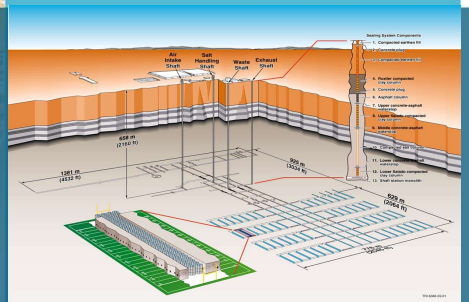
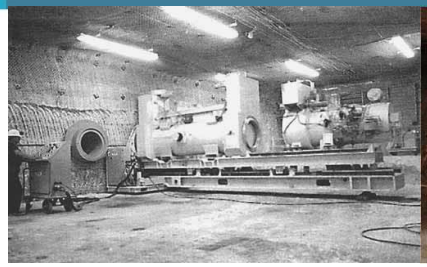
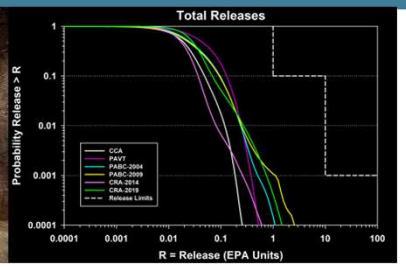
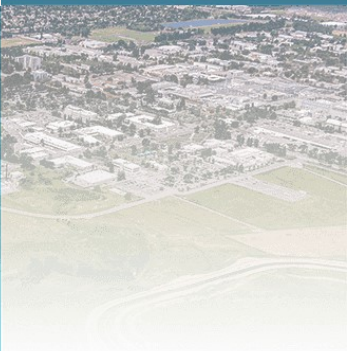
Sandia National Laboratories

Summary of Changes to WIPP Performance Assessment for the Replacement Panels Planned Change Request









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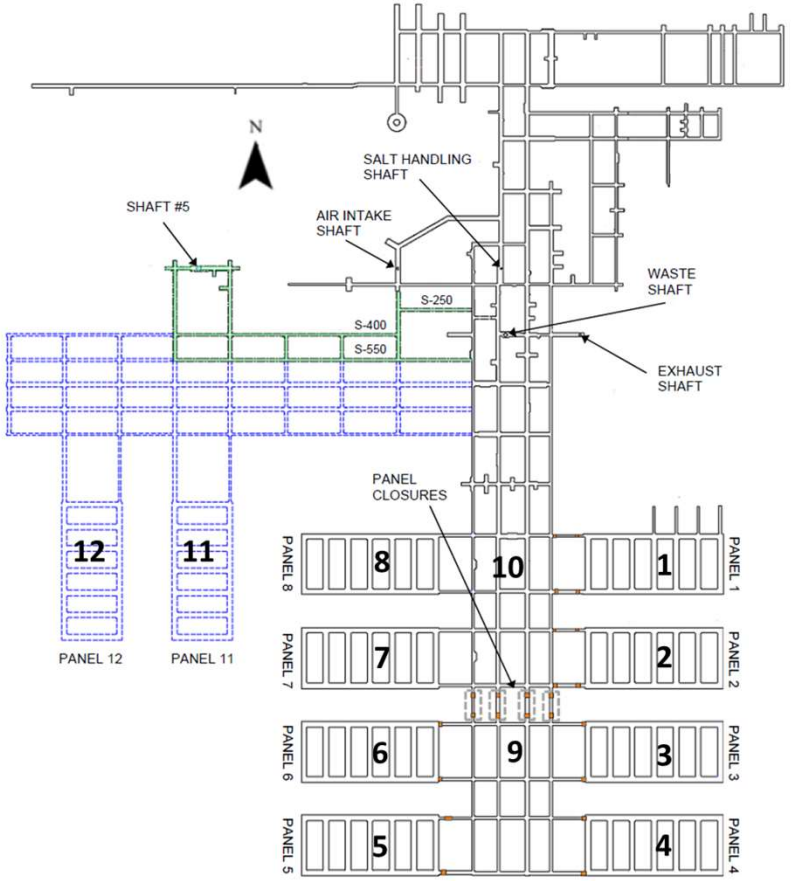
The Waste Isolation Pilot Plant (WIPP)

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

- Located in southeast New Mexico
- Owned by U.S. Department of Energy (DOE)
- Disposal capacity of 6.2 million ft^3 set by WIPP Land Withdrawal Act
- Regulatory Compliance is certified by U.S. Environmental Protection Agency (EPA)
- Defense-related TRU waste is emplaced in a salt formation deep underground
- Long-term repository performance is demonstrated via Performance Assessment (PA)

