

WIPP STARTUP: OVERCOMING UNPRECEDENTED CHALLENGES

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ABSTRACT

Since its authorization by the U.S. Congress in Public Law 96-164, the Waste Isolation Pilot Plant Program has achieved significant progress. Subsequent to a Record of Decision based on the October 1980 Final Environmental Impact Statement (FEIS), the scientific and engineering challenge of constructing a 100-acre mined repository to demonstrate the safe and environmentally sound disposal of defense program generated transuranic waste became reality.

Since initial conception, however, a complex program has evolved. Demonstration of compliance with the requirements of the Resource Conservation and Recovery Act (RCRA) and Environmental Protection Agency (EPA) disposal Standards defined in 10 CFR 191, Subpart B (yet to be repromulgated), became prerequisites to a disposal decision. On June 13, 1990, based on a supplement to the 1980 FEIS, the decision was made to redefine the program to include a formal test phase. This decision required an addendum to the Final Safety Analysis Report to assure commitment to safety considerations, an intensive operational readiness review effort, and the need for a No-Migration Determination for the Environmental Protection Agency.

In addition to meeting the technical challenges, the need to satisfy a broad spectrum of oversight groups (some directly funded by the Department of Energy) was required. With the decision making process publicly displayed on the Secretary of Energy's Decision Plan, the unprecedented challenges of the WIPP Program were painstakingly met, one by one, in an accountable and visible manner.

INSTITUTIONAL CHALLENGES

Secretary of the U. S. Department of Energy James Watkins issued the "Draft Decision Plan for the WIPP" in October 1989 which stipulated the prerequisites and basis for the assessment of the WIPP's readiness to initiate testing using waste that meets the WIPP's acceptance criteria. The plan addressed all safety, environmental, and technical factors to be satisfied prior to acceptance of mixed (transuranic and hazardous) waste at the WIPP facility in southeastern New Mexico. The Decision Plan also provided a means of involving the public in the DOE's decision making process.

The Decision Plan concept, its preparation, and approval, provided a forum for unprecedented participation and openness in the DOE decision-making processes. Interested parties and oversight organizations were given the opportunity for involvement in the identification of safety and environmental issues through their review and comment on the decision plan and its subsequent revisions. States, federal agencies, and oversight organizations involved in the review and comment on evolving decision plans included:

- The states of
 - New Mexico
 - Colorado
 - Idaho
 - Nevada
 - South Carolina
 - Tennessee
 - Washington
- Environmental Protection Agency (EPA)
- Department of Defense
- Department of the Interior
- Environmental Evaluation Group

- Defense Nuclear Facilities Safety Board (DNFSB)
- Advisory Committee on Nuclear Facility Safety (ACNFS)
- Blue Ribbon Panel
- Congress

From October 19, 1989, when the initial Draft Decision Plan was issued, until September 27, 1991, when the Final Decision Plan for WIPP was issued, 15 Decision Plan iterations were approved and issued and 50 prerequisites for dry bin waste receipt at WIPP were completed. Nineteen readiness reviews were conducted by a variety of oversight organizations both internal and external, and 550 prestart findings resulting from those reviews were resolved with corrective actions completed.

This level of external involvement in a DOE project and the challenges it presented was essentially unheard of before the WIPP. Opinions on the WIPP's readiness from the various oversight groups were presented to Congress in the DOE's request for legislative land withdrawal. Although three different versions of land withdrawal legislation were pending, not one was approved when Congress recessed in December 1991.

The October 3, 1991, declaration of readiness was followed by an administrative land transfer that subsequently became the subject of legal action initiated by the New Mexico Attorney General. An injunction prohibiting waste shipments was granted on November 26, effectively delaying the start of the on-site test phase using mixed waste. By law, administrative land withdrawal must be temporary (i.e. reversible). The state's concern is that potential underground room instability could impact waste retrieval and lead to a "defacto disposal" situation. Thus, the state contends that a permanent legislative withdrawal of lands is required.

As the WIPP Project developed, it had to keep pace with the ever changing environmental regulations. The regulations of the Resource Conservation and Recovery Act (RCRA) for the management of mixed waste required the preparation of a No-Migration Variance Petition and applications for the RCRA Part A and Part B permits. As a first-of-a-kind facility, there were no precedents to follow in the development or review of these environmental permit applications. Both the preparers and the reviewers faced unprecedented challenges.

