Technical Document for License Application Preparation, Chapter 4, Repository Surface Design, YMP/97-03, Rev. 01

NM5507

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CHAPTER 4. REPOSITORY SURFACE DESIGN

Chapter 4 describes the geologic repository operations area (GROA) surface facilities. Authors preparing the License Application (LA) shall use this document for guidance and must read the Introduction and Appendix B before writing their respective sections.

Proposed 10 CFR 63.24(b) (64 FR 8640) recognizes that all information may not be available at the time of docketing the LA. The guidance in this chapter adopts a differentiated approach for some required information. A differentiated approach means providing the information required at construction authorization (CA) versus that required at license to receive and possess high-level radioactive waste (HLW). Information in any section that is identified as "Information Required at the Time of Construction Authorization" will be provided at the time the LA is submitted for docketing. The information at the CA stage will be replaced or supplemented with additional information developed since docketing the LA. Some of the information that is required at the time to receive and possess may be totally new information. The additional information is identified as "Information Required at the Time of Update to the License Application to Receive and Possess." Because the Repository Surface Facility design has licensing precedent, the level of detail required in Chapter 4 will be less than is required for those chapters that contain the structures, systems, and components (SSCs) that do not have licensing precedent. The minimum required level of design detail for the Surface Facility SSCs is provided in Section 4.1.

4. PURPOSE AND SUMMARY

Provide an introductory discussion outlining the purpose and organization of this chapter. Describe the mission of the GROA. Include a mission statement, planned waste disposal totals, and emplacement duration for wastes (i.e., 24 years).

Provide a summary and conclusions regarding how the surface facility design process and specific designs support safe operation of the repository as demonstrated in Chapter 7 of the LA.

4.1 SURFACE FACILITIES DESIGN

Briefly describe how the repository is designed to withstand natural phenomena such as seismic events. Refer to Chapter 7 for the specific natural phenomena considered and evaluated for design basis events (DBEs). State that the surface SSCs design adequately addresses these DBEs, demonstrating that the performance objectives of the proposed 10 CFR 63.111 (64 FR 8640) can be met given the occurrence of these events.

Provide an overview of the major site features that affect GROA design and performance. Refer to Chapter 3 for the detailed description of this information. Provide a reference to additional descriptions of site conditions expected to be encountered in constructing the surface facilities. Discuss the site-related design bases relevant to the GROA design. The site-related design bases include ambient temperature and humidity extremes, seismic loadings, maximum wind loadings (including tornado), meteorology, and foundation design assumptions. Briefly describe the interpretation of site geology such as stratigraphy, structural features, major and minor faults, old

volcanoes, and history of seismic activity. Provide a reference to Chapter 3 for sources of site information and descriptions.

Describe the surface drainage characteristics.

Provide the following information and reference Chapter 3 for details:

- Soil properties and other relevant data for the design of foundations
- Relevant meteorological data
- Rock data and properties relevant to the design of surface facilities.

Describe the U.S. Department of Energy and Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O) documents that direct and control the repository design such as the generic requirements documents, the system description documents (SDDs), and system and subsystem requirements documents. State that the repository design also meets any other legal requirements of federal, state, and local agencies applicable to the mined geologic disposal of spent nuclear fuel (SNF) and HLW.

Briefly discuss the integrated safety analysis (ISA) performed to ensure the preclosure performance objectives are satisfied. Refer to Chapter 7 of the LA for a detailed discussion of the ISA. Briefly discuss how the ISA results are reflected in this chapter.

4.1.1 Surface Facility Design Overview

Provide a general description of the GROA surface facilities, including surface operational and support facilities that are Quality Level (QL) 1, 2, or 3. Identify the major surface operations performed at the facility, which are related to QL 1, 2, or 3 SSCs, while considering the following: receipt of HLW, cask maintenance, development operations, waste management, and balance of plant functions. Provide a brief overview of the waste stream to be placed in the repository and a cross-reference to more detailed discussions in Chapter 5. Describe the relationship and interface with the other portions of the monitored geologic repository. Provide the location of the GROA relative to the boundaries of the site. Provide drawings or figures to identify the appropriate facilities and GROA. Provide key descriptive parameters for the facilities, such as number of facilities, construction type, site area, overall floor space, and site location and terrain.

Briefly describe or list the major design features important to safety, retrievability, and waste isolation.

4.1.2 Level of Design Detail

This section provides the guidance for the required level of detail that must be provided for the SSCs that are discussed in Chapter 4. There will not be a Section 4.1.1 in the LA.

QL 1, 2, and 3 SSCs and non-safety SSCs are required to be described in the LA per the *Level of Design Detail Necessary for the License Application for Construction Authorization* (CRWMS M&O 1999). See Section 2.4 for more information related to QL classifications. For any SSC, the level of design detail required depends on the following (CRWMS M&O 1999):

- Importance to protection of public health and safety
- Importance to protection of worker health and safety
- Need to demonstrate compliance with regulatory requirements
- Need to support submittal of a docketable LA.

