

Waste Isolation Pilot Plant Repository Footprint Redesign -11238

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ABSTRACT

The Department of Energy (DOE)/Carlsbad Field Office is responsible for managing all activities related to the disposal of defense-related Transuranic (TRU) and TRU-mixed waste at the Waste Isolation Pilot Plant (WIPP), located in southeastern New Mexico. The configuration of the WIPP deep geologic repository has eight waste disposal panels, with four panels on each side of the four main access drifts. Waste panels consist of seven rooms. Each room has nominal dimensions of 91 m (300 ft) long, 10.1 m (33 ft) wide, and 4.0 m (13 ft) high. Pillars between rooms are 30 m (100 ft) thick. The waste panels are separated from each other and the main access drifts by nominally 61 m (200 ft) pillars.

In addition to the eight panels, the main north-south and east-west access drifts in the waste regions are available for waste disposal, as described in the original repository design in the Compliance Certification Application (CCA) [1]. The CCA specified that the main access drifts, used to transport waste to disposal panels and for supplying and exhausting ventilation air, would eventually be filled with waste, and subsequently be designated as waste panels 9 and 10. One of the features in the design basis for this configuration was based on the visco-plastic (creep) properties of the rock salt formation in which the repository is located. When an opening, e.g., a waste disposal room or access drift, is excavated, it has a tendency to “heal” or close within a relatively short period of time. The advantage of this process is that, after waste is emplaced in the repository, the salt formation eventually entombs the waste containers, effectively sealing and isolating them from the accessible environment. There is, however, limited time to perform disposal activities before the salt formation “creeps” to a point where maintaining the openings is not feasible or safety is potentially compromised. Preliminary engineering analyses identified certain geotechnical issues with disposing of TRU waste in the main access drifts, portions of which were initially mined 5 to 30 years ago. DOE plans to relocate Panels 9 and 10 to a more desirable location after preparing the necessary documentation and obtaining regulatory approvals from the U.S. Environmental Protection Agency (EPA) and the New Mexico Environmental Department (NMED).

INTRODUCTION

The WIPP is a deep geologic repository for the permanent disposal of the United States’ defense-related TRU and TRU-mixed waste. TRU-mixed waste consists of TRU waste mixed with hazardous waste. The disposal of TRU waste is regulated under 40 CFR Parts 191 and 194, whereas the disposal of hazardous waste is regulated under the Resource Conservation and Recovery Act. The repository is located 600 meters (2,150 ft) below the surface in southeastern New Mexico in a bedded salt formation.

The regulatory-approved repository design [1] contains eight panels, each with seven rooms approximately 10.1 m (33 ft) across, 4 m (13 ft) high and 91 m (300 ft) long, and four main access drifts that are slated to be used for waste disposal once the panels are filled with waste. The waste disposal areas in the main access drifts are referred to as Panels 9 and 10.

Preliminary engineering analyses have identified geotechnical issues with disposing of TRU waste in the main access drifts. The specified room and pillar dimensions were selected to ensure no contact-handled TRU containers would breach due to creep closure while a panel is being filled with waste. More specifically, a nominal five-year lifetime for a disposal panel was planned for mining, emplacement, and closure with no risk of contact-handled TRU waste containers breaching during that period. Given the age of the main access drifts and the need to widen these drifts for emplacement of remote-handled transuranic waste (as discussed below), the DOE has evaluated several options for relocating the waste destined for Panels 9 and 10 to an alternate location in the underground facility. The present plan is to prepare and submit a Planned Change Request to the U.S. Environmental Protection Agency and a permit modification request to the New Mexico Environment Department to change the location of Panels 9 and 10.

HISTORY

Preliminary designs [2] of the WIPP repository were developed in the early 1980s with validation efforts for the early designs starting in 1981 under the Site and Preliminary Design Validation program. The Site Preliminary Design Validation program was developed to further characterize the site, obtain geotechnical data, and validate early WIPP site geology and the preliminary repository design. The Site and Preliminary Design Validation program confirmed that the site was suitable for permanent disposal of the planned wastes and complied with established design criteria. For example, data obtained through this program and documented in the Design Validation Report [3] helped confirm the design criteria and validate the basis being used for underground disposal room design. The repository design is shown in Fig. 1.