No-Migration Determination

More than 75 percent of the waste destined for WIPP during the test phase and beyond meets the definition of mixed waste. Mixed waste is defined as a mixture of hazardous wastes regulated under Subtitle C of RCRA and radioactive wastes regulated under the Atomic Energy Act. As a result, the hazardous portion is subject to the regulation of RCRA. Under RCRA, land disposal of hazardous waste is prohibited unless either (1) the wastes meet treatment standards specified by the EPA, or (2) the EPA Administrator determines that the prohibition is not required in order to protect human health and the environment. This determination must be based on a demonstration "that there will be no migration of hazardous constituents from the disposal unit...as long as the wastes remain hazardous" (*Federal Register, Vol. 55, No. 220, November 14, 1990, Pg. 47700*). In March 1989, the WIPP No-Migration Determination Petition was submitted to the EPA. In April 1990, the EPA proposed to grant the variance and published the proposed conditions for public comment. On November 14, 1990, the EPA granted the WIPP an unprecedented ten-year Conditional No-Migration Determination.

RCRA Part A and Part B Permit Applications

The state of New Mexico was granted authority to regulate mixed waste under RCRA on July 25, 1990. In order to obtain interim status, the DOE was required to submit the Part A RCRA permit application by January 22, 1991. The application was submitted to the state as requested, and was followed by the submission of the Part B application in February, 1991.

The state of New Mexico is presently evaluating the RCRA permit applications. The DOE has fulfilled the compliance requirements as established by RCRA regulations. The only RCRA permit application for a geologic repository for mixed waste (40 CFR 264, Subpart X) was completed and submitted as requested.

TECHNICAL CHALLENGES

1991 began with the issuance of revision 6 to the Draft Decision Plan. It included the following technical challenges:

- Closeout of the DOE-Environment, Safety and Health readiness appraisal and of prestart commitments to the ACNFS
- Issuance of the waste characterization and quality assurance plans for the waste generator sites
- Dry Bin Final Safety Analysis Report (FSAR) Addendum approval
- Completion of an Integrated Systems Checkout (ISC) and declaration of facility readiness

In May 1989, the DOE Office of the Deputy Assistant Secretary for Safety, Health, and Quality Assurance (DOE-EH) conducted a WIPP Readiness Review Inspection (RRI). The RRI team subsequently issued a report identifying 73 prestart findings. Follow-up visits were made and through this process, all prestart RRI findings were satisfactorily resolved and closed out on March 11, 1991.

The ACNFS conducted various reviews of WIPP operations. Based on the findings which resulted from those reviews, the DOE made 29 commitments to the ACNFS focusing on long-term environmental performance and safety issues related to conduct of operations. On August 19, 1991, all prestart commitments were closed.

The Waste Characterization Program Plan and Quality Assurance Program Plan were issued in July 1991 incorporating the Conditional No-Migration Determination and the Resource Recovery and Conservation Act compliance requirements identified to date. Sub-tier Quality Assurance Project Plans were also developed to address the conditions specific to each waste generator site. The Idaho National Engineering Laboratory (INEL) presently has over 200,000 drums of waste in temporary storage and will be the first generator site to ship waste to the WIPP in support of the test phase. There were five quality assurance project plans developed for the INEL and Argonne National Laboratory-West complex. As prerequisites to their final acceptance, these documents were revised to incorporate EPA no-migration conditions, comments made by the Waste Acceptance Criteria Certification Committee, and the lessons learned during the first dry bin loading demonstration.

The INEL site's readiness to ship waste was declared on August 31, 1991. Activities in support of their declaration included operational training; bin loading; operational readiness reviews, including participation in the integrated systems checkout and an end-to-end shipping and receiving demonstration; qualification of laboratories to perform gas sample analysis; and the issuance of their Waste Profile Plan. The first bin of test waste was loaded in April 1991.

The Dry Bin FSAR Addendum supplements the May 1990 WIPP FSAR by addressing conduct (both normal and off-normal) of the dry bin portion of the WIPP's bin-scale test phase. The addendum addresses receipt and preparation of dry bin-scale test containers; underground emplacement, including installation of monitoring equipment; test plan operation, including routine monitoring, sampling, and maintenance; and post-test retrieval, including preparation for possible off-site shipment. The addendum also addresses the long-term stability of the underground test rooms.

