Division of High-Level Waste Repository Safety - Interim Staff Guidance
HLWRS-ISG-03, PRECLOSURE SAFETY ANALYSIS - DOSE PERFORMANCE OBJECTIVES AND RADIATION PROTECTION PROGRAM

DRAFT

Introduction

The purpose of this Interim Staff Guidance (ISG) is to supplement the Yucca Mountain Review Plan (YMRP) [Ref. 1] for the staff review of consequence estimates for the preclosure safety analysis (PCSA), and the associated radiation protection program (RPP) that will be implemented by the U.S. Department of Energy (DOE) during geologic repository operations area (GROA) operations. This ISG revises Sections 2.1.1.5 and 2.1.1.8 of the YMRP. A sufficient description of the RPP and adequate technical bases for consequence estimates are needed to demonstrate compliance with the performance objectives of 10 CFR Part 63 and radiation protection requirements of 10 CFR Part 20.

Discussion

Section 63.111 establishes the preclosure performance objectives. Section 63.111(a)(1) requires the GROA to meet the requirements of Part 20. Section 63.111(b)(1) requires that the GROA be designed so that taking into consideration Category 1 event sequences, the limits specified in 10 CFR 63.111 will be met. The requirements in Part 20 establish standards for protection against radiation resulting from activities conducted during preclosure operations at the GROA. To ensure compliance with the dose limits during operations, DOE will be required to implement an RPP that is commensurate with the scope of the licensed GROA activities. To the extent practical, DOE should use procedures and engineering controls, based on sound radiation protection principles, to achieve occupational doses, and doses to members of the public, that are as low as is reasonably achievable (ALARA). Part 20 specifies annual dose limits for all persons who may be within the controlled site boundary, including those (hereafter referred to as "radiation workers") who receive occupational doses, and other on-site members of the public, such as potential GROA construction workers (hereafter referred to as "on-site persons").

The performance-based requirements in 10 CFR 63.111 specify dose objectives for normal operations, Category 1, and Category 2 event sequences. Normal operations are those planned, routine activities in which closely monitored exposures are expected from the high-level waste (HLW) processed at the GROA facilities.[1] Category 1 event sequences include unintended system component failures that could potentially lead to exposure of individuals to radiation. Category 1 event sequences are expected to occur at least one or more times before permanent closure of the GROA. Category 2 event sequences are other rare events that lead to exposure of individuals to radiation, and have at least one chance in 10,000 of occurring before permanent closure of the GROA. As illustrated in Table 1, the requirements of 10 CFR 63.111 specify annual dose limits to any real member of the public located beyond the site boundary for normal operations and Category 1 event sequences, and for the single Category 2 event sequence. The site boundary is analogous to the controlled-area site boundary defined in Part 20. The numerical design objectives in 10 CFR 63.111(b) also refer to the requirements of Part 20 as performance objectives for normal operations and Category 1 event sequences.

[1] Deviations from procedures or equipment failures that do not involve ITS SSCs failures and do not lead to significantly elevated exposures to radiation workers are considered off-normal and not Category 1 events (see also footnote 3).

DOE may rely, in part, on the description of its proposed general RPP in the license application (LA), to demonstrate compliance with the normal operation and Category 1 dose objectives. Structures, systems, and components (SSCs), including SSCs from the RPP, that are credited with limiting or preventing potential Category 1 event sequences, or mitigating their consequences, must be designated as important to safety (ITS). The NRC review will focus on the most significant activities, hazards, event sequences, and potential consequences related to the proposed design and operations submitted with the LA.

Staff Guidance

RPP for Normal Operations and Category 1 Events

DOE should present a description of the RPP, described in 10 CFR 20.1101, and considerations for meeting ALARA requirements, based on the proposed design and scope of operations defined in the LA. In addition, the RPP should address: (1) the RPP's administrative organization; (2) the descriptions of health physics equipment, facilities, and instruments; (3) the description of policies and procedures for controlling access to radiation areas, procedures for the accountability and storage of radioactive material, and the radiation protection training and retraining programs; and (4) the description of the implementation of the program.[2]

For normal operations, the staff will verify that DOE has identified controlled area site boundaries, restricted areas, and potential radiation zones (e.g., high-radiation areas, and very-high-radiation areas) where radiation exposures could exceed the specified limits and, otherwise, would result in the most significant individual doses to radiation workers and on-site persons, for appropriate modes of operation. DOE should address whether the restricted-area boundaries may change, during the preclosure period, as a result of phased construction or other operational conditions. The maximum dose rates should be defined for each zone, depending on the anticipated occupancy and access controls. The staff should examine the use of barriers, access controls, shielding systems, ventilation systems, area radiation and airborne contamination monitors, environmental monitoring programs, and other accepted practices and procedures, to control and minimize doses to radiation workers and on-site persons in these zones.

