Title 40 CFR Part 191
Subparts B and C
Compliance Recertification Application 2014
for the
Waste Isolation Pilot Plant

Executive Summary

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

Compliance Recertification Application 2014
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Acronyms and Abbreviations

CCA	Compliance Certification Application
CCDF	complementary cumulative distribution functions
CFR	Code of Federal Regulations
CH	contact-handled
CRA	Compliance Recertification Application
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEPs	features, events, and processes
LWA	Land Withdrawal Act
MgO	magnesium oxide
PA	performance assessment
PABC	Performance Assessment Baseline Calculation
PCN	planned change notice
PCR	planned change request
PCS	Panel Closure System
RH	remote-handled
SDI	Salt Disposal Investigations
TRU	transuranic
ROMPCS	Run-of-Mine Panel Closure System
WIPP	Waste Isolation Pilot Plant

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EXECUTIVE SUMMARY

EXECSUM-1.0 Overview

The Waste Isolation Pilot Plant (WIPP), located near Carlsbad, New Mexico, is a deep geologic repository for the disposal of defense-related transuranic (TRU) waste. The WIPP Land Withdrawal Act (LWA) (Pub. L. 102-579, 106 stat. 4777, as amended by Pub. L. 104-201, 110 stat. 2422) requires the U.S. Environmental Protection Agency (EPA) to certify the WIPP's compliance with the disposal regulations of Title 40 CFR Part 191 Subparts B and C prior to the commencement of disposal operations. To meet this requirement, the U.S. Department of Energy (DOE) submitted the Compliance Certification Application (CCA) in October 1996, demonstrating compliance with the disposal standards and the criteria established in Title 40 CFR Part 194. The CCA demonstrated that the geological, hydrological, physical, chemical, and environmental characteristics of the site, along with engineered features of the facility, would safely contain radioactive waste for the 10,000-year regulatory time period. After a thorough review of the CCA, the EPA certified the WIPP's compliance with these regulations in May 1998, paving the way for waste disposal operations which began on March 26, 1999.

The WIPP LWA requires the DOE to submit documentation of the WIPP's continued compliance with the disposal regulations to the EPA not later than five years after initial receipt of TRU waste for disposal at the repository, and every five years thereafter until the decommissioning of the facility is completed. This periodic documentation of continued compliance is referred to as "recertification." The DOE has completed two recertification cycles. The first Compliance Recertification Application (CRA-2004) was received by the EPA on March 26, 2004. After a thorough review, the EPA recertified the WIPP's compliance on March 29, 2006. The second Compliance Recertification Application (CRA-2009) was received by the EPA on March 26, 2009, and the EPA recertified the WIPP's compliance on November 18, 2010. The third five-year recertification cycle begins on March 26, 2014. The CRA-2014 is being submitted to the EPA in accordance with the provisions of the LWA, and is the DOE's documentation of the WIPP's continued compliance with the applicable radioactive waste disposal standards and WIPP Compliance Criteria.

According to the WIPP Compliance Criteria in 40 CFR § 194.15, recertification applications must include any information that is new or different from information contained in the most recent compliance application. Therefore, the DOE must review any new information that relates to the WIPP's certification basis and include the new information in each CRA. The CRA-2014 includes several changes that resulted from continuing scientific investigations and operations at the WIPP during the time period between January 1, 2008, and the CRA-2014 data cut-off date of December 31, 2012. These changes include planned repository changes, performance assessment (PA) parameter updates based on new WIPP-specific data, and PA implementation refinements. Other non-significant changes, such as procedure revisions and PA software and hardware changes, are summarized in the Annual Change Reports submitted to the EPA as required by 40 CFR § 194.4(b)(4). None of the changes compromise compliance with the radioactive waste disposal standards. The PA results in this recertification application show that the repository will not adversely impact public health or the environment during the 10,000-

year regulatory compliance time period. The CRA-2014 demonstrates that the WIPP remains in compliance with EPA requirements.

EXECSUM-1.1 Contents of the CRA-2014

The CRA-2014 has been developed in accordance with the EPA's Certification Criteria found in Part 194. This document addresses all topics relevant to the certification process. Topics addressed in the CRA-2014 include, but are not limited to, the following:

- Natural and engineered features of the disposal system, including geology, geophysics, and hydrogeology of the repository and its environs, as well as the geochemistry and actinide chemistry of interactions between the disposal system and the emplaced TRU wastes.

