from WIPP to the Operations Office to the Assistant Secretary for Defense Programs (DP).

During the construction and testing phases of the WIPP project, many organizations have necessarily directed the development of various aspects of WIPP programs. Typically, the weight of influence changes among the Architect Engineer,

the Constructor, the Laboratory and the Operating Contractor as the project develops. However, there comes a time on any major project when responsibility for "ownership" must shift to the MOC. That time is now for WIPP. The committee found several instances where the MOC has deferred to outside direction involving operating practices without first determining that such practices did not degrade safety.

The committee is very encouraged by the recent trend of improvements at WIPP which are the result of positive actions by DOE and Westinghouse managers and, in particular, their actions to bring qualified seasoned managers and staff onto the project. However, these trends are fragile and could reverse. The two most likely causes for a downturn would be failure to maintain very high standards in replacing managers and staff who leave through normal attrition and the departure of the best people for "greener pastures" unless clear, achievable goals are set and met for operating the WIPP facility.

Recommendations:

- *Redefine organizational responsibilities so that operational safety responsibility runs from a single operating contractor to the WIPP Project Office to a Headquarters Program senior official.*
- *DOE WIPP management should clearly indicate that Westinghouse has the responsibility to insure that all inputs relating to facility operations are properly reviewed for safety implications.*
- *In the event of attrition, high importance must be placed on proper replacements to insure the continuation of recent improving trends. Start-up plans need to consider the schedule effects on motivation, and thus retention, of the current DOE and MOC staff.*

TRU Waste Certification

The committee's review shows that appropriate plans, procedures, and work practices appear to be in place for the certification of TRU wastes to be shipped to the WIPP site from both the Rocky Flats Plant and the Idaho National Engineering Laboratory. The techniques for the real-time x-ray radiography of drums were observed and appeared to be very effective, particularly for the detection of free liquids that might have accumulated in the drums. Procedures for the detection of loose surface contamination were sound. While the committee identified no safety significant concerns related to the waste certification program, there are several areas which should be strengthened to assure a high level of continued performance.

Recommendations:

Audits conducted by the WIPP-Waste Acceptance Criteria (WIPP-WAC) Committee should be more frequent than the now specified one



per year, particularly during the initial start-up phase. These should include unannounced audits and increased surveillance.

The WIPP - WAC should be reviewed in detail to insure full compliance with all applicable Department of Transportation (DOT) requirements.



The Department should review and standardize to the maximum extent possible the criteria applied to the numerous separate generator "sites" within the overall Rocky Flats complex and develop a systems approach to the preparation and shipment of TRU waste from the complex.

The variability of results from TRU waste content measuring techniques should be investigated and resolved to reduce the uncertainties that result from such differences.

There should be increased communication among generators, shippers, and the DOE and Westinghouse staff, especially on "lessons learned", consistent application of good practices, measurement techniques, and changes in waste forms.

Summary

The committee's review of the WIPP project focussed on short-term operational related issues and long-term performance of the repository. The operational issues are readily soluble and we have provided recommendations consistent with other comprehensive reviews, to address open safety questions.

Our review of the long-term performance issues has led to the primary recommendations we are making to the Department. The discussions presented above lead to the following major recommendations:

1. Perform an analysis of long-term performance relative to EPA Subpart B standards as a basis for initiating the experimental test phase (bin and alcove). The test phase would be conducted in compliance with 40 CFR Part 191 Subpart A after all other required permits/approvals have been obtained.
2. Emplace TRU waste for the experimental test program upon determining that there is reasonable confidence that WIPP can eventually be shown to meet release quantities and undisturbed site doses as required by EPA Subpart B, including a carefully considered intrusion scenario based on "reasonable projections". The basis for these projections should be explored with EPA as they apply to intrusion and distant time frames.
3. Continue performance assessment and experimental test programs, including study of the gas generation issue, and engineering enhancement studies to gain higher confidence in the expectation of achieving compliance with Subpart B. If the Department finds it necessary to use the EPA default values

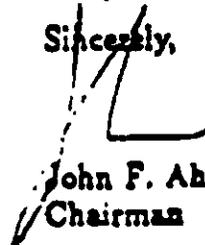
in the performance assessment, it will need to consider use of engineering enhancements.

4. Upon determination that a high degree of confidence exists that EPA Subpart B requirements will be met, initiate the operational test phase as a graded emplacement program committed to deliberate steps to evaluate and work out operational issues identified in various reviews.
5. After formal documentation of compliance with Subpart B standards, implement the full program for long-term isolation of TRU waste.

Once these steps are taken for the operational and long-term issues addressed, we believe the WIPP will be a responsible repository for the disposal of TRU waste.

I would be pleased to discuss any of these issues further.

Sincerely,



John F. Ahearn
Chairman



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Final Report
on
DOE Nuclear Facilities

by the

Advisory Committee on Nuclear Facility Safety
to the
Secretary of Energy

November 1991

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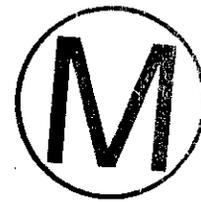
¹. Because of other commitments, Dr. Schull did not participate in the preparation of the final report.



TERMS SERVICE FOR ACNFS MEMBERS

NAME	BEGINING	ENDING
1. Ahearne, John F.	March 2, 1988	November 12, 1991
2. Auxier, John A.	March 2, 1988	August 30, 1988
3. Bayne, J. Phillip	January 2, 1989	April 1, 1991
4. Cleveland, Jesse M.	May 16, 1990	November 12, 1991
5. Culler, Floyd L.	May 11, 1990	November 12, 1991
6. Denning, Richard E.	March 2, 1988	February 20, 1991
7. Fabrikant, Jacob I.	February 1, 1990	November 12, 1991
8. Kastenber, William E.	March 2, 1988	November 12, 1991
9. Lash, Terry R.	June 6, 1990	November 12, 1991
10. Lewis, Harold R.	March 2, 1988	November 12, 1991
11. Martin, James E.	March 2, 1988	November 12, 1991
12. Ohanain, Mirhan J.	March 2, 1988	March 1, 1990
13. Powers, Dana A.	March 2, 1988	November 12, 1991
14. Rice, Paul D.	March 2, 1988	October 22, 1990
15. Schull, William J.	February 1, 1990	November 12, 1991
16. Schwartz, Elmer G.	March 2, 1988	March 1, 1990
17. Seale, Robert L.	March 2, 1988	November 12, 1991
18. Sears, C. Frederick	January 2, 1991	November 12, 1991
19. Tape, Gerald F.	January 2, 1988	November 12, 1991
20. Tschinkel, Victoria J.	March 2, 1988	November 12, 1991

The Committee was originally chartered November 13, 1987 and was renewed on November 13, 1989. In a letter to Dr. John F. Ahearne, Chairman, dated February 1, 1991, the Secretary of Energy stated his intention not to renew the ACNFS charter.



