

## **Recertification CARD No. 44**

### **Engineered Barriers**

#### **BACKGROUND**

Assurance requirements were included in the disposal regulations to compensate in a qualitative manner for the inherent uncertainties in projecting the behavior of natural and engineered components of the repository for many thousands of years (50 FR 38072). Section 194.44 is one of the six assurance requirements in the Compliance Criteria. Section 194.44 implements the assurance requirement of 40 CFR 191, Section 191.14(d) to incorporate one or more engineered barriers at radioactive waste disposal facilities. The disposal regulations define a barrier as “any material or structure that prevents or substantially delays movement of water or radionuclides toward the accessible environment” (Section 191.12(d)). Section 194.44 requires the U.S. Department of Energy (DOE or Department) to conduct a study of available options for engineered barriers at the Waste Isolation Pilot Plant (WIPP) and submit this study and evidence of its use with the compliance application. Consistent with the containment requirement at Section 191.13, DOE must analyze the performance of the complete disposal system, and any engineered barrier(s) that DOE ultimately implements at the WIPP must be considered in this analysis and the U.S. Environmental Protection Agency’s (EPA or Agency) subsequent evaluation

#### **REQUIREMENTS**

(a) “Disposal systems shall incorporate engineered barrier(s) designed to prevent or substantially delay the movement of water or radionuclides toward the accessible environment.”

(b) “In selecting any engineered barrier(s) for the disposal system, DOE shall evaluate the benefit and detriment of engineered barrier alternatives, including but not limited to: cementation, shredding, supercompaction, incineration, vitrification, improved waste canisters, grout and bentonite backfill, melting of metals, alternative configurations of waste placements in the disposal system, and alternative disposal system dimensions. The results of this evaluation shall be included in any compliance application and shall be used to justify the selection and rejection of each engineered barrier evaluated.”

(c)(1) “In conducting the evaluation of engineered barrier alternatives, the following shall be considered, to the extent practicable:

(i) The ability of the engineered barrier to prevent or substantially delay the movement of water or waste toward the accessible environment;

(ii) The impact on worker exposure to radiation both during and after incorporation of engineered barriers;

- (iii) The increased ease or difficulty of removing the waste from the disposal system;
- (iv) The increased or reduced risk of transporting the waste to the disposal system;
- (v) The increased or reduced uncertainty in compliance assessment;
- (vi) Public comments requesting specific engineered barriers;
- (vii) The increased or reduced total system costs;
- (viii) The impact, if any, on other waste disposal programs from the incorporation of engineered barriers (e.g., the extent to which the incorporation of engineered barriers affects the volume of waste);
- (ix) The effects on mitigating the consequences of human intrusion.

(2) If, after consideration of one or more of the factors in paragraph (c)(1) of this section, DOE concludes that an engineered barrier considered within the scope of the evaluation should be rejected without evaluating the remaining factors in paragraph (c)(1) of this section, then any compliance application shall provide a justification for this rejection explaining why the evaluation of the remaining factors would not alter the conclusion.”

(d) “In considering the ability of engineered barriers to prevent or substantially delay the movement of water or radionuclides toward the accessible environment, the benefit and detriment of engineered barriers for existing waste already packaged, existing waste not yet packaged, existing waste in need of repackaging, and to-be-generated waste shall be considered separately and described.”

(e) “The evaluation described in paragraphs (b), (c) and (d) of this section shall consider engineered barriers alone and in combination.”

## **1998 CERTIFICATION DECISION**

EPA expected DOE’s Compliance Certification Application (CCA) to document its analysis of potential engineered barriers, including a comparison of the benefits and detriments of each.

In the CCA, DOE proposed multiple barriers to help guard against unexpectedly poor performance from one type of barrier. DOE’s multiple barrier approach included

shaft seals, the panel closure system, magnesium oxide (MgO) and borehole plugs.

EPA evaluated the information regarding engineered barriers that was provided by DOE in the CCA, CCA, Chapters 3 (pp. 3-14 to 3-45), 6 (pp. 6-105 to 6-114), and 7 (pp. 7-89 to 7-96), as well as in CCA Appendices BACK, EBS, SEAL, PCS, SOTERM.2.2, and WCA.4.1. The Agency also considered supplemental information provided in the report “Implementation of Chemical Controls Through a Backfill System for the Waste Isolation Pilot Plant (WIPP)” (Docket A-93-02, Item II-I-15) and in a letter to EPA dated February 26, 1997, (Docket A-93-02, Item II-I-10, Enclosure 2g).