- Information concerning the inventories of TRU waste emplaced in the repository, waste stored at DOE sites, and waste expected to be generated at those sites and shipped to the WIPP in the future.

- WIPP-relevant features, events, and processes (FEPs), updated based on data and information acquired since the CRA-2009.

- Assessments of the disposal system's long-term performance, including the input parameters and models used in those assessments.

- Demonstration that the WIPP meets or exceeds individual and groundwater protection standards and will continue to do so.

- Assurance requirements, including active and passive institutional controls, monitoring, engineered barriers and the effects of natural resource extraction.

EXECSUM-1.2 Programmatic Changes Since the CRA-2009

This application incorporates information about changes that have taken place since the CRA-2009. These changes have been proposed by the DOE and approved by the EPA, requested by the EPA, or driven by the availability of new data, and include:

- Inventory: The inventory used in the CRA-2014 is updated from that used in the CRA-2009 Performance Assessment Baseline Calculation (PABC). Section 24 of this application contains a summary of the CRA-2014 waste inventory.

- CRA-2009 PABC Parameters: Changes to the CRA-2009 PA were made during the recertification process as part of the CRA-2009 PABC. The CRA-2009 PABC included updated information on transmissivity fields found in the Culebra Dolomite Member and updated Culebra matrix partition coefficients. These changes are brought forward to the CRA-2014 PA.

- Planned Repository Changes:

Shielded Containers - On November 15, 2007, the DOE submitted a planned change request (PCR) to the EPA for the use of shielded containers for the disposal of a portion of the remote-handled (RH) waste inventory in the rooms of the WIPP. The walls of the shielded container include a layer of lead, making it more effective than previously authorized containers in maintaining a low dose rate at its external surface. Shielded containers could be managed and disposed of as contact-handled (CH) waste based on the external surface dose rate. Even though the RH-TRU waste in shielded containers will be handled as if it were CH-TRU waste, these containers will still be recorded as RH-TRU waste in the WIPP Waste Data System, and the volume of the waste will be counted against the limit of 250,000 cubic feet (7,080 cubic meters) of RH-TRU waste, as set by the Consultation and Cooperation Agreement between the DOE and the State of New Mexico. This PCR was described in detail in the CRA-2009. On August 8, 2011, the EPA granted the DOE conditional approval to dispose of shielded containers pending the demonstration of a consistent complex-wide procedure to ensure the surface dose rate limit is not greater than 200 millirems per hour.

Neutron Shielded Canister - On May 21, 2010, the DOE submitted to the EPA a planned change notice (PCN) to employ a polyethylene liner inside some standard RH-TRU waste canisters to shield neutron-emitting waste destined for disposal at the WIPP.

Salt Disposal Investigations (SDI) - The DOE submitted a PCN to the EPA on August 11, 2011, that presented plans to carry out additional excavation to the WIPP experimental area for the SDI research project and showed that there will be no impact on operations or post-closure performance. A PA was performed to determine the impact of the additional SDI excavation on long-term WIPP performance. Total normalized releases calculated with the additional excavation were indistinguishable from those obtained in the CRA-2009 PABC, and remained below regulatory release limits. After reviewing the DOE proposal and written responses to questions related to the effects of increasing the mined area, the EPA found that the mining phase of the SDI activities will not adversely impact the WIPP's waste handling activities, air monitoring, disposal operations, or long-term repository performance. The CRA-2014 PA includes this additional excavated volume in the WIPP experimental area. The implementation of the additional volume is described in Appendix PA-2014, Section PA-1.1.2 and the references therein. Subsequent to the EPA's November 17, 2011, response, the EPA was further notified of planned changes to the testing in this volume related to ventilation (May 18, 2012) and reduction of thermal loads (June 13, 2012).

Repository Reconfiguration - On August 30, 2011, the DOE submitted to the EPA a PCR for the reconfiguration of Panels 9 and 10 within the WIPP repository footprint. The proposed change replaces the use of the north-south access drifts as future Panels 9 and 10 with two new panels mined to the south of Panels 4 and 5. This proposed change continues to be important to the DOE, even though it is only mentioned briefly in a few sections.