The QL information following this paragraph lists the specific information to be included in the description of SSCs that fall into one of the three QL classifications. If a specific information item is not relevant for a given SSC, that information item need not be addressed for that SSC in the LA.

4.1.2.1 Quality Level 1 Structures, Systems, and Components

The following information, as applicable, must be provided for each QL 1 SSC.

Regulatory Bases–These are primarily the proposed 10 CFR 63 (64 FR 8640) requirements.

- Identify the SSCs relied upon to limit or prevent potential accidents or mitigate their consequences; refer to Chapter 7 for details on the analysis that identified the SSCs as such. Identify the specific DBEs. Describe the design features incorporated into the SSCs and describe the function of the SSCs, including controls that are relied upon to limit, prevent, or mitigate the consequences of DBEs. Use drawings such as piping and instrument diagrams, electrical one-line diagrams, general arrangement drawings, and handling drawings as necessary to present the information. Identify measures taken to ensure the availability of identified safety systems (Interim Guidance Section 112(e) [Dyer and Horton 1999]). Discuss the design considerations that prevent releases of radioactive materials that could result in a dose of 0.25 mSv (25 mrem) to an individual member of the public at the boundary. Where appropriate, identify the sequence of events and how the system responds to the event (proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) and Interim Guidance Section 111(b)(2) [Dyer and Horton 1999]).

- Identify the SSCs that limit and control radiation exposures and radiation levels in restricted and unrestricted areas and the release of radioactive materials to unrestricted areas, and address the limits of 10 CFR 20.1201, 10 CFR 20.1301, and the as low as is reasonably achievable (ALARA) provisions of 10 CFR 20.1101(b) and 10 CFR 20.1101(d). The limits are as follows (proposed 10 CFR 63.111(a)(1) and proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) [Dyer and Horton 1999]):

  – No worker shall receive the more limiting total effective dose equivalent (TEDE) of 0.05 Sv (5 rem) or the sum of deep-dose equivalent and committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 0.50 Sv (50 rem) annually. The annual dose equivalent to the lens of the eye shall not exceed 0.15 Sv (15 rem). The annual shallow dose equivalent to the skin or any extremity shall not exceed 0.50 Sv (50 rem).

  - No individual member of the public shall receive a TEDE in excess of 1 mSv (0.1 rem) annually, and the dose in any unrestricted area from external sources does not exceed 0.02 mSv (0.002 rem) per hour.

- Identify ALARA design considerations for facility features that limit and control occupational dose and dose to members of the public as required by 10 CFR 20.1101(b) and 10 CFR 20.1101(d) (proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

- Describe the design considerations for systems that monitor and control effluents. Describe design considerations for facility features and systems that control and monitor radiation levels to limit occupational radiation exposure (proposed 10 CFR 63.21(c)(14) and proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

License Specifications

- **Information Required at the Time of Construction Authorization**–When discussing equipment or parameters credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE, note that the item is being considered as a subject for a license specification in accordance with proposed 10 CFR 63.21(c)(13) (64 FR 8640). Include supporting information to demonstrate how and why the item is credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE. Refer to Chapter 11 for an identification of the license specifications and summary of their justification for being considered as a license specification (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

- **Information Required at the Time of Update to the License Application to Receive and Possess**–Identify equipment and parameters used to mitigate the consequences of a Category 1 or 2 DBE as being addressed in the license specifications. Refer to Chapter 11 for a discussion of the license specification development process (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

Applicable Codes and Standards–List the codes and standards (including guidance documents and technical positions) required in the design and construction of the GROA. The codes, standards, and other documents should be listed on a structure or system level. The codes and standards listed must be the same as those found in corresponding SDDs (proposed 10 CFR 63.21(c)(3) [64 FR 8640]).

Design Criteria–A design criterion is a standard or rule against which a design can be judged. The U.S. Nuclear Regulatory Commission (NRC) defines principal design criteria in 10 CFR 50, Appendix A, as criteria that establish the necessary design, fabrication, construction, and performance requirements for SSCs important to safety (CRWMS M&O 1999). Examples include:

- The lifetime of the waste package (WP) shall be long enough to contain the waste throughout the thermal period.

- Provisions shall be made so that, if there is a loss of the primary electric power source or circuit, reliable and timely emergency power can be provided to instruments, utility service systems, and operating systems, including alarm systems, important to safety.
- The facility design shall comply with the ALARA criteria of 10 CFR 20.
- See the example table below.

Summary of Centralized Interim Storage Facility Principal Design Criteria

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards, & Bases
Seismic (Ground Motion)	Design response spectra anchored at horizontal acceleration of 0.75g	Accident	N/A
Seismic (Surface Faulting)	No surface faulting	Accident	N/A

Source: DOE 1998

The design criteria are found in the appropriate SDD.