For Category 1 event sequences that could potentially lead to on-site exposures, the staff should focus on those sequences that lead to the most significant exposure fields (e.g., direct dose rate or radionuclide concentrations in air) and the locations of representative persons who may receive the greatest exposure.

The staff will examine the adequacy of the RPP in terms of: (i) identification of restricted or unrestricted areas (or zones within these areas) that may expect elevated exposure fields; (ii) use of radiation monitoring and warning systems; (iii) implementation of evacuation plans or other self-protection procedures; and/or (iv) the use of shielding and ventilation systems, to

[2]The program's implementation would be subject to NRC inspection, during preclosure operations, if the GROA is licensed.

mitigate unintentional exposures, during the evolution of the event sequence.[3] The event sequence should be considered terminated when elevated exposure conditions to persons have ended (e.g., by evacuation of personnel or physical mitigation), and the affected systems are no longer reasonably vulnerable to additional failure progression or additional failures related to the event sequence. Recovery actions are discussed in the next section.

Recovery Actions for Category 1 Event Sequences

Recovery actions are defined here for the time period after the termination of the event sequence. Emergency actions taken before the termination of the event sequence are not considered to be recovery actions here. Because Category 1 event sequences are expected to occur one or more times during the preclosure period, the staff should verify that potential recovery actions from such events are considered and planned for in the LA. Recovery actions may take place to safely recover materials and/or place the facility back into a safe condition in compliance with Part 63. The staff expects that the recovery actions would be planned, based on actual conditions, and closely monitored under the RPP. The detailed procedures would have to be tailored to the specific circumstances of the end state of the event. Therefore, in the context of the RPP, the staff will only verify that DOE has described the key elements of recovery actions in sufficient detail for the types of Category 1 event sequences in the LA.

The recovery actions should provide reasonable confidence that recovery back to a safe condition in compliance with Part 63 is feasible without exceeding the Part 20 limits to individual radiation workers, or threatening public health and safety. This plan may include a description of the basic steps taken to recover from an expected type of event, including major equipment that may be needed to safely handle any HLW in its end-state configurations, and a description of the general radiation exposure levels that may be present during recovery. The plans should describe the location of vital areas, in which personnel occupancy may be unduly limited, during operations after an event sequence, and of corrective actions needed (e.g., installation of portable shielding) to assure adequate access to potential vital areas and protection of safety equipment.

Estimation of Doses in the PCSA

During normal operations, and for the Category 1 event sequences, DOE should demonstrate that the aggregated annual dose does not exceed the annual dose objectives of 10 CFR 63.111(a)(2), for off-site members of the public -- and the annual dose limits, for on-site persons (public and workers), in Part 20. The aggregate annual dose is the sum of: (i) doses from normal operations, involving direct radiation or airborne radioactivity, that are not associated with SSC failures; (ii) doses from those Category 1 event sequences that are expected to occur one or more times per year; and (iii) the dose, from the maximum Category 1 event sequence, that is expected to occur less than once per year. For Category 1 event sequences, and for normal operations involving major functions, and modes of operations, DOE may select representative radiation workers, on-site persons, and off-site members of the public to demonstrate compliance with the preclosure performance objectives. DOE may use

[3] These systems may be implemented as standard practices in a sound RPP, under Part 20, but should be designated as ITS, if they are relied on to satisfy Category 1 and 2 performance dose objectives in the PCSA.

representative exposure locations and representative occupancy times, based on the identified restricted areas, radiation zones, and other respective controls described in the proposed RPP. As discussed above, the RPP should provide confidence that radiation workers and on-site persons are protected, through engineered safety features, active radiation monitoring, and administrative controls and procedures. For example, potential high-exposure locations may be eliminated from consideration, in dose estimates, because of access controls and personnel monitoring. As another example, occupancy time in the calculation may be limited to a few minutes, because of the presence of high-radiation warning systems and reasonable evacuation plans. The NRC staff should specify the administrative control elements of the RPP in the licensing specifications, as appropriate and reviewed in Section 2.5.10 of the YMRP, and also consider the extent the program is relied on to demonstrate compliance with performance objectives.