Panel Closure System - The 1998 rulemaking that certified the WIPP to receive TRU waste required the DOE to implement the "Option D" Panel Closure System (PCS). The DOE has reassessed the engineering of the panel closure and has proposed a revised design which is simpler, more cost effective and easier to construct. The DOE submitted a PCR to the EPA on September 28, 2011, requesting that the EPA modify Condition 1 of the Final Certification Rulemaking for 40 CFR Part 194 for the WIPP, and that a revised PCS design be approved for use in the repository. The revised PCS design, denoted as the Run-of-Mine Panel Closure System (ROMPCS), is comprised of 100 feet of run-of-mine salt (i.e., unaltered, mined WIPP salt) with barriers to restrict personnel access and control ventilation at each end. Regulatory compliance impacts associated with the implementation of the ROMPCS in the WIPP were assessed in a PA titled PCS-2012. Total normalized releases calculated in the PCS-2012 PA remained below the regulatory limits. Long-term WIPP performance with the ROMPCS design is similar to that seen with Option D, and the WIPP remains in compliance with the containment requirements of 40 CFR Part 191 with the new panel closure. Details regarding the ROMPCS and its modeling can be found in Appendix PA-2014, Section PA-4.2.8. The ROMPCS is implemented in the CRA-2014 PA.

Placement of Magnesium Oxide (MgO) - On February 14, 2012, the DOE submitted a PCN, based on operating experience and historical data, to inform the EPA that a process was being instituted to emplace MgO on every other row of waste containers, in contrast to emplacing MgO on every waste stack. Historical data showed the MgO excess factor on a per room basis ranged from 1.22 to 2.85 when MgO was placed on every stack of waste. These values were higher than the excess factor of 1.2 mandated by the EPA's letter dated February 11, 2008. The PCN also described the process that requires the Waste Handling Engineer to continue to calculate the excess factor at the end of each shift and to direct the placement of additional MgO if the excess factor dropped below 1.2. Details regarding this change can be found in Appendix MgO, Section MgO-2.1.4.

- CRA-2014 PA Updates: Changes to PA since the CRA-2009 PABC include parameter updates and WIPP PA implementation refinements. Parameters were updated based on new data and include drilling rate and corresponding plugging pattern parameters, radionuclide solubilities and their uncertainties, colloid enhancement factors, the probability of encountering pressurized brine during a hypothetical drilling intrusion, the corrosion rate of steel, and the effective shear strength of WIPP waste. These parameter changes are made to accommodate new data. The repository water balance implementation is refined in the CRA-2014 PA in order to include major gas and brine producing and consuming reactions. Radionuclide concentrations in brine are more closely linked to repository brine volume in the CRA-2014 PA through the use of a variable volume, eliminating a mass imbalance for ligands in the PA calculations. These updates are discussed in Appendix PA-2014, Section PA-1.1.

EXECSUM-1.3 PA Results

Performance of the WIPP disposal system is evaluated by means of the WIPP PA, which gives rise to a methodology for quantifying the probabilistic distribution of possible radionuclide releases from the WIPP repository over the next 10,000 years and characterizing the uncertainty

in the distribution. The WIPP PA results are required to be expressed as complementary cumulative distribution functions (CCDFs). A CCDF represents the probability of exceeding various levels of cumulative release. Compliance analyses performed on the undisturbed repository result in no releases from the repository to the accessible boundary. As a result, all total normalized releases in the CRA-2014 PA correspond to the disturbed repository. The CRA-2014 compliance analysis demonstrates that the overall mean releases have decreased since the CRA-2009 and that the WIPP continues to comply with the individual and groundwater protection standards in Part 191 Subparts B and C. The mean CCDFs for total normalized release from the CRA-2009 PABC and the CRA-2014 PA are shown in Figure EXECSUM-1. The mean CCDF for the CRA-2014 is further to the left of the mean CCDF for the CRA-2009 PABC, indicating lower normalized releases for the CRA-2014 PA at most probabilities, and the WIPP remains in compliance. In addition, there is a greater than 95% level-of-confidence that the mean of the population of CCDFs is in compliance with the containment requirements of 40 CFR § 191.13. The 95% level-of-confidence limits are not shown in Figure EXECSUM-1 (see Appendix PA-2014, Section PA-9.5, Figure PA-81).

