

# **Safety Evaluation Report Related to Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada**

Volume 5:  
Proposed Conditions on the  
Construction Authorization  
and Probable Subjects of  
License Specifications

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**NOTE TO READER:** In June 2008, the U.S. Department of Energy (DOE) submitted a license application seeking authorization to construct a geologic repository at Yucca Mountain. After docketing the DOE license application, the U.S. Nuclear Regulatory Commission (NRC) staff began documenting its review in a Safety Evaluation Report (SER). In March 2010, DOE filed a motion to withdraw its application before the Atomic Safety and Licensing Board, which denied DOE's motion in June 2010. During this time period, Congress reduced funding for the NRC's review of the application, with no funds appropriated for Fiscal Year 2012. On September 30, 2010, DOE's Office of Civilian Radioactive Waste Management ceased operations and assigned the remaining Yucca Mountain-related responsibilities, such as site closure, to other offices within DOE. In October 2010, the NRC staff began orderly closure of its Yucca Mountain activities. In September 2011, the Commission announced it was evenly divided on whether to overturn or uphold the Atomic Safety and Licensing Board's decision denying DOE's motion to withdraw its application. The Commission directed the Board, in recognition of budgetary limitations, to complete all necessary and appropriate case management activities, and the Atomic Safety and Licensing Board suspended the proceeding on September 30, 2011.

In August 2013, the U.S. Court of Appeals for the District of Columbia Circuit issued a decision granting a writ of mandamus and directed NRC to resume the licensing process for DOE's license application. In November 2013, the Commission directed the NRC staff to complete and issue the SER associated with the license application. Because of the lapse in time and changes within DOE between license application submittal and the issuance of this SER volume, some information in the application does not reflect current circumstances.

The SER details the NRC staff's review of DOE's license application and supporting information consistent with NRC regulations and the Yucca Mountain Review Plan (YMRP) (NRC, 2003aa), as supplemented by the Division of High-Level Waste Repository Safety Director's Policy and Procedure Letter 14: Application of YMRP for Review Under Revised Part 63 (NRC, 2009ab).

This volume is one of five volumes that comprise the SER. Each volume was published separately as it was completed. The SER volume number and section number within a volume are based on the YMRP. Use of SER section numbers that correspond to the YMRP section numbers facilitated the NRC staff's writing of the SER and allows the reader to easily find the applicable review methods and acceptance criteria within the YMRP. The following table provides the topics and SER sections for each volume.

<b>Chapter</b>	<b>SER Section</b>	<b>Title</b>
<b>Volume 1 General Information</b>		
1	1.1	General Description
2	1.2	Proposed Schedules for Construction, Receipt, and Emplacement of Waste
3	1.3	Physical Protection Plan
4	1.4	Material Control and Accounting Program
5	1.5	Description of Site Characterization Work
<b>Volume 2 Repository Safety Before Permanent Closure</b>		
1	2.1.1.1	Site Description as it Pertains to Preclosure Safety Analysis
2	2.1.1.2	Description of Structures, Systems, Components, Equipment, and Operational Process Activities
3	2.1.1.3	Identification of Hazards and Initiating Events
4	2.1.1.4	Identification of Event Sequences
5	2.1.1.5	Consequence Analyses
6	2.1.1.6	Identification of Structures, Systems, and Components Important to Safety; and Measures to Ensure Availability of the Safety Systems
7	2.1.1.7	Design of Structures, Systems, and Components Important to Safety and Safety Controls
8	2.1.1.8	Meeting the 10 CFR Part 20 As Low As Is Reasonably Achievable Requirements for Normal Operations and Category 1 Event Sequences
9	2.1.2	Plans for Retrieval and Alternate Storage of Radioactive Wastes
10	2.1.3	Plans for Permanent Closure and Decontamination or Decontamination and Dismantlement of Surface Facilities
<b>Volume 3 Repository Safety After Permanent Closure</b>		
1	2.2.1.1	System Description and Demonstration of Multiple Barriers
2	2.2.1.2.1	Scenario Analysis
3	2.2.1.2.2	Identification of Events with Probabilities Greater Than $10^{-8}$ Per Year
4	2.2.1.3.1	Degradation of Engineered Barriers
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10	2.2.1.3.7	Radionuclide Transport in the Unsaturated Zone
11	2.2.1.3.8	Flow Paths in the Saturated Zone
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13	2.2.1.3.10	Igneous Disruption of Waste Packages
14	2.2.1.3.12	Concentration of Radionuclides in Ground Water
15	2.2.1.3.13	Airborne Transportation and Redistribution of Radionuclides
16	2.2.1.3.14	Biosphere Characteristics
17	2.2.1.4.1	Demonstration of Compliance with the Postclosure Individual Protection Standard
18	2.2.1.4.2	Demonstration of Compliance with the Human Intrusion Standard

<b>Chapter</b>	<b>SER Section</b>	<b>Title</b>
<b>Volume 3 Repository Safety After Permanent Closure (continued)</b>		
19	2.2.1.4.3	Demonstration of Compliance with the Separate Groundwater Protection Standards
20	2.5.4	Expert Elicitation
<b>Volume 4 Administrative and Programmatic Requirements</b>		
1	2.3	Research and Development Program to Resolve Safety Questions
2	2.4	Performance Confirmation Program
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4	2.5.2	Records, Reports, Tests, and Inspections
5	2.5.3.1	Training and Certification of Personnel
6	2.5.3.2	U.S. Department of Energy Organizational Structure as it Pertains to Construction and Operation of Geologic Repository Operations Area
7	2.5.3.3	Personnel Qualifications and Training Requirements
8	2.5.5	Plans for Startup Activities and Testing
9	2.5.6	Plans for Conduct of Normal Activities, Including Maintenance, Surveillance, and Periodic Testing
10	2.5.7	Emergency Planning
11	2.5.8	Controls to Restrict Access and Regulate Land Uses
12	2.5.9	Uses of Geologic Repository Operations Area for Purposes Other Than Disposal of Radioactive Wastes
<b>Volume 5 Proposed Conditions on the Construction Authorization and Probable Subjects of License Specifications</b>		
1	2.5.10.1	Proposed Conditions on the Construction Authorization
2	2.5.10.2	Probable Subjects of License Specifications

## References

NRC. 2009ab. "Division of High-Level Waste Repository Safety Director's Policy and Procedure Letter 14: Application of YMRP for Review Under Revised Part 63." Published March 13, 2009. ML090850014. Washington, DC: U.S. Nuclear Regulatory Commission.

NRC. 2003aa. NUREG-1804, "Yucca Mountain Review Plan—Final Report." Rev. 2. ML032030389. Washington, DC: U.S. Nuclear Regulatory Commission.





## ABSTRACT

The Safety Evaluation Report (SER) evaluates the U.S. Department of Energy's (DOE's) license application for a construction authorization including the information DOE provided in response to the U.S. Nuclear Regulatory Commission (NRC) staff's requests for additional information (RAIs) and other information that DOE provided related to the Safety Analysis Report (SAR). The NRC staff is issuing its SER in five volumes. The five SER Volumes document the NRC staff's review of the general information (SER Volume 1), repository safety before permanent closure (Volume 2), repository safety after permanent closure (Volume 3), administrative and programmatic requirements (Volume 4), and proposed conditions on the construction authorization and probable subjects of license specifications (Volume 5).

This SER Volume 5 documents the NRC staff's proposed conditions of construction authorization, including proposed conditions documented in the other SER Volumes. In addition, SER Volume 5 documents the NRC staff's review of DOE's probable subjects of license specifications provided in its SAR in DOE's June 3, 2008, license application submittal (DOE, 2008ab), as updated on February 19, 2009 (DOE, 2009av). The NRC staff also reviewed information DOE provided in response to the NRC staff's RAIs and other information that DOE provided related to the SAR.

The NRC staff has found that DOE has met the applicable regulatory requirements, subject to the proposed conditions of construction authorization identified in Table 2.5-1 in SER Volume 1 (General information), Volume 2 (repository safety before permanent closure), Volume 3 (repository safety after permanent closure); Volume 4 (administrative and programmatic requirements), and Volume 5 (with respect to probable subjects of license specifications), except for the requirements in 10 CFR 63.121(a) and 10 CFR 63.121(d)(1) regarding ownership of land and water rights, respectively. The NRC staff is not recommending issuance of a construction authorization at this time because the NRC staff determined that DOE has not met these regulatory requirements regarding ownership and control of the land where the GROA would be located and certain water rights. In addition, a supplement to DOE's environmental impact statement has not yet been completed.

Nevertheless, in accordance with 10 CFR Part 63 requirements regarding conditions of construction authorization, SER Volume 5 includes proposed conditions of construction authorization identified by the NRC staff based on its review of DOE's SAR, supplemental documents referenced in the SAR, and DOE's responses to NRC staff requests for additional information (RAIs). These NRC staff proposed conditions could be included in a Construction Authorization if there is a Commission decision to authorize construction. However, these proposed conditions do not represent an approach for addressing regulatory requirements that DOE has not met regarding ownership and control of certain land and water rights. Should the applicant provide additional information, the NRC staff may remove or revise a condition identified in the NRC staff's SER, or could add one or more conditions, based on its review of the information.







## ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CA	construction authorization
DOE	U.S. Department of Energy
GROA	geologic repository operations area
HLW	high-level waste
HVAC	heating, ventilation, and air conditioning
IEEE	Institute of Electrical and Electronics Engineers
ITS	important to safety
ITWI	important to waste isolation
LA	license application
MCO	multicanister overpacks
MOX	mixed oxide
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
PCSA	preclosure safety analysis
RAI	requests for additional information
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SSCs	structures, systems, and components
SNF	spent nuclear fuel
TAD	transportation, aging, and disposal
YMRP	Yucca Mountain Review Plan



## INTRODUCTION

Disposal of high level waste (HLW) in a geologic repository at Yucca Mountain, Nevada, by the U.S. Department of Energy (DOE) is governed by the U.S. Nuclear Regulatory Commission (NRC) rules in 10 CFR Part 63. Pursuant to 10 CFR Part 63, there are several stages in the licensing process: the site characterization stage, the construction stage, a period of operations, and termination of the license. The period of operations includes (i) the time during which emplacement would occur, (ii) any subsequent period before permanent closure during which the emplaced wastes are retrievable, and (iii) permanent closure. The multistaged licensing process affords the Commission the flexibility to make decisions in a logical time sequence that accounts for DOE collecting and analyzing additional information over the construction and operational phases of the repository. DOE's license application must be as complete as possible in light of the information that is reasonably available.