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Advisory Committee on Nuclear Facility Safety

to the
United States Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

November 12, 1991

The Honorable James D. Watkins
Secretary of Energy
US Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Admiral Watkins:

In your letter of February 1, 1991 notifying us that our charter would end in November, you requested that the Committee provide for an orderly turnover of any issues or ongoing reviews which are currently under consideration by the Committee. The charter of the Advisory Committee on Nuclear Facility Safety ends November 12, 1991, and this letter and attachments will be the final report, and follows the plan submitted to you by the Office of Nuclear Energy in September 1991. Here we review our major conclusions and recommendations and we discuss some key pending matters, including summaries of unfinished business that in your letter of October 17, 1991 you requested be provided to the Office of Nuclear Safety. Most of our reports to you and your predecessor have focused on safety concerns at a single Departmental site or facility, or on safety issues in a single aspect of DOE's nuclear safety program. In this report, however, we give you our perspective on the state of the Department's safety programs by commenting on a critical few issues that apply DOE-wide. Attachment 1 provides a summary of conclusions and recommendations in addition to those in this letter. Attachment 2 provides more detailed discussions of these recommendations and issues in the report chapters developed by our Subcommittees.¹ Each chapter also contains discussions and recommendations regarding additional, more specific concerns. We urge that appropriate persons within the Department consider the applicability to their respective programs of the comments and recommendations.



¹ The ACNFS had twelve subcommittees, covering the following areas: PRA and Severe Accidents, Research and Test Reactors, Process Facilities, Health Physics, Rocky Flats Plant, Waste Isolation Pilot Plant, Environmental Cleanup, Safety Policy, Savannah River Reactor, New Production Reactor, High Flux Beam Reactor, and High Flux Isotope Reactor.

GENERAL STATUS

Nearly four years of involvement on the Advisory Committee have provided us with an overall perspective on safety issues within the DOE. In many ways there have been positive changes. In others, there has been little or no progress. The DOE of November 1991 is much improved over that of March 1988, when the Advisory Committee held its first meeting. Perhaps the most obvious improvement is a better understanding of nuclear safety issues by DOE, by Congress, and by the public. The DOE staff and contractors now show an awareness that the past level of performance in many areas is no longer acceptable. The barrier that prevented knowledge of commercial safety practices from entering the weapons production community has been broken, and practices developed over the last decade in commercial nuclear safety have begun to be introduced into the weapons complex. Preceding this recognition of how to improve has been a growing awareness of how much improvement is necessary, and an understanding of how serious are the conditions in DOE's nuclear facilities complex.

As more information has become available outside the Department, the public has become disturbed about the perceived conditions at the weapons facilities. We heard this concern expressed often at our public meetings. The Advisory Committee held 32 meetings at 11 DOE sites, including 15 meetings in Washington, D.C. Our meetings were open to the public. This afforded the public the opportunity to hear the DOE staff and contractors. At each of our Committee meetings, an opportunity was provided for the public to comment. Some of these sessions were heavily attended and heated. All were mutually informative. We frequently have been told that our meetings provided the best opportunity for the public to hear what DOE was doing. Furthermore, the public, bitter and angry at DOE, praised our willingness to give them an opportunity to air their views. We encourage the Department to have public meetings in which management officials listen to the public. Congress also is highly critical of the DOE's weapons production facilities, although it shares responsibility with the Executive Branch for the decades of neglect.

We know that DOE's goal is to have a safe, efficient DOE weapons complex. DOE now stresses that safe operations, environmental protection, and meeting production and research goals are simultaneously achievable objectives. You have directed that there be negotiations among DOE, EPA, and state governments, thereby ending years of agency reticence to work with regulators. We recognize that noticeable progress has been made in providing access by the states to DOE plans and in discussing environmental cleanup. However, adequate progress in providing radioactive waste management facilities is not

being made. In particular, the means for disposal of mixed low level wastes and mixed TRU wastes is still unresolved.

The Department faces many problems that have developed over decades. The Department in some respects is demoralized and weakened in talent. The rapid proliferation of advisory and oversight groups has identified problems at a greater rate than available resources can be found to address and solve the problems. A distressing level of confused and unfocused thinking still exists, and the interrelation among headquarters, field offices, and the contractors continues to be characterized by change, overlap, and unclear guidance.

As stated above, DOE and its contractors have made progress in recognizing both the many safety issues and the attention that must be given to their resolution. In particular, significant effort has been placed on identification of weaknesses and the actions necessary to place safety on par with production and research. DOE has addressed deficiencies and has shut down facilities while corrective actions are taken. Modern concepts and technologies for improvement of safety are being accepted and used. For example, probabilistic risk assessments are being used for evaluation of risk and risk management, and unusual occurrences are being subjected to root cause analysis.

The concerns for the very high operating power densities in certain of the test and material irradiation reactors, and the related problem with irradiation damage to structure, pressure vessels and piping, have been addressed. The Category A research reactors are all currently authorized for operation. Significant improvements followed from the consolidation of the DOE management responsibility for Category A research reactor operations in the Office of Nuclear Energy. For example, the lines of communication from DOE Headquarters through to the contractors' reactor operations groups now are clear and unambiguous. Where problems have occurred, the flow of information has been prompt and problem solving responses have been forthcoming.

