

**COMPLIANCE DETERMINATION STRATEGY  
RRT 4.2 ASSESSMENT OF COMPLIANCE WITH DESIGN CRITERIA  
FOR SURFACE FACILITIES**

**APPLICABLE REGULATORY REQUIREMENTS:**

10 CFR 60.21(c)(1)(ii)(E)  
10 CFR 60.21(c)(2)  
10 CFR 60.21(c)(3)  
10 CFR 60.21(c)(6)  
10 CFR 60.21(c)(7)  
10 CFR 60.21(c)(9)  
10 CFR 60.21(c)(11)  
10 CFR 60.21(c)(12)  
10 CFR 60.21(c)(14)  
10 CFR 60.111  
10 CFR 60.130  
10 CFR 60.131(a)  
10 CFR 60.131(b)(1)  
10 CFR 60.131(b)(2)  
10 CFR 60.131(b)(3)  
10 CFR 60.131(b)(4)  
10 CFR 60.131(b)(5)  
10 CFR 60.131(b)(6)  
10 CFR 60.131(b)(7)  
10 CFR 60.131(b)(8)  
10 CFR 60.131(b)(9)  
10 CFR 60.132  
10 CFR 60.137

**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 the license application content requirements of 10 CFR 60.21(c) and the Section 4.2 of 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 considered to be related to radiological safety and any waste retrieval operations that may be necessary. 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 the applicable regulatory requirements.

There are a number of review plan topics that are closely-related for which geologic repository operations area (GROA)-related design reviews will take place. They concern both engineering design and performance. This particular regulatory requirement topic focuses on the review of compliance with the pre-closure design criteria for surface facilities of the GROA set forth, as applicable, in 10 CFR 60.130, 60.131, and 60.132.

In conducting the Safety Review, the descriptions provided in Section 4.1.1 ("Description of the GROA Structures, Systems, and Components: Surface Facilities") of the license application, will support the reviews described below. However, it should be noted that the adequacy of GROA design will eventually be evaluated in the context of compliance with the pertinent performance objectives, and this review strategy should be understood in that context.

The staff concludes that there is a low risk of noncompliance with the design criteria for GROA surface facilities set forth in 10 CFR Part 60. This conclusion is based on the knowledge that past licensees have designed comparable types of nuclear facilities to meet NRC's regulations. Therefore, the type of review for this regulatory requirement topic will be a "Type 3" Safety Review.

### **REVIEW STRATEGY:**

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

In conducting the Acceptance Review of the assessment of the U.S. Department of Energy's (DOE's) geologic repository operations area (GROA) surface facilities design, the reviewer should determine if the information present in the license application and its references for demonstrating compliance with the applicable regulatory requirements is complete in technical breadth and depth as identified in Section 4.2 of regulatory guide "Format and Content for the License Application for the High-Level Waste Repository (FCRG)."

The descriptions provided in Section 4.1.1 ("Description of the GROA Structures, Systems, and Components: Surface Facilities") of the license application will support the Safety Review of the information contained in Section 4.2 of the license application. Thus, the review of the information contained in Section 4.1.1 will be performed in parallel with the review of the information contained in Section 4.2. Therefore, during the Acceptance Review of Section 4.2, the reviewer should verify from the reviewer of Section 4.1.1 that all appropriate descriptive information of the GROA surface facility design has been provided in Section 4.1.1, and that the information is both internally consistent, and consistent from section-to-section.

The reviewer should determine that all appropriate information necessary for the staff to review the demonstration of compliance with the applicable regulatory requirements is presented such that the assessments required by the regulatory requirements associated with pre-closure performance objectives

or other GROA design and technical criteria can be performed. The reviewer should determine that the information in the license application is presented in such a manner that the assumptions, data, and logic leading to a demonstration of compliance with the applicable regulatory requirements are clear and do not require the reviewer to conduct extensive analyses or literature searches. The reviewer should also determine that controversial information and appropriate alternative interpretations and models have been acceptably described and considered.