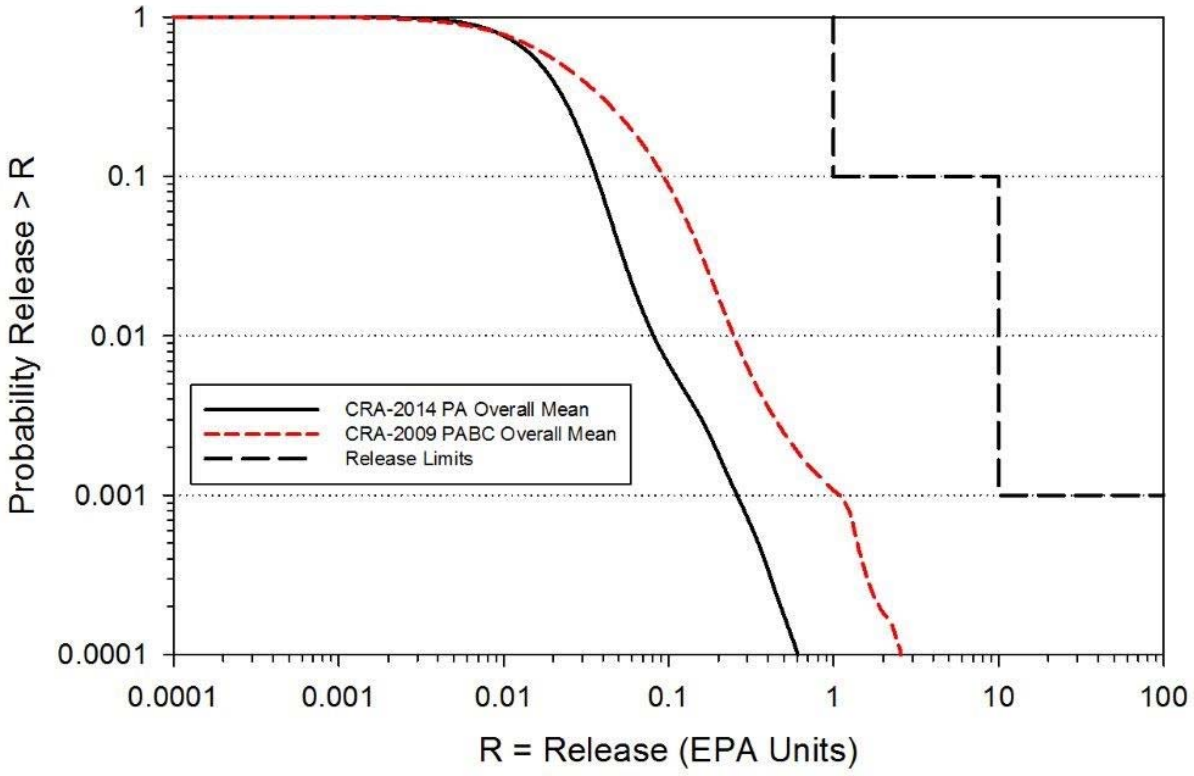

Figure EXECSUM-1. CRA-2014 PA and CRA-2009 PABC Overall Mean CCDFs for Total Normalized Releases

The waste shear strength is the maximum shear stress at which erosion of the waste can occur. Cavings release volumes comprise the solid waste material eroded from the walls of an intrusion borehole by shear stresses from the circulating drill fluid. The impact of the CRA-2014 PA waste shear strength refinement is to reduce cavings release volumes. The combined impact of changes included in the CRA-2014 PA is an overall net reduction to normalized direct brine

releases and spallings releases as compared to the CRA-2009 PABC. Radionuclide transport releases to the Culebra are most likely to occur during hypothetical drilling intrusions that encounter pressurized brine in the Castile Formation. The refinement to the probability that a drilling intrusion results in a pressurized brine pocket intersection results in increased Culebra transport releases for some futures and decreases in others. The net effect is a reduction in normalized Culebra transport releases in the CRA-2014 PA as compared to the CRA-2009 PABC. Total normalized releases decrease from the CRA-2009 PABC to the CRA-2014 PA as each contributing component is reduced in the CRA-2014 PA.