During normal operations, and for Category 1 event sequences, average annual doses to representative workers and other on-site persons may be provided for the restricted areas (or zones within the restricted areas), and unrestricted areas, for the major modes of waste-handling operations. DOE should define and provide a technical base for bounding or representative source terms assumed in the analyses. The staff should recognize that radiation workers will be trained and closely monitored in restricted areas (e.g., dosimetry badges and radiation work permits). Areal monitoring, personal monitoring, and other procedures also may be used to assure doses are not exceeded for other on-site persons. Procedural measures would be taken, if accumulated annual doses to individuals approach any Part 20 limits during the course of normal activities.

For determining doses to real members of the public, beyond the controlled area site boundary, during normal operations, and for Category 1 event sequences, DOE should consider appropriate weather parameters, deposition factors, exposure pathways, and assumed exposure times, taking into account the uncertainties and limitations associated with models and data. Locations of a real member of the public should be based on specified geographical locations, the estimated time individual spend near the GROA facility, the distance the real individual is from the GROA, and/or other realistic factors that may affect radiological exposures. For Category 2 event sequences, doses to a real member located at or beyond the controlled area site boundary, DOE may conservatively calculate the doses using an exposure time of 30 days.[4] However, DOE may justify a more realistic accident-exposure time, based on the site demographics, emergency planning, and/or the timing and exposure pathways of the actual Category 2 event sequence.

[4]A conservative 30-day exposure assumption has typically been used as a licensing precedent, in estimating design-basis accident doses involving spent nuclear fuel releases, under 10 CFR Part 72, and long-term reactor accident releases, under 10 CFR Part 100.

- Table 1 -

Part 63 Performance Objectives (Illustrative TEDE values)[a]

	Normal Operations & Event Sequences		
Receptor Type	Normal Operations	Category 1 Event Sequence	Category 2 Event Sequence[b]
Radiation Worker[c]	5 rem per year	5 rem per year[d]	None
On-site Person[e]	100 mrem per year	100 mrem per year[d]	None
Real Member of the Public Located Beyond the Site Boundary but on the Nellis Air Force Range or Nevada Test Site	100 mrem per year	100 mrem per year[d]	5 rem per event
Real Member of the Public Located Beyond the Site Boundary and In the General Environment[f]	15 mrem per year	15 mrem per year[d]	5 rem per event

Notes

a Total Effective Dose Equivalent (TEDE) values are for illustrative purposes. Other dose limits to individual organs and tissues apply, as specified in 10 CFR 63.111.

b Category 2 event sequences apply to any individual located on, or beyond, the boundary of the site.

c Radiation Worker is a GROA worker, within the controlled-area boundary, with assigned duties that involve exposure to radiation or radioactive material, and who receives an occupational dose as defined in Part 20.

d Aggregated Annual Dose is the sum of: (i) doses from routine operations, involving direct radiation or airborne radioactivity, that are not associated with SSC failures; (ii) doses from those Category 1 event sequences that are expected to occur one or more times per year; and (iii) the dose from the maximum Category 1 event sequence that is expected to occur less than once per year.

e On-site Person is a GROA worker or other person, within the controlled area boundary, with assigned duties that does not involve exposure to radiation or radioactive material, and is considered a member of the public, as defined in Part 20.

f General Environment means everywhere outside the Yucca Mountain site, the Nellis Air Force Range, and the Nevada Test Site.

Regulatory Basis

The following regulations provide the bases for this ISG:

1. Each licensee should develop, document, and implement a radiation protection program commensurate with the scope and extent of license activities, and sufficient to ensure compliance with the provisions of [Part 20]. The licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable. [10 CFR 20.1101, "Radiation Protection Program"]

2. The licensee shall control the occupational dose to individual adults, except for planned special exposures under § 20.1206, to the following dose limits. (1) An annual limit, which is the more limiting of: (i) The total effective dose equivalent being equal to 5 rems (0.05 Sv); or (ii) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 Sv). (2) The annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are: (i) A lens dose equivalent of 15 rems (0.15 Sv), and (ii) A shallow dose equivalent of 50 rem (0.5 Sv) to the skin of the whole body or to the skin of any extremity. [10 CFR 20.1201, "Occupational Dose Limits for Adults"]

3. Each licensee shall conduct operations so that: (1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation, from any administration the individual has received, from exposure to individuals administered radioactive material and released under § 35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with § 20.2003; and (2) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with § 35.75, does not exceed 0.002 rem (0.02 millisievert) in any one hour. [10 CFR 20.1301, "Dose Limits for Individual Members of the Public"]

