

## **COMPLIANCE DETERMINATION STRATEGY**

### **RRT 8.3 PERFORMANCE CONFIRMATION FOR THE ENGINEERED BARRIER SYSTEM**

#### **APPLICABLE REGULATORY REQUIREMENTS:**

10 CFR 60.140  
10 CFR 60.142 (a)  
10 CFR 60.142 (b)  
10 CFR 60.142 (c)  
10 CFR 60.143

#### **TYPES OF REVIEW:**

Acceptance Review (Type 1)  
Safety Review (Type 3)

#### **RATIONALE FOR TYPES OF REVIEW:**

##### **Acceptance Review (Type 1) Rationale:**

This regulatory requirement topic is related to the license application because, as specified in the license application content requirements of 10 CFR 60.21(c) and the regulatory guide "Format and Content for the License Application for the High-Level Waste Repository (FCRG)," it must be addressed by the U.S. Department of Energy (DOE) in its license application. Therefore, the staff will conduct an Acceptance Review of the license application for this regulatory requirement topic.

##### **Safety Review (Type 3) Rationale:**

This regulatory requirement topic is related to containment and waste isolation, and therefore, it is associated with public radiological health and safety. It concerns the performance confirmation program for the repository engineered barrier system (EBS) and its components, including the waste packages. It is focused on DOE's plans and activities during the performance confirmation period which are intended to evaluate the assumptions made in the design of the EBS. Compliance with this requirement is necessary in order to make a safety determination for construction authorization, as defined in 10 CFR 60.31(a) (i.e., regulatory requirements in Subparts E, G, H, and I of 10 CFR Part 60). Therefore, the staff will conduct a Safety Review of the license application to determine compliance with this regulatory requirement topic.

## **REVIEW STRATEGY:**

### **Acceptance Review:**

In conducting the Acceptance Review of the performance confirmation program for the engineered barrier system (EBS), including the waste packages and their components, the reviewer should determine if the content of the license application is complete in technical breadth and depth with respect to the information requested in Section 8.3 of the regulatory guide "Format and Content for the License Application for the High-Level Waste Repository (FCRG)." The reviewer should determine whether the license application contains all appropriate information that is required to conduct a review of the performance confirmation program for the EBS. The program described in this plan is applicable to the following sections of the license application and to the engineered components of the EBS, which are described therein:

<b>License Application Section</b>	<b>Section Title</b>
5.2	Assessment of Compliance with the Design Criteria for the Waste Package and Its Components
5.3	Assessment of Compliance with the Design Criteria for the Post-Closure Features of the Underground Facility
5.4	Assessment of Compliance with the Engineered Barrier System Performance Objectives

The reviewer should determine that the information contained in the license application is presented in such a way that the reasoning, analyses, assumptions, and data lead to a clear demonstration of compliance with the requirements. The reviewer should not be required to conduct extensive independent analyses or literature searches. The reviewer should also determine whether controversial information and appropriate alternative interpretations and models have been acceptably described and considered.

Finally, the reviewer should determine whether the DOE either has resolved all the NRC staff objections that apply to this requirement or has provided all the available information requested in Section 1.6.2 of the FCRG regarding unresolved objections. The reviewer should evaluate the effects of any unresolved objections, both individually and in combinations with others, on (1) the reviewer's ability to conduct a meaningful and timely review, and (2) the Commission's ability to make a decision regarding construction authorization within the three-year statutory period.

### **Safety Review:**

The purpose of the performance confirmation program for the EBS is to substantiate with reasonable assurance that the engineered systems, including the waste packages and their components, such as containers, shielding, packing and other absorbent materials, which are designed or assumed to operate as barriers after permanent closure, are functioning as intended and anticipated. In

conducting the Safety Review the reviewer will, at a minimum, determine the adequacy of the plans presented in the license application to support DOE's demonstrations regarding the acceptability of its performance confirmation program for the EBS. The specific aspects of the license application on which the reviewer will focus are described below, and the Acceptance Criteria are identified in Section 3.0 of this review plan.

Specifically, the reviewer will review DOE's plans and make the following determinations to ensure that an adequate performance confirmation program is planned for the EBS:

- (1) the program begins as early as is practical during site characterization and continues until permanent closure;
- (2) the program includes adequate plans for surveillance, measurement, laboratory and field experiments, and any *in-situ* tests that may be required to provide, through analysis of the information to be obtained, reasonable assurance that design parameters are confirmed to be within the limits assumed in the licensing review. For example, does the program: (a) provide for determinations on whether the stability or some other characteristic or property of a material is adequate in relation to various other properties, characteristics and behaviors; and (b) provide for development of further evidence that the models used for predicting performance are valid under the anticipated repository conditions of interest?;
- (3) the program includes plans for using the confirmation period to more firmly establish that the actual EBS and its components are performing as assumed in the original design;
- (4) the program includes plans for evaluating that the differences between values of measured parameters and those assumed (in calculations made in the design) are within acceptable limits;
- (5) the program includes plans for detection, monitoring, and analysis of changes in any assumed baseline conditions of the environmental parameters that are important for meeting the performance objectives;
- (6) the program includes plans: (a) for reviewing design and construction methods; (b) for determining the need for modifications (in design or construction methods); and (c) for reporting any differences with respect to the baseline conditions of the environmental parameters, design, and construction methods, and recommended design changes, where appropriate, so as to assure that the repository will function as intended;
- (7) the program includes plans to modify and analyze effects of the changes that may result from Item (6), above, so as to assure that the geologic repository can still meet the pertinent 10 CFR Part 60 regulatory requirements.

