

MGDS License Application Annotated Outline

Section 4.2 Assessment of Compliance for Surface Facilities

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- 4.2.0.1-2 Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.
- 4.2.0.1-3 Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
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- 4.2.0.2-1 Provide description of overall approach to accident analyses including the selection of the accident scenarios.
- 4.2.0.2-2 Provide discussion and a list of accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
- 4.2.0.2-3 Provide an analysis that demonstrates that surface facility SSCs are designed to withstand the effects of each accident.
- 4.2.0.2-4 Provide a description of the design features that prevent accidents, including those caused by natural phenomena.
- 4.2.0.3-1 Provide the bases for the SSCs important to safety, waste isolation, and retrievability.
- 4.2.0.3-2 Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
- 4.2.0.4-1 Provide a table containing the models used to perform the compliance assessments for the surface facilities.
- 4.2.0.4-2 Provide an explanation of measures supporting models used in both design applications and accident analyses.
- 4.2.0.4-3 Provide a discussion on the variability and uncertainty of data and the propagation of errors.

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- 4.2.0.4-5 Provide a table containing the input and output data for the models used to assess compliance of the surface facilities with 10 CFR 60 requirements.
- 4.2.1.1-1 Provide an analysis to demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20.
- 4.2.1.1-2 Provide a table listing each source term used to estimate these concentrations including anticipated concentrations during occupancy.
- 4.2.1.1-3 Provide a table of estimates of maximum individual and total person-hours of occupancy.
- 4.2.1.1-4 Provide a table listing the models and model parameters used in calculations.
- 4.2.1.1-5 Provide a description of the provisions for personnel protective measures such as repository equipment or exhaust hoods.
- 4.2.1.2-1 Provide a discussion that demonstrates the means to limit the occupancy time required to perform work in restricted areas.
- 4.2.1.3-1 Provide a discussion to demonstrate that each system is provided with suitable shielding.
- 4.2.1.4-1 Provide a discussion to demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas.
- 4.2.1.5-1 Provide a description of the means to control access to high-radiation areas or airborne radioactivity areas.

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- 4.2.1.6-1 Provide a description of the radiation alarm systems that warn operating personnel of:
- Significant increases in radiation levels
 - Significant increases in airborne material concentrations
 - Increased radioactivity in effluents
- 4.2.1.6-2 Provide a description of the provisions for calibration and operability testing for the radiation alarm systems.
- 4.2.1.7-1 Provide a discussion to demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20.
- 4.2.1.7-2 Provide a table containing estimates of the annual collective person-rem doses.
- 4.2.1.7-3 Provide a discussion of the bases, models, assumptions for values presented.
- 4.2.1.7-4 Provide a discussion that identifies dose conversion factors and illustrates how they are used to calculate exposure.
- 4.2.1.7-5 Provide a description of the biological and dosimetry models and how compliance with 10 CFR 20 is ensured.
- 4.2.1.8-1 Provide a discussion that describes how exposures and effluent discharges are ALARA for each system per 10 CFR 20.
- 4.2.1.8-2 Provide a discussion that describes management policy regarding ALARA sources and with respect to system design and operation.
- 4.2.1.8-3 Provide a discussion that describes how guidelines in Reg Guide 8.8 were used for each individual system.
- 4.2.1.9-1 Provide a discussion to demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
- 4.2.1.10-1 Provide a discussion to demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.

LIST OF INFORMATION NEEDS (continued)

- 4.2.1.11-1 Provide a discussion that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions.
- 4.2.1.12-1 Provide a discussion that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials.
- 4.2.1.13-1 Provide a discussion that demonstrates that the GROA is designed with sufficient fire and explosion system capacity and redundancy to reduce adverse effects of fires and explosions on SSCs important to safety.
- 4.2.1.14-1 Provide a discussion that demonstrates that GROA surface facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function.
- 4.2.1.15-1 Provide a discussion that demonstrates that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency.
- 4.2.1.16-1 Provide a discussion that demonstrates how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions.
- 4.2.1.17-1 Provide a discussion that demonstrates that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions.
- 4.2.1.18-1 Provide a discussion that demonstrates that utility system design incorporates adequate redundancy to perform safety functions.
- 4.2.1.19-1 Provide a discussion that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems, and alarm systems.
- 4.2.1.20-1 Provide a discussion that demonstrates that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
- 4.2.1.21-1 Provide a discussion that demonstrates that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality and that each system has been designed for criticality safety under normal and accident conditions.

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- 4.2.1.21-2 Provide a discussion that demonstrates that K_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation.
- 4.2.1.22-1 Provide a discussion that demonstrates that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions.
- 4.2.1.23-1 Provide a discussion that demonstrates that the design includes adequate provisions for worker protection to ensure that SSCs important to safety can perform their intended function.
- 4.2.1.23-2 List any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N, and provide rationale for these deviations.
- 4.2.1.24-1 Provide a discussion that demonstrates that hoists important to safety are design to:
- Preclude cage freefall
 - Have a reliable system of interlocks that will fail safely upon malfunction
- 4.2.1.25-1 Provide a discussion that demonstrates that GROA surface facilities are designed to allow safe handling and storage of wastes during emplacement and retrieval operations.
- 4.2.1.26-1 Provide a discussion that demonstrates that surface facility ventilation systems are designed to protect against radiation exposures and offsite release during waste transfer, waste inspection, decontamination, waste processing, and waste packaging.
- 4.2.1.27-1 Provide a discussion that demonstrates that the surface facilities are designed to control the release of radioactive materials on effluents during normal operations in compliance with 10 CFR 60.111(a).
- 4.2.1.28-1 Provide a discussion that demonstrates that the effluent monitoring systems are designed to measure the amount and concentration of radionuclides with adequate precision.
- 4.2.1.28-2 Provide a table that shows the accuracy of effluent monitoring equipment with respect to design requirements.