Design Bases–Design bases refer to the information that identifies the specific functions to be performed by an SSC of a facility and the specific values or range of values chosen for controlling parameters as reference bounds for design. These values may be restraints derived from generally accepted "state-of-the-art" practices for achieving functional goals or requirements derived from analysis (based on calculation or experiments) of the effects of a postulated event under which an SSC must meet its functional goals. The values for controlling parameters for external events include (CRWMS M&O 1999):

- Estimates of severe natural events, to be used for deriving design bases, that will be based on consideration of historical data on the associated parameters, physical data, or analysis of upper limits of the physical processes involved
- Estimates of severe external human-induced events, to be used for deriving design bases, that will be based on analysis of human activity in the region, taking into account the site characteristics and the risks associated with the event.

The project design bases are the combination of the system functions and the performance parameters found in the SDDs.

General Description–This is an overall description of the SSCs, equipment, and process activities. Base this description on the information contained in the related SDDs. Include in this description the information required to support the safety analysis of the system or that which can be readily derived from it. Provide a summary of the system functions, operations, the system design, concept of operations, and a description of system interfaces. Include a discussion on any special construction or fabrication techniques, unique testing programs, or special design and analysis procedures used for the SSCs, as applicable. Include diagrams to show concepts or ideas as needed to support the text (proposed 10 CFR 63.112(a) [64 FR 8640]).

Discussion of the materials of construction (including general arrangement and approximate dimensions) for the GROA (proposed 10 CFR 63.21(c)(3) [64 FR 8640]) includes the following:

- **Information Required at the Time of Construction Authorization**–Include only the principal materials used in the design of SSCs that either prevent or mitigate a Category 1 or 2 DBE or are required for worker safety. Examples of principal materials are structural such as steel beam construction or reinforced concrete, systems components such as stainless steel piping, high-efficiency particulate air (HEPA) filters with charcoal absorbers, or leaded glass used for shielding. The materials of construction should be discussed on an SSC level as they are described in the various sections.

- **Information Required at the Time of Update to the License Application to Receive and Possess**–In addition to information provided at the time of CA, present a detailed description of the materials of construction. This should be done by component or subsystem as each is discussed in the description of the specific SSCs. The information should include the compatibility of the material with its environment during normal operations or post-accident situations, whichever is the most limiting as it relates to the service that the component provides. Three examples are provided here:

  – HEPA filters

    HEPA filter elements are made of pleated fiberglass with an aluminum separator design, measure 24 x 24 x 11.5 in., and are each capable of handling a nominal flow rate of 1,000 ft^3/min. The filter medium is cased in stainless steel, has face guards on both sides, and is water- and fire-resistant.

  – Cooling coils

    The cooling coils are of nonferrous construction with aluminum fins mechanically bonded to seamless copper tubing. Coils are arranged for counter-flow operation using chilled water. The tube bundle is enclosed in a steel frame.

  – Low total dissolved solids holdup tank (T-01 C)

Quantity per unit	=	1
Capacity (each)	=	30,000 gal
Design pressure and temperature	=	Atmospheric pressure and 150°F
Operating pressure and temperature	=	Atmospheric pressure and 80°F
Material	=	304 stainless steel

Research and Development

- **Information Required at the Time of Construction Authorization**–Identify SSCs that require research and development (R&D) to confirm the adequacy of design. Provide available information that describes the type of R&D required and the reason the

additional information is needed. Refer to Chapter 11 for a description of the R&D program and the proposed schedule (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).

- **Information Required at the Time of Update to the License Application to Receive and Possess**–Provide the results from the required R&D identified in the LA at the time of CA for the various SSCs. Discuss the reason the additional information was originally needed (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).

Decontamination

Information Required at the Time of Update to the License Application to Receive and Possess–Provide the specific decontamination design considerations as part of the SSC discussion (proposed 10 CFR 63.21(c)(18) [64 FR 8640]).

Drawings and Diagrams–The drawings and diagrams required for QL 1 SSCs included and discussed in Chapter 4 are those that show information to support the safety case. Typical types of drawings and diagrams are listed below (proposed 10 CFR 63.112(a) [64 FR 8640]).

- Piping and instrument diagrams
- Electrical one-line diagrams
- General arrangement drawings
- Handling diagrams.

4.1.2.2 Quality Level 2 Structures, Systems, and Components

The following information, as applicable, must be provided for each QL 2 SSC.

Regulatory Bases–These are primarily the proposed 10 CFR 63 (64 FR 8640) requirements.

- Identify the SSCs relied upon to limit or prevent potential accidents or mitigate their consequences; refer to Chapter 7 for details on the analysis that identified the SSC as such. Identify the specific DBEs. Identify and describe the design features incorporated into the SSC and describe the function of the SSCs, including controls that are relied upon to limit, prevent, or mitigate the consequences of DBEs. Include identification of measures taken to ensure the availability of identified safety systems (Interim Guidance Section 112(e) [Dyer and Horton 1999]). Discuss the design considerations that prevent releases of radioactive materials that could result in a dose of 0.25 mSv (25 mrem) to an individual member of the public at the boundary. Where appropriate, identify the sequence of events and how the system responds to the event (proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) and Interim Guidance Section 111(b)(2) [Dyer and Horton 1999]).