The FSAR Addendum received exhaustive reviews by various internal and external organizations, including:

- DOE-AI Office of Environment, Safety, and Health
- DOE-EH (including the preparation of Supplement 3 to the Safety Evaluation Report)
- Office of Nuclear Safety
- DOE-EM Operational Readiness Review Team
- New Mexico Environment Department
- Environmental Evaluation Group
- ACNFS
- DNFSB

It was approved by DOE EM-1 on August 30, 1991.

To verify that the prerequisites identified by the Secretary's Decision Plan had been satisfactorily met, the WIPP's management and operating contractor, the Westinghouse Waste Isolation Division, conducted an internal Operational Readiness Review indexed to TSA (Technical Safety Assessment) criteria. A readiness review was also deemed necessary to ensure that DOE Orders and other regulatory requirements were being properly implemented. The ORR was conducted in two phases. Phase I addressed the readiness of the Base Facility (management controls, administrative controls, personnel, systems and equipment, and the environmental, safety, and quality assurance programs) and the Transportation System. Phase II focused on the conduct of an Integrated Systems Checkout (ISC) and the readiness of management controls, administrative controls, personnel, systems and equipment, and the environmental, health, safety, and quality assurance programs as they pertain to the Bin-Scale Test Program.

The Phase I review was completed on March 1, 1991, with all prereadiness items successfully completed and verified. At the time of the declaration, readiness of the complete transportation system was qualified as dependent on the satisfactory closeout of a DOE audit of the Transuranic Package Transporter Model II (TRUPACT-II) manufacturing process. That prerequisite was closed on August 1, 1991. On September 10, 1991, all the quality assurance reviews for all 15 TRUPACT-IIs were completed and the units were accepted for use, representing yet another first for the project.

The Phase II, which focused on the ISC, was completed on August 16, 1991. The ISC demonstrated that operational activities required to perform the dry bin-scale test could be effected in a safe manner at the WIPP site. The two-part ISC entailed the sequential testing of every system necessary to receive, unload, emplace, and retrieve waste. The first part of the ISC was completed in early July 1991. It validated procedures, operations, interaction, and performance of the systems necessary to support the dry bin-scale test program. It included activities such as:

- Procedure development
- Monitoring of systems installation and checkout to ensure that they meet test criteria
- Initial system operation to validate procedural controls and equipment compatibility
- Personnel training
- Verification of the capability to respond to off-normal events
- Documentation of acceptance test data and personnel training and qualification requirements

The second part of the ISC consisted of a walk-through of the entire process using actual test bins containing simulated waste. Prior to starting the procedure, an integrated engineering test of the bin pressure relief and control system was successfully performed to verify that operational aspects

of the tests remained within the bounds of the safety envelope. Technicians received a TRUPACT-II, unloaded the waste bin, prepared it for emplacement, performed a leak check, purged the bin of oxygen, and sampled the headspace gas. The bin was transferred to the underground, connected to the data acquisition system, purged, oxygen gettered, and tested in a series of equipment failure drills. The bin was then disconnected and returned to the above ground facility. The ISC was successfully completed on July 23, 1991. The process was observed by members of the DOE-EM ORR team, the Environmental Evaluation Group, the New Mexico Environment Department, DOE-AL (safety), and DOE-Headquarters (HQ) (EH and Office of Nuclear Safety [ONS]). A successful demonstration of the WIPP's ability to effectively deal with the challenges of test phase operations was complete.

In May 1991, the DNFSB* recommended that DOE-HQ conduct an "external" operational readiness review. The objective of this review (referred to as the EM-ORR) was to independently assess and verify the safety, health, and environmental compliance programs as well as management readiness to package, transport, and receive TRU waste at WIPP for dry bin-scale tests. The review addressed all aspects of the WIPP site, the conduct of the ISC, as well as the transportation system and packaging requirements and a review of related waste preparation activities at the INEL. A dry-run demonstrating the process of loading and shipping waste from the INEL, and receiving and emplacing the waste at the WIPP, essentially an "end-to-end" ISC, was also conducted.

The EM ORR was subject to internal oversight by the DOE Office of Nuclear Safety and the DOE Assistant Secretary for Environment, Safety and Health (ES&H). The DNFSB provided external oversight and was ultimately the deciding body for concluding that the DOE-EM ORR was satisfactorily completed. Each of these oversight groups has concluded that its concerns have been resolved and that the WIPP is ready to initiate the test phase with transuranic and hazardous waste materials.