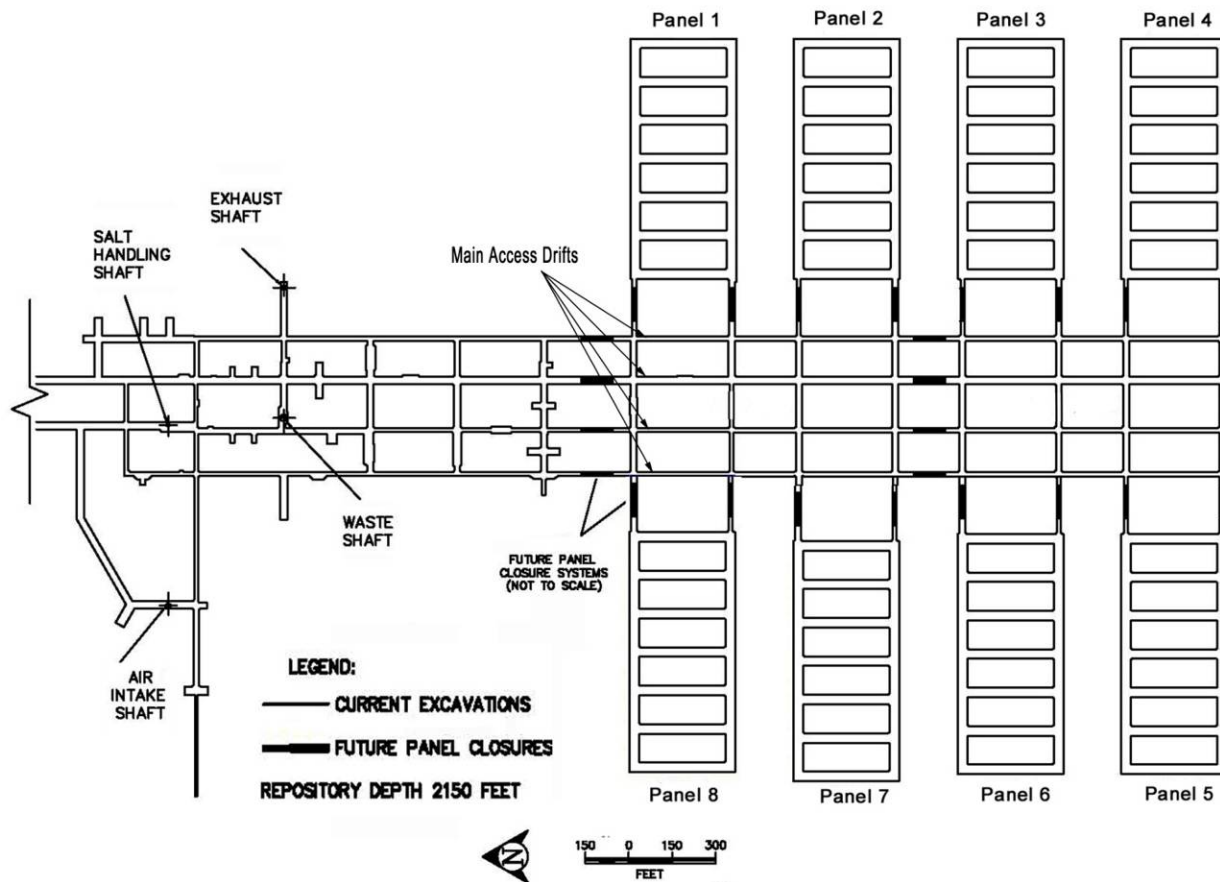


Fig. 1. - Repository Design

OPERATIONAL ISSUES WITH INITIAL DESIGN

When the initial access drifts to waste disposal Panels 1 through 8 were mined in the late 1980s, it was expected that the access drifts and rooms in Panels 1 through 8 would only stay open for five years [3]. Because regulatory approvals took at least ten years longer than expected, engineering analyses were conducted to evaluate the operational feasibility and safety aspects of the original design. The original design describes disposing of waste on the floors and in the walls of the transportation and ventilation access drifts. These drifts are currently 4.3 m (14 ft) wide to 7.6 m (25 ft) wide. These drifts must be expanded to 10.1 m (33 ft) wide, the width of a disposal room, in order to accommodate the equipment for emplacing remote-handled (RH) TRU waste in the walls. Widening the access drifts for disposal Panels 9 and 10 is not believed to be geotechnically feasible due to age-related deterioration. The access drifts were initially mined 5 to 30 years ago and the surrounding rock in these areas is highly fractured. Given these facts and requirements, it may not be possible to continue to safely support some of the areas upon widening.

