

## COMPLIANCE DETERMINATION STRATEGY

### RRT 8.1.1 PERFORMANCE CONFIRMATION FOR THE NATURAL SYSTEMS OF THE GEOLOGIC SETTING — GEOLOGIC SYSTEM

#### APPLICABLE REGULATORY REQUIREMENT(S):

10 CFR 60.21(c)(14)  
10 CFR 60.140(a-d)  
10 CFR 60.141(a-e)  
10 CFR 60.142(a)  
10 CFR 60.143(b)

#### 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 license application-related because, as specified in 10 CFR 60.31(a)(1)(i), it is information the Commission shall consider in determining if there is reasonable assurance that the types and amounts of radioactive materials described in the application can be received, possessed, and disposed of in a geologic repository operations area without unreasonable risk to public health and safety. As presented in the license application content requirements of 10 CFR 60.140 and 60.141 and Section 8.1.4 of 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 radiological safety, retrievability, containment, or waste isolation. It concerns the performance confirmation program for the geologic system and focuses on plans and activities of DOE which are intended to support the assumptions made during the period of performance assessment. It is a requirement for which compliance is necessary 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). 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 for the performance confirmation of the geologic system of the site, the reviewer should determine if the content of the license application is complete in technical breadth and depth with respect to the information requested by Section 8.1.1 of the FCRG. The reviewer should determine whether the license application contains all appropriate information the staff needs to review the performance confirmation program for the geologic systems. The information must be sufficient to support assessments required by the regulatory requirements. Those sections of the license application which will be subject to the program described in this plan are listed in Table 8.1.1-1.

The information presented in the license application should be presented in such a way that the assumptions, data, and logic lead to a clear demonstration of compliance with the requirements. The reviewer should not be required to conduct extensive analyses or literature searches. The reviewer should also determine whether an appropriate range of alternative interpretations and models has been described.

Finally, the reviewer should determine if the U.S. Department of Energy (DOE) has either resolved all the NRC staff objections that apply to this requirement or provided all the 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 combination with others, on: (1) the ability of the reviewer to conduct a meaningful and timely review; and (2) the ability of the Commission to make a decision regarding construction authorization within the three-year statutory period.

### **Safety Review:**

The purpose of the performance confirmation program is to ensure that the natural and engineered systems and components required for repository operation, or 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. 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: (1) review DOE's plans to determine how it will assure that the performance confirmation program begins during site characterization and continues until permanent closure; (2) determine if the program includes plans for surveillance, measurement, laboratory testing, geologic mapping, and *in-situ* experiments, as appropriate, to ensure, where practicable, that geotechnical and design parameters are confirmed and are within the limits assumed in the licensing review; (3) determine if the program includes plans for comparing these measurements and observations with the original design bases and assumptions and if significant differences exist between the measurements and observations and the original design bases and assumptions, that the program has plans for reviewing these differences and determining the need to make modifications to the design and(or) in construction method; (4) for those baselines modified, determine if the program includes plans to monitor and analyze changes in the baseline conditions to assure that the geologic repository can still meet the 10 CFR Part 60 performance objectives; and (5) determine if the program has plans for reporting any differences in the baseline and any recommended design changes to ensure that the repository will function as intended and anticipated.

Subsurface conditions, including an environment representative of that in which the waste packages are to be emplaced, shall be monitored and evaluated against design assumptions. At a minimum, the reviewer should determine if the program includes plans for measurements related to: (1) rock deformation and displacement; (2) changes in rock stress and strain; (3) rock pore water pressures including those along faults and joints; (4) thermal and thermomechanical response of the rock mass caused by development and operations of the geologic repository; (5) *in-situ* testing of the thermal interaction effects of the waste packages, backfill, rock, and groundwater during the early or developmental stages of construction; and (6) *in-situ* monitoring of the thermomechanical response of the underground facility until permanent closure to ensure that the performance of the natural and engineering features is within design limits.

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 any of the 10 CFR Part 60 performance objectives; (2) it provides sufficient baseline information and an analysis of that information on those parameters and natural processes pertaining to the geologic setting that may be changed by site characterization, construction, and operational activities; (3) it monitors and analyzes changes from the baseline condition of parameters that could affect the performance of a geologic repository; and (4) it provides an established plan for feedback and analysis of data, and implementation of appropriate action including plans to ensure that appropriate and timely action is taken to inform the Commission of changes in the field conditions being monitored and the subsequent need for changes in design, construction method, or a 10 CFR Part 60 performance objective.