DOE specified the proposed method of incorporating the engineered barrier (MgO backfill) into the disposal system in the CCA, CCA Chapter 3.3.3 and CCA Appendix BACK. DOE identified MgO as the backfill material of choice, and provided the rationale for choosing the physical form of MgO to be used, the approximate grain size of the MgO to be emplaced, and the type and size of packages to be used to transport and emplace the MgO. The CCA also described how the MgO mini sacks and super sacks would be arranged around waste containers in the disposal rooms and indicated that the MgO backfill could be emplaced in the same manner and with the same equipment as the waste containers.

EPA found that DOE conducted the requisite analysis of engineered barriers and selected an engineered barrier designed to prevent or substantially delay the movement of waste or radionuclides toward the accessible environment. In the 1998 Certification Decision, EPA specified that only MgO backfill met the regulatory definition of an engineered barrier. EPA determined that DOE provided sufficient documentation to show that MgO can effectively reduce actinide solubility in the disposal system.

A complete description of EPA’s 1998 Certification Decision for Section 194.44 can be obtained from Docket A-93-02, Items V-A-1 and V-B-2.

## **CHANGES IN THE CRA**

DOE did not report any significant changes to the information on which EPA based the 1998 Certification Decision. DOE did not conduct a new analysis to evaluate the benefit and detriment of engineered alternatives, as required by 194.44 (b) through (e). The 2004 Compliance Recertification Application (2004 CRA) reflects EPA’s determination that only MgO meets EPA’s requirements for an engineered barrier.

## **EVALUATION OF COMPLIANCE FOR RECERTIFICATION**

Based on EPA’s review of the activities and conditions in and around the WIPP site, EPA did not identify any significant changes in the implementation of the requirement for engineered barriers. The 2004 CRA did not reflect any changes to the analysis of engineered barrier options. The 2004 CRA accurately reflects the 1998 Certification Decision and its conclusion that MgO is the only engineered barrier that meets EPA’s requirements.

Since the 1998 Certification Decision DOE reported changes and requested EPA approval of changes to a few MgO activities. First, DOE requested EPA approval to eliminate the use of MgO mini-sacks to enhance worker safety. EPA approved this change in the MgO emplacement in January 2001. (Docket A-98-49, II-B3-15). EPA's approval noted that the elimination of the MgO mini-sacks is insignificant to long-term repository performance since a large excess of MgO will remain, and MgO liberated from super-sacks will be available to react chemically with CO<sub>2</sub>. At this time, EPA also noted that DOE must maintain a safety factor of at least 1.67 in the disposal facility.

Second, DOE notified EPA of a change in the vendor for MgO. DOE's evaluation indicated that the product from the new vendor meets the established criteria and has no impact on the required function of the engineered barrier.

Following EPA direction (Docket A-98-49, II-B2-72), in 2005, DOE improved tracking of the MgO emplacement. DOE is now able to calculate the MgO safety factor for each room of the repository. Through this new system, DOE is able to demonstrate that the 1.67 safety factor is being maintained in each room. (Docket a-98-49, II-B2-58)

EPA did not receive any public comments on DOE's continued compliance with the engineered barriers requirements of Section 194.44.

## **RECERTIFICATION DECISION**

Based on a review and evaluation of the 2004 CRA, Appendix AIC (1998), and supplemental information provided by DOE (FDMS Docket ID No. EPA-HQ-OAR-2004-0025, Air Docket A-98-49), EPA determines that DOE continues to comply with the requirements for Section 194.44.

## **REFERENCES**

DOE 2004. U.S. Department of Energy. DOE's emplacement plan letter to from Detwiler to Cotsworth, October 20, 2004, Docket A-98-49, Item II-B2-38.

DOE 2005. U.S. Department of Energy. Additional MgO emplacement and tracking information from Triay at DOE to Gitlin. March 8, 2005, Docket A-98-49, II-B2-58.

EPA 2001. U.S. Environmental Protection Agency. Approval of Elimination of Ministack. January 11, 2001, Docket A-98-49, II-B3-15.

EPA 2004. U.S. Environmental Protection Agency. AMWTP approval letter from Marcinowski to Detwiler, March 26, 2004, Docket A-98-49, Item II-B3-68.

EPA 2004a. U.S. Environmental Protection Agency. EPA completeness comment, G-4, related to MgO emplacement and tracking plan from Cotsworth to Detwiler, May 20, 2004, Docket A-98-49, II-B3-72.

EPA 2005. U.S. Environmental Protection Agency. Comments on DOE's MgO emplacement and tracking plan letter DOE 2004 from Gitlin to Triay. February 3, 2005, Docket A-98-49, Item II-B3-79.

EPA 2005a U.S. Environmental Protection Agency. Emplacement Inspection Report, June 2005, Docket A-98-49, II-B3-81.