Finally, the reviewer should determine if 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, for unresolved objections. The reviewer should evaluate the effects of any unresolved objections, both individually and in combination 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 (Type 3):**

This regulatory requirement topic is limited to assessment of compliance of the GROA surface facilities design with the pertinent 10 CFR Part 60 pre-closure design criteria and performance objectives. The assessment of the GROA surface facilities design to permit the waste retrieval option will be evaluated in Section 4.5.2 ("Assessment of Integrated GROA Compliance with the Performance Objectives: Retrievability of Waste") of the license application.

The reviewer's objectives during the Safety Review of this regulatory requirement topic are to:

- conduct a preliminary review of the data base, used for demonstrating compliance with the applicable regulatory requirements, to determine data completeness;
- determine whether the data and/or analyses submitted are appropriate, and if portions of them will need further detailed review (in addition to those areas requiring detailed Safety Reviews which may arise in the future);
- understand and evaluate DOE's compliance demonstration logic; and
- determine whether any use of expert opinion (in lieu of experiments or analyses) is appropriate.

In conducting the Safety Review, the reviewer should determine if the information presented in the license application and its references is an acceptable demonstration of compliance with all applicable regulatory requirements. At a minimum, the reviewer should determine the adequacy of the data and analyses that are presented in the license application as DOE's supporting information concerning its demonstration that its design for the GROA surface facilities meets those design criteria and performance objectives specified in 10 CFR Part 60, that are applicable to the pre-closure period. The review should include consideration of the design that has been presented, and evaluation of the contribution of design to meeting the performance objectives.

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. The reviewer should determine if DOE has demonstrated that its design for GROA surface facilities meets the design criteria used to

support the pre-closure performance objective concerning radiation exposure to workers specified in 10 CFR 60.111(a), the general design criteria for GROA specified in 10 CFR 60.130 and 60.131, as applicable, and those additional design criteria specified in 10 CFR 60.132 that are applicable for the GROA during the pre-closure period. The reviewer should determine whether GROA surface facilities design will permit the implementation of a performance confirmation program defined in 10 CFR 60.137.

Pertinent design criteria chosen by DOE should also be reviewed for adequacy. The reviewer should determine whether or not DOE has demonstrated that the design bases for the pre-closure features of the GROA surface facilities appropriately take into account the results of DOE's site characterization activities.

In presenting the GROA surface facilities design, the reviewer should determine if DOE has described, at a minimum, the following systems:

- (1) hot cells;
- (2) on-site radioactive waste management systems;
- (3) ventilation systems;
- (4) fire suppression and explosion protection systems;
- (5) utility systems;
- (6) emergency systems;
- (7) communication systems;
- (8) operational support systems;
- (9) decommissioning systems;
- (10) instrumentation and control systems; and
- (11) on-site transportation systems.

In conducting the Safety Review, the staff will evaluate the adequacy of the following information related to the systems listed above, as appropriate:

- (1) a description and discussion of the GROA surface facilities' systems design including: (i) the principal design criteria and their relationship to any general performance objectives promulgated by the Commission; (ii) the design bases and the relation of the design bases to the principal design criteria; (iii) information relative to materials of construction (including geologic media, general arrangement, and approximate dimensions); and (iv) codes and standards that DOE proposes to apply to the design and construction of GROA surface facilities;
- (2) a description and analysis of the design and performance requirements for surface facilities of the GROA to identify which structures, systems, and components are important to safety (SSCIS). This analysis should consider: (i) the margins of safety under normal conditions and under conditions that may result from anticipated operational occurrences, including those of natural origin; and (ii) the adequacy of SSCIS provided for the prevention of accidents and mitigation of the consequences of accidents, including those caused by natural phenomena;
- (3) an identification and justification for the selection of those variables, conditions, or other items which are determined to be probable subjects of license specifications. Special attention should be given to those items that may significantly influence the final design; and

- (4) an identification of those structures, systems, and components (SSC) of the GROA surface facilities which may require research and development to confirm the adequacy of design. For SSCIS and for the engineered and natural barriers important to waste isolation, DOE should provide a detailed description of the programs designed to resolve safety questions, including a schedule indicating when these questions would be resolved.