Replacement Panels Planned Change Request

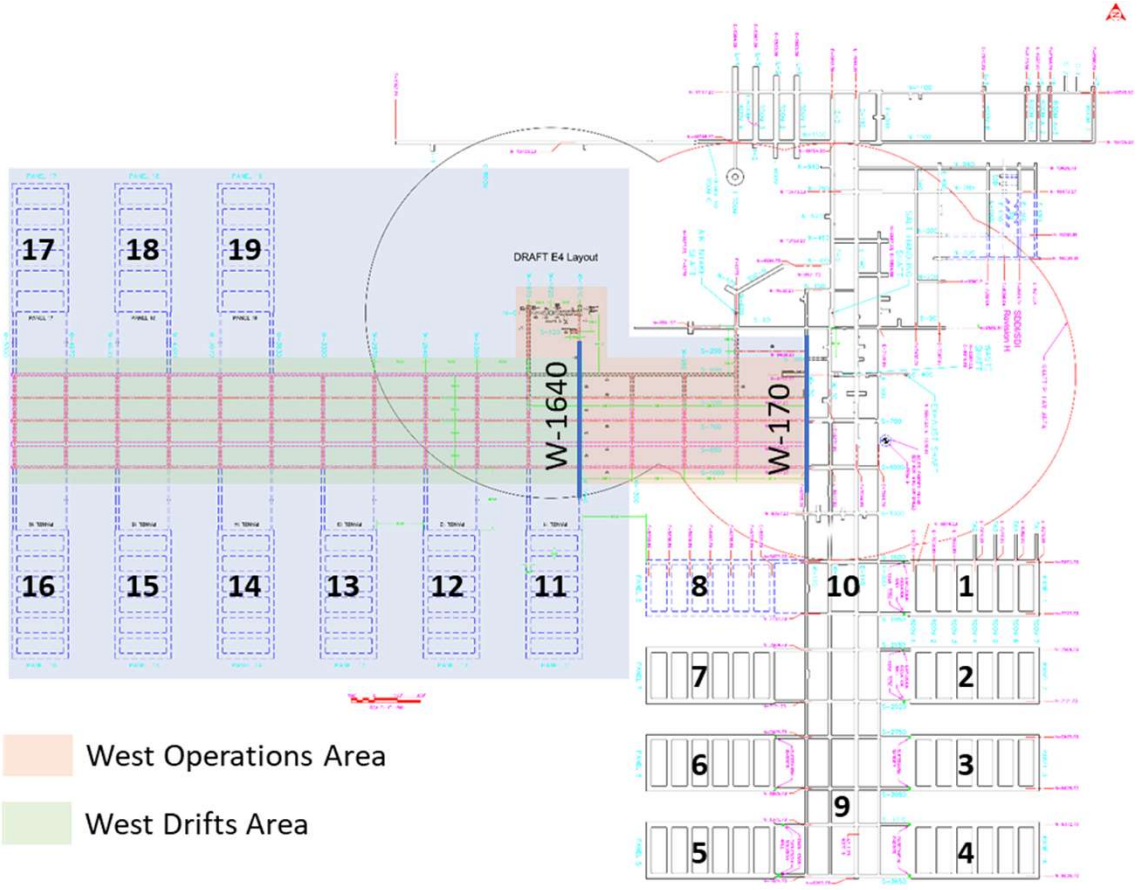
- Replacement Panels 11 and 12 are intended to recover the lost disposal capacity.
- Additional storage space is needed to accommodate the 6.2 million ft^3 set by the Land Withdrawal Act.
- DOE is requesting approval for the replacement panels via a Planned Change Request (PCR).
- The 2023 Replacement Panels Planned Change Request Performance Assessment (RPPCR PA) demonstrates continued compliance of the WIPP with EPA containment requirements.



12-Panel PCR, 19-Panel Performance Assessment

- Panel 11 and Panel 12 will not provide enough storage capacity for the full volume of waste authorized by the Land Withdrawal Act
- At the request of EPA, a PA analysis was executed based on the anticipated repository design at closure

DOE is currently only seeking approval for Panel 11 and Panel 12



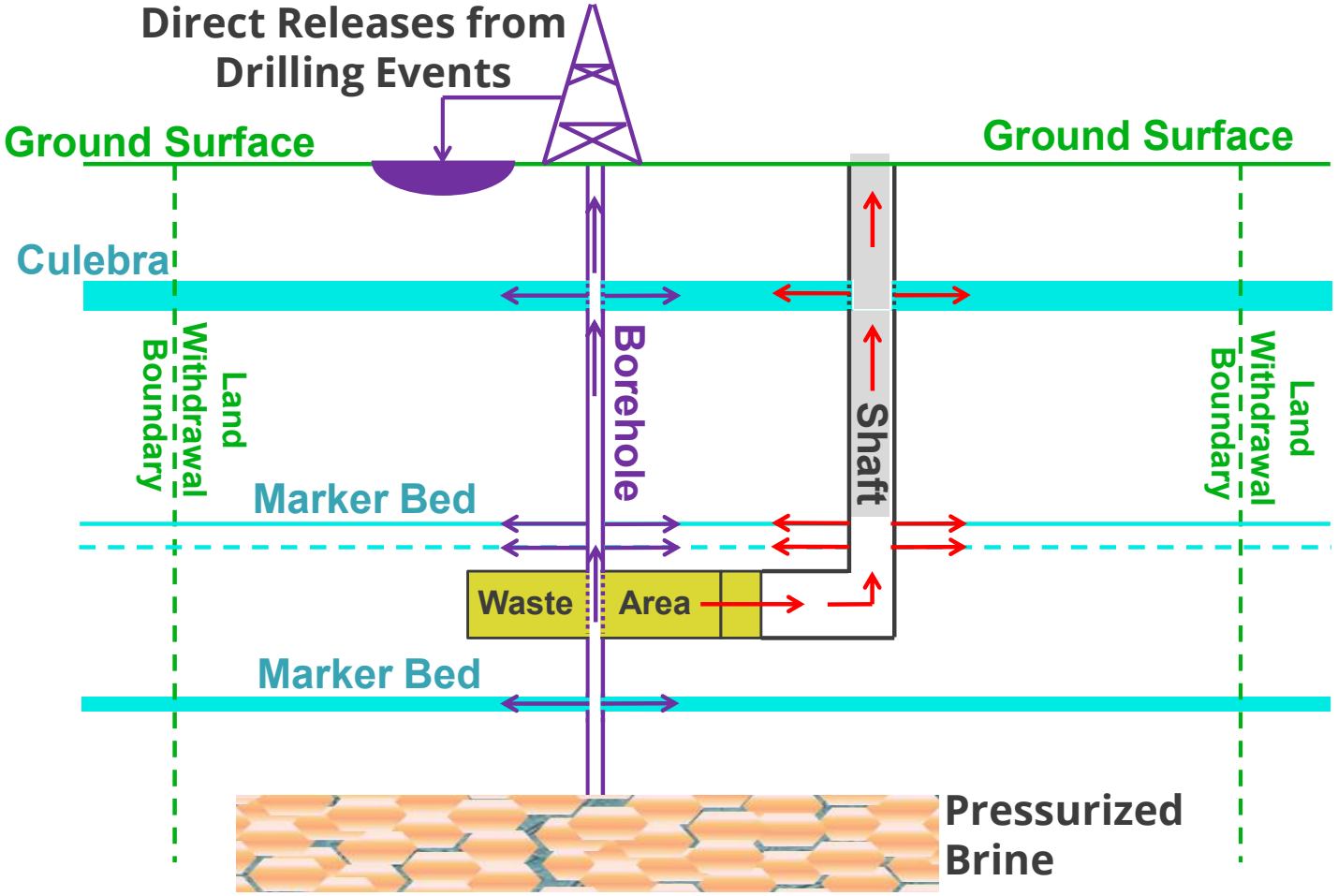
WIPP Performance Assessment

EPA regulations require performance assessment (PA) analyses to estimate the cumulative releases of radionuclides considering the associated uncertainties, caused by all significant processes and events that may affect the disposal system. Two scenarios are considered, undisturbed repository performance and disturbed repository performance.

