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

Peer Review
(40 CFR § 194.27)

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

Compliance Recertification Application 2014
Peer Review
(40 CFR § 194.27)

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Acronyms and Abbreviations

BCLDP	Battelle Columbus Laboratory Decommissioning Project
CAO	Carlsbad Area Office
CARD	Compliance Application Review Document
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CRA	Compliance Recertification Application
CTAC	CBFO Technical Assistance Contractor
DOE	U.S. Department of Energy
DRZ	Disturbed Rock Zone
EEG	Environmental Evaluation Group
EPA	U.S. Environmental Protection Agency
IAEA	International Atomic Energy Agency
LANL	Los Alamos National Laboratory
MP	Management Procedure
NAS	National Academy of Sciences
NEA/OECD	Nuclear Energy Agency/Organization for Economic Cooperation and Development
QA	quality assurance
RCHCM	Revised Culebra Hydrology Conceptual Model
RHPIP	Remote-Handled TRU Waste Characterization Program Implementation Plan
RH	remote-handled
RSI	Institute for Regulatory Science
SNL	Sandia National Laboratories
SRS	Savannah River Site
T	transmissivity
TRU	transuranic
VE	visual examination
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant

Elements and Chemical Compounds

CO_2	carbon dioxide
MgO	magnesium oxide

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27.0 Peer Review (40 CFR § 194.27)

27.1 Requirements

§ 194.27 Peer Review

(a) Any compliance application shall include documentation of peer review that has been conducted, in a manner required by this section, for:

(1) Conceptual models selected and developed by the Department;

(2) Waste characterization analyses as required in § 194.24(b); and

(3) Engineered barrier evaluation as required in § 194.44.

(b) Peer review processes required in paragraph (a) of this section, and conducted subsequent to the promulgation of this part, shall be conducted in a manner that is compatible with NUREG–1297, ''Peer Review for High-Level Nuclear Waste Repositories,'' published February 1988. (Incorporation by reference as specified in § 194.5.)

(c) Any compliance application shall:

(1) Include information that demonstrates that peer review processes required in paragraph (a) of this section, and conducted prior to the implementation of the promulgation of this part, were conducted in accordance with an alternate process substantially equivalent in effect to NUREG–1297 and approved by the Administrator or the Administrator's authorized representative; and

(2) Document any peer review processes conducted in addition to those required pursuant to paragraph (a) of this section. Such documentation shall include formal requests, from the Department to outside review groups or individuals, to review or comment on any information used to support compliance applications, and the responses from such groups or individuals.

27.2 Background

According to 40 CFR § 194.27 (U.S. EPA 1996), the U.S. Department of Energy (DOE) is required to conduct peer review evaluations related to conceptual models, waste characterization analyses, and a comparative study of engineered barriers. A peer review involves an independent group of experts who perform an in-depth critique of assumptions, calculations, extrapolations, alternative interpretations, methodology and acceptance criteria employed, and conclusions drawn in the original work. Peer review confirms the adequacy of the work (NRC 1988). The required peer reviews must be performed in accordance with NUREG-1297, Peer Review for High-Level Nuclear Waste Repositories (NRC 1988), which establishes guidelines for the conduct of a peer review exercise. 40 CFR § 194.27(c)(2) also requires the DOE to document in the compliance application any additional peer reviews beyond those explicitly required. These additional peer reviews will be identified in this section as informal peer reviews.

For the formal peer reviews performed before submitting the Compliance Certification Application (CCA) (U.S. DOE 1996a), the DOE developed Carlsbad Area Office (CAO) Team Procedure 10.5, Peer Review (U.S. DOE 1996b), to guide all Waste Isolation Pilot Plant (WIPP) peer reviews and to show a process compatible with section 194.27 and NUREG-1297 requirements. For the 2004 Compliance Recertification Assessment (CRA-2004) (U.S. DOE 2004a), the DOE updated this procedure to Carlsbad Field Office (CBFO) Management Procedure (MP) 10.5, Peer Review (U.S. DOE 2002). MP 10.5 has been revised several times since 2002, and the latest version (Rev. 8, 2/16/10) (U.S. DOE 2010) provides the criteria for selecting the peer review panel, peer review process used, review plan development

requirements, peer review report preparation requirements, and many other aspects of the peer review process.