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 NRC's Office of Nuclear Regulatory Research, in addition to information provided by the DOE in its license application. The reviewer should focus on additional data which can refine knowledge of the performance confirmation of the climatological and meteorological systems, and should perform, as necessary, additional analyses to confirm the resolution capabilities of the methodologies. In preparing to conduct the review, it is incumbent upon the reviewer to acquire a body of knowledge regarding these and other critical considerations.

Finally, it is possible that conclusions drawn from the performance confirmation program may identify deviations from the original design baseline. Analysis of 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 and its attendant review plan.

**Contributing Analysts:**

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

Type 1

10 CFR 60.21(c)(14)  
10 CFR 60.140(a-d)  
10 CFR 60.141(a-e)  
10 CFR 60.142(a)  
10 CFR 60.143(b)

Type 3

10 CFR 60.140(a-d)  
10 CFR 60.141(a-e)  
10 CFR 60.142(a)  
10 CFR 60.143(b)

**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 8.1.1-1 Sections of the License Application Which Require Input from the "Performance Confirmation for the Natural Systems of the Geologic Setting: Geologic System" Section of the License Application.**

<i>License Application Section</i>	<i>Section Title</i>
<b>Geologic System-Favorable Conditions</b>	
3.2.1.1	Nature and Rates of Physical Processes
3.2.1.2	Minimum Waste Emplacement Depth
3.2.2.1	Nature and Rates of Hydrogeologic Processes
3.2.3.1	Nature and Rates of Geochemical Processes
<b>Potentially Adverse Conditions</b>	
3.2.1.4	Evidence of Dissolution
3.2.1.5	Structural Deformation
3.2.1.6	Historic Earthquakes
3.2.1.7	Correlation of Earthquakes with Tectonic Processes
3.2.1.8	Increasing Earthquake Frequency/Magnitude
3.2.1.9	Evidence of Igneous Activity
3.2.1.10	Evidence of Extreme Erosion
3.2.1.11	Presence of Naturally Occurring Materials
3.2.1.12	Evidence of Subsurface Mining
3.2.1.13	Evidence of Drilling
3.2.1.14	Geomechanical Properties
3.2.2.6	Human Activity and Groundwater
3.2.2.7	Natural Phenomena and Groundwater
3.2.2.8	Structural Deformation and Groundwater
3.2.2.9	Changes to Hydrologic Conditions
3.2.2.10	Complex Engineering Measures
8.5	Analysis of Changes from Performance Confirmation Baseline
<b>Performance Objectives</b>	
3.3	Assessment of Compliance with the Groundwater Travel Time Performance Objective
4.5	Assessment of Integrated GROA Compliance with the Performance Objectives
4.5.1	Protection against Radiation Exposures and Releases of Radioactive Material to Unrestricted Areas
4.5.2	Retrievability of Waste
5.4	Assessment of Compliance with the Engineered Barrier System Performance Objectives
6.1	Assessment of Compliance with the Requirement for Cumulative Releases of Radioactive Materials

**TABLE 8.1.1-1 Sections of the License Application Which Require Input from the "Performance Confirmation for the Natural Systems of the Geologic Setting: Geologic System" Section of the License Application. (Continued)**

<i>License Application Section</i>	<i>Section Title</i>
6.2	Assessment of Compliance with the Individual Protection Requirements
6.3	Assessment of Compliance with the Groundwater Protection Requirements
8.4	Radiation Protection during Performance Confirmation
<b>Design Criteria</b>	
4.1	Description of the GROA Structures, Systems, and Components
4.1.1	Surface Facilities
4.1.2	Shafts and Ramps
4.1.3	Underground Facility
4.1.4	Radiation Protection Systems
4.2	Assessment of Compliance with Design Criteria for Surface Facilities
4.3	Assessment of Compliance with Design Criteria for Shafts
4.4	Assessment of Compliance with Design Criteria for the Underground Facility
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 Engineered Barrier System
5.5	Radiation Protection of the Engineered Barrier System