Specific initiatives regarding the research reactors include definition of the minimum staffing requirements for control rooms, the scope and uses of approved procedures, training program requirements and objectives, detailed review of safety of normal operation and accident consequences, the evaluation of plant aging affects, enhanced communication between the DOE reactor operating contractors, and the preparation of Level 1 probabilistic risk assessments. The DOE contractors established the Association for Excellence in Reactor Operations (AERO) to provide professional interchange of technical and operational information between the operating staffs of the DOE Category A reactors, thereby correcting a significant weakness.



Notwithstanding these improvements, it must be recognized that most of the Department's research reactors are being operated beyond their initial design lifetimes. Increased maintenance costs and costs associated with facility safety upgrades, coupled with reduced performance, will make continued operation of the aged reactors quite unattractive when compared to the potential safety features and high level of performance that can be designed into a modern reactor facility. If the Department foresees a long-term mission for its research and test reactors, then the Department should move forward expeditiously to replace the aging reactors.

As we conclude our role as your Advisory Committee, we must emphasize that significant deficiencies remain. These problems are addressed in the following sections.

ACHIEVING SAFETY

There are many possible variations in the means used to achieve an acceptable level of safety in DOE operations, but four elements are common to all of them. For each, we will first simply state the essentials in bare-bones form, then provide more detail, specifically noting where we believe the current DOE safety program falls short.

Safety Policy

First, there must be a safety policy. This means that the goals of the safety program must be set out in terms clear enough to all the participants that the means do not become a surrogate for the ends. The goals must be expressible in an objective and explicit form, so that it will be possible for different individuals to agree whether they have been met. It is desirable that they be numerical. It is essential that they be objectively measurable. A policy of "continuous improvement" is no substitute for a goal.

A clear and precise safety policy serves many purposes. It must relate the safety program to the Department's mission and its risk profile, and it must resolve the conflicts between safety on the one hand and production schedule and other mission objectives on the other. If that is not done in the safety policy, it will not be done. The safety policy sets the framework for the various elements of the Department who are responsible for drafting the many rules, orders, guides, and manuals that themselves form the body of a safety management plan. It ensures that the structure erected by the many different participants is internally consistent, while providing criteria through which upper management can judge the program.

It can also further enhance public understanding of the intent of the Department's safety program, which can only be beneficial in the political arena. In addition to promoting

public understanding of the DOE nuclear safety program, such a statement would give the Department an integrated framework for assessing whether proposed new or revised nuclear safety requirements and criteria are needed, are consistent with existing requirements and criteria, and are likely to produce safety benefits commensurate with the expected costs of their implementation.

A few years ago the Department had an active program to develop a meaningful safety policy and a set of policy goals. Good progress was being made in this effort. In the course of various reorganizations this program was dropped. The Department has now issued SEN-35-91 as its safety policy. In our view, SEN-35-91 falls far short of being a meaningful safety policy in each of the areas cited above. Its focus and objectives are too narrow, and it contains no criteria for determining whether the limited safety goals it does define have been met. It draws its quantitative standards from those of the Nuclear Regulatory Commission, which regulates different kinds of risk to different people, in regulated facilities. There are limited similarities between the two cases. The DOE policy substitutes "continuous improvement" for measurable standards, pays little attention to the largely chemical nature of the risk at some Department facilities, neglects the major risk to the workers, and treats the inevitable conflict between the Department's safety and production responsibilities by simply asserting that they are "compatible." That is inadequate guidance for those who must, in the end, make practical day-to-day decisions.

We continue to believe that a program for developing a set of safety goals should be reestablished, using the resources available to the Department, and that it should be regarded as a precursor to a safety management plan, not a consequence thereof.

The alternative to a meaningful safety policy is confusion, public opposition, disarray in the establishment of safety regulations, inconsistency among organizations, undisciplined regulation, and, ultimately, disaster.

Safety Management

There must also be a management plan, and supporting resources, both aimed at, and adequate for, the achievement of the goals. This plan should, in particular, spell out the roles and responsibilities of all the participants, the chain of authority, an appropriate mechanism for the allocation of resources, and a means by which each individual will be made aware of his or her place in the effort. Where there is a shortage of the needed skills, the management plan must include provisions for alleviating the problem.

The Department's facilities are, for the most part, contractor-operated, and the front-line responsibility for the safe operation of the plants clearly lies with those on the scene. Yet





they have to function according to standards and criteria established by the Department, according to priorities which must be set at the highest levels of the Department. Such matters as the importance of the nation's need for the materials produced at the facilities cannot be delegated to the contractors, yet these priorities determine resource allocation at the lowest levels. It is not easy to practice effective management without drifting into micromanagement, but that is inevitable if the management plan is not carefully drawn to clarify the issue of roles.

Much has been said of the new "safety culture" within the Department, and there is no doubt that safety considerations, long neglected in the past, have been accorded greater significance in the last seven or eight years. But there is little likelihood that safety will take a clear and appropriate position in the values held at the working level if its position is not clearly understood within the Department itself. People need to know not only that safety is important, but why it is important, and also just how important it is. To say "safety first" to the workers is to avoid the issue—they have heard that before. Safety is not first; its priority is one of many that must be set in context, in view of the Department's responsibilities. A safety management plan should provide the mechanism, while the safety policy provides the perspective.

We have often heard reports of safety appraisals and Tiger Teams, in which the result is characterized as some large number of deficiencies, often in the hundreds. But our experience is that it is rare that any of them are life-threatening, and even less often are they specific to the DOE chemical/nuclear plant. If there is any effort at all to set priorities, it is in very broad categories, leaving the contractor with no sense of an alternative to simply doing everything at once. The failure to set priorities results in too little attention to the most important safety issues. It is the Department's responsibility to provide a clear mechanism through which priorities can be set, and resources allocated.