27.3 1998 Certification Decision

For the CCA, the DOE completed the required peer reviews and documented them in the CCA, Chapter 9.0 and Appendix PEER. The CCA, Chapter 9.0 and Appendix PEER, also contain documentation demonstrating that the DOE's procedures and plans for the required peer reviews are compatible with NUREG-1297. Peer reviews conducted after promulgation of 40 CFR Part 194 and intended to demonstrate compliance with section 194.27 were subject to the requirements of the pertinent procedures and plans. To assess the peer review process during the CCA, the U.S. Environmental Protection Agency (EPA) conducted an audit of the DOE's quality assurance (QA) records for peer review (U.S. EPA 1997). The audit consisted of an extensive review of the DOE's records and interviews of DOE staff and contractors responsible for managing the required peer reviews.

The EPA published the certification decision in 1998 (U.S. EPA 1998a). The EPA found the DOE in compliance with the requirements of section 194.27. The EPA's independent audit established that the DOE had conducted and documented the required peer reviews in a manner compatible with NUREG-1297. The EPA also determined that the DOE adequately documented additional peer reviews in the CCA (see Compliance Application Review Document [CARD] 27, U.S. EPA 1998b).

27.4 Changes in the CRA-2004

The DOE performed two conceptual model peer reviews between the CCA and the CRA-2004: the Salado Flow Conceptual Model Peer Review in March 2003 (see CRA-2004, Chapter 9.0, Section 9.3.1.3.4) and the Spallings Model Peer Review in September 2003 (see CRA-2004, Chapter 9.0, Section 9.3.1.3.5).

External informal peer reviews that fall under section 194.27(c)(2) requirements were also performed during this period. Reviews conducted by the National Academy of Sciences (NAS), the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (NEA/OECD), the Institute for Regulatory Science (RSI), and the Environmental Evaluation Group (EEG) are described in the CRA-2004, Chapter 9.0, and the reports are included in Appendix PEER-2004.

27.5 EPA's Evaluation of Compliance for the 2004 Recertification

The EPA thoroughly reviewed MP 10.5, Rev. 5 (U.S. DOE 2003a) and determined that it was adequately comparable with section 194.27 requirements and NUREG-1297 guidance. The DOE followed MP 10.5, Rev. 5, for the Salado Flow Conceptual Model Peer Review (U.S. DOE 2003b) and the Spallings Model Peer Review (U.S. DOE 2003c).

The Salado Flow Conceptual Model Peer Review was performed from April 2002 to March 2003. The final peer review report was published in March 2003 (U.S. DOE 2003d). The EPA reviewed the peer review plan (U.S. DOE 2003b) and the final peer review report (U.S. DOE

2003d) for the Salado Flow Conceptual Model Peer Review. The EPA also observed the actual performance of the peer review, evaluated the process for the selection of the review panel, observed the interaction of the review panel with the DOE and Sandia National Laboratories (SNL), and reviewed the documents produced during and as a result of the peer review. The EPA determined that the peer review process and the implementation of MP 10.5 met the requirements of section 194.27 and the guidance in NUREG-1297 (U.S. EPA 2003a).

The Spallings Model Peer Review was performed from July 2003 to October 2003. The final report was published in October 2003 (U.S. DOE 2003e). The EPA reviewed the peer review plan (U.S. DOE 2003c) and the final peer review report (U.S. DOE 2003e ;U.S. DOE 2004b) and found them to adequately fulfill the requirements of section 194.27 and NUREG-1297. The EPA observed the actual performance of the peer review, evaluated the process for the selection of the panel, observed the interaction of the panel with the DOE and SNL, and reviewed the documents produced during and as a result of the peer review. The EPA determined the peer review process and the implementation of MP 10.5 met the requirements of section 194.27 and the guidance in NUREG-1297 (U.S. EPA 2003b).