- Identify the SSCs that limit and control radiation exposures and radiation levels in restricted and unrestricted areas and the release of radioactive materials to unrestricted areas, and address the limits of 10 CFR 20.1201, 10 CFR 20.1301, and the ALARA provisions of 10 CFR 20.1101(b) and 10 CFR 20.1101(d). The limits are as follows

(proposed 10 CFR 63.111(a)(1) and proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) [Dyer and Horton 1999]):

- No worker shall receive the more limiting TEDE of 0.05 Sv (5 rem), or the sum of deep-dose equivalent and committed dose equivalent, to any individual organ or tissue (other than the lens of the eye) of 0.50 Sv (50 rem) annually. The annual dose equivalent to the lens of the eye shall not exceed 0.15 Sv (15 rem). The annual shallow dose equivalent to the skin or any extremity shall not exceed 0.50 Sv (50 rem).

- No individual member of the public shall receive a TEDE in excess of 1 mSv (0.1 rem) annually, and the dose in any unrestricted area from external sources does not exceed 0.02 mSv (0.002 rem) per hour.

- Identify ALARA design considerations for facility features that limit and control occupational dose and dose to members of the public as required by 10 CFR 20.1101(b) and 10 CFR 20.1101(d) (proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

- Describe the design considerations for systems that monitor and control effluents. Describe design considerations for facility features and systems that control and monitor radiation levels to limit occupational radiation exposure (proposed 10 CFR 63.21(c)(14) and proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

License Specifications

- **Information Required at the Time of Construction Authorization**–When discussing equipment or parameters credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE, note that the item is being considered as a subject for a license specification in accordance with proposed 10 CFR 63.21(c)(13) (64 FR 8640). Include the supporting information to demonstrate how and why the item is credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE. Refer to Chapter 11 for an identification of the license specifications and summary of their justification for being considered as a license specification (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

- **Information Required at the Time of Update to the License Application to Receive and Possess**–Identify equipment and parameters used to mitigate the consequences of a Category 1 or 2 DBE as being addressed in the license specifications. Refer to Chapter 11 for a discussion of the license specification development process (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

Applicable Codes and Standards–List the codes and standards (including guidance documents and technical positions) required in the design and construction of the GROA. The codes, standards, and other documents identified should be listed on a structure or system level. The codes and standards listed must be the same as those found in corresponding SDDs (proposed 10 CFR 63.21(c)(3) [64 FR 8640]).

Design Criteria–A design criterion is a standard or rule against which a design can be judged. The NRC defines principal design criteria in 10 CFR 50, Appendix A, as criteria that establish the necessary design, fabrication, construction, and performance requirements for SSCs important to safety (CRWMS M&O 1999). Examples include the following:

- The lifetime of the WP shall be long enough to contain the waste throughout the thermal period.
- Provisions shall be made so that, if there is a loss of the primary electric power source or circuit, reliable and timely emergency power can be provided to instruments, utility service systems, and operating systems, including alarm systems, important to safety.
- The facility design shall comply with the ALARA criteria of 10 CFR 20.
- See the example table in Section 4.1.1.1.

The design criteria are found in the SDD.

General Description–This is an overall description of the SSCs, equipment, and process activities. Base this description on the information contained in the related SDDs. Include in this description the information required to support the safety analysis of the system or that which can be readily derived from it. Provide a summary of the system functions, operations, the system design, concept of operations, and a description of system interfaces. Include a discussion on any special construction or fabrication techniques, unique testing programs, or special design and analysis procedures used for the SSCs, as applicable. Include diagrams to show concepts or ideas as needed to support the text (proposed 10 CFR 63.112(a) [64 FR 8640]).

Discussion of the materials of construction (including general arrangement and approximate dimensions) for the GROA includes the following (proposed 10 CFR 63.21(c)(3) [64 FR 8640]):

- **Information Required at the Time of Construction Authorization**–Include only the principal materials used in the design of SSCs that either prevent or mitigate a Category 1 or 2 DBE or are required for worker safety. Examples of principal materials are structural such as steel beam construction or reinforced concrete, systems components such as stainless steel piping, HEPA filters with charcoal absorbers, or leaded glass used for shielding. The materials of construction should be discussed on an SSC level as they are described in the various sections.
- **Information Required at the Time of Update to the License Application to Receive and Possess**–In addition to information provided at the time of CA, a detailed description of the materials of construction must be presented. This should be done by component as each is discussed in the description of the specific SSCs. The information should include the compatibility of the material with its environment during normal operations or post-accident situations, whichever is the most limiting and as it relates to the service that the component provides. See the examples provided under QL 1 SSCs.

Research and Development

- **Information Required at the Time of Construction Authorization**–Identify SSCs that require R&D to confirm the adequacy of design. Provide available information that describes the type of R&D required and the reason the additional information is needed. Refer to Chapter 11 for a description of the R&D program and the proposed schedule (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).