The NRC staff documents its review and evaluation of a license application in a Safety Evaluation Report (SER). The SER evaluates the DOE's license application for a construction authorization, including the information DOE provided in response to the NRC staff's requests for additional information (RAIs) and other information that DOE provided related to the Safety Analysis Report (SAR). The NRC staff is issuing its SER in five volumes. The five SER Volumes document the NRC staff's review of general information (SER Volume 1), repository safety before permanent closure (Volume 2), repository safety after permanent closure (Volume 3), administrative and programmatic requirements (Volume 4), and proposed conditions on the construction authorization and probable subjects of license specifications (Volume 5).

Volume 5 of this Safety Evaluation Report (SER) is entitled "Proposed Conditions on the Construction Authorization and Probable Subjects of License Specifications." Although the Yucca Mountain Review Plan uses the heading "License Specifications" for this volume, the title for Volume 5 was revised to more accurately reflect the contents of the volume. Volume 5 includes information and findings from the other four volumes of the SER that document the NRC staff's review of the SAR DOE provided in its June 3, 2008, license application submittal (DOE, 2008ab), as updated on February 19, 2009 (DOE, 2009av). The NRC staff also reviewed information DOE provided in response to the NRC staff's requests for additional information (RAIs) and other information that DOE provided related to the SAR. In particular, this SER Volume 5 documents the NRC staff's proposed conditions of construction authorization, including proposed conditions documented in other SER Volumes, and review of DOE's probable subjects of license specifications.

### References

DOE. 2009av. DOE/RW-0573, "Update to the Yucca Mountain Repository License Application (LA) for Construction Authorization." Rev. 1. February 2009. ML090700817, ML090710096. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2008ab. DOE/RW-0573, "Yucca Mountain Repository License Application." Rev. 0. ML081560400, ML081560542. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.





## CHAPTER 1

### 2.5.10.1 Proposed Conditions on the Construction Authorization

#### 2.5.10.1.1 Introduction

NRC regulations at 10 CFR 63.32 specify conditions that the NRC must include in any construction authorization (CA) issued under 10 CFR Part 63. As explained in SER Volume 4, Section 2.5.8.4, the NRC staff finds that the regulatory requirements regarding ownership and control of the land where the geologic repository operations area (GROA) would be located and certain water rights are not met. In addition, a supplement to DOE's environmental impact statement has not yet been completed. Therefore, the NRC staff is not recommending issuance of a CA at this time. Nevertheless, in accordance with 10 CFR Part 63 requirements regarding conditions of a CA, the NRC staff has identified proposed conditions of a CA based on its review of DOE's Safety Analysis Report (SAR) in DOE's June 3, 2008, license application submittal (DOE, 2008ab), as updated on February 19, 2009 (DOE, 2009av), supplemental documents referenced in the SAR, and DOE's responses to NRC staff requests for additional information (RAIs), which could be included in a CA if there is a Commission decision to authorize construction.

This section of the SER provides the NRC staff's evaluation of portions of DOE's license application relevant to the NRC staff's proposed conditions of CA. Additionally, this SER section identifies the NRC staff's proposed conditions of CA as required by 10 CFR 63.32 and the Nuclear Waste Policy Act (NWPA), as amended, as well as proposed conditions identified in other volumes of the NRC staff's SER.

#### 2.5.10.1.2 Regulatory Requirements

In accordance with 10 CFR 63.32, the Commission must include certain conditions on any CA. Specifically, 10 CFR 63.32 requires that a CA issued by the Commission

- Include any conditions the Commission considers necessary to protect the health and safety of the public, the common defense and security, or environmental values. [10 CFR 63.32(a)]
- Incorporate provisions requiring DOE to furnish periodic or special reports regarding progress of construction; any data about the site, obtained during construction that are not within the predicted limits on which the facility design was based; any deficiencies in design and construction that, if uncorrected, could adversely affect safety at any future time; and the results of research and development programs being conducted to resolve safety questions. [10 CFR 63.32(b)(1)–(4)]
- Include restrictions on subsequent changes to the features of the geologic repository and the procedures authorized. The restrictions that may be imposed under 10 CFR 63.32(c) can include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the geologic repository operations area. These restrictions will fall into three categories of descending importance to public health and safety:

- 1) Those features and procedures that may not be changed without 60 days prior notice to the Commission, 30 days notice of opportunity for a prior hearing, and prior Commission approval.
  - 2) Those features and procedures that may not be changed without 60 days prior notice to the Commission and prior Commission approval.
  - 3) Those features and procedures that may not be changed without 60 days notice to the Commission. Features and procedures falling in this section may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders. [10 CFR 63.32(c)(1)–(3)]
- Must be subject to the limitation that a license to receive and possess source, special nuclear, or byproduct material at the Yucca Mountain site geologic repository operations area may not be issued by the Commission until DOE has updated its application, as specified at 10 CFR 63.24; and the Commission has made the findings stated in 10 CFR 63.41. [10 CFR 63.32(d)]

### **2.5.10.1.3 Technical Review**

The NRC staff's evaluation and identification of proposed conditions of the CA has been integrated with the NRC staff reviews documented in SER Volumes 1–4. The NRC staff's evaluation of proposed conditions of CA follows for the proposed conditions that are not evaluated and documented in the other SER volumes.

#### **2.5.10.1.3.1 Conditions on the Construction Authorization**

Based on its review in SER Volume 4, Section 2.5.8, the NRC staff determined that DOE has not met certain regulatory requirements. The NRC staff's proposed conditions, based on its review of the SAR, RAI responses, and supporting information, do not represent an approach for addressing the regulatory requirements that DOE has not met. Should the applicant provide additional information, the NRC staff may remove or revise a condition stated herein, or could add one or more conditions, based on its review of the information.

##### **2.5.10.1.3.1.1 Restrictions on Subsequent Changes Following the Issuance of a Construction Authorization**

###### **2.5.10.1.3.1.1.1 DOE's Commitment to Apply 10 CFR 63.44**

In Chapter 5 of the SAR, DOE committed to apply, after issuance of a CA, the requirements of 10 CFR 63.44, as well as any specific conditions imposed in accordance with 10 CFR 63.32, to any changes to the repository design or procedures described in the SAR. NRC regulations at 10 CFR 63.44(b)(1) provide, in part, that DOE may make changes in the geologic repository operations area (GROA) as described in the SAR, make changes in the procedures as described in the SAR, and conduct tests or experiments not described in the SAR, without obtaining Commission approval (i.e., an amendment of a CA) if (i) a change in the conditions incorporated in the CA is not required; and (ii) the change, test, or experiment does not meet the 10 CFR 63.44(b)(2) criteria for identifying changes that require an amendment. NRC regulations at 10 CFR 63.44(b)(2) in turn require DOE to obtain prior Commission approval through an amendment before implementing a change, test, or experiment if it would

- (i) Result in more than a minimal increase in the frequency of occurrence of an event sequence previously evaluated in the SAR;
- (ii) Result in more than a minimal increase in the likelihood of occurrence of a malfunction of structures, systems, components important to safety or important to waste isolation, which were previously evaluated in the SAR;
- (iii) Result in more than a minimal increase in the consequences of an event sequence previously evaluated in the SAR;
- (iv) Result in more than a minimal increase in the consequences of malfunction of structures, systems, components important to safety or important to waste isolation, which were previously evaluated in the SAR;
- (v) Create the possibility for an event sequence, or of a pathway for release of radionuclides, of a different type than any evaluated previously in the SAR;
- (vi) Create the possibility for a malfunction of structures, systems, and components important to safety or important to waste isolation, with a different result than any evaluated previously in the SAR;
- (vii) Result in a departure from a method of evaluation described in the SAR used in establishing the preclosure safety analysis or the performance assessment.

NRC regulations at 10 CFR 63.44(a) define 'change' as a modification or addition to, or removal from, the GROA design or procedures that affect a design function, event sequence, method of performing or controlling the function, or an evaluation that demonstrates that intended functions will be accomplished. In addition, 10 CFR 63.44(b)(4) provides that the 10 CFR 63.44 provisions would not apply to changes to the GROA or procedures when the applicable regulations establish more specific criteria for accomplishing such changes. NRC regulations at 10 CFR 63.44(d) provide that changes to the quality assurance program description, which is discussed and evaluated in SER Volume 4, Section 2.5.1.4.2.2, must be processed in accordance with 10 CFR 63.144.

DOE described how it will implement its commitment to apply 10 CFR 63.44 after issuance of any CA. In SAR Chapter 5 (Management Systems), DOE stated that its management systems are used throughout the life of the repository to control activities and integrate programs to provide assurance that the repository will be constructed and operated within analyzed conditions and that the validity of the design and analytical bases is maintained as modifications occur. These management systems are applied to the structures, systems, and components (SSCs) that are important to safety (ITS) and important to waste isolation (ITWI). DOE also described its initial screening process to be used for changes to the SAR that could impact the design, analysis, or operation of the repository (DOE, 2009av; page 5-5). If, during DOE's initial screening, it is determined that the proposed change could impact the SAR, DOE stated that the proposed change will be subject to additional evaluation and documentation pursuant to the 10 CFR 63.44 requirements. Additionally, DOE stated that (i) the screenings will be performed by personnel who are properly trained and familiar with the subject matter and the content of the SAR (consistent with the Quality Assurance program required by 10 CFR 63.141 through 143); (ii) the screening process will include procedures for approval of new or revised drawings, calculations, specifications, science products, operation/maintenance procedures, construction procedures, and programmatic plans; and (iii) any proposed change determined to require a full

evaluation will be evaluated to determine if it impacts a license condition or specification and evaluated against the seven criteria specified in 10 CFR 63.44(b).