4. If the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals. [10 CFR 20.1301, "Dose Limits for Individual Members of the Public"]

5. Important to safety, with reference to structures, systems, and components, means those engineered features of the geologic repository operations area whose function is: (1) To provide reasonable assurance that high-level waste can be received, handled, packaged, stored, emplaced, and retrieved without exceeding the requirements of 63.111(b)(1) for Category 1 event sequences; or (2) …prevent or mitigate Category 2 event sequences that could result in radiological exposures exceeding the values specified at § 63.111(b)(2) to any individual located on or beyond the boundary of the site. [10 CFR 63.2, "Important to Safety"]

6. …Those event sequences that are expected to occur one or more times before permanent closure of the geologic repository operations area are referred to as Category 1 event sequences. Other event sequences that have at least one chance in 10,000 of occurring before permanent closure are referred to as Category 2 event sequences. [10 CFR 63.2, "Event Sequences"]

7. A description of the program for control and monitoring of radioactive effluents and occupational radiological exposures to maintain such effluents and exposures in accordance with the requirements of § 63.111. [10 CFR 63.21(c)(6), “Content of Application”]

8. A description of the plan for responding to and recovering from, radiological emergencies that may occur at any time before permanent closure and decontamination, or decontamination and dismantlement of surface facilities, as required by § 63.161. [10 CFR 63.21(c)(21), “Content of Application”]

9. During normal operations, and for Category 1 event sequences, the annual total effective dose equivalent (TEDE) to any real member of the public located beyond the boundary of the site may not exceed the preclosure standard specified in 10 CFR 63.204. [10 CFR 63.111(a)(2), “Protection Against Radiation Exposure and Releases of Radioactive Material”]

10. The geologic repository operations area must be designed so that, taking into consideration Category 1 event sequences and until permanent closure has been completed, the aggregate radiation exposures and the aggregate radiation levels in both restricted and unrestricted areas, and the aggregate releases of radioactive materials to unrestricted areas, will be maintained within the limits specified in paragraph (a) of this section. [10 CFR 63.111(b)(1), "Numerical guides for design objectives”]

11. The geologic repository operations area must be designed so that, taking into consideration any single Category 2 event sequence and until permanent closure has been completed, no individual located on, or beyond, any point on the boundary of the site will receive, as a result of the single Category 2 event sequence, the more limiting of a TEDE of 0.05 Sv (5 rem), or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 0.5 Sv (50 rem). The lens dose equivalent may not exceed 0.15 Sv (15 rem), and the shallow dose equivalent to skin may not exceed 0.5 Sv (50 rem). [10 CFR 63.111(b)(2), "Numerical guides for design objectives"]

12. The preclosure safety analysis of the geologic repository operations area must include a general description of the structures, systems and components, equipment, and process activities at the geologic repository operations area. [10 CFR 63.112(a), “Preclosure Safety Analysis”]

13. The preclosure safety analysis of the geologic repository operations area must include an analysis of the performance of the structures, systems and components to identify those that are important to safety. This analysis identifies and describes the controls that are relied on to limit or prevent potential event sequences or mitigate their consequences. This analysis also identifies measures taken to ensure the availability of

safety systems. The analysis … must include, but not necessarily be limited to, consideration of ability of structures, systems and components to perform their intended safety functions, assuming the occurrence of event sequences. [10 CFR 63.112(e)(8), "Preclosure Safety Analysis"]

14. Means to control radioactive waste and radioactive effluents, and permit prompt termination of operations and evacuation of personnel during an emergency. [10 CFR 63.112(e)(10), "Preclosure Safety Analysis"]

15. DOE must ensure that no member of the public in the general environment receives more than an annual dose of 0.15 mSv (15 mrem) from the combination of: (a) Management and storage (as defined in 40 CFR 191.2) of radioactive material that: (1) Is subject to 40 CFR 191.3(a); and (2) Occurs outside of the Yucca Mountain repository but within the Yucca Mountain site; and (b) Storage (as defined in § 63.202) of radioactive material inside the Yucca Mountain Repository. [10 CFR 63.204, "Preclosure Standard"]

Recommendations:

The following changes to the YMRP are recommended:

1. **Revise Section 2.1.1.5, "Consequence Analyses," as follows:**

Page 2.1-29: Section 2.1.1.5.1.2, Review Method 1, insert the following after item (3) as item (4) and renumber item (4) as item (5):

(4) Major functions and modes of operations during normal operations; and selection of the representative radiation workers, on-site persons, and off-site members of the public; to comply with the PCSA performance objectives. Representative exposure locations and representative occupancy times may be based on the identified restricted areas, radiation zones, and other respective controls described in the proposed radiation protection program, as reviewed in Section 2.1.1.8 of the YMRP.