As of December 2010, contact-handled (CH) TRU waste is being emplaced in Room 2 of Panel 5 and RH waste is being emplaced in Room 1 of Panel 5. For each panel, Room 7 is farthest

from the main access drifts and Room 1 is closest to the main access drifts; waste emplacement begins in Room 7 and proceeds forward toward the access drifts. A panel is filled with RH waste (located in wall boreholes) first and then followed by CH waste on the floor. RH and CH waste emplacement cannot take place in the same room at the same time. Panel 6 has been mined, outfitted and certified by the New Mexico Environment Department for waste emplacement, which is planned to begin in early 2011. Boreholes for RH waste are being drilled in Room 7 of Panel 6. The first of seven rooms in Panel 7 has been mined. It is anticipated that Panel 7 will be mined and certified for waste disposal by March 2012 and Panel 8 by June 2013, with waste disposal beginning in July 2012 and December 2013, respectively.

Several options for the relocation of Panels 9 and 10 were evaluated. These include:

1. Extending Panels 7 and 8 further to the west with twice the normal number of rooms (14 vs. 7),
2. Adding two panels north of Panels 1 and 8
3. Adding two panels south of Panels 4 and 5

Option 1, extending Panels 7 and 8, has the advantages of short travel times for mining and waste emplacement equipment (less wear and tear), minimal reconfiguration of the ventilation system, and it would not affect the shaft pillar area (see Fig 2). The shaft pillar area is designed to protect the surface structures and shafts from settlement resulting from the natural closure of the underground openings. The shaft pillar area was defined based on analyses developed by the U. S. Bureau of Mines. Excavation in this area is limited to operations and maintenance and must not to exceed a 15 percent extraction ratio. In spite of these advantages, the option of extending Panels 7 and 8 was rejected because their existing configuration (7 rooms per panel) had already been approved by the regulators and because the start of mining operations in Panel 7 was imminent. Stated differently, mining and emplacement in Panels 7 and 8 would have to be suspended pending regulatory approval of this option, and this suspension could last 24 months.

