

**Panel Closure - A Change in WIPP's Future Operations through Regulatory Compliance -
11240**

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ABSTRACT

The Department of Energy (DOE) Carlsbad Field Office is responsible for managing activities related to the disposal of Transuranic (TRU) and TRU-mixed waste at the Waste Isolation Pilot Plant (WIPP) facility. The main function of the geologic repository disposal design, including the disposal system barriers, is to limit radionuclide releases to the environment so that the impacts on mankind and the environment not harmful. Panel closures are part of the sealing system designed to delay the migration of radionuclides to the accessible environment. In the Compliance Certification Application [1] the DOE described four possible panel closure designs for use at the WIPP facility. In the Hazardous Waste Facility Permit Application [2] to the State of New Mexico five possible panel closure designs were submitted. The U. S. Environmental Protection Agency (EPA) in their 1998 certification decision [3] for the WIPP disposal system and the New Mexico Environment Department (NMED) in their initial hazardous waste facility permit [4], specified the panel closure system called “Option D” to be used for all WIPP repository panel closures. Based on eleven years of operational experience at the WIPP facility and extensive monitoring of gas generated in the closed panels, DOE is developing a new panel closure design that will be simpler, easier and safer to construct. DOE plans to prepare and submit the required regulatory documentation to the EPA and the NMED to change the panel closure design before the next recertification of the WIPP disposal system, scheduled for 2014.

INTRODUCTION

The WIPP deep geologic repository for the disposal of the United States' defense related TRU and TRU mixed waste is located 655 meters (2,150 ft) below the surface in southeastern New Mexico in a bedded salt formation. The approved repository design [1] consists of 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 two main access drifts that are slated to be used for waste disposal and are referred to as Panels 9 and 10. There are two drifts that enter each panel; the air-intake and the air-exhaust drifts. A panel closure will be placed in each of these drifts for a total of 20 panel closures (see Fig. 1.).

The regulatory-approved repository panel closure design is called “Option D”. The Option D panel closure consists of a 3.7 meter block explosion-isolation wall followed by 9.1 meters of open drift and then a 7.9 meter Salado Mass Concrete monolith “keyed-in” to the surrounding salt formation (see Fig. 2.). The present plan is to submit a Planned Change Request for the

EPA and a Permit Modification Request for the NMED to change the panel closure design to be used at WIPP.