Safety Assessment

The Secretary has issued SEN-6, 6B, 6C and 6D making line managers responsible for safety and directing them to have self assessment through an established office to assure that they act. Currently managers are treating self-assessment as another identifiable and auditable entity to which people and resources can be assigned, but they need to build self assessment for safety into what they do every day. These offices tend to be more inspection than assessment oriented. The various offices and NS in particular have undertaken to produce guides on performing self assessment, but this just perpetuates what SEN-6 set out to avoid; i.e., managers cannot depend on other entities for assuring safety, they must do it themselves. However, they do need to understand how DOE

oversight will measure whether and how they have embraced safety for their operations. Our reviews indicate that it will be some time before effective self assessment will occur.

There must be an agreed means of measuring both success and progress that is objective. Senior management reviews, oversight committees, and Tiger Teams are of little use if the criteria on which they base their judgments are hidden or unclear. Again, the goals need not be numerical, but the standards against which the participants will be judged must be expressible in such a way as to minimize inconsistency among judges.

What has been described above is closely related to what is called "management by objective" in the business world. An essential part of this approach is a means of judging to what extent the objectives have been met, without which programs have a tendency to feed on themselves, long past the point of diminishing returns. Not only organizations, but also individuals, have inertia, and a safety plan must have some objective means through which its achievements can be measured and compared to its goals.

There is a trend toward the increasing use of probabilistic risk assessment as a methodology for the assessment of residual risk, and of progress toward the reduction of risk, in part because its use has led to considerable improvements in safety understanding where it has been used. There are other less systematic disciplines in use in industry and government. It is not our purpose here to advocate any particular approach. But we do believe strongly that management judgment by itself is an inadequate tool for the measurement of progress in the reduction of risk. Management, quite simply, is biased. Similarly, conformance to all "federal, state, local, and DOE" regulations is not equivalent to a safety assessment, although often required for other reasons. It requires a great leap of faith to believe that these disparate entities have somehow assembled a collection of requirements both necessary and sufficient to guarantee that compliance is a measure of safety.

Criteria for success should be objective and defensible. There will always be those who contend that not enough has been done, as there will always be those urging that too much has been done. It is the responsibility of the Department to state its goals in sufficiently clear terms that success or failure in meeting them is measurable. While it is possible to define quantitative goals and measures for each of the risks, and it would be of great benefit to do so where possible, it would be difficult to find a single numerical statement for the Department's safety goals. There are alternatives, like the comparison with other normally accepted risks, but, whatever the goals, they must serve as the Department's answer to the question of "how safe is safe enough." It is not necessary that the full and complex methods of probabilistic risk assessment or cost/benefit analysis be



brought to bear here, but it is necessary that people of divergent views be able to find a consistent measure and position on the Department's achievements.



We recognize that it will be difficult to set standards and goals sufficiently broad to encompass all the risks we have recommended the DOE consider. Nevertheless, the absence of standards and goals allows undisciplined regulation. Unless there is a means of determining the extent to which the stated goals have been met, there is no basis for adjustment of the safety goals or the safety management program, for knowing whether to be proud or ashamed of one's achievements, or for knowing when to stop. While we do not recommend a specific measure here, we think that it is a subject of equal importance to the formulation of a coherent safety policy, and that the group charged with that task (if our recommendation in that regard is accepted) should make the choice of measure an integral part of the policy.

Feedback

Channels must exist for the transmission of information up the chain of command, so the program can strengthen itself dynamically. The state of the effort in each area should make its way from the continuous assessment implied in Safety Assessment to the management and resource allocation scheme required by Safety Management. Indeed, the wisdom gained in operating the program may easily result in modifications to the goals expressed in the Safety Policy. It is easy for managers to believe that they have provided for such channels, while people down the line perceive the situation as quite different. It is the latter perception that matters.

It is possible to manage an old, static, and simple organization with only one-way communication, in which well-established methods and rules are promulgated and distributed to the lower level personnel, who are expected simply to conform to time-tested procedures. In the case of the relatively recent Department recognition of the importance of safety, in a period in which the DOE is finding its way to a balanced posture, and given the extraordinary complexity of the organization, this is clearly not possible at DOE. It is therefore important to make the best of the experience gained in restructuring the Department's safety posture, to acknowledge failures when they occur, and to derive the benefits of the accumulated experience of the work force. This can only be done if the management is receptive to information from below, both good and bad, and if this receptivity is known and trusted throughout the complex. The pattern is set at the highest levels.

In an attempt to implement the new philosophy, DOE has rushed to address various safety issues. When new problems are identified, unrealistic resolution schedules are often

announced prior to development of a clear understanding of the problems, or of what is necessary to resolve them. This insistence on rapid response without adequate understanding has produced premature action plans and decisions, with resultant frequent schedule revisions, organizational changes, and unclear explanations of the need and bases for the actions and decisions. Workers may be left with no alternative but to consider production in fact as the continuing, dominant priority, and safety as simply a passing fancy of the current Secretary. Thus, too often workers may continue to perform and think as they did in the past, with no significant improvement in either their safety or the basic safety of operations. Further, as a result of the demand for progress, there appears to be a growing reluctance within DOE and contractor organizations to identify problems or to admit lack of progress to higher management, because this would appear nonsupportive of management's plan. Inculcation of the "new culture" has gone slowly, and we have heard many accounts suggesting upper management unwillingness to receive bad news. This is ultimately bound to be self-defeating.

ENVIRONMENTAL POLICY

The Department of Energy has embarked on a massive cleanup effort to remedy decades of neglect, and this undertaking may become the most costly environmental remediation effort in history. Unfortunately, DOE's cleanup goals are vague. Unless clear policy is developed and implemented, the difficulties that the EPA has experienced with the Superfund Program will be dwarfed by those that the DOE will face.

As the Department recognizes, not enough is understood about all of its contaminated areas to allow development of effective plans for cleaning them up. The process of gathering the needed information and developing clean up plans will take many years. The decision process for selecting cleanup approaches, which is both technically and institutionally complicated, requires substantial time. Moreover, cost-effective and politically permissible technologies do not yet exist for cleaning up many sites.