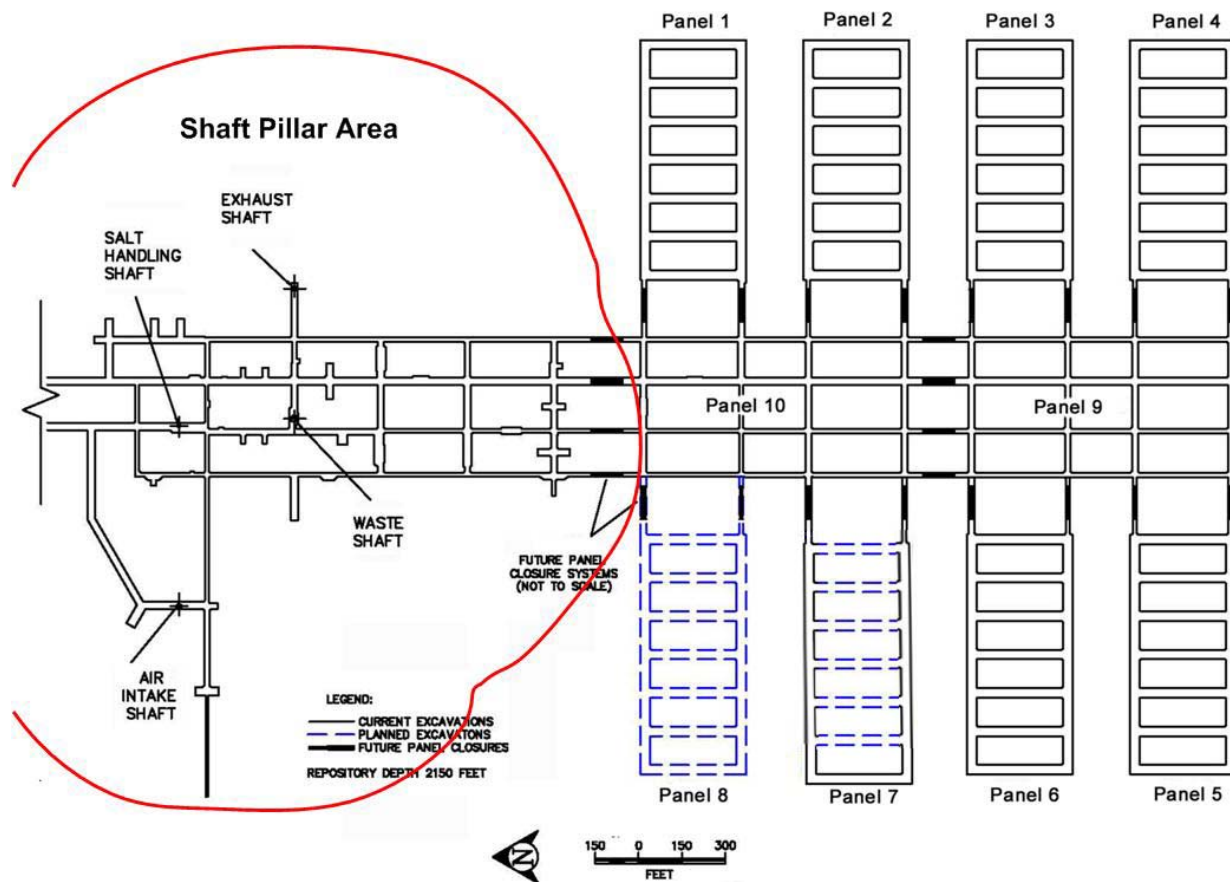


Fig. 2 Shaft Pillar Area

Adding two panels north of Panels 1 and 8 would place them in the shaft pillar area. Excavating two waste panels in the shaft pillar area would exceed the maximum extraction ratio of 15 percent in this area, which is not acceptable.

Adding two new panels south of the existing Panels 4 and 5, is judged to provide the best approach for meeting the constraints imposed by mining, by the schedule for waste emplacement, and by the schedule for regulatory approvals. More specifically, assuming an optimistic regulatory approval process of two years, mining and waste receipt schedules dictated that Panels 9 and 10 be relocated directly south of Panels 4 and 5. However, several issues will need to be resolved:

1. longer travel distances for mining and emplacement equipment (more wear and tear),
2. ventilation to mining and disposal areas needs to meet certain configurations and minimum flow rates,
3. the Hazardous Waste Facility Permit requires separation of routes used by equipment to transport waste to the disposal area and equipment used to transport mined salt for removal to the surface, and
4. increased maintenance for the access drifts.

These issues are currently being evaluated by DOE.

The relocated panels are being designated 9A and 10A to avoid confusion with the initially designed panels, as shown in Fig. 3.