The EPA conducted desktop evaluations of other reviews done since the CCA for compliance with section 194.27(c)(2). These included reviews done by the NAS, IAEA, NEA/OECD, RSI, and EEG from October 1996 to September 2003. The EPA found these reviews to be useful, reasonable, and helpful to the WIPP project, and determined that they reasonably fulfilled the requirements of section 194.27(c)(2).

The EPA did not receive any public comments on the DOE's continued compliance with the peer review requirements of section 194.27. Based on a review and evaluation of the CRA-2004 and supplemental information provided by the DOE (U.S. DOE 2004a), in Chapter 9.0 and Appendix PEER-2004, the EPA (U.S. EPA 2006a;U.S. EPA 2006b) determined that the DOE continued to comply with the requirements of section 194.27.

27.6 Changes or New Information Between the CRA-2004 and the CRA-2009 (Previously: Changes or New Information Since the 2004 Recertification)

The DOE initiated four, and completed three, peer reviews between the CRA-2004 and the CRA-2009 (U.S. DOE 2009a). Peer reviews of conceptual models included the WIPP Revised Disturbed Rock Zone (DRZ) and Cuttings and Cavings Sub-Models Peer Review (see CRA-2009, Section 27.6.3), and the Culebra Hydrogeology Conceptual Model Peer Review summarized below. The Culebra Hydrogeology Conceptual Model Peer Review was not described in the CRA-2009 since the DOE completed the peer review after the CRA-2009 Performance Assessment to support the 2009 Performance Assessment Baseline Calculation. Peer reviews of waste characterization analyses included the Los Alamos National Laboratory (LANL) Sealed Sources Peer Review (see CRA-2009, Section 27.6.1) and the LANL Remote-Handled (RH) Transuranic (TRU) Waste Visual Examination Data Verification Peer Review (see CRA-2009, Section 27.6.2). Additionally, the DOE conducted an external expert review of its Planned Change Request to reduce the magnesium oxide (MgO) excess factor from 1.67 to 1.2 (see CRA-2009, Section 27.6.4).

The Culebra Hydrogeology Conceptual Model Peer Review was conducted in Albuquerque, NM, from August 11 to 14, 2008. The Culebra Dolomite Member of the Rustler Formation is the most significant potential groundwater transport pathway for radionuclides released from the WIPP repository. The Culebra Hydrogeology Conceptual Model describes the overall hydrologic framework of the Culebra Dolomite Member of the Rustler Formation at the WIPP site, and provides the basis for the development of transmissivity (T) fields used in calculations of radionuclide transport. The original conceptual model developed for the CCA was found to be inadequate in the CCA's conceptual model peer review because a strong correlation was not established between the conceptual model and the numerical model used in performance assessment. Sandia National Laboratories proposed the Revised Culebra Hydrology Conceptual Model (RCHCM), incorporating information obtained and developed after the CCA, correlating measured hydrologic properties at well locations to geologic conditions in order to assign values to untested locations. The scope of the peer review was limited to Culebra flow modeling, and the Peer Review Report (Burgess, Doe, and Lowenstein 2008 (Burgess 2008)), issued September 24, 2008, concluded that the RCHCM demonstrated that the conceptual understanding of the Culebra is adequate to support the development of T-fields. The CBFO Office of Quality Assurance, with support from the CBFO Technical Assistance Contractor (CTAC), conducted the surveillance of the peer review process and found that it was satisfactorily performed and documented (Appendix AUD-2014, Table AUD-15, Surveillance S-08-17).

27.7 EPA's Evaluation of Compliance for the 2009 Recertification

The CBFO MP 10.5 was revised several times between the CRA-2004 and the CRA-2009. The latest version during this period was MP 10.5, Rev. 7 (U.S. DOE 2007). The EPA's review verified that the DOE's process used to perform these peer reviews continued to meet NUREG-1297 requirements.