The most critical issue facing the Department in this area is the need to adopt a practical, specific policy on cleanup. The Department has set as a general goal the cleanup of all of its facilities by the year 2019. But the goal has not been defined in terms that will enable determining when the goal has been achieved. Confusion and frustration at the local level have resulted from the current approach.

The Committee recommends that the Department use land use planning as the approach to a workable environmental cleanup policy. The purpose of land use planning would be to designate which parts of DOE sites may eventually be released for unrestricted use, which parts may be released for restricted use (e.g., commercial, industrial, wildlife habitat,



recreational, etc.), and which parts probably will never be released for any purpose. We recognize that this approach would cause controversy because it would make explicit what is widely understood but not openly spoken: taxpayers cannot afford to return all of DOE's contaminated land to pristine conditions.



A policy based on the concept of land use planning would lead naturally to the appropriate selection of new cleanup criteria based on an initial assessment of environmental risk, rather than on the assessment of an ill-defined future public health risk with its attendant uncertainties. It also would lead to a better understanding of the need for improvement of existing, and the development of new, technologies for removing or containing contaminants. A land use planning approach would focus DOE Headquarters on overall guidance and would free the field offices to deal with the diversity of cleanup problems at the local level.

A land use planning focus also might obviate the need for an environmental impact statement on the total cleanup program, because such a statement would be inconsistent with the localized nature of land use planning. This focus would encourage a "bias for action", that emphasizes near-term actions at the most important contaminated areas as defined by the land use planning process.

OTHER ITEMS

The attached list of Conclusions and Recommendations identifies the major points regarding other areas which the Committee believes should be stressed. More complete descriptions of these issues, as well as those presented in this letter, can be found in the report chapters in Attachment 2.

CONCLUSIONS

Most facilities of the DOE weapons production complex are old. The underlying problems developed over decades. In the last three years, major facilities at Rocky Flats, Savannah River, and Hanford have been shut down by the Department to undergo changes needed to bring them into compliance with modern safety standards, procedures and practices. Some of these facilities will not be brought back on line (N-Reactor), some have been put in stand-by condition (Purex, PFP), and substantial upgrades are being made at Savannah River and Rocky Flats. Even after several organizational changes, false starts in the development of new procedures and training to the new procedures, and system and equipment upgrades of the facilities, the job is far from complete. Operational Readiness Reviews are uncovering further problems. Some problems can be solved quickly. Others can be addressed, but their correction will take into the next century.

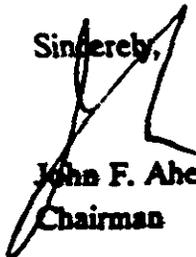
In view of the Advisory Committee's charge, we have focussed on broad areas of concern: the general status of safety issues within the DOE, achieving safety, nuclear safety policy, nuclear safety management, safety assessment, and environmental policy. From our observations, deliberations, reports, and letters, we submit herewith key conclusions and recommendations on the Risk Analysis, Research Reactors, Process Facilities, Radiation Protection, Rocky Flats Plant, Waste Isolation Pilot Plant, Environmental Cleanup, and Safety Policy (Attachment 1).

The recent announcement by President Bush, making another major step in ending the nuclear standoff with the "Soviet Union", significantly increases the pressure on rethinking what kind of nuclear weapons complex is needed. During this period, emphasis on safety must be increased. With the elimination of production pressures and, as we have frequently noted, employee attitude that production is most important, complacency may become the dominant attitude, leading to carelessness, and, finally, accidents.

The members of the Advisory Committee join me in expressing our appreciation for the privilege of serving on the Committee. It has been an interesting, challenging, and educational experience for each of us. We hope that the comments and recommendations the Committee has made in our 39 letters over the last three and one-half years have been of benefit to the Department.

We thank you for the opportunity to advise on matters of major national importance. We offer the very best wishes for success in what often must seem an endless and thankless task.

Sincerely,



John F. Ahearne
Chairman

Attachments
As Stated





ATTACHMENT 1
KEY CONCLUSIONS AND RECOMMENDATIONS



Note to Reviewers:

Pages 14 through 20 of this ACNFS report were not reproduced for Appendix PEER; these pages pertain to facilities other than the WIPP.

- o Once deficiencies identified in the operational readiness reviews have been corrected and a new operational readiness review is conducted successfully, Building 559 could be restarted to support rehabilitation of the Rocky Flats facilities and waste handling.

7. WASTE ISOLATION PILOT PLANT (WIPP)

The WIPP project is very important to the continued operation of DOE's facilities generating transuranic waste, and to future radioactive waste disposal projects that will have to comply with EPA's radioactive and mixed waste disposal requirements. Success or failure with WIPP will set precedents for the waste disposal program for years to come. The Advisory Committee believes, therefore, that DOE should take every reasonable initiative now to assure that WIPP succeeds in a manner that supports future waste disposal projects. Unfortunately, the Advisory Committee has serious concerns about whether DOE's current program will be able to demonstrate, in a timely manner, compliance with EPA's proposed long-term performance and human intrusion requirements (40 CFR 191) for disposal of TRU and high-level radioactive wastes. ~~_____~~

To increase the probability of successful compliance with EPA's proposed standards in a shorter period of time, DOE should take the following steps with regard to WIPP long-term performance:

- o Prepare a concise report in a timely manner comparing the expected performance of WIPP with the requirements in EPA's proposed standard (40 CFR 191). This report should specifically focus on those parameters that are currently significantly uncertain and set forth the actions including alternatives, necessary to reduce the uncertainties to acceptable levels for demonstrating regulatory compliance.
- o Change current project priorities by putting more emphasis on the use of experts. At this time, panels of experts will provide more significant input to the demonstration of compliance with EPA standards than will the results of the Dry Bin Tests. The Bin Test Program should continue to be focused on reducing uncertainties in those parameters that are most important in determining compliance with EPA's proposed standards.
- o Initially dispose only the contact handled TRU waste that will not pose a gas generation problem. Other TRU wastes can be safely stored above ground until it is determined whether they can be buried at WIPP in compliance with regulatory requirements or have to be treated so that disposal at WIPP is acceptable.



