Performance Assessment of the WIPP Run-of-Mine Salt Panel Closure System

R. Chris Camphouse, PhD
Performance Assessment Department, 6211
Sandia National Laboratories
WIPP Performance Assessment
WIPP Regulatory Requirements

- Regulatory requirements guide the WIPP PA framework.
  - The WIPP must be designed to provide reasonable expectation that cumulative releases of radionuclides to the accessible environment for 10,000 years after disposal from all significant processes and events shall be less than specified releases limits.
• Reasonable expectation: regulations acknowledge substantial uncertainties
• 10,000 years: PA must predict behavior for entire regulatory time period
• Significant processes and events: PA must include all of these, including the possibility of human intrusion
Release Mechanisms

- Direct Releases (occur during or immediately after drilling)
  - Cuttings (Solids removed due to drilling)
  - Cavings (Solids from borehole wall)
  - Spallings (Solids from pressure release)
  - Direct Brine Release (Brine from pressure release)

- Long-term Releases
  - Groundwater Transport in Culebra
Direct Releases

Direct Releases Dominate Total Releases

Borehole

Cuttings
Cavings
Spallings
Direct Brine Release

Waste Panel
Release Pathways

Direct Releases of Cuttings, Cavings, Spallings, and DBRs

Waste Area

Access Drift

Panel Closure
WIPP Panel Closures in PA
WIPP Panel Closures

- WIPP panel closures have been represented in PA since the original 1996 Compliance Certification Application.
- The function of panel closures is to protect workers during the operational period of the repository.
- Panel closures are included in PA because they are part of the disposal system, not because they inhibit releases. The panel closure system was not designed or intended to support long-term repository performance.
The "Option D" design was designated as the approved panel closure in the 1998 rulemaking that certified the repository for waste disposal.

The "Option D" design is exceedingly difficult to implement and is prohibitively expensive.

A simpler panel closure design can meet operational requirements while being cost-effective and easier to implement.
Panel Closure Re-Design

The Run-of-Mine Panel Closure System (ROMPCS)

Panel closure with 100 feet of ROM salt between two ventilation bulkheads

Panel closure with 100 feet of ROM salt between a ventilation bulkhead & explosion wall
Changing the Approved WIPP Panel Closure Design

- Changing the WIPP panel closure design from Option D to the ROMPCS invokes a federal rulemaking process.

- The DOE has submitted a Planned Change Request to the EPA to formally request a change to the approved design.

- A PA that demonstrates regulatory compliance impacts associated with the new design is included as part of the Planned Change Request. The PA is named PCS-2012.
PCS-2012 PA Approach and Results
Baseline Comparison

The current WIPP PA baseline was established by the 2009 Performance Assessment Baseline Calculation (PABC-2009)

- Option D panel closures were implemented in the PABC-2009

- The PCS-2012 PA incorporates the ROMPCS into the PABC-2009 baseline.

- ROMPCS compliance impacts are assessed via a direct comparison of PABC-2009 and PCS-2012 results.
ROMPCS Processes

The representation of the ROMPCS in the PCS-2012 PA accounts for several physical processes.

- Creep closure of the surrounding salt rock results in consolidation of ROM salt placed in panel entries.

- ROM salt comprising the closures will approach a condition similar to intact salt.

- Imposed back stress on the surrounding rock will result in eventual healing of the surrounding salt rock.
ROMPCS Parameters

ROMPCS parameters and timings were developed over a period of 1 ½ years.

- ROMPCS represented as 100 feet of run-of-mine salt.

- Calculations and data analyses were performed to determine ROMPCS parameters and their temporal extent.

- Numerous technical exchanges were had with the EPA to discuss and refine ROMPCS parameters and timings prior to commencement of the PCS-2012 PA.
The ROMPCS is modeled as having short-term and long-term characteristics in the PCS-2012 PA, with properties based on three time periods:

- **0 to 100 years**: Emplaced ROM salt undergoes some re-consolidation with no impact on surrounding salt rock.

- **100 to 200 years**: ROMPCS continues to re-consolidate with no impact on surrounding salt rock.

- **200 to 10000 years**: ROMPCS is re-consolidated and the surrounding salt rock is healed.
Results: Total Releases

- PCS-2012 PA Overall Mean
- PABC-2009 Overall Mean
- Release Limits

*R = Total Release (EPA Units)*
Results: Release Components

![Graph showing probability release vs. R (EPA units)]

- PCS-2012 PA Total Overall Mean
- PCS-2012 PA Cuttings and Cavings Overall Mean
- PCS-2012 PA Spallings Overall Mean
- PCS-2012 PA Direct Brine Overall Mean
- PCS-2012 PA Total From Culebra Overall Mean
- Release Limits
Results: Spallings Releases

![Probability Release vs Spallings Release](image-url)
Results: Direct Brine Releases
Summary

- The DOE has submitted a Planned Change Request to the EPA requesting a change to the approved WIPP panel closure system.

- A Performance Assessment has been completed that quantifies regulatory compliance impacts associated with the change.

- The WIPP remains below regulatory release limits with the revised panel closure system.