Undisturbed repository performance (see 40 CFR § 191.15 and 40 CFR Part 191 Subpart C) – in general, performance assessment models the effects of salt creep with fluid flow (e.g., pressurized brine and gas flow) and waste degradation processes within the waste disposal system. Results for RPPCR indicate that there are no releases to the accessible environment from the undisturbed repository. The behavior of the undisturbed performance of the disposal system will result in extremely effective isolation of the radioactive waste for the 10,000-year regulatory time period.

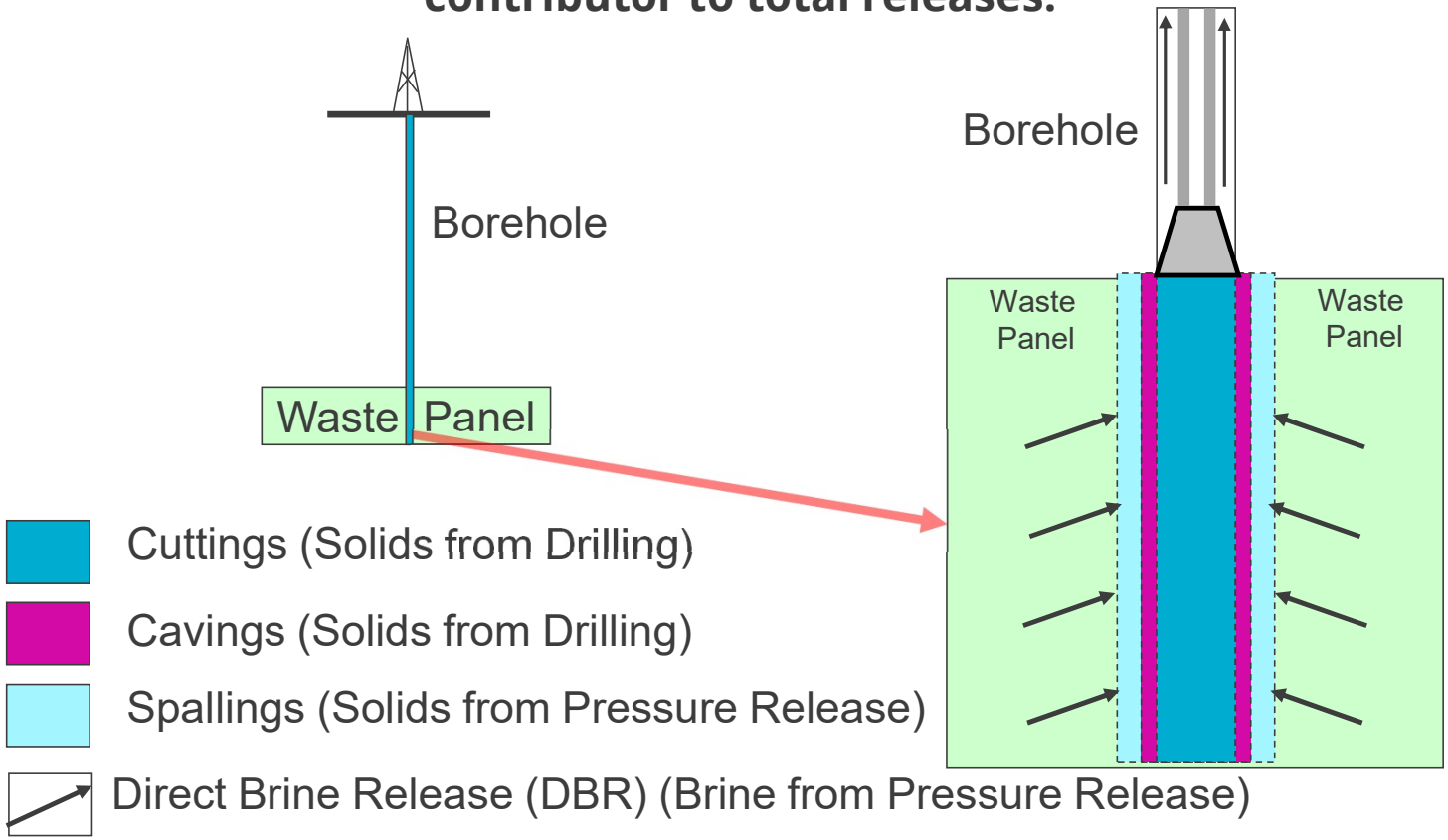
Disturbed repository performance (see 40 CFR 194.32, 194.33, & 194.41) - performance assessment is required by regulation to consider scenarios that include human intrusion into the repository by inadvertent and intermittent drilling and mining for resources after 100-years of active institutional controls. Inadvertent human intrusion is the only credible mechanism to release radionuclides to the accessible environment, and even still, releases are well beneath the compliance limits.