- August 21, 1991. The Assistant Secretary for ES&H concluded that the EM ORR was adequate to assess the readiness of the facility for start-up.
- September 13, 1991. The Office of Nuclear Safety concluded that all their prestart-up concerns have been resolved.
- September 25, 1991. The EM ORR team concluded that the objective of their review was met and that the WIPP had satisfactorily closed all prestart findings and therefore was ready to operate in a safe manner.
- September 26, 1991. The Defense Nuclear Facilities Safety Board concluded that the EM ORR is complete, that all prestart findings have been satisfactorily resolved, and that the WIPP is ready to start test phase operations.

Based on these conclusions, the Secretary of Energy declared the WIPP ready to begin test phase operations with

* In 1988, Congress created the Defense Nuclear Facilities Safety board (DNFSB) to provide advice and recommendations to the President and the Secretary of Energy regarding public health and safety issues at DOE defense nuclear facilities. This independent organization is comprised of five members appointed by the President, with the advice and consent of the Senate. The DNFSB has the authority to transmit its recommendations directly to the President of the United States in the event that any aspect of an operation, practice, or occurrence presents an imminent or severe threat to the public health or safety.

mixed waste on October 3, 1991. This was supported by the Department of the Interior's issuance of a Notice to Proceed with administrative land transfer.

Underground Room Stability

Underground storage in bedded salt was selected for a number of technical reasons, including the plastic deformation property which makes salt essentially self-healing. However, as the institutional and technical prerequisites extended the start of test phase operations, this desirable characteristic of salt presented yet another challenge to overcome. The underground room planned for the first test phase operations was mined in 1986, raising a concern that it could remain stable for the anticipated five to seven year test phase. To address this concern, a panel of geotechnical experts was convened to independently evaluate the geomechanical performance of the underground area of Room 1, Panel 1. A consensus was reached that with limited maintenance the room would be usable for test activities for seven to eleven years from the time of excavation, translating to a remaining life of at least two years to possibly six years. The panel members recommended various enhancements for support and maintenance work that would likely extend the room life to at least 14 years from the date of mining.

Based on these recommendations, a supplementary support system was designed. A roof support system capable of yielding and providing uniform roof support was selected as the design basis. The system includes steel channel supports, 13-foot-long, resin-anchored rock bolts, and steel wire lacing cables underneath a mat of steel welded wire mesh and expanded metal. Chain-linked wire mesh is pinned to the side-walls to contain any minor spalling down to about seven feet above the floor.

Prior to installing the support system, an external design review panel of experts representing a cross-section of industry, government, research, safety, academia, and independent design firms was convened. Their focus was to independently assess the adequacy of the design as presented by members of the WIPP's engineering department. The panel members developed a review design checklist to critique the design against

specific requirements. The panel concluded that the design meets its objective: Room 1, Panel 1 can be expected to provide a useful life of at least seven years from the time at which the support system is installed.

Integrated into the roof support system design is the capability to monitor its geomechanical performance. The comprehensive monitoring system is designed to monitor loads on each rock bolt, measure continuing creep and deformation in and around the room, identify stress loads on the rock and resultant deflections of the steel channel supports. The monitoring system will provide (1) early indication of any unusual closure activity, and (2) the basis for adjusting the load on the rock bolts to accommodate room creep.

The quality and conservatism of the DOE's approach to assuring the stability of Room 1, Panel 1, was recently acknowledged during an inspection by the New Mexico Institute of Mining and Technology, Bureau of Mine Inspection. The inspection report dated October 17, 1991, states: "In the neighboring potash mines it is not unusual for completely unsupported roof to remain intact for several decades. The operator of the WIPP site is installing three separate ground support systems in Room 1 which should be capable of supporting the roof. This degree of conservatism is unheard of in the mining industry."

Based on this information, the DOE satisfied the challenge of assuring that the integrity of Room 1, Panel 1, will fully support the current scope of the Test Phase scheduled therein through full retrievability of the waste upon conclusion of the test.

CONCLUSION

Unprecedented challenges for the WIPP program have been met. Through the evolving Decision Plan process, the DOE has confirmed that all prerequisite requirements have been met for the proper preparation of test program waste, for the waste to be transported in the TRUPACT-II, and for mixed waste tests to begin at the WIPP site. Upon resolution of the current litigation and/or Congressional action on legislative land withdrawal, the in-situ mixed waste test program can be safely initiated. The WIPP system is ready.