- **Information Required at the Time of Update to the License Application to Receive and Possess**–Provide the results from the required R&D identified in the LA at the time of CA for the various SSCs. Discuss the reason the additional information was originally needed (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).

Decontamination

Information Required at the Time of Update to the License Application to Receive and Possess–Provide the specific decontamination design considerations as part of the SSC discussion (proposed 10 CFR 63.21(c)(18) [64 FR 8640]).

4.1.2.3 Quality Level 3 Structures, Systems, and Components

The information, as applicable, that must be provided for each QL 3 SSC includes the following.

Regulatory Bases–These are primarily the proposed 10 CFR 63 (64 FR 8640) requirements.

- Identify the SSCs relied upon to limit or prevent potential accidents or mitigate their consequences; refer to Chapter 7 for details on the analysis that identified the SSC as such. Identify and describe the function of the SSCs, including controls that are relied upon to limit, prevent, or mitigate the consequences of DBEs. Include identification of measures taken to ensure the availability of identified safety systems (Interim Guidance Section 112(e) [Dyer and Horton 1999]). Discuss the design considerations that prevent releases of radioactive materials that could result in a dose of 0.25 mSv (25 mrem) to an individual member of the public at the boundary. Where appropriate, identify the sequence of events and how the system responds to the event (proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) and Interim Guidance Section 111(b)(2) [Dyer and Horton 1999]).

- Identify the SSCs that limit and control radiation exposures and radiation levels in restricted and unrestricted areas and the release of radioactive materials to unrestricted areas, and address the limits of 10 CFR 20.1201, 10 CFR 20.1301, and the ALARA provisions of 10 CFR 20.1101(b) and 10 CFR 20.1101(d). The limits are as follows (proposed 10 CFR 63.111(a)(1) and proposed 10 CFR 63.111(b)(1) [64 FR 8640]; Interim Guidance Section 111(a)(2) [Dyer and Horton 1999]):

  – No worker shall receive the more limiting TEDE of 0.05 Sv (5 rem), or the sum of deep-dose equivalent and committed dose equivalent, to any individual organ or tissue (other than the lens of the eye) of 0.50 Sv (50 rem) annually. The annual dose

equivalent to the lens of the eye shall not exceed 0.15 Sv (15 rem). The annual shallow dose equivalent to the skin or to any extremity shall not exceed 0.50 Sv (50 rem).

- No individual member of the public shall receive a TEDE in excess of 1 mSv (0.1 rem) annually, and the dose in any unrestricted area from external sources does not exceed 0.02 mSv (0.002 rem) per hour.

- Identify ALARA design considerations for facility features that limit and control occupational dose and dose to members of the public as required by 10 CFR 20.1101(b) and 10 CFR 20.1101(d) (proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

- Describe the design considerations for systems that monitor and control effluents. Describe design considerations for facility features and systems that control and monitor radiation levels to limit occupational radiation exposure (proposed 10 CFR 63.21(c)(14) and proposed 10 CFR 63.111(a)(1) [64 FR 8640]).

License Specifications

- **Information Required at the Time of Construction Authorization**–When discussing equipment or parameters credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE, note that the item is being considered as a subject for a license specification in accordance with proposed 10 CFR 63.21(c)(13) (64 FR 8640). Include supporting information to demonstrate how and why the item is credited in the safety analysis for mitigating the consequences of a Category 1 or 2 DBE. Refer to Chapter 11 for an identification of the license specifications and summary of their justification for being considered as a license specification (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

- **Information Required at the Time of Update to the License Application to Receive and Possess**–Identify equipment and parameters used to mitigate the consequences of a Category 1 or 2 DBE as being addressed in the license specifications. Refer to Chapter 11 for a discussion of the license specification development process (proposed 10 CFR 63.21(c)(13) [64 FR 8640]).

Design Criteria–A design criterion is a standard or rule against which a design can be judged. The NRC defines principal design criteria in 10 CFR 50, Appendix A, as criteria that establish the necessary design, fabrication, construction, and performance requirements for SSCs important to safety (CRWMS M&O 1999). Examples include the following:

- The lifetime of the WP shall be long enough to contain the waste throughout the thermal period.

- Provisions shall be made so that, if there is a loss of the primary electric power source or circuit, reliable and timely emergency power can be provided to instruments, utility service systems, and operating systems, including alarm systems, important to safety.

- The facility design shall comply with the ALARA criteria of 10 CFR 20.
- See the example table in Section 4.1.1.1.

The design criteria are found in the SDD.

General Description–This is an overall description of the SSCs, equipment, and process activities. Base this description on the information contained in the related SDDs. Include in this description the information required to support the safety analysis of the system or that which can be readily derived from it. Provide a summary of the system functions, operations, the system design, concept of operations, and a description of system interfaces. Include a discussion on any special construction or fabrication techniques, unique testing programs, or special design and analysis procedures used for the SSCs, as applicable. Include diagrams to show concepts or ideas as needed to support the text (proposed 10 CFR 63.112(a) [64 FR 8640]).