Release Pathways in WIPP PA



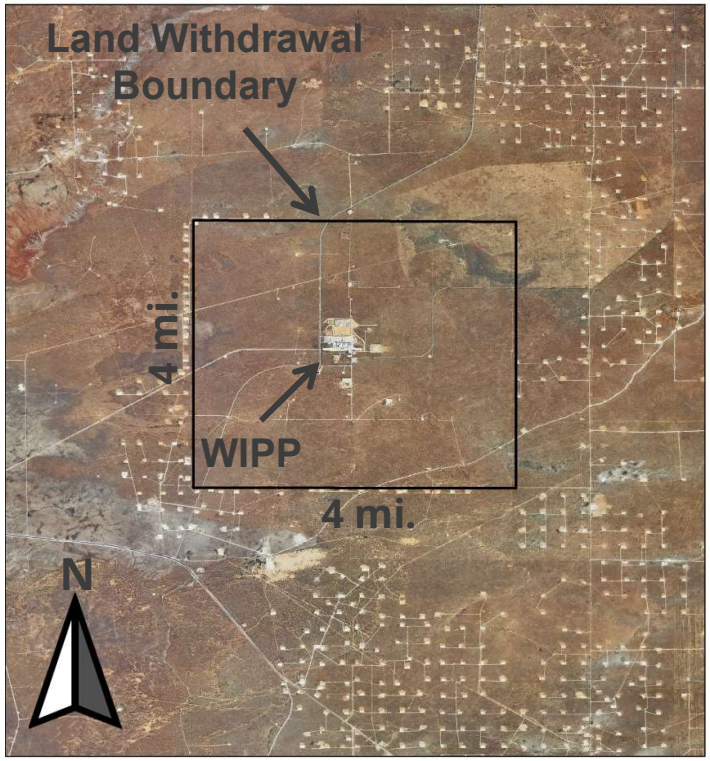
Direct Release Mechanisms

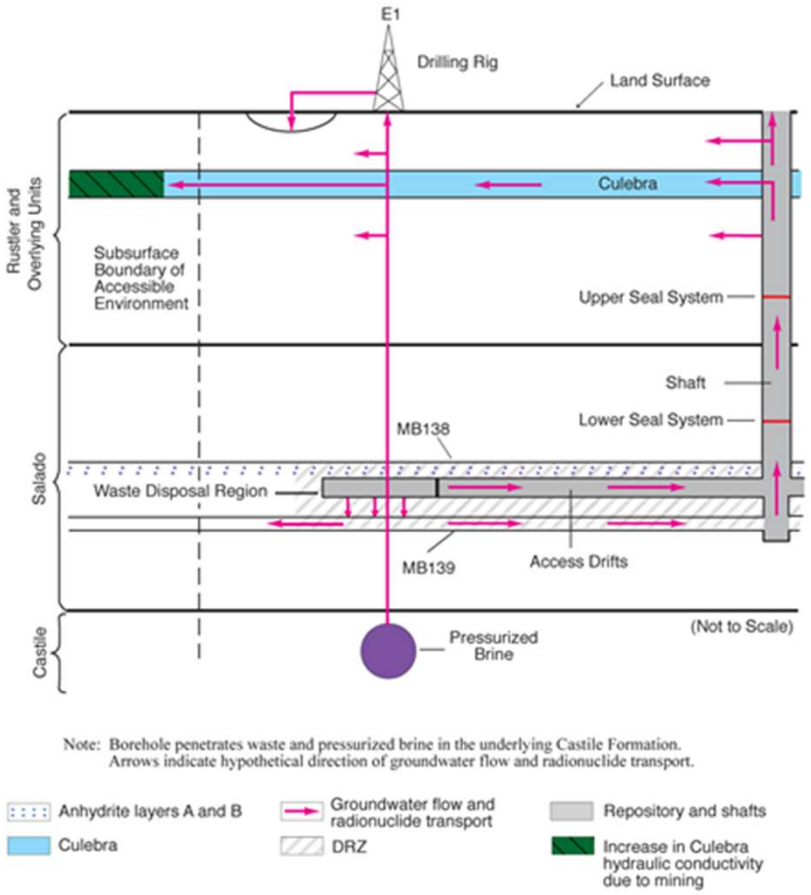
Direct releases comprise short-term releases, and are the main contributor to total releases.



Long-Term Direct Release Mechanism Considered in WIPP PA

Radionuclide transport through groundwater comprise long-term releases.





Parameter and Implementation Refinements Included in the RPPCR PA

A number of changes/refinements are included in the RPPCR PA, relative to the CRA-2019 PA, in addition to the planned changes to the repository footprint.

Standard updates:

- Drilling rate
- Plugging pattern probabilities
- Inventory
  - Radionuclides
  - Waste materials
  - Organics
- Radionuclide solubilities and their associated uncertainty

Changes to accommodate new waste panels:

- Parameters related to the updated repository area and volume
- Computational grids for Salado flow and direct brine release models
- Additional release points added to the Culebra transport models

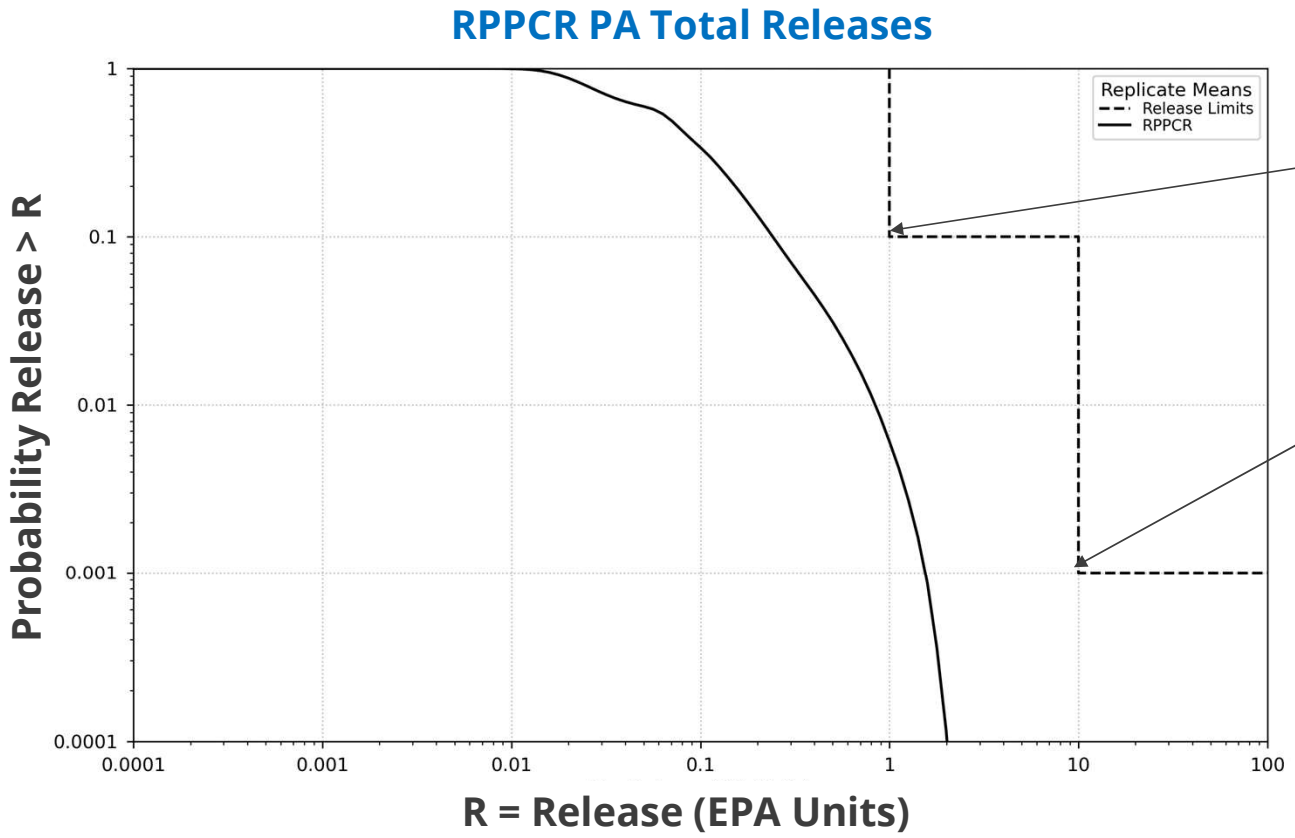
Parameter and Implementation Refinements Included in the RPPCR PA