### NRC Staff Evaluation

The NRC staff reviewed the information provided by DOE in Chapter 5 of the SAR regarding DOE's commitment to apply 10 CFR 63.44, upon issuance of a CA, to any changes to the repository design or procedures as described in the SAR, as well as to tests or experiments not described in the SAR. DOE stated that the scope of SSCs under its configuration management process, which would implement this commitment, includes SSCs that are being designed to be constructed and operated at the repository. DOE also stated that design documents, postclosure analyses, and supporting documents subject to configuration management include calculations, safety analyses, design criteria, engineering drawings, system descriptions, technical documents, and specifications that establish design requirements for SSCs.

The NRC staff finds that DOE's approach for the control of changes to the GROA design or procedures as described in the SAR, and any tests or experiments not described in the SAR [as defined in 10 CFR 63.44(a)], is adequate because (i) DOE described an initial screening process for evaluating whether or not a proposed change to the repository design or procedures, as described in the SAR, would impact the design, analysis, or operation of the repository; (ii) DOE stated its screening process is subject to the QA program required by 10 CFR 63.141 through 143 (e.g., screenings will be performed by personnel who are properly trained and familiar with the subject matter and the content of the SAR); (iii) those changes that are determined by DOE to have potential to impact the design, analysis, or operation of the repository will be subject to additional evaluation and documentation pursuant to the criteria of 10 CFR 63.44; and (iv) DOE's configuration management system would identify and control the preparation and review of documentation regarding changes to SSCs that are important to safety (ITS) and important to waste isolation (ITWI). Accordingly, the NRC staff is proposing, as part of the condition of construction authorization regarding restrictions required by 10 CFR 63.32(c), which is discussed further in SER Section 2.5.10.1.3.1.1.2, to include DOE's commitment to apply 10 CFR 63.44 to changes in the GROA design and procedures at the time of CA issuance, and any tests or experiments not described in the SAR. However, as described next, the NRC staff determines that the applicability of certain 10 CFR 63.44 provisions during the CA phase of the 10 CFR Part 63 licensing process should be clarified.

The NRC staff notes that 10 CFR 63.44(b)(3) defines "SAR (as updated)" as the Safety Analysis Report for the geologic repository, submitted in accordance with 10 CFR 63.21, as updated in accordance with 10 CFR 63.24. NRC regulations at 10 CFR 63.24 require DOE to update its application, before issuance of a license to receive and possess, to include additional information obtained during construction. As the NRC has not issued a CA and DOE has not provided the NRC staff with a SAR update in accordance with 10 CFR 63.24, references to the 10 CFR 63.24 update in 10 CFR 63.44 are not applicable at this time. Similarly, because DOE has not submitted an application for, nor has NRC issued, a license to receive and possess, specific references to evaluations or updates related to a license to receive and possess [e.g., references to amendments to a license to receive and possess in 10 CFR 63.44(b)(1) and (b)(3)] also are not applicable at this time. Therefore, the proposed condition specifies that DOE shall apply the 10 CFR 63.44 requirements to the SAR at the time of issuance of a CA, rather than applying it to the 10 CFR 63.24 SAR update because this update would not apply at this time. Thus, this condition clarifies the applicability of the 10 CFR 63.44 process to available information.

In addition, since DOE submitted the latest revision of its SAR in 2009 (DOE 2009av), it has provided responses to the NRC staff RAIs and, in some cases, has committed to update its SAR to reflect supplemental information contained in RAI responses. For example, DOE RAI responses state that DOE will update its SAR to correct labeling of ITS components in SAR figures (e.g., Figures 1.2.5-69 through 1.2.5-72). In conducting its review of DOE's license application and making its safety findings, the NRC staff relied on the information contained in certain RAI responses. As DOE has not updated its license application to incorporate supplemental information in RAI responses, the NRC staff finds that RAI responses should be subject to the same restrictions on subsequent changes as the SAR. Therefore, the NRC staff's proposed condition addressing DOE's 10 CFR 63.44 commitment specifies that the requirements of 10 CFR 63.44 would apply to the most current SAR, as well as the responses to the NRC staff RAIs referenced in the NRC staff's SER (see SER Section 2.5.10.1.4 for a list of the referenced RAI responses).

For the foregoing reasons, the NRC staff is proposing the following restrictions be included in any CA issued by the Commission as part of the condition regarding restrictions required by 10 CFR 63.32(c):

The licensee shall apply the requirements of 10 CFR 63.44 to any changes to the geologic repository operations area (GROA) design or procedures as described in the SAR, except for items specifically identified by condition, including (i) changes in the geologic repository operations area as described in the SAR, (ii) changes in the procedures as described in the SAR, and (iii) tests or experiments not described in the SAR. However, DOE may not use 10 CFR 63.44 to make changes to its QA program description required by 10 CFR 63.21(c)(20). In accordance with 10 CFR 63.44(d), any changes to this QA program description must be processed in accordance with 10 CFR 63.144. In addition, in accordance with 10 CFR 63.44(b)(4), DOE may not use the provisions in 10 CFR 63.44 to make changes to the GROA or procedures when applicable regulations establish more specific criteria for accomplishing such changes.

For purposes of applying the 10 CFR 63.44 requirements upon issuance of the construction authorization, the SAR is defined as including: (i) the SAR submitted on June 3, 2008, as updated by DOE's revised SAR submitted on February 19, 2009; and (ii) the DOE responses to NRC staff requests for additional information as referenced in SER Section 2.5.10.1.4.

#### 2.5.10.1.3.1.1.2 Requirements of 10 CFR 63.32(c)

The requirements in 10 CFR 63.32(c) specify that the Commission include in a CA restrictions on subsequent changes to the features of the geologic repository and the procedures authorized. These restrictions can include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the GROA for which there are three distinct categories of descending importance to public health and safety. The categories in 10 CFR 63.32(c)(1)–(3) provide for differing levels of restrictions.

In Chapter 5 of the SAR, DOE states that it is committed to apply, after issuance of a CA, any specific conditions imposed in accordance with 10 CFR 63.32 to any changes to the repository design or procedures as described in the SAR.

## NRC Staff Evaluation

Integrated with its review in SER Volumes 1–4, the NRC staff considered what restrictions on subsequent changes to features of the geologic repository, which includes the GROA as defined in 10 CFR 63.2, and procedures should be included in a CA. Specifically, in accordance with 10 CFR 63.32(c), the NRC staff considered whether any restrictions should be imposed that include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the GROA. As described below, the NRC staff considered what, if any, restrictions should be included in each of the three categories identified in 10 CFR 63.32(c)(1)–(3).

### *Category 1 Restrictions*

The first category, specified in 10 CFR 63.32(c)(1), includes restrictions on features and procedures that may not be changed without (i) 60 days prior notice to the Commission, (ii) 30 days notice of opportunity for a prior hearing, and (iii) prior Commission approval. Consistent with 10 CFR 63.32(c), the NRC staff considered whether any restrictions should be imposed that include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the GROA. Based on the NRC staff's review of DOE's SAR, responses to NRC staff RAIs, and references therein, the NRC staff did not identify any restrictions that would require prior notice, opportunity for prior hearing, and prior Commission approval. The staff has confidence that the restrictions identified in Categories 2 and 3 below are adequate to protect public health and safety because, as described below and in SER Section 2.5.10.1.3.1.1.1, these restrictions include provisions that provide appropriate constraints on potential changes to the GROA because (i) under Category 2 restrictions, an amendment of a construction authorization would be required for changes that could have adverse effects on the design and construction of the GROA in accordance with the 10 CFR 63.44 process and (ii) under Category 3 restrictions, certain features and procedures may not be changed without 60 days notice to the Commission, which also provides that features and procedures falling in this category may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders. An amendment would require prior notice, Commission approval, and allow for an opportunity to request a hearing. Accordingly, NRC staff is not proposing any Category 1 restrictions for inclusion in a CA.

### *Category 2 Restrictions*

The second category, specified in 10 CFR 63.32(c)(2), includes restrictions on features and procedures that may not be changed without (i) 60 days prior notice to the Commission; and (ii) prior Commission approval. Consistent with 10 CFR 63.32(c), the NRC staff considered whether any restrictions should be imposed that include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the GROA. Section 63.2 defines (i) geologic repository; (ii) GROA, which is part of a geologic repository; and (iii) geologic setting. GROA, as defined in Section 63.2, means a high-level radioactive waste facility that is part of a geologic repository, including both surface and subsurface areas, where waste handling activities are conducted. "[GROA] as described in the SAR" for the purposes of Section 63.44 is, however, defined as (i) the structures, systems, and components important to safety or barriers important to waste isolation that are described in the SAR and (ii) the design and performance requirements for such structures, systems, and components described in the SAR. Accordingly, the scope of the restrictions provided in 10 CFR 63.44 is narrower than the scope of restrictions that may be imposed under 10 CFR 63.32(c), which includes both the geologic setting and the GROA.

