

**2009 Compliance Recertification Application (2009 CRA)
Compliance Application Review Document (CARD) No.27
Peer Review**

27.0 Background

Section 194.27 of the Waste Isolation Pilot Plant (WIPP) Compliance Criteria requires the U.S. Department of Energy (DOE) or Department) 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 are convened to determine whether technical work was performed appropriately and in keeping with the intended purpose. The required peer reviews must be performed in accordance with the Nuclear Regulatory Commission's NUREG-1297, "Peer Review for High-Level Nuclear Waste Repositories," which establishes guidelines for the conduct of a peer review exercise. Section 194.27 also requires DOE to document in the compliance application any additional peer reviews beyond those explicitly required.

27.1 Requirements

(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.

(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 of individuals, to review or comment on any information used to support compliance applications, and the responses from such groups or individuals."

27.2 1998 Certification Decision

EPA expected DOE to adequately document any WIPP peer reviews. For the Compliance Certification Application (CCA), DOE completed the required peer reviews and included a description of its peer review process in CCA Chapter 9 and CCA Appendix PEER

(DOE 1996a). The CCA contained documentation demonstrating that DOE's procedures and plans for the required peer reviews are compatible with NUREG-1297. Peer reviews conducted after promulgation of 40 CFR 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, U.S. Environmental Protection Agency (EPA or Agency) conducted an audit of DOE's quality assurance records for peer review. The audit consisted of an extensive review of DOE's records and interviews of DOE staff and contractors responsible for management of the required peer reviews.

EPA found DOE in compliance with the requirements of §194.27 because EPA's independent audit established that DOE had conducted and documented the required peer reviews in a manner compatible with NUREG-1297. The Agency also proposed that DOE adequately documented additional peer reviews in the CCA.

A complete description of EPA's 1998 Certification Decision for Section 194.27 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2).

27.3 Changes in the 2004 Compliance Recertification Application (CRA-2004 or CRA04)

DOE performed two conceptual model peer reviews between the CCA and the 2004 Compliance Recertification Application (CRA-2004 or CRA04). These include the Salado Flow Conceptual Model Peer Review - March 2003 (see CRA04 Chapter 9, Section 9.3.1.3.4) and the Spalling Model Peer Review - September 2003 (see CRA04 Chapter 9, Section 9.3.1.3.5).

Numerous external peer reviews were also done during this same period that fall under 194.27 (c)(2) requirements. Reviews were done by the National Academy of Sciences (NAS), the International Atomic Energy Authority (IAEA) / Nuclear Energy Authority (NAE/OECD), Institute for Regulatory Science (RSI), and the Environmental Evaluation Group (EEG) are list in CRA04 Appendix PEER-2004 Table of Contents, pages iv and v.

27.3.1 Evaluation of Compliance for 2004 Recertification

EPA reviewed each of the conceptual model peer reviews as they were performed and all documents related to each peer review. EPA's review verified that DOE's process used to perform these peer reviews was compatible with NUREG-1297 requirements.

During the original CCA DOE developed Carlsbad Area Office (CAO) Team Procedure (TP) 10.5 Peer Review (DOE 1996b) to guide all WIPP peer reviews and to show a process that was compatible with Section 194.27 and NUREG-1297 requirements. DOE updated this procedure for CRA04 calling the new version CBFO Management Procedure (MP) 10.5 (DOE 2002a). MP 10.5 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. EPA thoroughly reviewed MP 10.5, and determined that it was adequately comparable with 194.27 requirements and NUREG-1297 guidance. DOE implemented MP 10.5 to perform the Salado Flow Conceptual Model Peer Review and Spalling Model Peer Review. EPA completed its Salado Flow Conceptual Model

Peer Review in June 2003 (EPA 2003a) and Spallings Model Peer Review in December 2003 (EPA 2003b).

The Salado Flow Conceptual Model Peer Review was performed from April 2002 to March 2003, publishing its final report in March 2003 (DOE 2003c). This peer review evaluated changes to three of twenty four conceptual models: Disposal System Geometry, Repository Fluid Flow, and DRZ. The three conceptual models were changed because of new information gained after the original certification or changes to conceptual model assumptions mandated by EPA in the final CCA decision, such as the Option D panel closure condition. Changes included modification of the computational grid to accommodate the new panel closure requirement, shaft simplification, changes in fluid flow paths, changing for a constant porosity for the DRZ to a range of values for the halite and anhydrite layers (DOE 2003c). EPA examined the peer review plan (DOE 2003b) and the final peer review report (DOE 2003c) for the Salado Flow Conceptual Model Peer Review. EPA also observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA determined that the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (EPA 2003a).

The Spalling Model Peer Review was performed from July 2003 to October 2003, publishing its final report in October of 2003 (DOE 2003e). This model was changed because the original conceptual peer review found the CCA spall model to be inadequate and EPA expected DOE to develop a new Spallings Model before the first recertification in 2004. The new Spallings Model includes three major elements: consideration of multiphase flow processes in the intrusion borehole, consideration of fluidization and transport of waste particulates from the intact waste mass to the borehole, and a numerical solution for the coupled mechanical and hydrological response of the waste as a porous medium (DOE 2003e). DOE developed a new numerical code to implement the new Spallings Conceptual Model which was written to calculate the volume of WIPP solid waste that may undergo material failure and be transported to the surface as a result of a drilling intrusion. EPA examined the peer review plan (DOE 2003d) and the final peer review report (DOE 2003e) for this peer review and found them to adequately fulfill the requirements of Section 194.27 and NUREG-1297. EPA observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA determined the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (EPA 2003b).