Additional Changes:

- Thermodynamic database
- Recalibrated Culebra T-Fields
- Actinide oxidation state model is extended to accommodate actinide-specific oxidation state distributions
- Salado flow model is updated with a new model of creep closure
- Castile brine reservoir model
- Borehole permeability parameter distribution
- Updated method of calculating iron surface area

Mean Total Release CCDF

The total release Complementary Cumulative Distribution Function (CCDF) curve is the measure of compliance. Releases are compared to regulatory release limits.



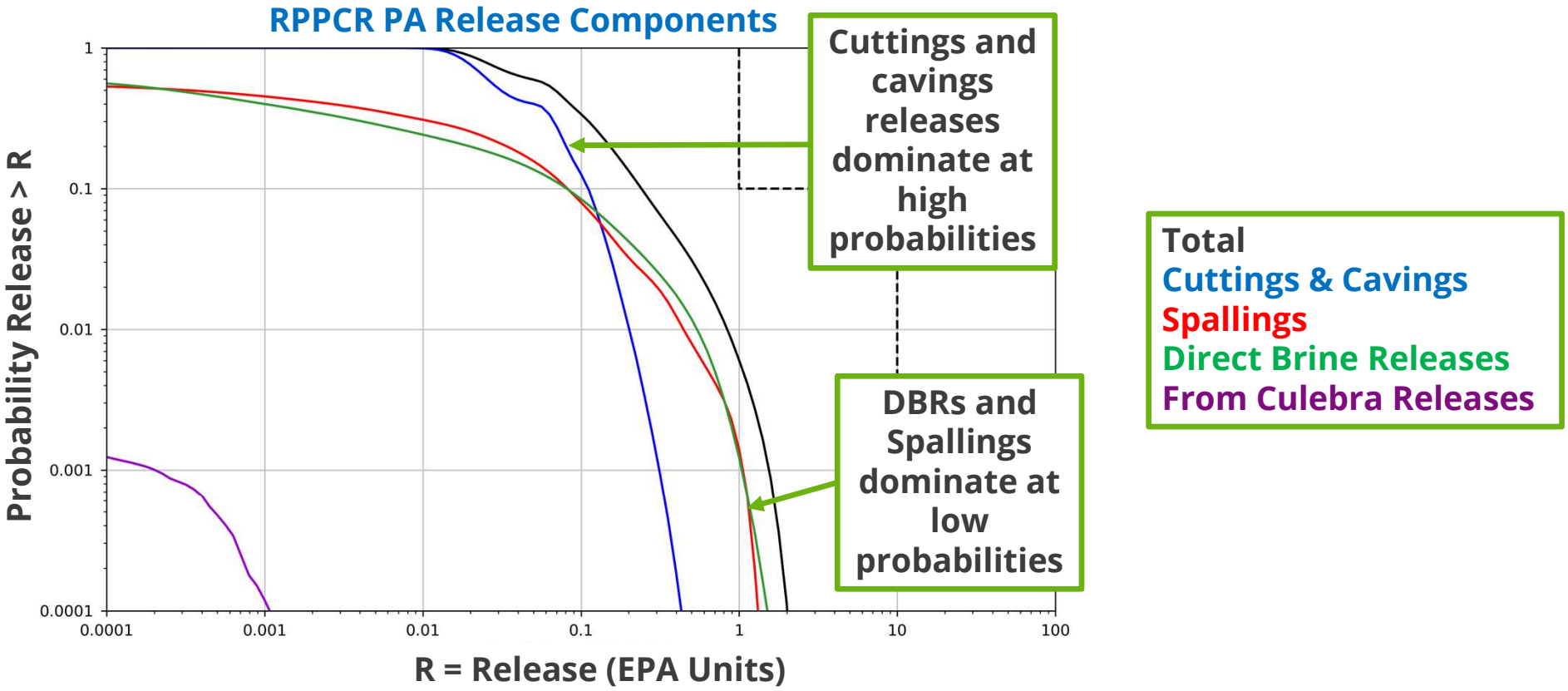
Less than 1 chance in 10 of exceeding 1 EPA unit