EXECSUM-1.4 Summary of Changes to the Application

Table EXECSUM-1 and Table EXECSUM-2 present a high-level summary of changes made to each section, appendix and attachment of the CRA-2014.

Table EXECSUM-1. CRA-2014 Sections, Appendices and Attachments with Non-Significant to No Changes Since the CRA-2009

CRA-2014 Sections and Appendices with Editorial or No Change Since the CRA-2009	CRA-2014 Sections, Appendices and Attachments with Changes Incorporating Updated Data Since the CRA-2009*
Section 26: Expert Judgment	Section 8: Approval Process for Waste Shipment From Waste Generator Sites for Disposal at the WIPP
Section 31: Application of Release Limits	Section 21: Inspections
Section 41: Active Institutional Controls	Section 22: Quality Assurance
Section 42: Monitoring	Section 25: Future States Assumptions
Section 43: Passive Institutional Controls	Section 33: Consideration of Drilling Events in Performance Assessments
Section 45: Consideration of the Presence of Resources	Section 51-52: Consideration of Protected Individual and Exposure Pathways
Section 46: Removal of Waste	Section 53: Consideration of Underground Sources of Drinking Water
Section 54: Scope of Compliance Assessments	Appendix AUD: Audits and Surveillances
Section 55: Results of Compliance Assessments	Appendix DATA: Monitoring Data and Reports
Appendix MON: WIPP Monitoring Programs	Appendix HYDRO: Hydrological Investigations
Appendix PORSURF: Porosity Surface	Appendix IGP: Individual and Groundwater Protection Requirements
	Appendix MASS: Performance Assessment Modeling Assumptions
	Appendix MgO: Magnesium Oxide as an Engineered Barrier
	Appendix TFIELD: Transmissivity Fields
	Attachment A: TFIELD Visualization

*Changes are routine data updates since the CRA-2009.

Table EXECSUM-2. CRA-2014 Sections and Appendices with Moderate Changes Since the CRA-2009

CRA-2014 Section or Appendix	Summary of Change
Section 15: Content of Compliance Recertification Application(s)	• Updated geologic, geophysical, geochemical, hydrologic, and meteorological information • New waste shear strength and iron and lead corrosion experiments • Status of mining and waste emplacement • PCN and PCR submittals
Section 23: Models and Computer Codes	• Repository planned changes (i.e., additional excavated area in the northern experimental area) • Parameter updates • Refinements to PA implementation • Two new codes, EQ3/6 and JAS3D, were added
Section 24: Waste Characterization	Changes in projected waste streams that directly affect the contact-handled and remote-handled waste scaling factors
Section 27: Peer Review	Added one peer review, the Savannah River Site Historical Radiochemistry Data Peer Review
Section 32: Scope of Performance Assessments	Updated the FEPs baseline for the CRA-2014 to account for planned changes, new information, or new data
Section 34: Results of Performance Assessments	Repository planned changes, parameter updates, and refinements to PA implementation
Section 44: Engineered Barriers	• The EPA accepted the DOE's PCN to emplace MgO supersacks on every other row unless additional sacks are needed to meet the 1.2 excess factor • The standard MgO supersack weight was changed to 3,000 pounds • MgO hydration studies have been completed and refinements were made to the water balance used in PA, which now includes the impact of MgO hydration/carbonation
Appendix PA: Performance Assessment	Updated to reflect repository planned changes, parameter refinements, and PA implementation changes occurring since the CRA-2009 PA
Appendix SCR: Feature, Event, and Process Screening for PA	Updated the FEPs baseline for the CRA-2014 to account for planned changes, new information, or new data
Appendix SOTERM: Actinide Chemistry Source Term	• New project-specific data in the areas of metal corrosion, microbial ecology, actinide/analog solubility in brine, and colloid enhancement parameters were added • Model parameters were modified in PA in two areas: 1) gas generation rates due to metal corrosion and 2) colloid enhancement parameters for mineral, intrinsic and microbial colloids • Geochemical modeling is now based on the EQ3/6 geochemical code and implements a variable brine volume approach to more realistically predict actinide concentrations