- o Immediately begin development and implementation of engineered alternatives, especially for newly generated waste. DOE should be a technological leader in waste management and this initiative should go forward even if it were not specifically required to demonstrate compliance with EPA's proposed standards.

The Advisory Committee recommends that DOE take the following steps with regard to operational issues:

- o Place additional emphasis on the importance of radiation protection to the safety and successful operation of the facility, and increase the authority of radiation protection managers and their access to senior management.
- o Give more extensive consideration to potential incidents at WIPP that, although not a radiation risk to the general public, could either pose risks to workers or create a substantial negative public reaction to continued operation of the facility.

As the first of a kind radioactive waste disposal facility, WIPP will be very carefully scrutinized and expectations of performance will be high. As with nuclear power plants and other nuclear facilities, performance that only protects the public from receiving significant doses of radiation is not good enough to maintain public support.



**ATTACHMENT 2
REPORT CHAPTERS**

Risk Analysis

Research Reactors

Process Facilities

Environmental Cleanup

Radiation Protection

Rocky Flats Plant

Waste Isolation Pilot Plant

Safety Policy

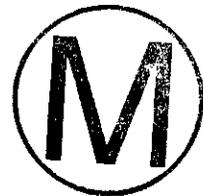
Other Activities



Note to Reviewers:

Pages 24 through 174 of this ACNFS report were not reproduced for Appendix PEER; these pages pertain to facilities other than the WIPP.

WASTE ISOLATION PILOT PLANT



WASTE ISOLATION PILOT PLANT



INTRODUCTION

In January 1989, the Deputy Secretary of Energy requested that the Advisory Committee on Nuclear Facility Safety (ACNFS) be briefed on the Waste Isolation Pilot Plant (WIPP) and that the Committee comment on any safety considerations [Ref. 1]. In May 1989, Secretary Watkins reaffirmed that request and asked for the Committee's "assessment of WIPP's safety and the identification of any potential safety concerns" [Ref. 2].

The Advisory Committee, in response to this request, visited WIPP in June 1989, at which time a Subcommittee was formed to review safety issues in further detail [Ref. 3]. The Subcommittee subsequently revisited WIPP and other related facilities: Sandia National Laboratory, the Department's scientific advisor on WIPP, and the Idaho National Engineering Laboratory and the Rocky Flats Plant, two sources of waste that would be shipped to WIPP. Areas selected for review were unresolved short-term technical and operational issues, including the Final Safety Analysis Report (FSAR), WIPP management and staffing policies, actual work practices in the field, and long-term environmental performance. A report to the Secretary was issued by the Advisory Committee on December 11, 1989 [Ref. 4].

The Waste Isolation Pilot Plant (WIPP) was authorized by Public Law 96-164 in 1979 to provide "a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States." Operation of the WIPP is expected ultimately to include receipt, handling, and permanent disposal of transuranic waste. It is classified in accordance with DOE orders as a "low

hazard facility," meaning that it is expected to have only minor on-site and negligible off-site impacts to people and the environment.

The Department of Energy (DOE) is using a phased approach, leading to a decision whether to designate WIPP an operating disposal facility. The construction phase of WIPP is essentially complete, except for the roof supports being installed to preclude failure of the ceilings in the test rooms. The objective of the Dry Bin Test Phase is to collect additional technical data to improve confidence in the prediction of the long-term behavior of the waste forms. Current DOE plans call for the facility to be evaluated at the conclusion of the 5-year (approximately) Test Phase to determine whether it is suitable for permanent disposal of TRU wastes. If WIPP is judged to be suitable, including meeting EPA standards and State of New Mexico requirements, DOE intends to initiate a 20-year Disposal Phase.

The Advisory Committee's review of the WIPP project was focused on two major aspects of the program, namely, environmental performance over the long-term and operational issues principally of short-term concern.

LONG-TERM PERFORMANCE

TRU wastes must be isolated from the general environment for many centuries. Predicting the performance of WIPP in isolating TRU wastes is a challenging task. The Environmental Protection Agency (EPA) is developing long-term performance standards (40 CFR 191 - still to be formally adopted) with which DOE will have to comply.

The ACNFS proposed a phased approach for the Department that would permit the Secretary to make an early determination of compliance and proceed with disposal of CH (contact handled) TRU waste [Ref. 4]. Briefly this called for the Department promptly to assemble the data to provide reasonable confidence that WIPP could eventually be shown to meet the EPA requirements and, having established this confidence, initiate TRU waste emplacement in support of the performance assessment program. The second phase recommended that, upon determination that a high degree of confidence exists that EPA Subpart B requirement will be met, DOE initiate the operational test phase as a gradual emplacement program committed to working out operational issues. This approach more likely would lead to disposal of TRU waste at WIPP earlier, and it more likely would assure compliance with EPA's proposed standard. The Advisory Committee urges DOE to revisit this approach.

COMPLIANCE WITH EPA STANDARDS

The major issue for WIPP continues to be whether long-term isolation can be predicted to occur in compliance with EPA's proposed standard. The Department unfortunately has not yet assembled and published in a suitable form the results of work it has done to show how WIPP is expected to perform against EPA standards, 40 CFR-191, Subpart B. (Subpart A requirements, which apply to management, storage, and capability to readily retrieve such wastes, are satisfactorily met.) We continue to believe that the Secretary should expect a high level of confidence that compliance can be demonstrated before he is asked to make a decision about permanent waste emplacement.

The Department's scientific advisor for WIPP, Sandia National Laboratories, in its performance assessment program, has continued to prepare analyses involving long-term radionuclide transport and dose assessment for several scenarios, the recent versions of which have included some comparisons with EPA standards [Ref. 5]. As refinements in methodology have been made and uncertainties in parameter values reduced, the results show that all of the scenarios lead to values that approach or are within the release limits stated in EPA requirements, including a reasonable human intrusion scenario.