The reviewer should determine whether DOE's performance confirmation program includes plans for *in-situ* monitoring of the condition of the waste packages. Waste packages chosen for the confirmation program shall be representative of those to be emplaced in the underground facility. At a minimum, this program should include plans for laboratory experiments that evaluate the internal conditions of the waste packages. To the extent practical, the environments experienced by the

emplaced waste packages within the underground facility during the waste monitoring program should be duplicated in the laboratory experiments. Subsurface conditions, particularly the environments representative of those in which the waste packages are to be emplaced, should be monitored and evaluated against design assumptions. At a minimum, the reviewer should determine if DOE's performance confirmation program includes: (1) plans for *in-situ* testing of the effects due to thermal interaction of the waste packages, backfill, rock, and groundwater, during the early or developmental stages of construction and during the confirmation period; and (2) plans for *in-situ* monitoring of the thermomechanical response of the underground facility until its permanent closure, so as to ensure that the performance of the engineering features is within design limits.

Consistent with safe operation at the geologic repository operations area (GROA), DOE's performance confirmation program should also include plans to construct a backfill test section and, using this section, DOE should be able to demonstrate, before permanent backfill placement is begun, the effectiveness of backfill placement and compaction procedures.

In evaluating DOE's plans for performance confirmation, the reviewer should determine if the program can be implemented so that:

- (1) it does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives;
- (2) it provides baseline information and analysis of that information on those parameters and natural processes pertaining to the geologic setting that: (a) may be changed by site characterization, construction, and operational activities; and (b) could have an adverse impact on the EBS and its components;
- (3) it monitors and analyzes changes that may depart from the baseline conditions of parameters that could affect the performance of a geologic repository; and
- (4) it provides an established plan for feedback and analysis of data, as well as implementation of appropriate actions, including plans to ensure that suitable and timely action is taken to inform the Commission of changes in the field conditions being monitored and the subsequent need for corrective actions.

In order to conduct an effective review, the reviewer will rely on staff expertise and independently acquired knowledge, information, and data such as the results of research activities being conducted by the U.S. Nuclear Regulatory Commission's (NRC) Office of Nuclear Regulatory Research, in addition to that provided by the DOE in its license application. The reviewer should consider the need for additional data that can improve knowledge of the EBS and its components, and that are important to waste isolation, and should perform, as necessary, additional analyses to confirm the resolution capabilities of the methodologies. It is incumbent upon the reviewer to have acquired a body of knowledge regarding these and other critical considerations in preparing to conduct the review.

As part of the Safety Review, the reviewer may be required to use additional information provided in other sections of the license application. The information in this section of the license application should be cross-referenced to information and analyses submitted in other sections of the license application as listed in Table 8.3-1.

Finally, it is possible that the performance confirmation program may identify deviations from the original design baseline. Procedures for evaluating the implications of any changes from the original baseline for design and/or performance will be treated in Section 8.5 ("Analysis of Changes from the Performance Confirmation baseline") of the license application.

**Contributing Analysts:**

NRC: Charles G. Interrante, Mike Lee

CNWRA: Gustavo A. Cragnolino

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**APPLICABLE REGULATORY REQUIREMENTS FOR EACH TYPE OF REVIEW:**

Type 1

10 CFR 60.140  
10 CFR 60.142 (a)  
10 CFR 60.142 (b)  
10 CFR 60.142 (c)  
10 CFR 60.143

Type 3

10 CFR 60.140  
10 CFR 60.142 (a)  
10 CFR 60.142 (b)  
10 CFR 60.142 (c)  
10 CFR 60.143

**REFERENCES:**

U.S. Nuclear Regulatory Commission, "Format and Content for the License Application for the High Level Waste Repository." Office of Nuclear Regulatory Research. [Refer to the "Products List" for the Division of High-Level Waste Management to identify the most current edition of the FCRG in effect.]

**TABLE 8.3-1.** Sections of the License Application That Might Provide Input to the "Performance Confirmation for the Engineered Barrier System" Section of the License Application

<i>License Application Section</i>	<i>Section Title</i>
<b>Performance Objectives</b>	
5.4	Assessment of Compliance with the Engineered Barrier System Performance Objectives
<b>Design Criteria</b>	
4.4	Assessment of Compliance with Design Criteria for the Underground Facility
5.1	Description of EBS and Components that Provide a Barrier Between the Waste and the Geologic Setting
5.2	Assessment of Compliance with the Design Criteria for the Waste Package and its Components
5.3	Assessment of Compliance with the Design Criteria for the Post-Closure Features of the Underground Facility
<b>Performance Confirmation Program</b>	
8.1	Performance Confirmation Program for the Natural Systems of the Geologic Setting
8.2	Performance Confirmation Program for Structures, Systems, and Components of the GROA