With respect to potential changes related to the GROA as defined in 10 CFR 63.44, the NRC staff considered whether the restrictions on changes, tests, and experiments under 10 CFR 63.44, which in certain instances would require prior Commission notice and approval, are sufficient to address restrictions under Category 2, which also requires prior Commission notice and approval. As discussed in SER Section 2.5.10.1.3.1.1, the NRC staff is proposing as part of the restrictions required by 10 CFR 63.32(c), that DOE apply the requirements of 10 CFR 63.44 to changes to the GROA design or procedures, and any tests or experiments not described in the SAR. In accordance with the 10 CFR 63.44 process, DOE would be required to evaluate changes in the GROA design or procedures, and any tests or experiments not described in the SAR, to determine whether prior Commission notification and approval is required. This process would require DOE to request an amendment of the CA, which would involve prior Commission notice and approval, if a proposed change would result in a change to any condition incorporated in the CA, or if the proposed change meets criteria in 10 CFR 63.44(b)(2). The NRC staff determines that this process provides adequate restrictions on potential changes to the GROA design or procedures, and tests or experiments (as defined in 10 CFR 63.44), because the condition would require prior Commission review and approval for any changes that could have adverse effects on the design and construction of the GROA. For example, 10 CFR 63.44(b)(2) requires prior Commission notice and approval if a change would result in more than a minimal increase in the frequency of occurrence of an event sequence previously evaluated in the SAR or create the possibility for a malfunction of structures, systems, and components important to safety or important to waste isolation, with a different result than any evaluated previously in the SAR. Based on its integrated review in SER Volumes 1–4, the NRC staff did not identify any additional restrictions that should be included for surface or subsurface features or procedures in the GROA that would not be included in the 10 CFR 63.44 Category 2 restrictions.

The NRC staff considered whether any additional restrictions for changes to the geologic repository, which is defined as a larger area than the GROA in 10 CFR 63.2, or authorized procedures would be warranted. The NRC staff also considered whether any restrictions are needed to prevent adverse effects on the geologic setting, which is defined in 10 CFR 63.2 as the region in which the geologic repository is or may be located. Based on its integrated review in SER Volumes 1–4, the NRC staff is proposing an additional restriction, should a construction authorization be granted, that any changes to land controls for the geologic setting of the repository require prior review and approval to ensure (i) the preclosure performance objectives continue to be met [compliance with 10 CFR 63.111(a) and (b)]; (ii) the description of an emergency plan that DOE would develop and be prepared to implement continues to meet applicable regulatory requirements (10 CFR 63.21(c)(21), 10 CFR 63.161); and (iii) controls to prevent adverse human actions that could significantly reduce the geologic repository's ability to achieve isolation [compliance with 10 CFR 63.121(b)].

Accordingly, the NRC staff is proposing a condition, to be included in a CA, that would require 60 days prior notice to the Commission and prior Commission approval for any proposed changes requiring an amendment of CA pursuant to the criteria in 10 CFR 63.44(b)(2), and any changes to preclosure land controls for the geologic setting of the repository.

### *Category 3 Restrictions*

The third category, specified in 10 CFR 63.32(c)(3), includes restrictions on features and procedures that may not be changed without 60 days notice to the Commission. It also provides that features and procedures falling in this category may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders. Consistent with 10 CFR 63.32(c), the NRC staff considered whether any restrictions should be

imposed that include measures to prevent adverse effects on the geologic setting as well as measures related to the design and construction of the GROA. Based on the NRC staff's review of DOE's SAR and responses to NRC staff RAs, the NRC staff finds that monitoring and maintenance programs for ensuring stability of repository drifts is important to safety and ensuring implementation of barriers important to waste isolation (e.g., installation of drip shields) have the potential to affect the final design of these SSCs. Therefore, the NRC staff concludes that changes to the scope (including the frequency of monitoring and maintenance activities) of the monitoring and maintenance programs for ensuring stability of repository drifts (described in SAR Section 1.3.1.2.1.6) shall require 60 days prior notice for NRC. In this notice, the applicant should confirm any proposed change will not adversely impact the reliability or safety functions for the potentially impacted SSCs important to safety or barriers important to waste isolation.

#### NRC Staff Conclusion

Therefore, based on the above evaluation, the NRC staff is proposing the following condition be included in a CA issued by the Commission:

Pursuant to 10 CFR 63.32(c), the licensee is restricted from making any changes, without 60 days prior notice to the Commission and prior Commission approval, that (i) require an amendment of the construction authorization pursuant to the criteria in 10 CFR 63.44(b)(2); or (ii) change land controls for the geologic setting of the repository related to compliance with the preclosure performance objectives [10 CFR 63.111(a) and (b)], emergency planning (10 CFR 63.21(c)(21), 10 CFR 63.161), and controls to prevent adverse human actions that could significantly reduce the geologic repository's ability to achieve isolation [10 CFR 63.121(b)].

The licensee is restricted from making any changes to the scope (including the frequency of monitoring and maintenance activities) of the monitoring and maintenance programs for ensuring the stability of repository drifts, as described in SAR Section 1.3.1.2.1.6, without 60 days prior notice to the Commission. In this notice, the applicant should confirm any proposed change will not adversely impact the reliability or safety functions for the potentially impacted SSCs important to safety or barriers important to waste isolation. Changes to the scope of the monitoring and maintenance programs for ensuring stability of repository drifts may not be changed without prior Commission approval if, after receiving the required 60 day notice, the Commission so orders.

#### 2.5.10.1.3.1.2                      Conditions on the Construction Authorization Based on Technical Review, Part 63 Requirements and Statutory Direction

In addition to the proposed conditions discussed in SER Section 2.5.10.1.3.1.1.2, the NRC staff identified conditions on the construction authorization based on its review documented in SER Volumes 1–4, the regulatory requirements in 10 CFR 63.32, and statutory requirements. In its reviews of General Information (SER Volume 1) and Postclosure Safety (SER Volume 3), the NRC staff did not identify any conditions for a construction authorization. The NRC staff did identify proposed conditions of construction authorization in its evaluations of Preclosure Safety (SER Volume 2) and Administrative and Programmatic Requirements (SER Volume 4). Table 2.5-1 provides the proposed conditions and, as appropriate, the SER Section where the proposed condition is discussed.



As noted previously, the NRC staff determined that DOE has not satisfied certain regulatory requirements. The NRC staff's proposed conditions, based on its review of the SAR, RAI responses, and supporting information, do not represent an approach for addressing regulatory requirements that DOE has not met regarding ownership and control of certain land and water rights. Should the applicant provide additional information, NRC staff may remove or revise a condition, or could add one or more conditions, based on its review of the information.

#### **2.5.10.1.4 Responses to NRC Staff RAIs as Referenced in the SER**

The NRC staff has referenced a number of DOE responses to NRC staff RAIs during its SER review. The following list provides the RAI responses, as referenced in the SER:

DOE. 2010aa. "Yucca Mountain—Response to Request for Additional information Regarding License Application (Safety Analysis Report Section 2.2.4), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.2, Set 4." Letter (January 29) J.R. Williams to J.H. Sulima (NRC). ML100290670. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ab. "Yucca Mountain—Response to Request for Additional information Regarding License Application (Safety Analysis Report Section 2.2.4), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.2, Set 4." Letter (February 12) J.R. Williams to J.H. Sulima (NRC). ML100470767. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ac. "Yucca Mountain—Response to Request for Additional information Regarding License Application (Safety Analysis Report Section 2.3.4), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.2, Set 3." Letter (January 28) J.R. Williams to J.H. Sulima (NRC). ML100290132. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ad. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (January 20) J.R. Williams to J.H. Sulima (NRC). ML100210164. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ae. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.6.8), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.1, Set 2." Letter (February 22) J.R. Williams to J.H. Sulima (NRC). ML100540266. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ah. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (January 7) J.R. Williams to J.H. Sulima (NRC). ML100110027. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ai. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.1), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.5, Set 1 and (Safety Analysis Report Sections 2.3.2 and 2.3.3), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.6, Set 1." Letter (February 2) J.R. Williams to J.H. Sulima (NRC). ML100340034. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010aj. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.7), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.4, Set 1." Letter (February 24) J.R. Williams to J.H. Sulima (NRC). ML100560258. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ak. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, 1.3.4, 1.6, 1.7, 1.2.2, and 1.2.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2; Chapter 2.1.1.3, Set 3; and Chapter 2.1.1.7, Set 3." Letter (January 7) J.R. Williams to C. Jacobs (NRC). ML100082160. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010al. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, 1.3.4, 1.6, 1.7, 1.2.2, and 1.2.7), Safety Evaluation Report Vol. 2, Chapters 2.1.1.1, Set 2; Chapter 2.1.1.3, Set 3; and Chapter 2.1.1.7, Set 3." Letter (January 10) J.R. Williams to C. Jacobs (NRC). ML100082160. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010am. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, 1.3.4, 1.6, 1.7, 1.2.2, and 1.2.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2; Chapter 2.1.1.3, Set 3; and Chapter 2.1.1.7, Set 3." Letter (January 25) J.R. Williams to C. Jacobs (NRC). ML100260215. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010an. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.6 and 1.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.3, Set 3." Letter (January 12) J.R. Williams to C. Jacobs (NRC). ML100120716. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2010ap. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 4), Safety Evaluation Report Vol. 4, Chapter 2.4, Set 2." Letter (February 23) J.R. Williams to F. Jacobs (NRC). ML100541535. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009aa. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.2.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.2, Set 2." Letter (January 27) J.R. Williams to J.H. Sulima (NRC). ML090280281. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ab. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2, Table 2.2-5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 2." Letter (February 23) J.R. Williams to J.H. Sulima (NRC). ML090550101, ML090550099. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ac. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 2.3.6.6, 2.3.6.8.4, and 2.2.2.3), Safety Evaluation Report Volume 3, Chapter 2.2.1.2.2, Set 2." Letter (January 9) J.R. Williams to J.H. Sulima (NRC). ML090120301. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009ad. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 2.3.6.6, 2.3.6.8.4, and 2.2.2.3), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.2, Set 2." Letter (January 16) J.R. Williams to J.H. Sulima (NRC). ML090210465. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009ae. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 1." Letter (January 23) J.R. Williams to J.H. Sulima (NRC). ML090260710. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009af. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2, Table 2.2-5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 3." Letter (March 4) J.R. Williams to J.H. Sulima (NRC). ML091830594. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ah. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2, Table 2.2-5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 2." Letter (March 3) J.R. Williams to J.H. Sulima (NRC). ML090860902. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ai. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report, Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (March 23) J.R. Williams to J.H. Sulima (NRC). ML090830357. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009aj. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report, Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (March 24) J.R. Williams to J.H. Sulima (NRC). ML090840280. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009al. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (March 26) J.R. Williams to J.H. Sulima (NRC). ML090860424. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009am. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.8), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.7, Set 1." Letter (February 9) J.R. Williams to J.H. Sulima (NRC). ML090410352. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009an. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.1), Safety Evaluation Report Vol. 3, Chapter 2.2.1.1, Set 1." Letter (February 6) J.R. Williams to J.H. Sulima (NRC). ML090400455. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ao. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report Vol. 2, Chapter 2.1.3, Set 1; (Safety Analysis Report Section 1.12.1)." Letter (March 4) J.R. Williams to C. Jacobs (NRC). ML090690434, ML090690439. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009ap. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 1.6 and 1.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.3, Set 3." Letter (April 17) J.R. Williams to C. Jacobs (NRC). ML091110193. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009aq. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.10, 1.2.2, 1.1.5.2, and 1.1.5.3), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 1." Letter (January 12) J.R. Williams to C. Jacobs (NRC). Enclosures (10). ML090270750, ML090270764. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ar. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, and 1.3.4), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2." Letter (March 20) J.R. Williams to C. Jacobs (NRC). ML090820299. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009as. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, and 1.3.4), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2." Letter (February 4) J.R. Williams to C. Jacobs (NRC). ML090360166. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009at. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, and 1.3.4), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2." Letter (March 20) J.R. Williams to C. Jacobs (NRC). ML090820301. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009au. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 5.8), Safety Evaluation Report Vol. 4, Chapter 2.5.8, Set 1." Letter (May 6) J.R. Williams to F. Jacobs (NRC). ML091330698. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ax. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.7), Safety Evaluation Report, Vol. 3, Chapter 2.2.1.3.4, Set 1." Letter (May 5) J.R. Williams to J.H. Sulima (NRC). ML091260473. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ay. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.7), Safety Evaluation Report, Vol. 3, Chapter 2.2.1.3.4, Set 2." Letter (May 12) J.R. Williams to J.H. Sulima (NRC). ML 091330282. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009az. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 5.3 and 1.14.1), Safety Evaluation Report Vol. 4, Chapter 2.5.3.2, Set 1." Letter (February 10) J.R. Williams to B. Benney (NRC). ML090420250. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ba. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.11), Safety Evaluation Report Vol. 2, Chapter 2.1.2, Set 1." Letter (June 2) J.R. Williams to C. Jacobs (NRC). ML091540129. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009bb. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.3.4, 1.3.5, and 1.11), Safety Evaluation Report Vol. 2, Chapter 2.1.2, Set 1." Letter (August 4) J.R. Williams to C. Jacobs (NRC). ML092170409. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009bc. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.9.2.2 and 2.3.9.2.3), Safety Evaluation Report Volume 3, Chapter 2.2.1.3.8, Set 1." Letter (January 30) J.R. Williams to J.H. Sulima (NRC). Enclosures (3): Numbers 1, 2, and 3. ML090330250. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009bd. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.2.2.), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.2, Set 3." Letter (July 20) J.R. Williams to J.H. Sulima (NRC). ML092010472. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE. 2009be. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 5.2), Safety Evaluation Report Vol. 4, Chapter 2.5.2, Set 1." Letter (January 16) J.R. Williams to B.J. Benney (NRC). ML090210487. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009bf. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.1.4, 1.1.5, and 1.3.4), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 2." Letter (September 15) J.R. Williams to Christian Jacobs (NRC). ML092590134. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009bg. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections, 1.1.4, 1.1.5, 1.1.10, 1.2.2, and 1.3.4), Safety Evaluation Report Vol. 2, Chapter 2.1.1.1, Set 1 and 2." Letter (September 24) J.R. Williams to Christian Jacobs (NRC). ML093010629. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009bj. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 2.1, 2.3.11, 2.4.3, and 2.4.4), Safety Evaluation Report Vol. 3, Chapters 2.2.1.4.1, 2.2.1.4.2, and 2.2.1.4.3, Set 1." Letter (July 29) J.R. Williams to J.H. Sulima (NRC). ML092110472, ML092110474. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009ce. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2, Table 2.2-5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 6." Letter (November 17) J.R. Williams to J.H. Sulima (NRC). ML093220119. Washington, DC: U.S. Department of Energy, Office of Technical Management.



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DOE. 2009ch. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2, Table 2.2-5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 6." Letter (December 4) J.R. Williams to J.H. Sulima (NRC). ML093410044. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009co. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.2.1.2), Safety Evaluation Report Vol. 3, Chapter 2.2.1.2.1, Set 4." Letter (August 11) J.R. Williams to J.H. Sulima (NRC). ML092310639. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009cp. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.4.3), Safety Evaluation Report Vol. 3, Chapter 2.2.1.4.2, Set 1." Letter (October 20) J.R. Williams to J.H. Sulima (NRC). ML092940188. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009cr. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.1), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.5, Set 1." Letter (June 24) J.R. Williams to J.H. Sulima (NRC). ML091830849, ML091830848, ML091830071. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009ct. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 2.3.2, 2.3.3, and 2.3.5), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.6, Set 2." Letter (July 20) J.R. Williams to J.H. Sulima (NRC). ML092020410, ML092020413, ML092020414. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009cz. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.7), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.4, Set 1 and Set 2." Letter (June 26) J.R. Williams to J.H. Sulima (NRC). ML091770582. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009da. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 2.3.7), Safety Evaluation Report Vol. 3, Chapter 2.2.1.3.4, Set 3." Letter (September 11) J.R. Williams to J.H. Sulima (NRC). ML092600883. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009dk. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.2 and 1.9), Safety Evaluation Report Vol. 2, Chapter 2.1.1.6, Set 2." Letter (August 13) J.R. Williams to C. Jacobs (NRC). ML092260173. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009dv. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Sections 1.2.2, 1.2.8, 1.3.3, 1.4.1, 1.4.2, and 1.4.3), Safety Evaluation Report Vol. 2, Chapter 2.1.1.2, Set 2." Letter (September 9) J.R. Williams to C. Jacobs (NRC). ML092520730. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009ea. "Yucca Mountain—Supplemental Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 1.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.4, Set 3." Letter (December 3) J.R. Williams to C. Jacobs (NRC). ML100130738. Washington, DC: U.S. Department of Energy, Office of Technical Management.

DOE. 2009eb. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 1.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.4, Set 3." Letter (November 20) J.R. Williams to C. Jacobs (NRC). ML093360577. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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DOE. 2009ed. "Yucca Mountain—Response to Request for Additional Information Regarding License Application (Safety Analysis Report Section 1.7), Safety Evaluation Report Vol. 2, Chapter 2.1.1.4, Set 3." Letter (July 7) J.R. Williams to C. Jacobs (NRC). ML091880940. Washington, DC: U.S. Department of Energy, Office of Technical Management.

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**Table 2.5-1. Proposed Conditions on the Construction Authorization**

<b>Number</b>	<b>Condition on Construction Authorization</b>	<b>Basis</b>
1	<p style="text-align: center;"><i>Capacity of Repository</i></p> <p>The capacity of the repository shall not exceed 70,000 MTHM</p>	<p>Statutory requirement in the NWPA Section 114(d)</p>
2	<p style="text-align: center;"><i>Verification of Site Characterization Data</i></p> <p>Within 90 days of issuance of construction authorization, DOE must confirm that its site characterization information and related analyses in the SAR submitted in accordance with 10 CFR 63.21(c)(1) continue to be accurate with respect to (i) site boundaries; (ii) man-made features; (iii) previous land use; (iv) existing structures and facilities; and (v) potential exposure to residual radioactivity. DOE must provide to the NRC written notification when its confirmatory analysis is complete. This notification must include, for NRC staff's verification, a copy of DOE's confirmatory analysis.</p>	<p>see SER Volume 2 Sections 2.1.1.1.3.1 and 2.1.1.1.3.9</p>
3	<p style="text-align: center;"><i>DOE SNF in Multi-Canister Overpacks (MCOs) and Commercial MOX fuel</i></p> <p>DOE shall not, without prior NRC review and approval, accept DOE spent nuclear fuel (SNF) in multicanister overpacks (MCOs) or commercial mixed oxide (MOX) fuel.</p> <p>Any amendment request must include information that either (i) confirms that the current PCSA bounds the intended performance of these MCOs and MOX fuel at the GROA or (ii) demonstrates, through the PCSA, that MCOs and MOX fuel can be safely received and handled at the repository during the preclosure period in accordance with 10 CFR 63.112.</p>	<p>see SER Volume 2 Section 2.1.1.2.3.6.1</p>

**Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)**

Number	Condition on Construction Authorization	Basis
4	<p style="text-align: center;"><i>Flight Restrictions</i></p> <p>DOE shall provide the NRC staff written notification that the agreements for the six flight restrictions and operational constraints that DOE credits in its frequency analysis (SAR Section 1.6.3.4.1) are in place before commencement of construction to confirm that the technical bases for exclusion of aircraft crash hazards at the GROA from the Preclosure Safety Analysis (PCSA) that DOE provided in accordance with 10 CFR 63.112(d) remain valid. These restrictions and operational constraints are (i) prohibiting fixed-wing flights below 14,000 ft (mean sea level) within 9 km [5.6 mi] of the North Portal; (ii) 1,000 overflight limit per year for fixed-wing aircraft above 14,000 ft (mean sea level) within 9 km [5.6 mi] of the North Portal; (iii) overflights are limited to straight and level flights (i.e., maneuvering is not permitted); (iv) carrying ordnance is prohibited within 9 km [5.6 mi] of the North Portal; (v) electronic jamming activities are prohibited within 9 km [5.6 mi] of the North Portal; and (vi) helicopters are not permitted within 0.8 km [0.5 mi] of facilities that process, stage, or age nuclear waste forms.</p>	<p>see SER Volume 2 Section 2.1.1.3.3.1.3.3</p>
5	<p style="text-align: center;"><i>ITS Safety Controls (interlock subsystems)</i></p> <p>DOE shall not, without prior NRC review and approval, take or implement any exception to the IEEE Standards 308–2001, 384–1992, 379–2000, and 603–1998 in the design of the ITS safety interlock subsystems.</p> <p>Any amendment request must include the design basis for the use of the exception(s), including the ability of structures, systems, and components to perform their intended safety functions assuming the occurrence of event sequences in accordance with 10 CFR 63.112(e)(8).</p>	<p>see SER Volume 2 Section 2.1.1.6.3.2.8.2.1</p>



**Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)**

<b>Number</b>	<b>Condition on Construction Authorization</b>	<b>Basis</b>
6	<p style="text-align: center;"><i>Waste Packages and Canisters</i></p> <p>DOE shall not, without prior NRC review and approval, accept the following waste packages: (i) 5-DHLW/DOE long codisposal; (ii) 2-MCO/2-DHLW codisposal; and (iii) Naval Short.</p> <p>DOE shall not, without prior NRC review and approval, accept the following canisters: (i) DHLW long; (ii) DOE long; and (iii) Naval Short.</p> <p>Any amendment request must include information that either (i) confirms that the current PCSA bounds the intended performance of these waste packages and canisters at the GROA or (ii) demonstrates, through the PCSA, that these waste packages and canisters can be safely received and handled at the repository during the preclosure period in accordance with 10 CFR 63.112.</p>	<p>see SER Volume 2 Section 2.1.1.7.3.9.1</p>
7	<p>DOE shall not, without prior NRC review and approval, accept DPCs at the repository.</p> <p>Any amendment request must include information that either (i) confirms that the current PCSA bounds the intended performance of the DPCs at the GROA or (ii) demonstrates, through the PCSA, that the DPCs can be safely received and handled at the repository during the preclosure period in accordance with 10 CFR 63.112.</p> <p style="text-align: center;"><i>Progress of Construction</i></p> <p>DOE shall furnish periodic reports every 6 months regarding the progress of construction</p>	<p>see SER Volume 2 Section 2.1.1.7.3.9.3.3</p>
8	<p style="text-align: center;"><i>Progress of Construction</i></p> <p>DOE shall furnish periodic reports every 6 months regarding the progress of construction</p>	<p>Section 63.32(b)(1) requires DOE to report on the progress of construction;</p> <p>Periodic reports every 6 months on the progress of construction is consistent with the frequency for progress reports during the conduct of site characterization activities as specified at 10 CFR 63.16.</p>

**Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)**

<b>Number</b>	<b>Condition on Construction Authorization</b>	<b>Basis</b>
9	<p style="text-align: center;"><i>Site Data Not Within Predicted Limits</i></p> <p>DOE shall furnish special reports in a timely manner but no later than 6 months following a finding of any data about the site, obtained during construction, that are not within the predicted limits on which the facility design was based.</p>	<p>Section 63.32(b)(2) requires DOE to report on any data about the site, obtained during construction, that is not within predicted limits.</p> <p>Special reports no later than 6 months following the finding is consistent with the timing of progress reports during the conduct of site characterization activities as specified at 10 CFR 63.16.</p>
10	<p style="text-align: center;"><i>Deficiencies in Design and Construction</i></p> <p>DOE shall furnish special reports in a timely manner but no later than 6 months following a finding of any deficiencies, in design and construction, that, if uncorrected, could adversely affect safety at any future time.</p>	<p>Section 63.32(b)(3) requires DOE to report on any deficiencies in design and construction that, if uncorrected, could adversely affect safety at any future time.</p> <p>Special reports no later than 6 months following the finding is consistent with the timing for special reports about site data not within predicted limits as discussed under the proposed condition number 9 above.</p>
11	<p style="text-align: center;"><i>Research and Development Program</i></p> <p>If DOE identifies safety questions that require research and development programs being conducted, the results of those programs must be reported to the NRC in accordance with 10 CFR 63.32(b)(4). DOE shall furnish such periodic reports in a timely manner beginning no later than 6 months following the identification of a safety question that requires a research and development program and every 6 months thereafter until the completion of the research and development program or resolution of the issue.</p>	<p>Section 63.32(b)(4) requires DOE to report on the results of research and development programs being conducted to resolve safety questions.</p> <p>[see SER Volume 4 Section 2.3.3]</p>

**Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)**

<b>Number</b>	<b>Condition on Construction Authorization</b>	<b>Basis</b>
12	<p><i>License to Receive and Possess</i></p> <p>DOE shall not receive and possess source, special nuclear, or byproduct material at the Yucca Mountain site geologic repository operations area until:</p> <p>(1) DOE has updated its application, as specified at 10 CFR 63.24; and</p> <p>(2) The Commission has made its findings stated in 10 CFR 63.41.</p>	<p>Section 63.32(d) places specific requirements on DOE before it is allowed to receive and possess source, special nuclear, or byproduct material at the Yucca Mountain site geologic repository operations area.</p>
13	<p><i>Repository Construction Statements, Representations, and Commitments</i></p> <p>Subject to the conditions and requirements incorporated herein, the licensee is authorized to construct a repository at Yucca, Mountain, NV in accordance with the statements, representations, and commitments in the SAR as defined under Condition 14. This information is hereby incorporated by reference, except where superseded by license condition.</p> <p>Whenever the words “will,” “shall,” or “would” are used in the above referenced documents, it shall denote a requirement.</p>	<p>Section 63.32(a) provides that the Commission shall include any conditions it considers necessary to protect the health and safety of the public, the common defense and security, or environmental values. This condition will ensure that an approved repository is constructed consistent with statements, representations, and commitments reviewed and approved by NRC.</p>
14	<p><i>Restrictions on Subsequent Changes After Construction Authorization</i></p> <p>In accordance with 10 CFR 63.32(c), the following restrictions on subsequent changes to the features of the repository and procedures shall apply:</p> <ul style="list-style-type: none"> <li>The licensee shall apply the requirements of 10 CFR 63.44 to any changes to the geologic repository operations area design or procedures as described in the SAR, except for items specifically identified by condition, including <ul style="list-style-type: none"> <li>(i) changes in the geologic repository operations area as described in the SAR, (ii) changes in the procedures as described in the SAR, and (iii) tests or experiments not</li> </ul> </li> </ul>	<p>see SER Volume 5 Section 2.5.10.1.3.1.1.1</p>

Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)

Number	Condition on Construction Authorization	Basis
	<p>described in the SAR. However, DOE may not use 10 CFR 63.44 to make changes to its QA program description required by 10 CFR 63.21(c)(20). In accordance with 10 CFR 63.44(d), any changes to this QA program description must be processed in accordance with 10 CFR 63.144. In addition, in accordance with 10 CFR 63.44(b)(4), DOE may not use the provisions in 10 CFR 63.44 to make changes to the GROA or procedures when applicable regulations establish more specific criteria for accomplishing such changes.</p> <p>For purposes of applying the 10 CFR 63.44 requirements upon issuance of the construction authorization, the SAR is defined as including: (i) the SAR submitted on June 3, 2008, as updated by DOE's revised SAR submitted on February 19, 2009; and (ii) the DOE responses to NRC staff requests for additional information identified in SER Section 2.5.10.1.4.</p> <ul style="list-style-type: none"> <li> <p><i>Category 2 and 3 Restrictions</i></p> <p>Pursuant to 10 CFR 63.32(c), the licensee is restricted from making any changes, without 60 days prior notice to the Commission and prior Commission approval, that (i) require an amendment of the construction authorization pursuant to the criteria in 10 CFR 63.44(b)(2); or (ii) change land controls for the geologic setting of the repository related to compliance with the preclosure performance objectives [10 CFR 63.111(a) and (b)], implementation of emergency planning [10 CFR 63.161], and controls to prevent adverse human actions that could significantly reduce the geologic repository's ability to achieve isolation [10 CFR 63.121(b)].</p> </li> </ul> <p>The licensee is restricted from making any changes to the scope (including the frequency of monitoring and maintenance</p>	

**Table 2.5-1. Proposed Conditions on the Construction Authorization (continued)**

<b>Number</b>	<b>Condition on Construction Authorization</b>	<b>Basis</b>
	<p>activities) of the monitoring and maintenance programs for ensuring the stability of repository drifts, as described in SAR Section 1.3.1.2.1.6, without 60 days prior notice to the Commission. In this notice, the applicant should confirm that any proposed change will not adversely impact the reliability or safety functions for the potentially impacted SSCs important to safety or barriers important to waste isolation. Changes to the scope of the monitoring and maintenance programs for ensuring stability of repository drifts may not be changed without prior Commission approval if, after receiving the required 60 day notice, the Commission so orders.</p>	



## CHAPTER 2

### 2.5.10.2 Probable Subjects for License Specifications

#### 2.5.10.2.1 Introduction

NRC regulations at 10 CFR 63.21(c)(18) require the U.S. Department of Energy (DOE) to provide, as part of the Safety Analysis Report (SAR), probable subjects of license specifications. By letter dated June 3, 2008, as supplemented on February 19, 2009 (DOE 2009av), the DOE provided in its license application [SAR Volume 5, Section 5.10 (DOE, 2008ab)] its proposals for potential subjects of license specifications. This section of the SER provides the NRC staff's evaluation of DOE's identification and justification of probable subjects of license specifications. The NRC staff review of the probable subjects of license specifications has been integrated with the NRC staff's review documented in SER Volumes 1–4.

#### 2.5.10.2.2 Regulatory Requirements

The regulation at 10 CFR 63.21(c)(18) requires DOE to provide in the Safety Analysis Report “an identification and justification for the selection of those variables, conditions, or other items that are determined to be probable subjects of license specifications” noting that “[s]pecial attention must be given to those items that may significantly influence the final design.”