The results of expert panels formed by Sandia, e.g., radionuclide solubility, retardation in the Culebra, future societies, have been most useful to the outcome and confidence in recent performance assessments. Sandia has plans to form additional important expert panels, e.g., design features of passive communication to the public, and waste form performance. Some panels have been delayed because of budget restrictions, yet their costs are small. Considering the relative value of the outputs of the expert panels in demonstrating compliance with EPA standards, we believe the Department should fund them now, even if it means some delay in the Dry Bin Test Program.

We believe that the Department can now provide "reasonable assurance" that release quantities in Subpart B would be achieved. It appears to us that DOE's recent analyses have interpreted the guides appropriately, and that it is not necessary to analyze WIPP performance for conditions worse than the EPA default values. We believe DOE should promptly prepare a report using these "reasonable projections" based on available data and expert judgment and move forward with a firm decision on graded operations at WIPP. A success oriented approach is warranted.

The Department should not delay carefully documenting its environmental performance assessment until the Dry Bin Tests are completed, because we believe these tests will not-in-and-of-themselves provide the type of results that will significantly change the perfor-

mance assessment. We strongly believe that DOE will eventually have to base its decision on professional judgments that it can make now or in the near term.

The report directed toward documenting compliance with EPA standards would serve many objectives. It would provide the basis for discussions with other parties, especially EPA; it would provide a focus for the "test phase" experiments to assure that they serve to reduce uncertainties in performance assessments assumptions; it would identify key laboratory measurements needed; it should identify any engineering modifications that may be necessary to accommodate present TRU wastes, and to indicate whether justifiable improvements should be made in future waste forms to prevent or mitigate gas generation. The Department can use data obtained over the next few years, while the waste is retrievable, to build additional confidence in the facility. The proposed tests could also be more useful in determining whether future waste forms can reasonably be improved (see below), a program we encourage.

GAS GENERATION

The Advisory Committee's original report urged DOE to expedite obtaining and using reasonable parameters to evaluate the potential effects of gas generation and other events on the performance assessment for WIPP [Ref. 4]. We believed then (as well as now) that the performance assessment for meeting EPA standards is a critical demonstration. Some of the original objectives of the bin tests have been deferred, for example Wet Bin Tests that involve brine and moist microbial processes. Thus data from future bin tests are expected to be utilized more for confirmatory purposes.

The potential problem of gas generation raises questions concerning the current waste form and future DOE management of TRU wastes that are worthy of further review. Specifically, a reduction in the amount of metals and organics or a change in the form of organic materials could reduce the gas generation. We do not believe that an attempt to change the form of existing TRU waste would be justified in view of the risks and cost it would entail. Therefore, to the extent necessary, efforts to ameliorate gas generation within the repository appear to be the most reasonable approach. For future TRU waste, however, a different form that would significantly reduce gas generation should be considered. The recent engineering enhancement study explored various measures for reducing the quantities of decomposable waste, of using nonmetallic containers, and of stabilizing the waste by incineration or vitrification [Ref. 6]. Some of these appear quite practical for the TRU waste shipments that WIPP will eventually manage, and could be beneficial if they can be conducted at reasonable cost and without appreciable risk to the personnel involved. Such an effort would be consistent with recently stated goals of improved waste management throughout the Department. The Department should

consider changing the waste form, at least for newly generated wastes, so that satisfactory long-term performance can be shown to comply with EPA's standard for disposal for these wastes [Ref. 4]. Disposal could then begin, and the Department could continue the gas generation study for those existing waste forms which would remain stored until adequate performance could be assured or necessary modifications made.

OPERATIONAL AND TECHNICAL ISSUES

A wide variety of issues, described under the general heading of Conduct of Operations in the December 1989 letter to the Secretary [Ref. 4], were raised by the Advisory Committee. Recommendations were made, DOE has acted and closure has been obtained [Ref. 12]. Before initiation of the Dry Bin Test, the Committee was requested to review the FSAR Addendum that specifically addresses that test [Ref. 7]. A few of the more significant actions are highlighted here.

FINAL SAFETY ANALYSIS REPORT (FSAR)

The fundamental issue with the FSAR concerns its basic purpose, its content and how it is handled, both in terms of initial approval and future approval of changes. In response to an Advisory Committee recommendation, a Policy Statement on the WIPP Project was issued by DOE [Ref. 5] which states that:

The configuration and operations of the Waste Isolation Pilot Plant (WIPP) facility are controlled to remain consistent with the Operational Safety Requirements (OSRs), the FSAR, and approved changes thereto. Changes to the WIPP OSRs will require approval at the same management level as the original FSAR approval (i.e., by EM).

The WIPP FSAR is the top level safety commitments document that presents facility descriptions, design basis operational limits, and safety analyses of the facility as a whole and of individual structures, systems, and components.

The Advisory Committee strongly supports this policy.

The Committee was requested [Ref. 7] to review the FSAR Addendum on the Dry Bin-Scale Test Program and concluded that there are no significant risks in excess of those estimated in the FSAR to the workers, the public, and the environment and that this test program can be conducted safely [Ref. 8].



Subsequent to the Committee's review, DOE was faced with the question of the long-term stability of the test rooms (roof falls). DOE convened two external expert panels, one to address geo-technical aspects and the other to review the Department's proposed corrective actions. The design that has been adopted and is being implemented is described in the FSAR Addendum - Dry Bin Scale Test approved by Mr. Duffy on August 30, 1991 [Ref. 13].



RADIOLOGICAL SAFETY

Good radiological safety will be the single most important aspect of day-to-day WIPP operations after disposal begins. Several reviews, including ours, have emphasized ways to improve radiological safety, and progress has been made. In response to the Advisory Committee recommendations, DOE made a slight revision to the organizational structure, and hired a capable Radiation Safety Program Manager for DOE-WIPP, while Westinghouse pursued equipment modifications, increased the number of technicians, and improved training programs (Refs. 9 and 10). Obtaining and retaining a senior health physicist for the Westinghouse Radiation Safety Program continues to present difficulties.

