40 CFR Part 191
Subparts B and C
Compliance Recertification Application 2026
for the
Waste Isolation Pilot Plant

Executive Summary

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

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ACRONYMS AND ABBREVIATIONS

CCDF	complementary cumulative distribution functions
CFR	Code of Federal Regulations
CRA	Compliance Recertification Application
DOE	U.S. Department of Energy
DBR	Direct Brine Release
EPA	U.S. Environmental Protection Agency
FEPs	features, events, and processes
LWA	Land Withdrawal Act
PA	performance assessment
PCR	Planned Change Request
RPPCR	Replacement Panels Planned Change Request
TRU	transuranic
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

EXECSUM-1.0 Overview

The Waste Isolation Pilot Plant (WIPP), near Carlsbad, New Mexico, is a U.S. Department of Energy (DOE) deep geologic repository for the permanent disposal of defense-related transuranic (TRU) mixed waste. Originally authorized by the Department of Energy National Security and Military Applications of the Nuclear Energy Authorization Act of 1980 (U.S. Congress 1979), the repository's mission and land jurisdiction were subsequently defined by the WIPP Land Withdrawal Act (LWA) of 1992. A key provision of the WIPP LWA, Pub. L. 102-579, 106 Stat. 4777, as amended by Pub. L. 104-201, 110 Stat. 2422 (U.S. Congress 1992) established the U.S. Environmental Protection Agency (EPA) as the primary regulatory authority for WIPP's long-term disposal of TRU mixed waste (U.S. Congress 1996). The U.S. Congress specifically requires the EPA to certify that the DOE complies with the waste-disposal regulations in Title 40 Code of Federal Regulations (CFR) Part 191, Subparts B and C (U.S. EPA 1996), and requires that the EPA recertify the facility every five years following the initial receipt of TRU waste. These regulations are designed to protect human health and the environment by limiting the release of radioactive materials from the disposal system into the accessible environment. As directed by the WIPP LWA, the EPA re-promulgated 40 CFR Part 191 in 1993 (U.S. EPA 1993) to establish the final environmental radiation protection standards, followed by the promulgation of 40 CFR Part 194 (U.S. EPA 1996) to establish the criteria for demonstrating compliance with those standards.

The EPA first certified WIPP on May 13, 1998, with waste disposal operations beginning on March 26, 1999. This 2026 Compliance Recertification Application (CRA-2026) is the fifth since the initial certification in May 1998. The scope of CRA-2026 is to provide updated information on geologic, geophysical, geochemical, hydrologic, and meteorologic characteristics relevant to the disposal system's safety, as well as changes in the TRU waste inventory and any inferred from monitoring and laboratory experiments. The purpose of this application is to demonstrate that changes since the last recertification decision have not significantly affected the performance of the disposal system. This CRA-2026 performance assessment (PA) demonstrates that the disposal system continues to meet disposal regulations and compliance criteria.

EXECSUM-1.1 Changes Since the CRA-2019

This application differs from past submissions in several ways. This CRA-2026 is the first to be submitted under an updated schedule based on completeness determination rather than the date of first waste receipt. The updated schedule authorizes the DOE to submit CRAs five years after the previous completeness determination, which, for CRA-2019, was November 26, 2021 (U.S. EPA 2023a,b). This new schedule provides the necessary time for the DOE to address the major technical concerns and regulatory expectations identified in the EPA's April 2021 correspondence (U.S. EPA 2021) and the CRA-2019 recertification decision (U.S. EPA 2022).

Another difference is the geometry of the disposal system. The DOE determined that two replacement waste disposal panels were necessary due to a loss of disposal capacity caused by several operational factors. These two panels resulted in a 12-panel configuration, a change from the 10-panel configuration used in previous applications. Consideration of the replacement panels in PA calculations required modifications to three conceptual models: Disposal System Geometry, Repository Fluid Flow, and Direct Brine Release (DBR). The proposed changes and their implementation were peer-reviewed and found to be an adequate and reasonable representation of the disposal system (Falta et al. 2021; U.S. EPA 2023c). In March 2024, the DOE submitted a Planned Change Request (PCR) to the EPA seeking approval to use the two replacement panels in the proposed 12-panel configuration (U.S. DOE 2024). The EPA approved the request in July 2025 (U.S. EPA 2025a, b).

Another change from CRA-2019 is that CRA-2026 addresses two distinct regulatory requirements that arise because the repository has not yet reached its final configuration. The currently approved 12-panel system is an "Interim State" that cannot accommodate the TRU waste inventory authorized by the LWA. This creates a dual analytical mandate that this CRA is designed to satisfy. Therefore, CRA-2026 presents two separate PA calculations to demonstrate compliance with the disposal standards of 40 CFR Part 191:

- An "Interim State" PA that demonstrates the approved 12-panel disposal system is compliant and protective for the specific volume of waste it is projected to contain (Van Soest 2025a). This analysis, which constitutes the CRA-2026 PA, confirms repository safety in its current, as-built configuration.

- A "Final State" PA that meets the requirement of 40 CFR § 194.24 by modeling the total LWA-authorized inventory within a conceptual 19-panel disposal system (Van Soest 2025b). This analysis demonstrates that a clear, technically defensible path forward exists for demonstrating compliance of the repository at its full, planned capacity.

The DOE regards the current 12-panel configuration as a planned, phased step toward fulfilling the WIPP mission. The transition to the 19-panel Final State will be formally sought through a future Planned Change Request. However, the Final State PA included within this application serves as the foundational technical analysis that will support that future action, demonstrating a proactive commitment to long-term planning and continuous regulatory compliance at every stage of repository operation.