In 2007, the DOE proposed to replace conservative estimates used in the DRZ Conceptual Model and Cuttings and Cavings Conceptual Model with experimental data. Since proposed modifications would impact 2 of the 24 conceptual models included in the Performance Assessment Baseline Calculation, an independent technical peer review on the adequacy of the proposed changes to the approved conceptual models was required under section 194.27. In October 2007, prior to the completion of the peer review, the DOE decided to indefinitely postpone consideration of the proposed modifications. On December 11, 2007, the peer review panel submitted a report (Time Solutions Corporation 2007b) documenting its interim findings.

The EPA examined the RCHCM peer review plan and the final peer review and found them to adequately fulfill the requirements of section 194.27 and NUREG-1297. The EPA observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with the DOE and SNL, and the documents produced during and as a result of the peer review. The EPA determined the peer review process and the implementation of MP 10.5 met the requirements of section 194.27 and the guidance in NUREG-1297 (U.S. EPA 2010a).

The LANL Sealed Sources Peer Review was held October 27 to 31, 2003, at LANL. The purpose of the peer review was to determine whether actinide-containing sealed sources (those containing plutonium-238, plutonium-239, and americium-241) generated over the past 60 years

and recovered by the Off-Site Source Recovery Project could be adequately characterized for compliance with the WIPP Contact-Handled TRU Waste Acceptance Criteria using existing data from original production, transportation, or source control documents. The peer review panel published its report on December 5, 2003 (LANL 2003), concluding that these records, either uniquely or as a sum of several individual records, are adequate Acceptable Knowledge documentation for determining the radionuclide type, content, activity and either the date of manufacture or a more conservative date for decay correction.

Contrary to statements in the CRA-2009, Section 27.6.2 (U.S. DOE 2009a), the EPA was present to observe the actual performance of the peer review, and reviewed the documents produced during and as a result of the peer review. The EPA also conducted a waste characterization inspection of the LANL CCP in April 2005. The Waste Characterization Report, published by the EPA in June 2005 (U.S. EPA 2005), concluded that "[Acceptable Knowledge data] used to determine these values [radionuclide content for compliance with the WIPP waste acceptance criteria (WAC)] had undergone Peer Review in October 2003 in accordance with NUREG 1298." The EPA determined that the peer review process and the implementation of MP 10.5 met the requirements of section 194.27 and the guidance in NUREG-1297.

The LANL Remote-Handled TRU Waste Visual Examination Data Verification Peer Review was held from April 9 to 12, 2007, in Albuquerque, NM. The final report was published by Time Solutions Corporation on April 27, 2007 (Time Solutions Corporation 2007a). The panel was tasked with determining whether visual examination [VE] data recorded by LANL technicians from 1986 to 1992, prior to any WIPP-approved QA program, were technically robust enough to support decisions regarding the residual liquid content and physical form of wastes derived from the cleanup of hot cells located in Wing 9 of the Chemistry and Metallurgical Research Building. The panel determined that VE data may be used for the stated purposes.

The EPA examined the panel's report as part of its baseline inspection of the RH-TRU waste characterization program conducted at LANL May 8 to 10, 2007. The EPA's review found the results of the peer review process to be reasonable (U.S. EPA 2008, p. 44).

The RSI Expert Review of the DOE's use of MgO in the WIPP disposal rooms was conducted in 2005 at the request of the DOE. In its report (RSI 2006), the panel concluded that most of the MgO will be available for chemical reaction; only a small fraction of the cellulosic, plastic and rubber material is likely to be biodegraded to produce carbon dioxide (CO_2), and it is therefore likely that the EPA release standards would be met even if there is less MgO than the quantity required to consume all the CO_2 produced. The panel's findings were published in RSI 2006 (RSI 2006), and submitted to the EPA in 2006 in support of the DOE's Planned Change Request for reducing the MgO excess factor from 1.67 to 1.2. The EPA considered this review when evaluating the DOE Planned Change Request, and found it to reasonably fulfill the requirements of section 194.27(c)(2).