DOE needs to place additional emphasis on the importance and priority of radiological activities to the safety and successful operation of the WIPP facility. Although radioactivity is the unique factor that differentiates WIPP operations from other industrial operations, current organizational reporting relationships (both Westinghouse and the DOE) would indicate that radiation safety is just another set of requirements for routine operations. (This is not peculiar to the WIPP project within DOE, unfortunately.) For example, WIPP organization charts and the FSAR show the senior manager directly responsible for all radiation programs still positioned at well below the top manager and below the managers of Public Affairs, Human Resources, and Administrative Services (Refs. 9 and 10). Although the FSAR and WIPP organization charts indicate a direct access line to the senior facility manager, it is a dotted one that must bypass other line manager levels. While this may suffice for incidents and highly important events, it deprives the manager of the day-to-day perspectives that must exist to deal with this most important aspect of an operational facility. We believe DOE and Westinghouse should define a better organizational structure that provides senior radiation program management with sufficient authority and with direct access to senior facility management.

FIRE RISK

The Advisory Committee recommended that a fire risk assessment of the pre-closure operations of WIPP be performed. This assessment, which has now been completed [Ref. 11], concludes that the radiological risk to the public posed by fire to be extremely

low. Risks associated with injury to the workers and stoppage of waste handling operations were also considered, but the evaluations concentrated on the radiological risk to the public.

The Advisory Committee is concerned that the Department is giving insufficient attention to low probability events that present a negligible radiological risk to the public, but that may be significant when worker safety or plant shut-down is considered. These latter cases may not even be radiation related. This is not an issue unique to WIPP.

TRU WASTE CERTIFICATION

Since accident analyses have been based upon specific bin loading and since programmatic results are dependent upon knowledge of specific loadings, there is a strong need for quality control in waste loading and certification. The Advisory Committee's review shows that appropriate plans, procedures, and work practices appear to be in place for the certification of TRU wastes to be shipped to the WIPP site from both the Rocky Flats Plant and the Idaho National Engineering Laboratory. Committee recommendations in several areas (e.g., audits, compliance with Department of Transportation requirements, and the variability of results from TRU waste content measuring techniques) have been suitably addressed by the DOE (Refs. 9 and 10).

CONCLUSIONS AND RECOMMENDATIONS

The WIPP project is very important to the continued operation of DOE's facilities generating transuranic waste, and to future radioactive waste disposal projects that will have to comply with EPA's radioactive and mixed waste disposal requirements. Success or failure with WIPP will set precedents for the waste disposal program for years to come. The Advisory Committee believes, therefore, that DOE should take every reasonable initiative now to assure that WIPP succeeds in a manner that supports future waste disposal projects. Unfortunately, the Advisory Committee has serious concerns about whether DOE's current program will be able to demonstrate, in a timely manner, compliance with EPA's proposed long-term performance and human intrusion requirements (40 CFR 191) for disposal of TRU and high-level radioactive wastes.

To increase the probability of successful compliance with EPA's proposed standards in a shorter period of time, DOE should take the following steps with regard to WIPP long-term performance:

- o Prepare a concise report in a timely manner comparing the expected performance of WIPP with the requirements in EPA's proposed standard (40 CFR 191). This



report should specifically focus on those parameters that are currently significantly uncertain and set forth the actions including alternatives, necessary to reduce the uncertainties to acceptable levels for demonstrating regulatory compliance.

- o Change current project priorities by putting more emphasis on the use of experts. At this time, panels of experts will provide more significant input to the demonstration of compliance with EPA standards than will the results of the Dry Bin Tests. The Bin Test Program should continue to be focused on reducing uncertainties in those parameters that are most important in determining compliance with EPA's proposed standards.
- o Initially dispose only the contact handled TRU waste that will not pose a gas generation problem. Other TRU wastes can be safely stored above ground until it is determined whether they can be buried at WIPP in compliance with regulatory requirements or have to be treated so that disposal at WIPP is acceptable.
- o Immediately begin development and implementation of engineered alternatives, especially for newly generated waste. DOE should be a technological leader in waste management and this initiative should go forward even if it were not specifically required to demonstrate compliance with EPA's proposed standards.

The Advisory Committee recommends that DOE take the following steps with regard to operational issues:

- o Place additional emphasis on the importance of radiation protection to the safety and successful operation of the facility, and increase the authority of radiation protection managers and their access to senior management.
- o Give more extensive consideration to potential incidents at WIPP that, although not a radiation risk to the general public, could either pose risks to workers or create a substantial negative public reaction to continued operation of the facility.

As the first of a kind radioactive waste disposal facility, WIPP will be very carefully scrutinized and expectations of performance will be high. As with nuclear power plants and other nuclear facilities, performance that only protects the public from receiving significant doses of radiation is not good enough to maintain public support.

REFERENCES

1. Letter from J. F. Salgado to John F. Ahearne, January 19, 1989.
2. Letter from J. D. Watkins to John F. Ahearne, May 8, 1989.
3. Minutes of Meeting of Advisory Committee on Nuclear Facility Safety, Carlsbad, New Mexico, June 30, 1989.
4. Letter from J. F. Ahearne to J. D. Watkins, December 11, 1989.
5. "Preliminary Comparison with 40 CFR Part 191, Subpart B for the Waste Isolation Pilot Plant, December 1990," SAND90-2347.
6. "Evaluation of the Effectiveness and Feasibility of the Waste Isolation Pilot Plant Engineered Alternatives: Final Report of the Engineered Alternatives Task Force," DOE/WIPP 91-007, Revision 0, July 1991.
7. Letter from J. E. Lyle to J. F. Ahearne, February 1, 1991.
8. Letter from J. F. Ahearne to J. D. Watkins, April 11, 1991.
9. Letter from L. P. Duffy to J. F. Ahearne, April 19, 1990.
10. Letter from L. P. Duffy to J. F. Ahearne, June 12, 1990.
11. "WIPP Fire Hazards and Risk Analysis," May 1991.
12. Letter from J. E. Lyle to J. F. Ahearne, August 19, 1991.
13. Memorandum from L. P. Duffy to Manager, DOE Field Office Albuquerque, "Waste Isolation Pilot Plant Final Safety Analysis Report Addendum: Dry Bin Scale Test Approval," August 30, 1991.