Information regarding updates to processes and events since CRA-2019 is detailed in the appropriate sections of this application. These sections highlight important developments and primary changes relevant to the repository's performance assessment. The DOE has not identified any new information or changes to the disposal system since CRA-2019 that would compromise compliance with the disposal standard. The following results from the CRA-2026 PA reflect this updated understanding and illustrate the effects of changes evaluated for CRA-2026.

EXECSUM-1.2 Summary of Performance Assessment Results

Waste containment in the disposal system is evaluated using a comprehensive PA methodology. The methodology identifies relevant features, events, and processes (FEPs), evaluates their effects using mathematical and numerical models, and estimates cumulative radionuclide releases and associated uncertainties. This approach supports DOE's conclusions regarding disposal system compliance under varying conditions. This methodology estimates the probability of radionuclide releases over 10,000 years. It quantifies release concentrations and magnitudes, while accounting for uncertainties, to ensure compliance with limits for individual and environmental protection. The probability of a release is presented as a complementary cumulative distribution function (CCDF), which represents the probability of exceeding various cumulative release levels. The approved replacement panel PCR (RPPCR) PA, based on the 12-panel Interim State configuration, serves as the baseline for the CRA-2026 PA. The probability and cumulative radionuclide releases are compared against EPA-specified limits.

The CRA-2026 PA addresses four key questions about the disposal system:

1. Which processes and events could affect it over the next 10,000 years?
2. How likely are these processes and events?
3. What are their consequences, specifically cumulative radionuclide releases?
4. How much confidence can be placed in these answers, given parameter uncertainties?

By addressing these questions, the CRA-2026 PA establishes a comprehensive understanding of expected system behavior. The key findings derived from this analysis are summarized below.

EXECSUM 1.2.1 Impact of Changes Since CRA-2019 PA

The CRA-2026 PA incorporates several changes and new information compared to previous assessments, including modifications to the repository design, updated waste inventory, and revised parameter distributions for various processes, leading to observed differences in the predicted performance of the disposal system.

Key conclusions and effects include:

- **Undisturbed Repository Performance:** For the undisturbed repository scenario, no radionuclide releases to the accessible environment are predicted through the shaft or anhydrite marker beds. This result indicates effective isolation under undisturbed conditions.

- **Updated TRU Waste Inventory:** Increased inventory concentrations of iron, cellulose, plastic, and rubber, combined with a higher proportion of long-lived radionuclides and a later closure date, contributed to increased gas generation and brine consumption. Increased concentration limits for actinides in the +III oxidation state, due to updated baseline solubility, uncertainty, and colloid-enhancement parameters, resulted in higher mobilized radionuclide concentrations in brine.

- **Updated Frequency of Deep Drilling Events**: Deep drilling frequency, calculated in accordance with 40 CFR 194.33, is notably higher than that used in previous assessments. As a result, the contribution from Direct Brine Releases (DBRs) has increased relative to CRA-2019 and is the primary driver of increased releases.

- **Direct Brine Releases (DBRs):** DBRs had a mixed effect. Even with an increased deep drilling frequency, the smaller footprint of the 12-panel interim-state configuration led to fewer total intrusions than the RPPCR's 19-panel configuration. Fewer intrusions reduced the likelihood of DBRs at a higher probability. However, at lower probability, higher TRU waste inventory and increased mobilized actinide concentrations led to larger DBRs, sometimes exceeding previous estimates.

- **Repository Design and Configuration Changes:** The transition from a 10-panel disposal system to the approved 12-panel Interim State, and the hypothetical 19-panel Final State, represents primary design modifications. These changes required updates to flow and transport computational grids in the Salado, adjustments to repository geometry parameters, and revisions to the DBR computational grid, thereby influencing both the magnitude and frequency of projected releases. However, changes to the repository footprint are not primary drivers of the observed differences in releases.

- **Impact on Salado Flow and Brine Saturation:** Changes in repository design, inventory parameters, and increased rates of MgO hydration led to decreased brine saturations attributed to increased brine consumption from higher concentrations of iron, cellulose, plastic, and rubber, and decay heat in the waste. This reduction in brine saturation reduced brine mobility, which in turn lowered the mean brine flow up the intrusion boreholes.

- **Spallings Releases:** The average non-zero spallings release volumes increased in the CRA-2026 PA compared to previous assessments, driven by increased radionuclide activity concentrations in the waste.

- **Groundwater Transport (Culebra):** Contributions to total releases from Culebra Transport are negligible in the CRA-2026 PA and notably reduced compared to previous assessments due to the exclusion of certain release points.

- **Parameter Sensitivity:** The intact halite porosity is the most dominant parameter influencing total release variability, primarily because it controls brine availability and repository pressure. Waste shear strength is the second most dominant parameter, affecting cavings releases. The particle diameter for disaggregated waste has gained importance due to its influence on spallings. Initial brine pressure in the Castile brine reservoir continues to influence DBRs.

Despite these shifts in individual release mechanisms, the overall pattern of releases is similar to previous assessments, with cuttings, cavings, and spallings dominating at high probabilities, and DBRs and spallings being most important at low probabilities. Total normalized releases, as

represented by CCDFs, remain below the specified regulatory limits. The DOE concludes that the CRA-2026 PA confirms that the WIPP disposal system continues to comply with the quantitative containment requirements defined in 40 CFR 191.13(a).

EXECSUM-2.0 References

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