Discussion of the materials of construction (including general arrangement and approximate dimensions) for the GROA include the following (proposed 10 CFR 63.21(c)(3) [64 FR 8640]):

- **Information Required at the Time of Construction Authorization**–Include only the principal materials used in the design of SSCs that either prevent or mitigate a Category 1 or 2 DBE or are required for worker safety. Examples of principal materials are structural such as steel beam construction or reinforced concrete, systems components such as stainless steel piping, HEPA filters with charcoal absorbers, or leaded glass used for shielding. The materials of construction should be discussed on an SSC level as they are described in the various sections.
- **Information Required at the Time of Update to the License Application to Receive and Possess**–In addition to information provided at the time of CA, a detailed description of the materials of construction must be presented. This should be done by component as each is discussed in the description of the specific SSCs. The information should include the compatibility of the material with its environment during normal operations or post-accident situations, whichever is the most limiting and as it relates to the service that the component provides. See the examples provided under QL 1 SSCs.

Research and Development

- **Information Required at the Time of Construction Authorization**–Identify SSCs that require R&D to confirm the adequacy of design. Provide available information that describes the type of R&D required and the reason the additional information is needed. Refer to Chapter 11 for a description of the R&D program and the proposed schedule (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).
- **Information Required at the Time of Update to the License Application to Receive and Possess**–Provide the results from the required R&D identified in the LA at the time of CA for the various SSCs. Discuss the reason the additional information was originally needed (proposed 10 CFR 63.21(c)(21) [64 FR 8640]).

Decontamination

Information Required at the Time of Update to the License Application to Receive and Possess–Provide the specific decontamination design considerations as part of the SSC discussion (proposed 10 CFR 63.21(c)(18) [64 FR 8640]).

4.1.2.4 Non-Safety Structures, Systems, and Components

The information that must be provided for any non-safety SSCs discussed in this chapter includes:

Regulatory Bases–These are primarily the proposed 10 CFR 63 (64 FR 8640) requirements.

General Description–Provide a general description only to the extent that is sufficient to demonstrate the non-safety classification, which should be based on information contained in Section 1 of the related SDDs. Other diagrams may be included to show concepts or ideas to support the text to the extent needed to demonstrate the non-safety classification (proposed 10 CFR 63.112(a) [64 FR 8640]).

Decontamination

Information Required at the Time of Update to the License Application to Receive and Possess–Provide the specific decontamination design considerations as part of the SSC discussion (proposed 10 CFR 63.21(c)(18) [64 FR 8640]).

4.2 CARRIER PREPARATION BUILDING

Provide the required level of design detail for these systems, buildings, and equipment, as outlined in Section 4.1.1, Level of Design Detail, taking into consideration the following information.

Describe the purpose of the Carrier Preparation Building, including its role in the overall GROA operational process. Refer to the site map for the location of the building to show how the various waste handling systems work together and how they interface with other site systems. Identify and discuss general layout criteria that have been included in the design to ensure confinement of radioactivity. Discuss each of the systems in a sequential order. Identify the QL classification for each SSC discussed.

Consider the following outline for this section:

- 4.2.1 Carrier Preparation Building Materials Handling System
- 4.2.2 Electrical Systems
- 4.2.3 Fire Protection System
- 4.2.4 Non-Nuclear Heating, Ventilation, and Air-Conditioning System
- 4.2.5 Piped Utility Systems

4.3 CARRIER/CASK TRANSPORT SYSTEM

Provide the required level of design detail for these systems, buildings, and equipment, as outlined in Section 4.1.1, Level of Design Detail, taking into consideration the following information.

Describe the purpose of the Carrier/Cask Transport System, including its role in the overall GROA operational process. Refer to the site map for the location of the system, as appropriate, to show how the various waste handling systems work together and how they interface with other site systems. Identify and discuss general layout criteria that have been included in the design to ensure confinement of radioactivity. Identify the QL classification for each SSC discussed.

Consider the following outline for this section:

- 4.3.1 Carrier/Cask Rail System
- 4.3.2 Carrier/Cask Road System
- 4.3.3 On-Site Prime Mover System

4.4 WASTE HANDLING BUILDING

Provide the required level of design detail for these systems, buildings, and equipment, as outlined in Section 4.1.1, Level of Design Detail, taking into consideration the following information.

Describe the purpose of the waste handling building, including its role in the overall GROA operational process. Refer to the site map for the location of the buildings where these activities take place to show how the various waste handling systems work together and how they interface with other site systems. Identify and discuss general layout criteria that have been included in the design to ensure confinement of radioactivity. Discuss each system sequentially beginning with the receipt of the SNF or HLW and ending with their loading onto the WP transporter in preparation for emplacement underground. Clearly identify the QL classification for each SSC discussed.