Page 2.1-31, Section 2.1.1.5.1.2 Review Method 3, Add the following at the end of the second paragraph:

The aggregate annual dose is the sum of: (i) doses from normal operations, involving direct radiation or airborne radioactivity, that are not associated with SSC failures; (ii) doses from those Category 1 event sequences that are expected to occur one or more times per year; and (iii) the dose, from the maximum Category 1 event sequence, that is expected to occur less than once per year.

2. Revise Section 2.1.1.8, "Meeting the 10 CFR Part 20 As Low As Is Reasonably Achievable and Radiation Protection Program Requirements for Normal Operations and Category 1 Event Sequences," as follows:

Page 2.1-79: Revise Review Method 3, "Incorporation of ALARA Principles into the proposed GROA", replace (4) with the following:"

(4) Recovery action plans for the types of Category 1 event sequences, that address the corrective actions needed to assure adequate access to vital areas and protection of safety equipment, basic steps taken to recover from an expected type of event, and a description of the general radiation exposure levels during recovery to normal operations.

Page 2.1-79: Section 2.1.1.8.2 Review Methods, add New Review Method 4, "Description of Radiation Protection Program."

Verify that DOE has provided a description of the proposed radiation protection program that is commensurate with the scope of normal activities proposed for the GROA and expected types of Category 1 event sequences. Confirm the description of the radiation protection program is consistent with the assumptions used in the PCSA consequence estimates, as reviewed in Section 2.1.1.5, the means to limit dose, as reviewed in Section 2.1.1.6, and the ALARA considerations, as reviewed in Section 2.1.1.8.

Verify that the radiation protection program also addresses: (1) the administrative organization of the radiation protection program; (2) the descriptions of health physics equipment, facilities, and instruments; (3) the description of policies and procedures for controlling access to radiation areas, procedures for the accountability and storage of radioactive material, and the radiation protection training and retraining programs; and (4) the description of the implementation of the program. Confirm the descriptions are consistent with commonly accepted programs and practices, such as the guidance in NUREG-1567 for radiation protection (U.S. Nuclear Regulatory Commission, 2000).

Page 2.1-81: Replace Acceptance Criterion 3(2)(d), as follows:

(d) Development of a comprehensive plan, listing major types of Category 1 event sequences that may necessitate a recovery action. The plan should provide for adequate access to vital areas and protection of safety equipment, basic steps taken to recover from an expected type of event, and a description of the general radiation exposure levels during recovery. The recovery actions are not precluded by the GROA design, and do not compromise the ability of the GROA to comply with its performance objectives; and

Page 2.1-80: Add New Acceptance Criterion 4, "Description of Radiation Protection Program."

The proposed radiation protection program is commensurate with the scope of normal activities proposed for the GROA and expected Category 1 event sequences. The description of the radiation protection program is consistent with the assumptions used in the PCSA consequence estimates, as reviewed in Section 2.1.1.5, the means to limit dose, as reviewed in Section 2.1.1.6, and the ALARA considerations, as reviewed in Section 2.1.1.8.

The radiation protection program also addresses: (1) the administrative organization of the radiation protection program; (2) the descriptions of health physics equipment, facilities, and instruments; (3) the description of policies and procedures for controlling access to radiation areas, procedures for the accountability and storage of radioactive material, and the radiation protection training and retraining programs; and (4) the description of the implementation of the program.

Page 2.1-81: Section 2.1.1.8.4, Evaluation Findings, Revise 2nd paragraph, as follows:

U.S. Nuclear Regulatory Commission staff has reviewed the Safety Analysis Report and other information submitted in support of the license application, and has found, with reasonable assurance, that the requirements of 10 CFR 63.111(a)(1) are satisfied. Based on the information provided, the staff has reasonable assurance that DOE will implement a radiation protection program that will maintain occupational doses and public exposures below the applicable limits of 10 CFR Part 20. The operations at the geologic repository operations area, through permanent closure, will comply with the as low as is reasonably achievable requirements in 10 CFR Part 20.