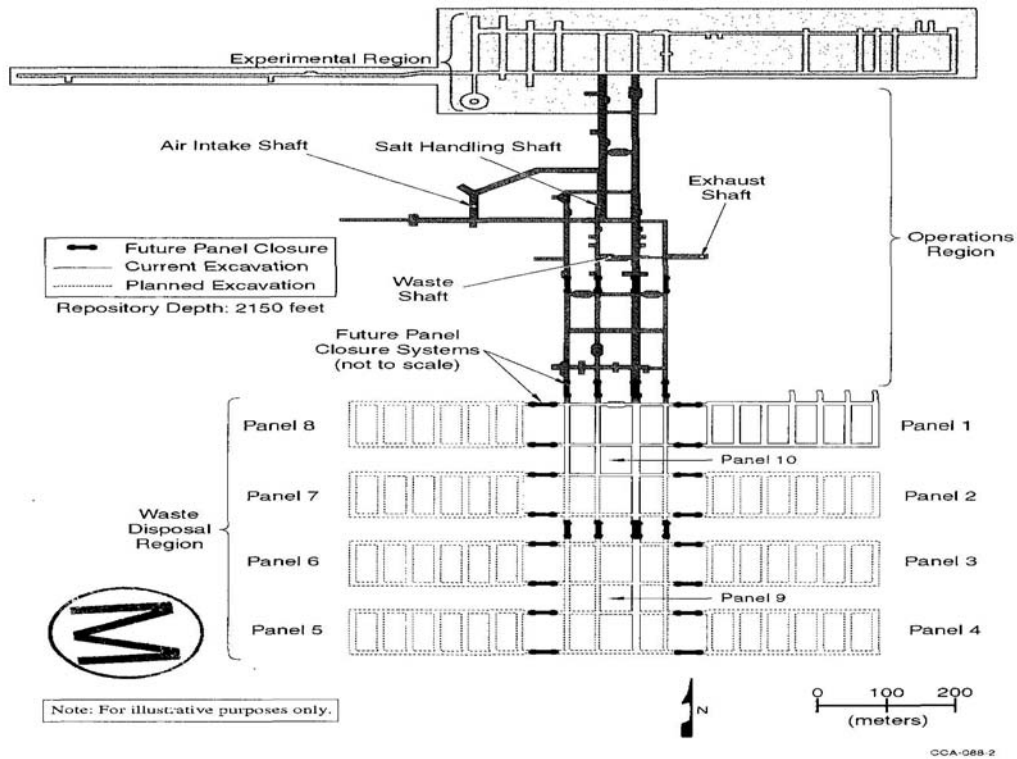


Fig.1. Schematic of underground showing panel closures

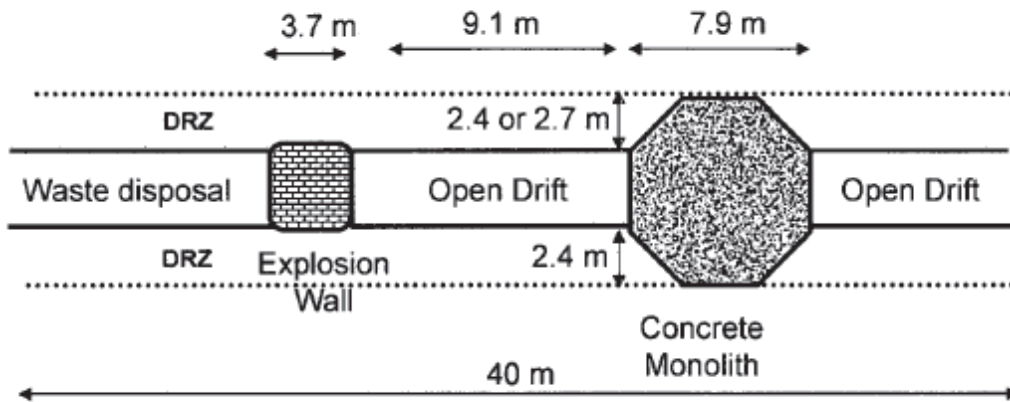


Fig. 2. Option D design. (Schematic is not to scale.)

HISTORY

Panel closure designs to be used as part of the WIPP repository panel seal system were first introduced in the Compliance Certification Application [1]. The panel closure system was designed to comply with regulatory requirements for a panel closure system promulgated by the Resource Conservation and Recovery Act, the Mine Health and Safety Administration and the EPA. The panel-closure system design criteria provides assurance that the limit for the migration of volatile organic compounds will be met at the point of compliance, to be effective for at least 35 years. The panel closure system components are designed to maintain their functional requirements under loads generated by salt creep, internal pressure, and a postulated methane-based explosion. DOE proposed in their regulatory submittals to the EPA for the Compliance Certification Application and to the NMED in the initial permit application that five different conceptual designs (Options A-E, see Fig. 3.) could meet these criteria. The panel closure design selected would be chosen based on repository stability and disturbed rock zone (DRZ) conditions in the underground at the location where the panel closure system is to be emplaced and based on future subsurface investigations. Option A of the range of options included a rectangular concrete barrier without the DRZ removed and a construction-isolation wall. Option B was a rectangular concrete barrier without the DRZ removed and an explosion-isolation wall. Option C was an enlarged concrete barrier with the DRZ removed (i.e., the concrete monolith is keyed into the entry walls, ceiling and floor) and a construction-isolation wall. Option D was the most extensive design, included an enlarged concrete barrier with the DRZ removed and an explosion-isolation wall. Option E was retained as primarily a design concept should two parameters be met: 1) Gas generation rates are smaller than anticipated, and 2) Average headspace gas concentrations are less than anticipated. Option E was a single explosion-isolation wall similar to Options B and D. In the EPA's 1998 certification decision [3], the Option D conceptual design with Salado Mass Concrete became the mandated design for WIPP panel closures. The NMED followed EPA's lead and incorporated this design into the Hazardous Waste Facility Permit granted to the DOE in 1999 [4].