Consider the following outline for this section:

- 4.4.1 Waste Handling Building Structure
- 4.4.2 Carrier/Cask Handling System
  - 4.4.2.1 Handling Equipment
  - 4.4.2.2 Supporting Equipment
- 4.4.3 Assembly Transfer System
  - 4.4.3.1 Assembly Drying System
  - 4.4.3.2 Assembly Handling System, Dry
  - 4.4.3.3 Assembly Handling System, Wet
  - 4.4.3.4 Basket Transport System
  - 4.4.3.5 Cask and Dual Purpose Canister Preparation System
  - 4.4.3.6 Cask Transport System

4.4.3.7 Control and Tracking System
4.4.3.8 Disposal Container Preparation System
4.4.3.9 Disposal Container Transport System
4.4.4 Canister Transfer System
4.4.4.1 Canister Handling System
4.4.4.2 Cask Preparation System
4.4.4.3 Control and Tracking System
4.4.4.4 Transport System
4.4.5 Disposal Container Handling System
4.4.5.1 Control and Tracking System
4.4.5.2 Disposal Container Handling System
4.4.5.3 Disposal Container Weld/Inspection System
4.4.5.4 Empty Disposal Container Preparation System
4.4.5.5 Waste Package Emplacement Preparation System
4.4.6 Waste Package Remediation System
4.4.6.1 Disposal Container/Waste Package Lid Removal System
4.4.6.2 Disposal Container/Waste Package Sampling System
4.4.6.3 Hot Cell Decontamination System
4.4.6.4 Hot Cell Hoist
4.4.6.5 Hot Cell Manipulator
4.4.7 Waste Handling Building Ventilation System
4.4.7.1 Confinement Area Ventilation System
4.4.7.2 Non-Confinement Area Ventilation System
4.4.8 Pool Water Treatment and Cooling System
4.4.8.1 Pool Water Cooling
4.4.8.2 Pool Water Leak Detection
4.4.8.3 Pool Water Level Control
4.4.8.4 Pool Water Makeup
4.4.9 Waste Handling Building Fire Protection System
4.4.9.1 Fire Detection System
4.4.9.2 Fire Suppression systems
4.4.10 Waste Handling Building Electrical System
4.4.10.1 Emergency Power Distribution
4.4.10.2 Emergency Power Source
4.4.10.3 Lightning Protection
4.4.10.4 Normal Power Distribution
4.4.10.5 Normal Power Source
4.4.11 Waste Handling Building Instrumentation and Control
4.4.11.1 Monitored Geological Repository Operations Monitoring and Control System
4.4.11.2 Performance Confirmation Data Acquisition/Monitoring System
4.4.12 Waste Handling Building Utility Systems
4.4.12.1 Facility Decontamination System
4.4.12.2 Piped Utility Systems
4.4.12.3 Process Supply Systems
4.4.12.4 Solid Sanitary Waste Collection System

4.5 WASTE TREATMENT BUILDING

State that this section provides a discussion of the Waste Treatment Building and associated SSCs. Explain that the SSCs involved in the solid, aqueous, and chemical low-level radioactive waste processing systems are discussed in Chapter 9 and will not be included in this section. Provide a reference to Chapter 9 for a discussion of the waste management systems and process and effluent monitoring and sampling systems. State that the source terms, design bases, parameters, system descriptions, capacities, and estimates of waste generation and processing are discussed in Chapter 9. State that dose assessments to the public are addressed in Chapter 7, and dose assessments to occupational workers are addressed in Chapter 10, which includes exposure from the waste management systems.

Provide the required level of design detail for this system as outlined in Section 4.1.1, Level of Design Detail, taking into consideration the following information.

Provide an overview of the waste management approach. Define the system scope including inputs, outputs, and interfaces with other systems such as utility and waste treatment, emergency and ventilation systems, and any other systems. Clearly identify the QL classification for each SSC discussed.

Consider the following outline for this section:

- 4.5.1 Waste Treatment Building
- 4.5.2 Radiological Monitoring System
- 4.5.3 Process Supply Systems
- 4.5.4 Piped Utility Systems
- 4.5.5 Fire Protection System
- 4.5.6 Electrical Systems
- 4.5.7 Waste Treatment Building Ventilation System
  - 4.5.7.1 Confinement Area Ventilation System
  - 4.5.7.2 Exhaust Stack Radiation
  - 4.5.7.3 Non-Confinement Area Ventilation System

4.6 BALANCE OF PLANT

Provide the required level of design detail for these systems, buildings, and equipment, as outlined in Section 4.1.1, Level of Design Detail, taking into consideration the following information.

State the purpose and refer to the site map for the location of the buildings or equipment discussed in this section. Discuss any related balance of plant activities that take place to show how they work together and interface with other site systems. Identify and discuss general layout criteria that have been included in the design to ensure confinement of radioactivity. Identify the QL classification for each SSC discussed.