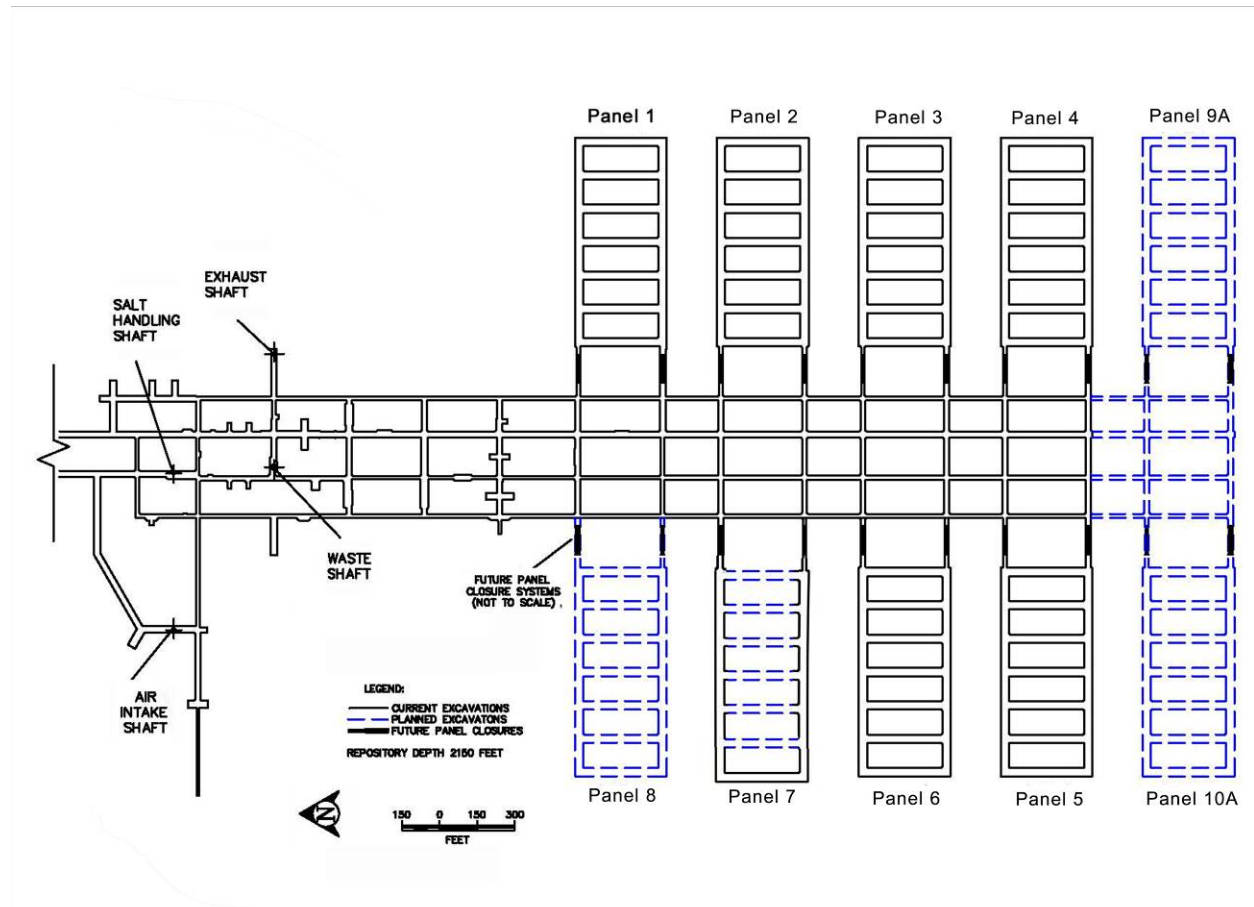


Fig. 3. Repository Design Showing Panels 9A and 10A

NEW DESIGN

The new panels (9A and 10A) will be mined within the disposal horizon envelope presented in the CCA in Figure ES-1 of Appendix Panel Closure System (PCS) and in Figure 3-6 from Chapter 3 of the CCA. The new panels south of Panels 4 and 5 avoid new excavations in the shaft pillar area, maintaining the extraction ratio in this area less than 15 percent. Mining the new panels will be performed using current methodologies that use conventional mining equipment and processes.

The challenges related to the new design will be primarily operational, e.g., maintaining the access drifts while concurrently mining the new panels, disposing of waste and maintaining adequate ventilation. A significant issue that is being considered is the need to reconfigure the ventilation system. The new panels would be constructed over 1500 m (5000 ft) from the waste shaft and providing adequate ventilation over that distance will be challenging. Construction of new shafts nearer to the proposed location of Panels 9A and 10A was considered to address the ventilation issue. Construction of new shafts was rejected in favor of reconfiguring the existing ventilation system because of operational, scheduling, and regulatory approval requirements for the new shafts.

It is anticipated the new design will be approved for construction by 2013. The construction of Panel 8 will also be completed that same year within a few months of the anticipated approval. This will maximize operational efficiency by not having the mining equipment and working crews idle for prolonged periods of time waiting for regulatory approval.

The cost in dollars to construct the new panels is under evaluation. The cost of not relocating the panels could mean a potential early closure of the current facility and its mission. The benefit of implementing this change is that the WIPP will have the capability to reach its design capacity of 175,564 m³ (6.2 million ft³).

REGULATORY CHALLENGES AND PROPOSED SOLUTIONS

The newly revised Hazardous Waste Facility Permit, issued by the New Mexico Environment Department on November 30, 2010 [4], limits waste disposal to eight panels. Current projections indicate that filling Panels 1 through 8 will not reach the design capacity and regulatory limit of 175,600 cubic meters (6.2 million cubic feet) of waste, as authorized by the WIPP Land Withdrawal Act, as amended.

Before a planned operational change at WIPP can be implemented, such as moving the planned TRU waste disposal locations from Panels 9 and 10 to Panels 9A and 10A, approval must be requested and obtained from the federal (U. S. Environmental Protection Agency) and state (New Mexico Environment Department) regulatory entities. This is accomplished by providing documentation to the U. S. Environmental Protection Agency and the New Mexico Environment Department that defines and explains the effects and potential impacts of the proposed change on WIPP operations, worker and public health and safety, and the short-term and long-term effects on the environment.

The regulatory submittal to the U.S. Environmental Protection Agency, also known as a Planned Change Request will include:

1. A description of and rationale for the proposed change, based on the results of the Geotechnical Evaluation that includes a discussion of the geotechnical model, stratigraphy considerations and lower horizon stability.
2. Design schematics that show the locations of Panels 9A and 10A.
3. The results of a performance assessment (PA) that evaluates the long-term impacts of relocating the two panels. A PA is an analysis that:

- a. Identifies the processes and events that might affect the disposal system;
- b. examines the effects of these processes and events on the performance of the disposal system; and
- c. estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events.