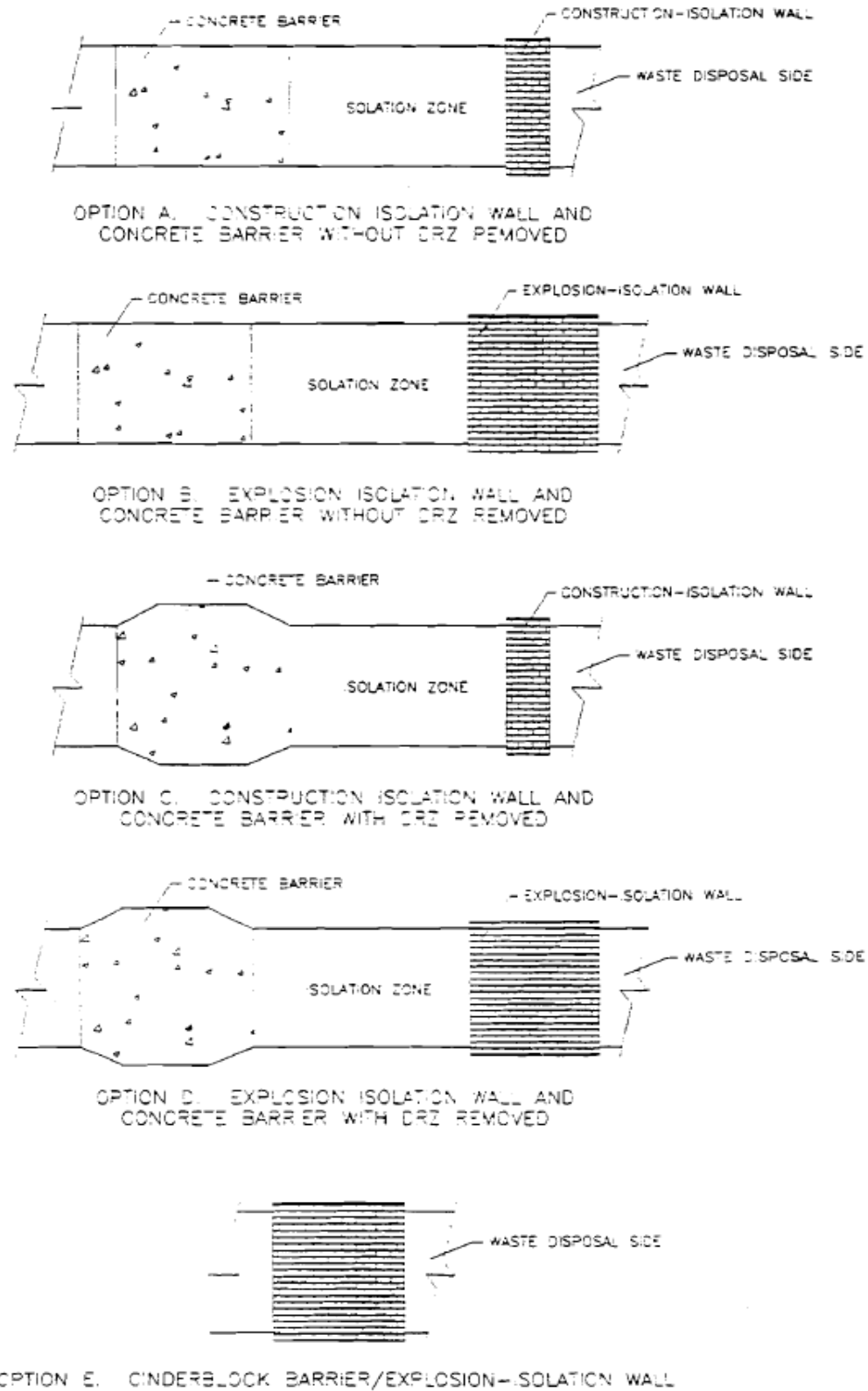


Fig. 3. Panel Closure Options A-E.

Starting in 2000 the DOE initiated subsurface investigations and determined there may be issues with emplacing the Option D panel closure system throughout the WIPP repository. In April 2001 DOE identified several changes to the panel closure system construction specifications to both the EPA and NMED. These changes consisted of 1) replace the Salado Mass Concrete with generic salt-based concrete, 2) replace the explosion-isolation wall with a construction wall, 3) replace freshwater grouting with salt-based grouting, 4) an option to allow local carbonate river rock aggregate in lieu of crushed quartz, 5) an option to allow surface or underground mixing, 6) an option to allow steel forms to be left in place or removed, in lieu of removing the forms, and 7) an option to allow up to one year for completion of closure in lieu of 180 days. The DOE withdrew this request 6 months later in order to re-evaluate the panel closure strategy based upon the subsurface investigation results.

Salado Mass Concrete was initially used in the design for shaft seals. This concrete mixture uses a Salado saturated brine, and is similar to the concrete required to plug abandoned resource exploration wells that penetrate the Salado Formation (the same geological formation in which the WIPP repository is located). A number of engineering tests were conducted in 2002 on the constructability of a panel closure system using this type of concrete. It was determined that it would be difficult if not impossible to meet the slump and strength criteria for the horizontally poured panel closure. These results provided the incentive for DOE to seek a different design that would still fulfill the overall regulatory requirements.

Throughout the remainder of 2002, the DOE performed a design study to develop a “new” panel closure system. Based on unfavorable results for Salado Mass Concrete, plus ground control and other safety issues in the underground, a replacement design for Option D that would meet the system requirements was needed.

In October 2002 the DOE proposed a new panel closure design to the EPA and NMED that consisted of two components, a 9.1 meter thick concrete block wall and a 27 meter run of mine salt backfill. Run of mine salt is material that is mined out to create disposal rooms. The EPA notified DOE shortly thereafter that the EPA staff would not evaluate DOE’s new panel closure design until after the Compliance Recertification Application (CRA 2004) was approved.