Consider the following outline for this section:

- 4.6.1 Administration System
- 4.6.2 Emergency Response System
  - 4.6.2.1 Medical System
  - 4.6.2.2 Radiological Emergency Response System
  - 4.6.2.3 Underground Response System
- 4.6.3 General Site Transportation System
- 4.6.4 Health Safety System
- 4.6.5 Monitored Geologic Repository Site Layout System
  - 4.6.6.1 Site Drainage
  - 4.6.6.2 Soil Stockpile
- 4.6.6 Maintenance and Supply System
- 4.6.7 Surface Environmental Monitoring System
  - 4.6.7.1 Meteorological Monitoring System
  - 4.6.7.2 Sample Collection System
  - 4.6.7.3 Seismic Monitoring System
- 4.6.8 Site Electrical Power System
  - 4.6.8.1 Grounding
  - 4.6.8.2 Lighting
  - 4.6.8.3 Lightning Protection
  - 4.6.8.4 Power Distribution System
  - 4.6.8.5 Power Transmission
  - 4.6.8.6 Standby Power Source
  - 4.6.8.7 Substations
  - 4.6.8.8 Switchgear Building
  - 4.6.8.9 Switchyard
- 4.6.9 Site Fire Protection System
- 4.6.10 Site Operations System
- 4.6.11 Site Radiological Monitoring System
  - 4.6.11.1 Area Radiation Monitoring System
  - 4.6.11.2 Continuous Air Monitoring System
- 4.6.12 Site Water System
- 4.6.13 Site Compressed Air System
  - 4.6.13.1 Air Compression System
  - 4.6.13.2 Industrial Air Distribution System
  - 4.6.13.3 Instrument Air Distribution System
- 4.6.14 Site Communications
  - 4.6.14.1 General Site Communications Systems
  - 4.6.14.2 Microwave Systems

4.7 DECONTAMINATION OR DISMANTLEMENT OF SURFACE FACILITIES

Information Required at the Time of Construction Authorization–Describe the decommissioning goal (e.g., return to near greenfield condition). Describe in general the decommissioning process for the surface facilities. State that design features that facilitate decontamination of the surface facility SSCs include those that minimize the quantities of

radioactive wastes, contaminated equipment, secondary waste streams, and mixed hazardous and radioactive waste (proposed 10 CFR 63.21(c)(18) [64 FR 8640]).

Provide a general description of design considerations intended to facilitate decontamination or dismantlement of surface facilities. The following are examples of some design considerations that could be described to help to meet the goal of facilitating decommissioning (proposed 10 CFR 63.21(c)(18) [64 FR 8640]):

- Selection of materials and processes in surface facility construction and operations to minimize waste production
- Minimization of the absolute mass of shielding materials subject to neutron activation by placing the shielding as close to the SNF and HLW sources as practicable
- Use of modular design and inclusion of lifting points (to facilitate future demolition and removal of equipment and structures)
- Use of minimum surface roughness finishes on SSC surfaces that may be exposed to contamination
- Use of selected coatings to preclude penetration of radioactive gas, condensate, or deposited aerosols (if potentially present) into porous materials to permit future decontamination by a surface treatment
- Use of selected admixtures and mix design for concrete that may be exposed to contamination in order to reduce porosity
- Incorporation of features to collect and retain any possible leaks or spills.

Identify the design considerations that address the requirements of 10 CFR 20.1406 to design the facility for eventual decommissioning and that minimize, to the extent practicable, the generation of radioactive waste. The decommissioning criterion also is addressed in proposed 10 CFR 63.21(c)(18) and proposed 10 CFR 63.111(a) (64 FR 8640).

Information Required at the Time of Update to the License Application to Receive and Possess–Explain that the specific decontamination aspects of the affected SSCs are addressed in the sections where they are described.

4.8 REFERENCES

The following references were used to develop this chapter of the TGD. For the LA, this section will contain the references used to develop this chapter of the LA.

References Cited

CRWMS (Civilian Radioactive Waste Management System) M&O (Management and Operating Contractor) 1999. *Level of Design Detail Necessary for the License Application for Construction*

Authorization. B00000000-01717-1710-00003 REV 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990708.0065.

DOE (U.S. Department of Energy) 1998. *Centralized Interim Storage Facility Topical Safety Analysis Report.* BA0000000-01717-5700-00017 REV 01. Two volumes. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.19990212.0117.

Dyer, J.R. and Horton, D.G. 1999. "Interim Guidance Pending Issuance of New Nuclear Regulatory Commission (NRC) Regulations for Yucca Mountain, Nevada." Letter from J.R. Dyer (DOE/YMSCO) to D.R. Wilkins (CRWMS M&O), June 18, 1999, OL&RC:AVG:1435, with enclosure, "Interim Guidance Pending Issuance of New NRC Regulations for Yucca Mountain." ACC: MOL.19990712.0039.

Codes, Standards, and Regulations

10 CFR (Code of Federal Regulations) 20. Energy: Standards for Protection Against Radiation. Readily available.

10 CFR 50. Energy: Domestic Licensing of Production and Utilization Facilities. Readily available.

64 FR (Federal Register) 8640. Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada. Proposed rule 10 CFR 63. Readily available.

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