In reviewing Items (1)-(4), above, the staff will determine that DOE has provided:

- (1) an adequate analysis of the design and performance of SCC, to identify those that are important to safety. For the purposes of this analysis, it should be assumed that operations at the GROA will be carried out at the maximum capacity and rate of receipt of radioactive waste stated in the license application; and
- (2) an adequate explanation of measures used to support the models used to perform the assessments required in Item (1), above. Analyses and models that will be used to predict future conditions should be supported by using an appropriate combination of such methods as field tests, *in situ* tests, laboratory tests which are representative of field conditions and monitoring data.

For the information described in Item (2), the following should be reviewed for completeness and acceptability:

- (a) discussions of data representativeness, including uncertainties associated with extrapolation of data;
- (b) variability and uncertainty of data and resultant propagation of errors in models or analyses for which such data was used;
- (c) identification of, and justification for, assumptions used in analyses and models;
- (d) documentation and validation of models and analyses;
- (e) input and output data and interpretations of the data with the basis for interpretation; and
- (f) the role of expert judgment, if used, in models and analyses.

Analyses and models used by the DOE to predict pre-closure behavior of the GROA surface facilities should be reviewed for completeness and acceptability. The items to be reviewed should include:

- (1) identification and evaluation of design parameters used to meet design criteria;
- (2) description of uncertainties in parameters and of how these uncertainties are reflected in models;
- (3) descriptions of analyses and models used to in the design of the surface facilities; and
- (4) description of uncertainties in analytical models and how such uncertainties affect predicted results.

The GROA design also needs to demonstrate that all SSC are properly integrated. Accordingly, when reviewing the GROA surface facilities design, the reviewer will rely on the information contained in Section 4.1.5 ("Description of the GROA Structures, Systems, and Components: Interfaces Between Structures, Systems, and Components") of the license application to ensure that the necessary design and operating interfaces are addressed.

Finally, the reviewer should assess the adequacy of the GROA surface facilities design for the control of radiation exposures and radiation levels, and releases of radioactive material to workers. The reviewer will determine if a reasonable effort has been made to maintain radiation exposures and radiation levels, and releases of radioactive material, in effluent, "as low as is reasonably achievable" (ALARA) as required by 10 CFR Part 20 (*Code of Federal Regulations*, Title 10, "Energy"). Those design enhancements that are necessary for the implementation of ALARA need to be identified as part of the GROA surface facilities design.

DOE's demonstration of compliance with the applicable regulatory requirements concerning radiation protection for workers is expected to consist of the following: (1) identification of conditions and events, associated with normal operations and those events that can be reasonably expected to occur prior to permanent closure (such as those events referred to in American Nuclear Society Standard, ANSI/ANS-57.9-1984, as Design Events I, II, and III), that could lead to the intake of radioactive materials by, or radiation exposures to workers; (2) estimation of the probabilities (numerical or qualitative) that these conditions and events may occur, and determination of the regulatory limits for the estimated conditions and events; (3) analyses of the source terms (quantities, concentrations, and specifications of potential releases and direct radiation exposures and levels) that are expected to occur for applicable conditions and events; (4) identification and analyses of receptors (locations and work characteristics of individuals potentially exposed); (5) use of models to determine potential radiological impacts within the restricted area; and (6) planning and design considerations used to meet the criteria of 10 CFR Part 20.