Less than 1 chance in 1000 of exceeding 10 EPA units

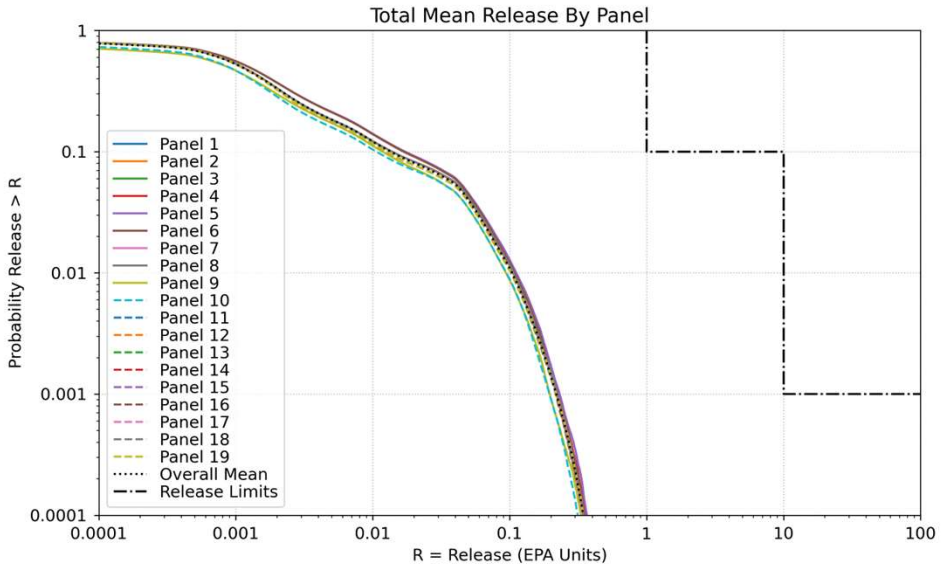
RPPCR PA Compliance Curve

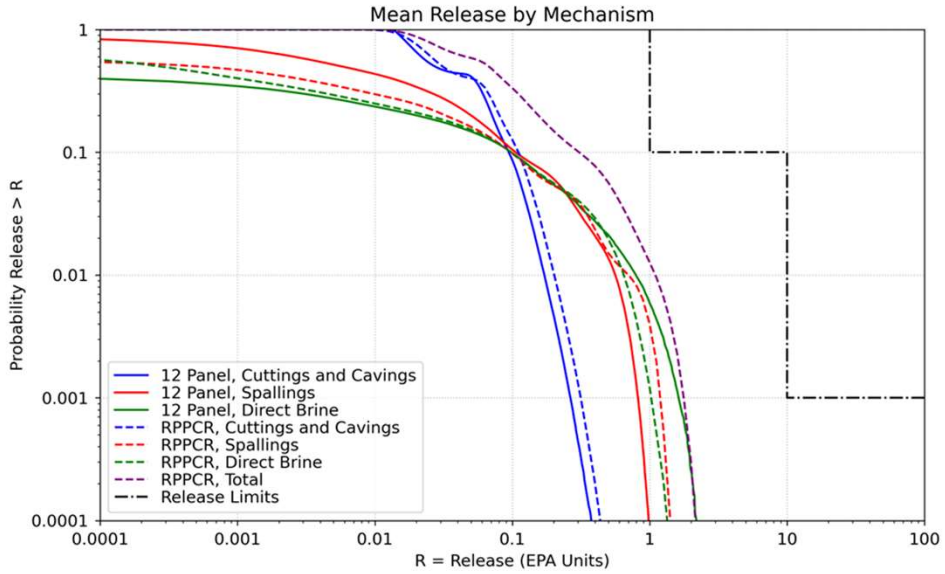
CCDFs for Each Release Mechanism

Each Release Component is Quantified by a Complementary Cumulative Distribution Function (CCDF)



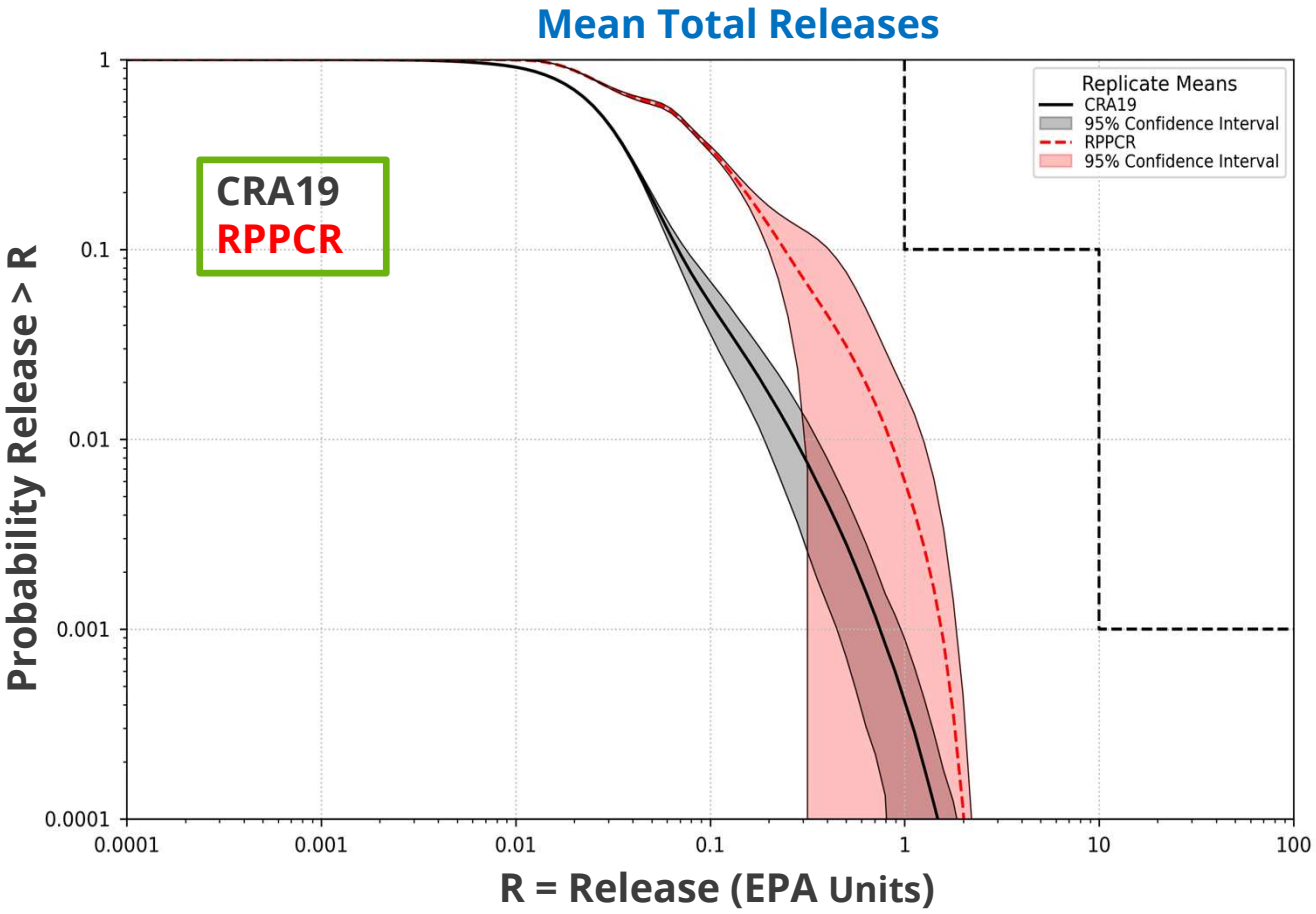
Impact of Replacement and Additional Panels on Results





- An additional analysis was undertaken to examine per-panel releases and approximate releases from a 12-Panel Repository
- This analysis demonstrates that total releases do not vary much between existing, replacement, and additional panels
- 12-Panel results were estimated based on results from the full 19-panel PA analysis