Requirements for license specifications, which would apply to any license to receive and possess source, special nuclear, or byproduct material at a geologic repository operations area at the Yucca Mountain site include 10 CFR 63.42 and 10 CFR 63.43. Section 63.42 states that “the Commission shall include any conditions, including license specifications, it considers necessary to protect the health and safety of the public, the common defense and security, and environmental values in a license issued under” Part 63.

10 CFR 63.43 identifies the following categories for license conditions:

- (1) Restrictions as to the physical and chemical form and radioisotopic content of radioactive waste.
- (2) Restrictions as to size, shape, and materials and methods of construction of radioactive waste packaging.
- (3) Restrictions as to the amount of waste permitted per unit volume of storage space, considering the physical characteristics of both the waste and the host rock.
- (4) Requirements relating to test, calibration, or inspection, to assure that the foregoing restrictions are observed.
- (5) Controls to be applied to restrict access and to avoid disturbance to the site and to areas outside the site where conditions may affect compliance with 10 CFR 63.111 and 63.113.

- (6) Administrative controls, which are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure that activities at the facility are conducted in a safe manner and in conformity with the other license specifications.

In accordance with 10 CFR 63.21(a), the application must be as complete as possible in light of information that is reasonably available at the time of docketing. For example, at the time of the submission of the license application, the construction of the GROA has not started and equipment has not been procured, therefore, the NRC staff does not expect that the proposed subject of license specifications would contain specific details that are dependent on final designs, such as maintenance schedules and requirements, or the operating conditions for equipment. Such details would be available after designs are finalized and equipment has been procured. Final license specifications would be incorporated in any license to receive and possess.

Review of the proposed subjects of license specifications as part of the NRC staff's evaluation regarding the construction authorization focuses on those specifications that could affect the final design. Therefore, the NRC staff's review evaluates the proposed subjects of license specifications to ensure that subjects important to final design are addressed and the justification is based on and consistent with the NRC staff's review of the design bases and criteria documented in SER Volumes 1 through 4. In its review of the SAR and supporting information regarding probable subjects of license specifications, the NRC staff uses the guidance in Yucca Mountain Review Plan (YMRP) (NRC, 2003aa) Section 2.5.10, as appropriate.

The acceptance criteria are:

**Acceptance Criterion 1:** Variables, Conditions, and Other Items That Are the Subject of Proposed License Specifications Are Adequately Identified, and Acceptable Technical Bases Have Been Provided.

**Acceptance Criterion 2:** Plans for Meeting the Proposed License Specifications and Their Technical Bases Are Adequately Defined.

The NRC staff notes that YMRP Section 2.5.10 also provides guidance regarding a review for compliance with 10 CFR 63.43, License specification, which addresses conditions and specifications for any license to receive and possess. The NRC staff is not evaluating DOE's application for compliance with 10 CFR 63.43 at this phase of the licensing process (i.e., construction authorization). At this stage of the licensing process, in accordance with 10 CFR 63.21(c)(18), the NRC staff's review focuses on whether DOE has provided adequate identification and justification for the selection of items as probable subjects of license specifications. In accordance with 10 CFR 63.42, the Commission would impose license specifications at a later stage in the licensing process (i.e., in its review of an application for a license to receive and possess).



## 2.5.10.2.3 Technical Review

### 2.5.10.2.3.1 Identification of Probable Subjects of License Specifications

#### DOE Approach

In SAR Section 5.10, the applicant stated that it used NRC guidance for technical specifications incorporated in operating licenses for commercial power reactors for developing the subjects of license specifications. NUREG–1430 (NRC 2004ad), for example, contains the standard technical specifications for commercial power plants that use Babcock and Wilcox–designed reactors and nuclear steam supply systems. Similar guidance for technical specifications for spent nuclear fuel (SNF) storage casks is contained in NUREG–1745 (NRC 2001aj). Using these guidance documents, the applicant grouped the proposed probable subjects of license specifications into three sections: (i) limiting conditions for operation, (ii) design features, and (iii) administrative controls. DOE stated

- The purpose of the license specifications is to impose those conditions or limitations upon repository operation necessary to (i) reduce, consistent with the preclosure safety analysis (PCSA), the probability of an off-normal situation or event that might present a threat to the public health and safety and (ii) provide assurance that the postclosure performance of the geologic repository will be consistent with the performance assessment.
- The purpose of the license specifications is accomplished by identifying those features that are of controlling importance to safety and waste isolation, and placing on them certain conditions of operation that cannot be changed without prior NRC approval.
- Proposed subjects of license specifications are selected considering the unique structure and function of the geologic repository and the GROA and the importance of programs; structures, systems, and components (SSCs); or features in preventing or mitigating event sequences or in providing adequate waste isolation.
- The proposed subjects were derived from the analyses and evaluations of the PCSA and postclosure performance assessment with special attention to those subjects that may significantly affect the final design of the repository.
- The probable subjects of license specifications proposed do not include parameters or features that are explicitly required by regulations. For example, the Performance Confirmation Program is required by regulation with explicit requirements relative to the scope of the program and required evaluations and reporting criteria, therefore, DOE stated that parameters subject to the Performance Confirmation Program are not included as probable subjects of license specifications.

DOE has identified the following as probable subjects for license specifications:

(1) **probable subjects of license specifications for operation**

(DOE 2009av, Table 5.10-1)

- (a) surface ITS confinement HVAC systems
- (b) ITS power system (e.g., ITS direct current power and diesel generators)

- (c) ITS HVAC system supporting cooling of ITS electrical and control equipment
  - (d) ITS fire detection and suppression system
  - (e) TAD canister dewatering and drying
  - (f) wet handling facility pool boron concentration
  - (g) ITS radiation detectors and interlocks
- (2) **probable subjects of license specifications for design features**  
(DOE 2009av, Table 5.10-2)
- (a) repository location (e.g., site boundaries)
  - (b) geologic constraints for emplacement drifts (e.g., depth above groundwater)
  - (c) location, size and capacity of aging pads
  - (d) waste form limits (e.g., maximum burnup, enrichment, and time out of reactor)
  - (e) waste package limits (e.g., waste package configuration)
  - (f) drip shield limits (e.g., interlocking design features)
- (3) **probable subjects of license specifications for administrative controls**  
(DOE 2009av, Table 5.10-3)
- (a) responsibilities (e.g., site operations manager, waste handling manager)
  - (b) organization (e.g., organization charts, functional descriptions of departmental responsibilities and relationships)
  - (c) repository staff qualifications (e.g., operation staff be trained and certified)
  - (d) procedures (e.g., emergency operations, alarms and annunciators, maintenance)
  - (e) high radiation areas (e.g., alternative methods to control access)
  - (f) license specifications bases control program
- (4) **probable subjects of license specifications for administrative controls for programs/manuals unique to the operation of a geologic repository and GROA required to ensure operations are consistent with the assumptions of the PCSA or postclosure analyses**  
(DOE 2009av, Table 5.10-3)
- (a) waste form and waste package qualification program
  - (b) canister and transportation cask acceptance program
  - (c) reliability centered maintenance
  - (d) waste package loading, handling, and emplacement program
  - (e) subsurface committed materials control program
  - (f) access control program (control access outside the GROA to avoid disturbance of site)
  - (g) fire protection program (e.g., ignition source control, fire barriers)
  - (h) technical requirements manual (e.g., approval process for changes to Technical Requirements Manual and associated bases)

DOE stated that (i) the limiting conditions for operation will include specific surveillance testing requirements or other inspections to verify that process variables are maintained within proper ranges or to support determinations of SSC capability to function in a manner that bounds the nuclear safety design bases for the PCSA and the postclosure performance assessment; (ii) the configuration management system will include necessary reviews to ensure compliance with 10 CFR 63.44 for proposed changes to the SAR that could impact the repository design, analysis, or operation; and (iii) it will submit a proposed draft set of license specifications to the

NRC prior to issuance of a license to receive and possess and the final license specifications issued by the NRC are expected to be incorporated as an appendix to the license to receive and possess.

Additionally, DOE stated that operating crews will be trained on the requirements and purpose of the license specifications and will be required to maintain strict adherence to the limiting conditions of operation. Implementation of license specifications will be supported by, and operations conducted in accordance with, procedures and instructions following the format and requirements provided in a Conduct of Operations Plan. DOE stated its Conduct of Operations Plan will be developed prior to the receipt of the license to receive and possess and will be patterned after published nuclear industry guidelines for conduct of operations.

### NRC Evaluation

The NRC staff reviewed DOE's selection of the probable subjects of license specifications provided in SAR Section 5.10 considering the information available at this stage of the licensing process and the guidance in the YMRP Section 2.5.10. The NRC staff's review focused on (i) DOE's identification of the probable subjects of the license specifications and the associated technical basis and (ii) the plans for implementing the license specifications.

The NRC staff determines that the applicant took a systematic approach for identification of the proposed subjects of license specifications and identified a variety of subjects that were provided under the categories of (i) limiting conditions for operation, (ii) design features, and (iii) administrative controls. The NRC staff concludes that the applicant's approach is acceptable because the applicant (i) used NRC guidance documents for technical specifications that include similar activities and designs related to the storage and handling of SNF [i.e., technical specifications incorporated in the operating licenses for commercial power reactors for developing the license specifications (NRC 2004ad; NUREG-1430) and technical specifications for SNF storage casks (NRC 2001aj; NUREG-1745)]; (ii) provided proposed subjects that included design features, limiting conditions for operations, and administrative controls; and (iii) used the PCSA and the postclosure performance assessment to assist in the identification of the proposed subjects of license specifications.