REFERENCES

1. U. S. Nuclear Regulatory Commission, "Yucca Mountain Review Plan," NUREG-1804, Revision 2, Final Report, July 2003.

Approved: _____Date: _____
Lawrence E. Kokajko, Director
Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety
and Safeguards

Glossary

GLOSSARY

CONTROLLED AREA: *Controlled area* means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason. [10 CFR 20.1003, "Controlled area"]

EVENT SEQUENCE: *Event sequence* means a series of actions and/or occurrences, within the natural and engineered components of a geologic repository operations area, that could potentially lead to exposure of individuals to radiation. An event sequence includes one or more initiating events and associated combinations of repository system component failures, including those produced by the action or inaction of operating personnel. Those event sequences that are expected to occur one or more times before permanent closure of the geologic repository operations area are referred to as Category 1 event sequences. Other event sequences that have at least one chance in 10,000 of occurring before permanent closure are referred to as Category 2 event sequences. [10 CFR 63.2, "Event sequences"]

GENERAL ENVIRONMENT: *General Environment* means everywhere outside the Yucca Mountain site, the Nellis Air Force Range, and the Nevada Test Site. [10 CFR 63.202, "Definitions for Subpart K"]

IMPORTANT TO SAFETY: With reference to SSCs, *important to safety* means those engineered features of the geologic repository operations area whose function is: (1) to provide reasonable assurance that high-level waste can be received, handled, packaged, stored, emplaced, and retrieved without exceeding the requirements of 10 CFR 63.111(b)(1) for Category 1 event sequences; or (2) to prevent or mitigate Category 2 event sequences that could result in radiological exposures exceeding the values specified at 10 CFR 63.111(b)(2) to any individual located on or beyond any point on the boundary of the site. [10 CFR 63.2, "Important to safety"]

MEMBER OF THE PUBLIC: *Member of the public* means any individual except when that individual is receiving an occupational dose. [10 CFR 20.1003, "Member of the public"]

OCCUPATIONAL DOSE: *Occupational dose* means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. [10 CFR 20.1003, "Occupational dose"]

ON-SITE PERSON: *On-site person* is a GROA worker or other person, within the controlled area boundary, with assigned duties other than receiving an occupational dose, and who is considered a member of the public, as defined in 10 CFR Part 20.

PRECLOSURE SAFETY ANALYSIS: *Preclosure safety analysis* means a systematic examination of the site; the design; and the potential hazards, initiating events, and event sequences, and their consequences (e.g., radiological exposures to workers and the public). The analysis identifies structures, systems, and components important to safety. [10 CFR 63.2, Preclosure safety analysis]

RADIATION WORKER: *Radiation Worker* is a GROA worker ,within the controlled area boundary, with assigned duties that involve exposure to radiation or radioactive material, and who receives an occupational dose, as defined in 10 CFR Part 20. .

RADIATION PROTECTION PROGRAM: *Radiation Protection Program* is the control and monitoring of radioactive effluents and occupational radiological exposures to maintain such effluents and exposures in accordance with the requirements of 10 CFR 63.111. [10 CFR 63.21(c)(6)]

RESTRICTED AREA: *Restricted area* means an area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. [10 CFR 20.1003, Restricted area]

STRUCTURES, SYSTEMS, AND COMPONENTS: A *structure* is an element, or a collection of elements, to provide support or enclosure, such as a building, free-standing tanks, basins, dikes, or stacks. A *system* is a collection of components assembled to perform a function, such as piping, cable trays, conduits, or heating, ventilation, and air-conditioning. A *component* is an item of mechanical, electrical or electronic equipment, such as a pump, valve, or relay, or an element of a larger array, such as a length of pipe, elbow, or reducer.

Page 2.1-81: Section 2.1.1.8.4, Evaluation Findings, Revise 2nd paragraph, as follows:

U.S. Nuclear Regulatory Commission staff has reviewed the Safety Analysis Report and other information submitted in support of the license application, and has found, with reasonable assurance, that the requirements of 10 CFR 63.111(a)(1) are satisfied. Based on the information provided, the staff has reasonable assurance that DOE will implement a radiation protection program that will maintain occupational doses and public exposures below the applicable limits of 10 CFR Part 20. The operations at the geologic repository operations area, through permanent closure, will comply with the as low as is reasonably achievable requirements in 10 CFR Part 20.

REFERENCES

1. U. S. Nuclear Regulatory Commission, "Yucca Mountain Review Plan," NUREG-1804, Revision 2, Final Report, July 2003.

Approved: _____Date: _____
Lawrence E. Kokajko, Director
Division of High-Level Waste Repository Safety
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Glossary

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