Confidence in Overall Results

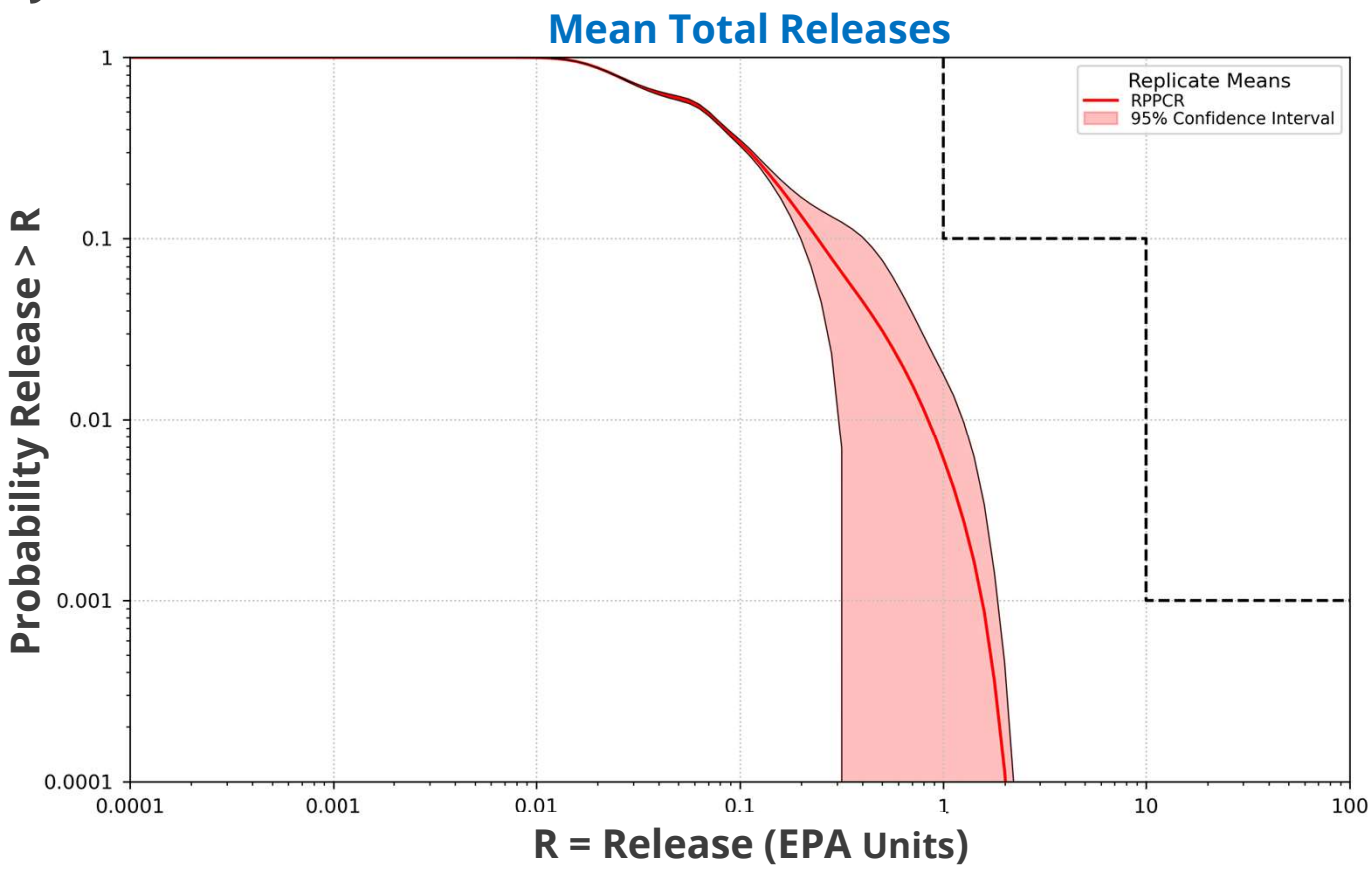


Mean total releases are increased at all probabilities.

Changes are mainly a result of:

- Increased drilling rate
- Updated inventory
- Updated model for salt creep closure onto the waste

Summary



The WIPP facility with replacement and additional panels remains in compliance with EPA containment requirements.

Additional Slides

Loss of Waste Storage Area

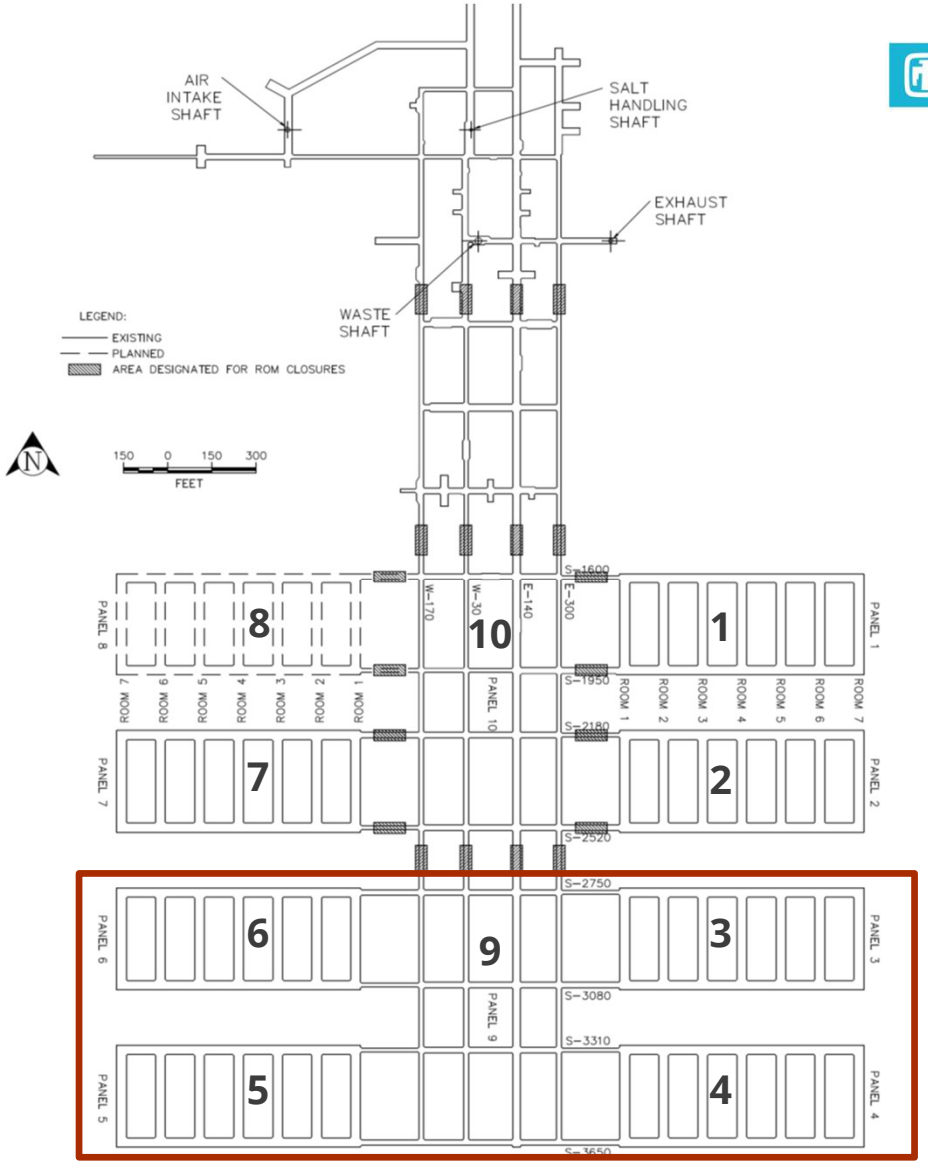
Worker safety concerns led to under-utilization of Panel 1 and Panel 7, and non-use of Panel 9.