The EPA received one comment agreeing with its request for more information regarding revisions to the Culebra model, and suggesting that "Section 27 peer review is incomplete because it does not accurately reflect current information regarding the Disturbed Rock Zone

(DRZ) conceptual model EPA must have full information about deficiencies of the DRZ and cutting and caving sub-models, and how those limitations affect other aspects of the CRA." These models did not change since the CRA-2004, and the EPA has already approved them after considering their limitations and impacts (U.S. EPA 2010a, Section 27.4.1).

Based on a review and evaluation of the CRA-2009 and supplemental information provided by the DOE (Federal Document Management System Docket ID No. EPA-HQ-QAR-2009-0330, Air Docket A-98-49), the EPA determined that the DOE continued to comply with the requirements for section 194.27 (U.S. EPA 2010a, Section 27.4.2; U.S. EPA 2010b).

27.8 Changes or New Information Since the CRA-2009

The DOE performed one peer review since the CRA-2009, namely, the Savannah River Site (SRS) Historical Radiochemistry Data Peer Review. Two Battelle Columbus Laboratory Decommissioning Project (BCLDP) waste streams at SRS, SR-BCLDP-004.002 and SR-BCLDP-004.003, used radionuclide-specific scaling factors that had been developed based on radiometric and mass spectrometry analyses of samples collected from these waste streams. The CBFO Office of the National TRU Program chose the peer review process to qualify historical radiochemistry data analyzed by the Battelle Radioanalytical Laboratory, which was used to establish radiological properties for these two waste streams.

The SRS Historical Radiochemistry Data Peer Review was conducted in Albuquerque, NM, May 3 to 6, 2010. The peer review logistics, coordination, and project control support was performed by CTAC. The process and documents created during the peer review were subject to all of the protocols described in MP 10.5, Rev. 8 (U.S. DOE 2010). The CBFO Office of Quality Assurance, with support from CTAC, conducted the audit of the peer review process and found that it was satisfactorily performed and documented (Appendix AUD-2014, Table AUD-8; Audit A-10-22).

The two waste streams consist of RH composite filter debris waste that was packaged into 0.105-inch steel drum liners and placed into 55-gallon drums at the Battelle Memorial Institute, and then shipped to the SRS. The DOE directed that the peer review pertained only to the information used to establish radiological properties for waste streams SR-BCLDP-004.002 and SR-BCLDP-004.003, and that the peer review evaluated the applicable radiological analytical results related to the data quality objectives for radiological properties defined in DOE/WIPP-02-3214, Revision 1, *Remote-Handled TRU Waste Characterization Program Implementation Plan* (RHPIP) (U.S. DOE 2009b), specifically for TRU waste determination and activity determination.

The peer review also evaluated the radiological analytical results against the applicable quality assurance objectives for precision, accuracy, representativeness, completeness, and comparability identified in the RHPIP. After in-depth analysis and due consideration, the peer review panel concluded the following (Patera and Winkler 2010):

1. The documentation presented provides sufficient evidence that the data from the BCLDP radioanalysis were obtained under an industry-acceptable quality program.

2. The data from the radioanalysis are sufficient for use in addressing the data quality objectives and quality assurance objectives for the characterization of RH-TRU waste.

3. The data can be qualified under the requirements of the RHPIP.

The EPA also observed the actual performance of the peer review, evaluated the process for the selection of the review panel, observed the interaction of the review panel with the DOE, CTAC, and other attendees, and reviewed the documents produced during and as a result of the peer review. The EPA found that the peer review for waste streams SR-BCLDP-004.002 and SR-BCLDP-004.003 was acceptable (U.S. EPA 2010c). Based on this information, the DOE believes that continued compliance with the provisions of section 194.27 is demonstrated for the CRA-2014.

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(*Indicates a reference that has not been previously submitted.)

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