The NRC staff's evaluation of compliance will also consist of six steps, paralleling the steps in DOE's demonstration of compliance. The specific aspects of the license application on which a reviewer will focus are discussed below, and the Acceptance Criteria are identified in Section 3.0 of this Review Plan. The scope of this review plan includes:

- (1) identification of conditions and events, associated with normal repository operations and those conditions and events that can be reasonably expected to occur prior to permanent closure, that could lead to the intake of radioactive materials by, or radiation exposures to workers during the pre-closure period. DOE is expected to use event tree analyses, fault tree analyses, and similar methods to identify repository conditions potentially leading to radiological impacts on workers. The NRC staff will review DOE's submittal, but will not independently develop its own identification of repository conditions;
- (2) estimation of the probabilities (numerical or qualitative) that these conditions and events may occur, and determination of the regulatory limits for the estimated conditions and events. The NRC staff will review DOE's submittal, but will not independently develop its own probability estimates. The NRC staff will independently confirm that the proper regulatory limits have been applied to the potential radiological impacts of the applicable repository conditions and events;

- (3) analyses of the source terms (quantities, concentrations, and specifications of potential releases and direct radiation exposure levels) that are expected to occur for applicable conditions and events. DOE's analyses of the source terms are expected to include the quantities and rates of discharges of radioactive materials to, and radiation fields for workers associated with the pre-closure period, as a result of those conditions and events that can be reasonably expected to occur prior to permanent closure. Analyses of the source terms are also expected to include any items intended to control or monitor radiological exposure as a result of those conditions and events that can be reasonably expected to occur prior to permanent closure that affect the concentration and exposure limits specified in 10 CFR Part 20. The NRC staff expects DOE's source term analyses to include estimates of the quantities of radionuclide releases and the field strengths associated with pre-closure repository activities. The NRC staff will review DOE's analyses of source terms, but will not independently develop its own estimates;
- (4) identification and analyses of receptors (locations and work characteristics of individuals who are potentially exposed) for each potential release and radiation exposure. DOE's identification and analyses of receptors is expected to be based on projections of facility design, planned schedules, work conditions within the repository and on DOE's plans for reducing potential exposures to ALARA for the conditions and events that can be reasonably expected to occur prior to permanent closure. Thus, different receptor analyses may be developed for various conditions and events that can be reasonably expected to occur at the repository. The NRC staff will review DOE's identification and analyses of receptors, but will not independently develop its own analyses;
- (5) use of models to determine potential radiological impacts on workers. The NRC staff expects DOE's estimates of impacts to include: (a) anticipated concentrations of each radionuclide during the pre-closure period and the contribution of each to the radiation dose; (b) calculations and explanations of the measures used to support the shielding and airborne concentration models used to determine exposures; (c) annual whole body individual and collective doses determined to be attributed to the pre-closure period; and (d) details specified in Section 8.4 of the FCRG, and the requirements specified in 10 CFR 60.131(a). The NRC staff will review DOE's use of models to determine potential radiological impacts, but will not independently develop its own determinations; and
- (6) planning and design considerations used to meet the criteria of 10 CFR Part 20 for workers. The NRC staff expects DOE's planning and design considerations to include: (a) design criteria and plans for pre-closure activities, e.g., source terms, expected conditions and events, expected functions and handling scenarios; (b) planning and design objectives for the pre-closure period, e.g. limits of radiation exposure, shielding objectives, containment integrity, maintaining exposures ALARA; and (c) planning and design bases for the pre-closure period, e.g., codes or standards used for design, shielding codes used, calculational methods applied, and safety procedures. The NRC staff will review DOE's plans and design considerations, but will not independently develop its own planning and design parameters.

In order to conduct an effective Safety 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 NRC's Office of Nuclear Regulatory Research, in addition to that provided by the DOE in its license

application. At the reviewer's discretion, independent analyses of results of DOE's models or analyses may be performed using data, descriptions, and models available to the NRC staff. Alternatively, when deemed appropriate, confirmatory calculations may be performed using appropriate procedures. Moreover, the reviewer should focus on additional data or information which can refine knowledge of the facilities design and operations related to compliance with the design criteria. The reviewer should perform, as necessary, any reviews needed to confirm the adequacy of the methodologies proposed to assure compliance with the design criteria and performance objectives for GROA facilities. Also, the reviewer should have available specific documents (design drawings, reports, planning documents, and procedures) bearing on this topic, that were commissioned by NRC, DOE, and others. These documents should be available to the reviewers in anticipation of the license application submittal and review. It is incumbent upon the reviewer to have acquired a body of knowledge regarding these and other critical considerations in anticipation of conducting the review to ensure that information on the assessment of compliance with the design criteria for GROA facilities in the license application is sufficient in scope and depth to provide needed information to resolve these concerns.