The applicant identified the probable subjects for license specifications for (i) the limiting conditions for operations, (ii) design features, and (iii) administrative controls. The applicant also provided the technical basis for the probable subjects for license specifications that can be directly related to repository safety (SAR Tables 5.10-1 through 5.10-3). For example, the applicant identified and described that (i) the surface ITS confinement HVAC systems is an active system whose operability is relied on to mitigate the radiological dose consequences in the event of a drop or mishandling event (limiting condition will establish operability and testing requirements for each surface facility with and ITS HVAC); (ii) the ITS power, including the backup diesel generators, is an active system used to provide uninterruptable power to the ITS HVAC (limiting condition will establish operability and testing requirements for ITS diesel generators and associated portions of the ITS power system); (iii) portions of the ITS supply and exhaust HVAC is an active system that supports the operation of the ITS power system by providing cooling of ITS electrical and control equipment and battery rooms (limiting conditions for operation will establish operability and testing requirement); (iv) the ITS fire detection and suppression system is an active system to prevent criticality by limiting the frequency of spurious actuation that could introduce moderator (i.e., water) into areas where potential breaches of the waste package might occur (limiting conditions for operation will establish operability and testing requirement for the fire protection system in the Canister Receipt and

Closure Facility and the Wet Handling Facility); (v) the limiting condition for the wet handling facility will specify requirements for maintaining a minimum concentration of soluble boron in the pool for criticality prevention; (vi) ITS radiation detectors and interlocks used to prevent the inadvertent opening of an ITS shield door should high radiation conditions be present (limiting conditions for operation will establish operability and testing requirements for ITS radiation detectors and interlocks for shield doors separating the waste package loadout areas in the Initial Handling Facility and the Canister Receipt and Closure Facility); (vii) key features of the waste package that contribute to postclosure performance of the engineered barrier system (outer corrosion barrier material, acceptable waste package configurations, and inner vessel materials and design/construction codes of record); and (viii) a systematic maintenance process by which equipment important to the repository's function is properly identified and specific maintenance activities are assigned and performed at the proper frequency to ensure reliability goals are achieved and/or maintained.

Based on the NRC staff's review of DOE's identification of probable subjects for license specifications and the associated technical bases, the NRC staff finds that DOE has identified probable subjects of license specifications that may significantly influence final design. For example the applicant described (i) specifications controlling the operation of the confinement for the HVAC system (e.g., specifications for the HVAC system may significantly influence the structural design of the buildings); (ii) specifications for the operability and testing requirements of the fire protection system in areas where potential breaches of waste canisters are postulated (e.g., specifications for the fire protection system may significantly influence the final design of equipment within the facilities); (iii) specifications for operability and testing requirements for radiation detectors and interlocks that function to preclude opening of shield doors in the presence of high radiation levels (e.g., specifications for radiation detectors and interlocks may significantly influence the final design of SSCs related to the handling of spent fuel within the facilities); (iv) specifications for the location, size, and capacity of the aging pads may significantly influence the final design for the aging pad; (v) specifications that provide limits on key parameters associated with the waste forms to be handled in the GROA and emplaced in the geologic repository may significantly influence the final design for repository drifts; (vi) specifications that provide limits on key features of the waste packages may significantly influence the final design of the waste package; (vii) specifications for the transportation, aging, and disposal (TAD) canister loading limitations (e.g., 22.0 kW thermal limit and compliance with loading restrictions on enrichment, burnup, and cooling) may significantly influence the final design of canister handling SSCs; (viii) specifications that provide limitations on waste handling including lift height restrictions may significantly influence the final design of buildings; and (ix) specifications for waste package emplacement requirements (e.g., spacing, and standoff distance from faults) may significantly influence the final design of repository drifts. Thus, the NRC staff finds that the applicant has adequately identified the probable subjects of license specifications that may significantly influence final design.

The NRC staff also finds that the applicant's plans for implementation of the proposed subjects of license specifications is acceptable because the applicant explained that it (i) will train the operating crews on the requirements and purpose of the license specifications and require strict adherence to the limiting conditions of operation; (ii) license specifications will be supported by, and operations conducted in accordance with, procedures and instructions following the format and requirements provided in a Conduct of Operations Plan (DOE stated its Conduct of Operations Plan will be developed prior to the receipt of the license to receive and possess and will be patterned after published nuclear industry guidelines for conduct of operations); and (iii) the configuration management system will include necessary reviews to ensure compliance with 10 CFR 63.44 for proposed changes to the SAR that could impact the repository design,

analysis, or operation. Additionally, DOE stated that it will submit a proposed draft set of license specifications to the NRC prior to issuance of a license to receive and possess and that final specifications will be part of the license to receive and possess.

Based on this evaluation, the NRC staff concludes, with reasonable assurance, that the requirements of 10 CFR 63.21(c)(18) are satisfied because (i) the applicant's identification and technical justification of the probable subjects for license specifications are acceptable; and (ii) the applicant acceptably described its plans for implementation of the probable subjects of license specifications.

#### **2.5.10.2.4           References**

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## CHAPTER 3

### Conclusions

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed and evaluated the U.S. Department of Energy's (DOE) Safety Analysis Report (SAR), provided in its June 3, 2008, license application (LA), as updated on February 19, 2009. The NRC staff also reviewed information DOE provided in response to the NRC staff's requests for additional information and other information that DOE provided related to the SAR. The staff has documented the results of its review in its Safety Evaluation Reports (SER) Volumes 1 through 5. In summary, the NRC staff has found that

- DOE has adequately described the proposed geologic repository at Yucca Mountain including the information, analyses, and programs associated with the preclosure and postclosure performance of the repository as specified in 10 CFR 63.21 of NRC's regulations.
- DOE has adequately described (i) the material control and accounting program; and (ii) security measures for physical protection in accordance with 10 CFR 73.51 (SER Volume 1: General Information).
- The NRC staff has found, with reasonable assurance, that subject to proposed conditions of the construction authorization, DOE's design of the proposed geologic repository operations area (GROA) and preclosure safety analysis complies with the preclosure performance objectives at 10 CFR 63.111 and the requirements for preclosure safety analysis of the GROA at 10 CFR 63.112. (SER Volume 2: Repository Safety Before Permanent Closure).
- The NRC staff has found, with reasonable expectation, that the proposed Yucca Mountain repository design meets the applicable postclosure performance objectives in Subpart E, including the requirement that the repository be composed of multiple barriers; and (ii) based on performance assessment evaluations that are in compliance with applicable regulatory requirements, meets the 10 CFR Part 63, Subpart L limits for individual protection, human intrusion, and separate standards for protection of groundwater. (SER Volume 3: Repository Safety After Permanent Closure).
- NRC staff has found, with reasonable assurance, that, except as noted below, DOE has addressed applicable administrative and programmatic requirements regarding, "Land Ownership and Control"; "Records, Reports, Tests, and Inspections"; "Performance Confirmation Program"; "Quality Assurance"; "Training and Certification of Personnel"; and "Emergency Planning Criteria." The NRC staff finds that DOE has not met the requirements in 10 CFR 63.121(a) and 10 CFR 63.121(d)(1) regarding ownership of land and water rights, respectively. (SER Volume 4: Administrative and Programmatic Requirements)
- The NRC staff has found, with reasonable assurance, that the requirements of 10 CFR Part 63.21(c)(18) are satisfied because: (i) the applicant's identification and technical justification of the probable subjects for license specifications are acceptable;

and (ii) the applicant acceptably described its plans for implementation of the probable subjects of license specifications.  
(SER Volume 5: Proposed Conditions on the Construction Authorization and Probable Subjects of License Specifications)

As noted above, the NRC staff determined that DOE has not satisfied certain regulatory requirements regarding ownership of the land where the GROA is located and water rights. In addition, a supplement to DOE's environmental impact statement has not yet been completed. Thus, the NRC staff is not recommending issuance of a construction authorization at this time.

Nevertheless, in accordance with 10 CFR Part 63 requirements, SER Volume 5 identifies conditions of Construction Authorization proposed by the NRC staff based on its review of DOE's SAR, supplemental documents referenced in the SAR, and DOE's responses to NRC staff requests for additional information (RAIs). These NRC staff proposed conditions could be included in a Construction Authorization if there is a Commission decision to authorize construction. However, these proposed conditions do not represent an approach for addressing the regulatory requirements regarding ownership of the land and water rights that DOE did not meet. Should the applicant provide additional information, the NRC staff may remove or revise a condition stated here or could add one or more conditions, based on its review of that information.



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(See instructions on the reverse)

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10. SUPPLEMENTARY NOTES

Docket No. 63-001

11. ABSTRACT (200 words or less)

The SER evaluates the U.S. Department of Energy's (DOE's) license application for a construction authorization including the information DOE provided in response to the U.S. Nuclear Regulatory Commission (NRC) staff's requests for additional information (RAIs) and other information that DOE provided related to the Safety Analysis Report (SAR). The NRC staff is issuing its SER in five volumes. This SER Volume 5 documents the NRC staff's proposed conditions of construction authorization, including proposed conditions documented in the other SER Volumes. In addition, SER Volume 5 documents the NRC staff's review of DOE's probable subjects of license specifications provided in its Safety Analysis Report (SAR) in DOE's June 3, 2008, license application submittal (DOE, 2008ab), as updated on February 19, 2009 (DOE, 2009av). The NRC staff also reviewed information DOE provided in response to the NRC staff's requests for additional information (RAIs) and other information that DOE provided related to the SAR.

The NRC staff is not recommending issuance of a construction authorization at this time because the NRC staff determined that DOE has not met the regulatory requirements regarding ownership and control of the land where the GROA would be located and certain water rights. In addition, a supplement to DOE's environmental impact statement has not yet been completed.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

10 CFR Part 63, Yucca Mountain, geologic repository, high-level radioactive waste, license application, construction authorization, safety evaluation report, SER, U.S. Department of Energy, DOE, Docket No. 63-001

13. AVAILABILITY STATEMENT

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14. SECURITY CLASSIFICATION

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**Safety Evaluation Report Related to Disposal of High-Level Radioactive Wastes  
in a Geologic Repository at Yucca Mountain, Nevada**

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