Some of the physical characteristics that must be represented in the PA are:

- Material characteristics of panel closures
- A revised repository configuration with two new panels located south of waste Panels 4 and 5, and
- The removal of panel closures in the central drift area, which results in an open central area. The panel closures will only be installed at the end of filled waste panels

Capturing the features of the updated repository configuration in the PA requires modifications to several of the numerical grids implemented in performance assessment. In particular, grids used to represent the waste disposal area in Salado flow and direct brine release calculations must be reconfigured to capture the revised repository geometry and material mappings.

It is expected that EPA will take 18-24 months to approve this planned change request.

The regulatory submittal to the New Mexico Environment Department will focus on short-term safety effects and any operational concerns for the proposed change. The scope of the documentation will likely include a description of the reconfigured footprint of the WIPP underground facility, description of disposal and construction traffic, and a revised ventilation configuration. It is expected that the NMED will take 18-24 months to approve this change.

The Council on Environmental Quality regulations (40 CFR Part 1501.2) [5] encourage Federal agencies to “integrate the National Environmental Policy Act (NEPA) process with other planning at the earliest possible time to insure planning and decisions reflect environmental values.” The *Final Supplement Environmental Impact Statement for the WIPP* [6] and the *WIPP Disposal Phase Final Supplemental Environmental Impact Statement* [7] discuss the mission of the WIPP Project and its potential impacts on the environment. The proposal to relocate Panels 9 and 10 has been carefully evaluated with regard to NEPA requirements and the existing NEPA documentation for the WIPP Project. It has been determined that relocating Panels 9 and 10 does not substantially change the WIPP mission, or the risks previously evaluated and estimated in the *WIPP Disposal Phase Final Supplemental Environmental Impact Statement* with regard to human health, safety, or the environment. Therefore, no further NEPA evaluation is planned for this proposal.

INTEGRATION WITH REGULATORY AGENCIES

The Land Withdrawal Act, as amended, assigns regulatory authority to the U. S. Environmental Protection Agency to regulate the radioactive components of the waste and to the New Mexico

Environment Department to regulate the hazardous components of the waste. To this end, the DOE plans to accomplish the regulatory review and approval process required to relocate Panels 9 and 10 in parallel, rather than sequentially as has been done in the past.

As with other changes to WIPP's regulatory structure, stakeholders in New Mexico such as Southwest Research and Information Center and Citizens Against Radioactive Dumping have expressed a desire to be involved early in discussions related to relocating Panels 9 and 10. The New Mexico Environmental Department has a long history of expecting the DOE to resolve stakeholder concerns prior to submitting requests to modify the Hazardous Waste Facility Permit. It is expected that DOE will be conducting pre-regulatory submittal briefings to stakeholders for the regulatory submittals to the New Mexico Environmental Department and to the U. S. Environmental Protection Agency.

CONCLUSION

Concerns have been identified with the operational aspects of disposing of TRU waste in the main access drifts, known as Panels 9 and 10, of the WIPP geologic repository. The DOE is preparing the required documentation to request a design change that moves the location of Panels 9 and 10 (in the middle of the repository "footprint") to Panels 9A and 10A, south of Panels 4 and 5. This change documentation will be provided separately, but in parallel, to the two regulators in 2011, and tailored for each regulators authority and concerns. It is DOE's goal to have the proposed change approved by the end of 2013, just as mining operations end and disposal operations begin in Panel 8.

REFERENCES

- [1] U.S. Department of Energy (DOE). 1996. *Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*. DOE/CAO 1996-2184, 21 vols. Carlsbad, NM: Carlsbad Area Office.
- [2] U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement, Waste Isolation Pilot Plant*. DOE/EIS-0026, Vol. 1 and 2. U.S. Department of Energy, Carlsbad, NM
- [3] US Department of Energy (DOE). 1986. *Waste Isolation Pilot Plant Design Validation Final Report*. DOE-WIPP-86-010. Carlsbad, NM: US DOE, Carlsbad Area Office.
- [4] New Mexico Environment Department. 2010. *Waste Isolation Pilot Plant Hazardous Waste Permit* (issued November 30, 2010).
- [5] US Environmental Protection Agency. 1978. *NEPA and Agency Planning 40 CFR Part 1501.2*.
- [6] US Department of Energy. 1990. *Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant*, DOE/EIS-0026-FS, Washington, D.C.
- [7] US Department of Energy. 1997 *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2, Washington, D.C.