EPA conducted desk-top evaluations of other reviews done since the CCA for compliance with 40 CFR 194.27(c)(2). These include those done by the NAS, IAEA, NEA/OECD, RSI, and EEG from October 1996 to September 2003. We found these reviews to be useful, reasonable, and helpful to the WIPP project. We found these reviews to reasonably fulfill the requirements of 40 CFR 194.27(c)(2).

EPA did not receive any public comments on DOE's continued compliance with the peer review requirements of Section 194.27.

27.3.2 2004 Recertification Decision

Based on a review and evaluation of the CRA-2004 and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-QAR-2004-0024, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.27.

27.4 Changes in the 2009 Recertification (CRA09 or CRA-2009)

During the interim between the 2004 CRA and the 2009 CRA, DOE initiated four, and completed three, peer reviews that impacted the areas specified by Section 194.27(a)(1-3). Peer reviews of conceptual models included the WIPP Revised DRZ and Cuttings and Cavings Submodels Peer Review, and the Culebra Hydrogeology Conceptual Model Peer Review. Peer reviews of waste characterization analyses included the LANL Sealed Sources Peer Review, and the LANL Remote-Handled TRU Waste Visual Examination Data Verification Peer Review. Additionally, DOE conducted an external expert review of its Planned Change Request to reduce the MgO excess factor from 1.67 to 1.2. This review did not rise to the level of the requirements found in 194.27(c)(1).

27.4.1 Evaluation of Compliance for 2009 Recertification

Carlsbad Field Office (CBFO) Management Procedure (MP) 10.5, *Peer Review* (U.S. Department of Energy 2002) has been revised several times since 2002, and the latest version (Rev. 7, 7/25/07) 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. EPA's review verified that DOE's process used to perform these peer reviews continues to meet NUREG-1297 requirements.

DOE revised DRZ and Cuttings and Cavings Submodels peer review was conducted in 2007 to review the adequacy of proposed changes to features, parameters and representation of the disturbed rock zone (DRZ) in the Disturbed Rock Zone Conceptual Model. Specifically, DOE proposed to replace conservative estimates used in the Disturbed Rock Zone (DRZ) Conceptual Model and Cuttings and Cavings Conceptual Model with experimental data. Since proposed modifications would impact two 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, DOE decided to indefinitely postpone consideration of the proposed modifications. On December 11, 2007, the peer review panel submitted a report (TSC 2007b) documenting its interim findings.

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 peer review, because a strong correlation was not established

between the conceptual model and the numerical model used in performance assessment. Sandia National Laboratory 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, 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.

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. EPA observed the actual performance of the peer review, the selection of the panel, the interaction of the panel with DOE and SNL, and the documents produced during and as a result of the peer review. EPA determined the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297 (see EPA report for details (EPA 2008b)).

The LANL Sealed Sources Peer Review was held from October 27, 2003 to October 31, 2003 at Los Alamos National Laboratories. The purpose of the peer review was to determine whether actinide-containing sealed sources (those containing plutonium-238 [²³⁸Pu], plutonium-239 [²³⁹Pu], and americium-241 [²⁴¹Am]) generated over the past 60 years and recovered by the Off-Site Source Recovery (OSR) Project could be adequately characterized for compliance with the WIPP Contact-Handled Transuranic (TRU) Waste Acceptance Criteria (WAC) using existing data from original production, transportation, or source control documents. These historical records included original manufacturing records; shipping data sheets; source control information, such as the Nuclear Materials Management and Safeguards System; and other corroborating sources of information, such as sealed source engraved markings. The peer review panel published its report on December 5, 2003 (Los Alamos National Laboratory 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, 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. EPA also conducted a waste characterization inspection of the LANL CCP in April 2005. The Waste Characterization Report, published by EPA in June 2005, concludes that “[AK 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.” (EPA 2005) EPA determined that the peer review process and the implementation of MP 10.5 met the requirements of 40 CFR 194.27 and the guidance in NUREG-1297.

The LANL Remote-Handled TRU Waste Visual Examination Data Verification Peer Review was held from April 9-12, 2007 in Albuquerque, NM. The final report was published by Time Solutions, Corp. on April 27, 2007 (TSC 2007a). The Panel was tasked with determining whether visual examination [VE] data recorded by LANL technicians from 1986-1992, 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 (CMR) Building. The panel determined that VE data may be used for the stated purposes.

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

The Institute for Regulatory Science (RSI) Expert Review of DOE's Use of MgO was conducted in 2005 at the request of DOE. RSI reviewed the DOE's use of magnesium oxide (MgO) in the WIPP disposal rooms. The RSI expert panel met for two days in July 2005 in Carlsbad, NM, where the DOE scientists presented the technical justification for reducing the MgO excess factor, and again for two days in September 2005 in Albuquerque, NM, where the DOE scientists responded to issues raised by the panel. The panel was asked to evaluate whether assumptions related to waste biodegradation, MgO reactivity, and actinide solubility were consistent with scientific and engineering principles, standards, and practices. In its report, the panel concluded that most of the MgO will be available for chemical reaction; only a small fraction of the CPR material is likely to be biodegraded to produce CO₂, 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 CO₂ produced.

The panel's findings were published in Institute for Regulatory Science (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. EPA considered this review when evaluating the DOE Planned Change Request, and found it to reasonably fulfill the requirements of 40 CFR 194.27(c)(2).

As noted above, EPA reviewed all activities performed since the 2004 recertification and found them to reasonably comply with 40 CFR 194.27 Peer Review requirements.

EPA received one comment agreeing with the Agency's 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 cuttings and cavings sub-models, and how those limitations affect other aspects of the CRA (cite)." These models did not change since the CRA-2004; EPA has already approved them after considering their limitations and impacts. EPA will remain involved in any revisions to conceptual models after recertification.

27.4.2 2009 Recertification Decision

Based on a review and evaluation of the CRA-2009 and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-QAR-2009-0330, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.27.