The reviewer should also use any additional data and knowledge that can refine the assessment of compliance with the design criteria for the pre-closure features of the surface facilities, and should perform, as necessary, additional analyses to confirm the resolution capabilities of the methodologies. As part of the Safety Review, the reviewer may choose to refer to additional information and analyses contained in other sections of the license application. The information in this section of the license application may be cross-referenced to information and analyses in the license application sections listed in Table 4.2-1.

**RATIONALE FOR REVIEW STRATEGY:**

Not applicable.

**Contributing Analysts:**

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**Date of Analyses:** July 8, 1993

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

Type 1:

10 CFR 60.21(c)(1)(ii)(E)  
10 CFR 60.21(c)(2)  
10 CFR 60.21(c)(3)  
10 CFR 60.21(c)(6)  
10 CFR 60.21(c)(7)  
10 CFR 60.21(c)(9)  
10 CFR 60.21(c)(11)  
10 CFR 60.21(c)(12)  
10 CFR 60.21(c)(14)  
10 CFR 60.111  
10 CFR 60.130  
10 CFR 60.131(a)  
10 CFR 60.131(b)(1)  
10 CFR 60.131(b)(2)  
10 CFR 60.131(b)(3)  
10 CFR 60.131(b)(4)  
10 CFR 60.131(b)(5)  
10 CFR 60.131(b)(6)  
10 CFR 60.131(b)(7)  
10 CFR 60.131(b)(8)  
10 CFR 60.131(b)(9)  
10 CFR 60.132  
10 CFR 60.137

Type 3:

10 CFR 60.111  
10 CFR 60.130  
10 CFR 60.131(a)  
10 CFR 60.131(b)(1)  
10 CFR 60.131(b)(2)  
10 CFR 60.131(b)(3)  
10 CFR 60.131(b)(4)  
10 CFR 60.131(b)(5)  
10 CFR 60.131(b)(6)  
10 CFR 60.131(b)(7)  
10 CFR 60.131(b)(8)  
10 CFR 60.131(b)(9)  
10 CFR 60.132  
10 CFR 60.137

**REFERENCES:**

American Nuclear Society, "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type)," American National Standards Institute, La Grange Park, Illinois, ANSI/ANS-57.9-1984, 1984.

*Code of Federal Regulations*, "Standards for Protection Against Radiation," Part 20, Chapter I, Title 10, "Energy."

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 in effect.]

TABLE 4.2-1.

Sections of the License Application that may support the Review of "Assessment of Compliance with the Design Criteria for the Pre-Closure Features of the Surface Facilities" Section of the License Application.

<b>License Application Section</b>	<b>Section Title</b>
1.1	General Description of the Facility
4.1	Description of the GROA Structures, Systems, and Components: 4.1.1 Surface Facilities 4.1.2 Shafts and Ramps 4.1.5 Interfaces between Structures, Systems, and Components
4.3	Assessment Compliance with Design Criteria for Shafts and Ramps
4.4	Assessment of Compliance with Design Criteria for the Underground Facility
4.5.1	Assessment of Integrated GROA Compliance with the Performance Objectives: Protection against Radiation Exposures and Releases of Radioactive Material to Unrestricted Areas;
4.5.2	Assessment of Integrated GROA Compliance with the Performance Objectives: Retrievalability of Waste
8.2	Performance Confirmation Program for the Structures, Systems, and Components of the Geologic Repository Operation Area