Delay of first waste shipment

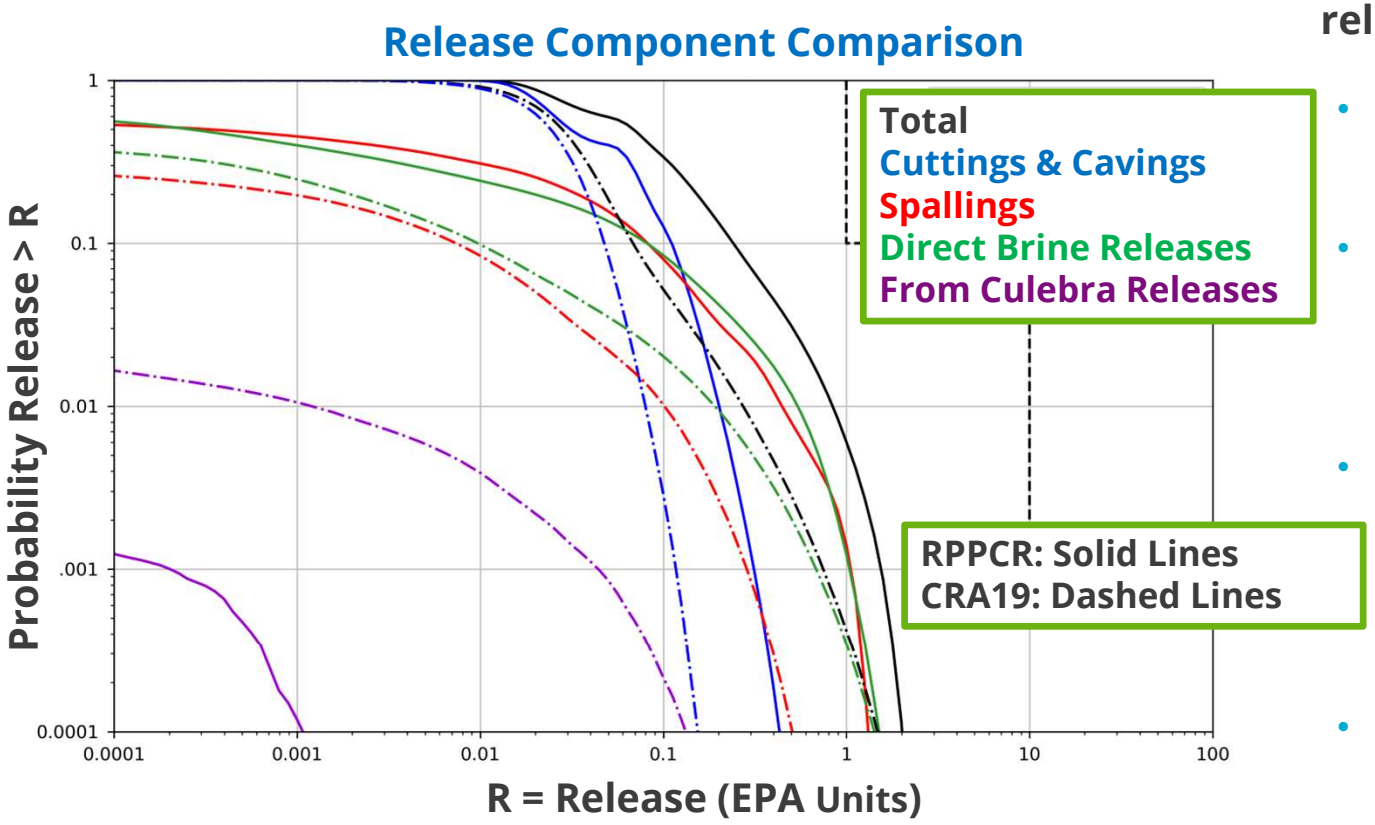
- Panel 1 mining began in 1986 with first waste shipment expected 1988.
- First waste was not received until 1999.
- Panel 1 was kept open long past its expected lifetime, and portions were abandoned for worker safety.

Fire and release events in 2014

- Ground control maintenance could not be performed in the south end, which resulted in deteriorating ground conditions.
- The safest resolution was to abandon the south end that contains Panels 3, 4, 5, 6, and 9.
- Result is under-utilization of Panel 7 and complete loss of storage area in Panel 9.



Results for Individual Release Mechanisms



Releases are increased for most release mechanisms.

- Cuttings and cavings releases increased due to increased drilling rate
- Spallings releases increased due to increased pressures in the repository, increased drilling rate, and increased activity in the inventory.
- Direct brine releases increased due to the increased drilling rate and an increase in the number of smaller DBR events (counteracted by a decrease in maximum DBR volumes).
- Culebra releases are decreased due to updated distribution for long-term borehole permeability.