In January 2007 the DOE proposed that the regulators delay further action on DOE’s proposed changes to the panel closure system until Hydrogen and Methane monitoring data could be collected in filled rooms of panels 3-5, and the system design could once again be re-evaluated based upon the monitoring results. The basis for this request was to determine the accumulation rate of combustible gases generated by the degradation of waste. If in fact no explosives gases would accumulate to explosive levels in closed rooms and panels, the need to include an explosion isolation wall was no longer necessary. To rescind the January 2007 regulatory requests, the DOE formally requested the EPA to remove the planned change request from consideration in favor of collecting hydrogen and methane concentration data in closed rooms. In addition, the DOE also submitted a permit modification request to the NMED to collect gas concentrations as previously described.

PRESENT DESIGN CONCERNS AND PLANNED CHANGES

The problems encountered with Option D can be summarized as follows:

- Salado Mass Concrete doesn't meet the concrete design criteria (as explained below) and it is difficult if not impossible to construct the concrete monoliths underground
- Construction of 20 large concrete monoliths, each involving multiple concrete pours in the underground environment, poses problems for worker safety
- Construction of 20 large concrete monoliths may be a significant disruption to waste emplacement activities

The present plan is to prepare a planned change request for the EPA and a permit modification request for the NMED to change the design of the panel closure system. WIPP engineers have revised the design criteria to include:

- Evaluate existing data from the emplaced waste and evaluate release rates from panels
- Develop material models for run-of-mine salt properties for various compaction phases
- Develop and execute geo-mechanical models of the proposed panel closure locations
- Analyze current and expected Volatile Organic Compounds and other gas generation data
- Analyze run-of-mine salt properties based on current mining methods
- Develop and execute geo-mechanical models of the run-of-mine salt emplacements
- Calculate Volatile Organic Compound and other gas release rates based on above analysis
- Develop material models for run-of-mine salt properties for various compaction phases
- Generate construction plans and specifications for various panels

The elimination of an explosion isolation wall from the design based on a statistical analysis and technical evaluation of the hydrogen and methane data collected since 2008 is an expected outcome. Approximately 1,000 data points for Hydrogen and Methane have been collected and reported in another paper in this session.

REGULATORY DOCUMENT PREPARATION AND SCHEDULE

Before a planned operational change like a change to panel closure, can occur at the WIPP facility, approval must be requested and obtained from the federal EPA and state NMED regulatory entities. This is accomplished by providing each regulator with documentation that delineates the effects of the proposed change on WIPP operations, worker and public health and

safety, and the short and long-term effects on the environment.

From the EPA's perspective, this is considered a major change that will require formal rulemaking as delineated in 40 CFR 194 [5].

The DOE plan is to prepare and submit a planned change request to the EPA in the second half of 2011. This planned change request will include engineering drawings, an assessment of impact on operations, and a performance assessment to evaluate the long-term impacts of changing the panel design. DOE intends to submit the proposed change to the panel closure design separate from the related change proposal to relocate Panels 9 and 10 (see Waste Management paper number 11238, "WIPP Repository Footprint Redesign"). It is expected that EPA will take 18-24 months to approve this planned regulatory change.

In the same timeframe as the submittal to the EPA, the DOE will submit a similar permit modification request to the NMED. The submittal to the state agency will focus more on short-term safety effects and the operational aspects of the change. This submittal will include the revised panel closure system design and schedule for installation.

STAKEHOLDER INTERACTIONS

As with other changes to the WIPP project regulatory structure, NM stakeholders such as Southwest Research and Information Center and Citizens Against Radioactive Dumping have expressed a desire to be involved early in discussions related to panel closure redesign. It is expected that DOE will be conducting pre-regulatory submittal meetings with stakeholders for both the NMED and the EPA regulatory submittals.

CONCLUSION

The DOE has identified concerns with the operational aspects and the meeting of design criteria with the proposed emplacement of "Option D" panel closures in the WIPP facility. The DOE is preparing a re-evaluation of the panel closure design that still meets the original regulatory requirements and is preparing the regulatory required documentation to request a design change. This change documentation will be provided separately to the two regulators in 2011, and tailored for each regulators authority and concerns. It is expected that the proposed change will be approved by the end of calendar year 2013.

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. Initial RCRA Part B permit application 1996 - U.S. Department of Energy (DOE). *Resource Conservation and Recovery Act. Part B Permit Application*. DOE/WIPP 91-005 Rev. 6.1, Vol. I-XIII.
3. Federal Register/ Volume 63, Number 95, Monday, May 18, 1998. Rules and Regulations. Page 27405.
4. NMED, Hazardous Waste facility Permit for the Waste Isolation Pilot Plant, 1999
5. Environmental Protection Agency (EPA). *Title 40 CFR Part 194 Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*.