Compliance Results of the 2009 Waste Isolation Pilot Plant Performance Assessment Baseline Calculation

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The Waste Isolation Pilot Plant (WIPP)

WIPP is a permanent disposal facility for transuranic (TRU) waste

- Located in southeast New Mexico
- Operated by U.S. Department of Energy (DOE)
- Regulated by U.S. Environmental Protection Agency (EPA)
- Waste is emplaced in a salt formation deep underground
- Regulatory compliance is demonstrated via Performance Assessment (PA)
WIPP Regulatory History

DOE submitted Compliance Certification Application in 1996
- WIPP certified in 1998
- First waste received in 1999

DOE submitted Compliance Recertification Application in 2004
- EPA requested additional Performance Assessment Baseline Calculation
- WIPP recertified in 2006

DOE submitted Compliance Recertification Application in 2009 (CRA-2009)
- EPA requested additional Performance Assessment Baseline Calculation (PABC-2009)
- 2009 Recertification Application currently undergoing EPA review
WIPP Regulatory Requirements

Regulatory requirements guide Performance Assessment framework

**Approach**
- Provide Reasonable Expectation
- Consider cumulative releases for 10,000 years after disposal
- Consider significant processes and events
- Compare cumulative releases to release limits

**Outputs**
- Complementary Cumulative Distribution Functions (CCDFs)
- Probability distributions for uncertain parameters
- Random sampling
- 95% statistical confidence in overall mean CCDF
Performance Assessment answers three questions about the repository system.

1. What can happen after permanent closure?
2. How likely is it to happen?
3. What can result if it does happen?

It answers one question about the analysis.

1. What level of confidence can be placed on release probabilities?
WIPP Performance Assessment

Screening of Features, Events, Processes (FEPS)

Possible Repository Futures (Using Screened-In FEPS)

Overall Repository Conceptual Model

Epistemic Uncertainty - Sampling Over Parameter Distributions

Mathematical Process Models

Numerical Implementations

Release Probabilities with Quantified Uncertainty

Aleatory Uncertainty - Sampling Over Possible Futures

WIPP Recertification (Waste Inventory Update, Planned Changes, Model and Parameter Refinements)
Direct Release Mechanisms

Inadvertent Human Intrusion (Drilling) Results in Direct Releases

- Cuttings (Solids from Drilling)
- Cavings (Solids from Drilling)
- Spallings (Solids from Pressure Release)
- Direct Brine Release (DBR) (Brine from Pressure Release)
Long-Term Release Mechanisms

Radionuclide Transport through Groundwater Could Result in Long-Term Releases
PABC-2009 Modifications

• Waste inventory parameters updated to agree with most recent information
  - Normalized waste inventory decreased slightly from CRA-2009 to PABC-2009
  - The amount of cellulose, plastic, and rubber materials in the inventory decreased from CRA-2009 to PABC-2009

• Radionuclide solubility limits increased
  - Increase in total mobilized concentration

• Geologic Transmissivity Fields updated
  - Increase in transmissivity near the repository due to mining
  - Updated fields contained a high transmissivity pathway out of the southeast portion of the Land Withdrawal Boundary

• Matrix Distribution Coefficient lower limit significantly decreased
  - Smaller retardation and consequent increased radionuclide transport
PABC-2009 Overall Mean

Overall Mean

Lower 95% CL

Upper 95% CL

EPA Release Limits

Probability Release > R

R = Release (EPA Units)
Conclusions

• WIPP PA is used to demonstrate compliance with EPA containment requirements.

• Parameters, models, and repository attributes are continually refined.

• Estimates of future repository performance are quantified in a probabilistic framework.

• Uncertainties are quantified.

• Relative importance of direct and long-term release mechanisms is determined.

• Most recent PA (PABC-2009) demonstrates that WIPP continues to be in compliance.
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