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- 4.2.1.28-3 Provide a discussion that demonstrates that the monitoring systems include alarms that can be periodically tested.
- 4.2.1.29-1 Provide a discussion that demonstrates that the radioactive waste treatment systems are designed to process all radioactive wastes at the GROA into forms suitable for safe storage onsite or transportation offsite, meeting all applicable regulations.
- 4.2.2-1 Provide an assessment of (demonstrate) how specific designs or design features of the surface facilities comply with the general and specific 10 CFR 60 requirements that are applicable to the surface facilities.

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4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES

- This section and subsequent subsections provide DOE's demonstration of compliance for the GROA surface facilities with 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, requirements. Compliance of the surface facilities with the preclosure performance objectives of 10 CFR 60.111(a) and the general and specific surface facility design requirements contained in 10 CFR 60.130, 60.131, 60.132, and 60.137 is discussed in the following two subsections: Subsection 4.2.1 identifies the general and specific design requirements and discusses overall system compliance and Subsection 4.2.2 provides the structure, system, and component detail needed to demonstrate how compliance will be achieved. The assessment of the surface facilities design to permit the retrieval option is evaluated in Section 4.5.2 of the LA.

[A statement similar to the following should be made in a potential LA: Analyses provided in this section demonstrate that GROA surface facility SSCs comply with all applicable regulatory requirements. Therefore, there are no credible circumstances by which surface facility operations threaten the health or safety of plant personnel or the public.]

4.2.0 Introduction

- Refer to surface facility descriptions in Section 4.1
- Provide a general description of the regulatory requirements and overall methods for assessing compliance. [INN 4.2.0-1]

4.2.0.1 Compliance with 10 CFR 60 Requirements

- All of the surface facility SSCs in each subsection of Section 4.1 that are subject to 10 CFR 60, requirements are listed in Table 4.2.0.1-1. [INN 4.2.0.1-1]
- Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC. [INN 4.2.0.1-2]
 - Demonstrate compliance with general requirements applicable to all GROA SSCs
 - Demonstrate compliance with individual design requirements applicable to GROA systems.

- Describe how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements. [INN 4.2.0.1-3]
- Justify how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements. [INN 4.2.0.1-4]

4.2.0.2 Accident Analyses

- Describe overall approach to accident analyses including the selection of the accident scenarios. [INN 4.2.0.2-3]
- Discuss (list) accidents that SSCs are designed to withstand and how each system is intended to perform during each accident. [INN 4.2.0.1-2]
- Demonstrate that surface facility SSCs are designed to withstand the effects of each accident. [INN 4.2.0.2-3]
- Describe design features that prevent accidents, including those caused by natural phenomena. [INN 4.2.0.2-4] [Provide DOE Petition for Rulemaking, 55 FR28771, 7/13/90.]

4.2.0.3 Basis for Identification of SSCs Important to Safety

- Provide the bases for the SSCs important to safety, waste isolation, and retrievability. These SSCs are listed in Table 4.1.0.5-1. [INN 4.2.0.3-1]
- Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin. [INN 4.2.0.3-2]

4.2.0.4 Description of Models

- The models used to perform the analyses are listed in Table 4.2.0.4-1. [INN 4.2.0.4-1]
- Explain measures supporting models used in both design applications and accident analyses. [INN 4.2.0.4-2]
- Support analyses and models used to predict future conditions with an appropriate combination of the following: [INN 4.2.0.4-2]
 - Field tests
 - In situ tests
 - Laboratory tests

- Monitoring data
- Natural analog studies.

- Discuss variability and uncertainty of data and the propagation of errors. [INN 4.2.0.4-3]

- Discuss the representativeness of data and uncertainties associated with extrapolation of data. [INN 4.2.0.4-3]

- Discuss conceptualizations, documentation, and validation of models and codes with respect to: [INN 4.2.0.4-4]
 - Uncertainties in the input data
 - Applicability of specific models
 - Appropriateness of assumptions
 - Sensitivity of results to the uncertainty of input data.

- Input and output data for each of the models are provided in Table 4.2.0.4-2. [INN 4.2.0.4-5]

- Provide interpretations of input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of results. [INN 4.2.0.4-4]

- Document role of expert judgement.

4.2.1 Applicable Requirements and Criteria

- This section identifies the general and specific design requirements. In addition, it discusses overall compliance of the surface facility systems with the preclosure performance objectives of 10 CFR 60.111(a) and each of the general design criteria for the GROA (10 CFR 60.131), including the referenced compliance requirements from 10 CFR 20, and with each of the additional design criteria for the Surface Facilities (10 CFR 60.132) as listed in Subsections 4.2.1.1 through 4.2.1.29.

- The general requirements for performance confirmation, contained in 10 CFR 60.137, are identified.

- [Consider FCRG comment to bulletize list of SSC's in Section 4.1.]

- Compliance is demonstrated for all surface subsystems with the additional requirements and criteria presented herein, as applicable.

4.2.1.1 Airborne Radioactive Materials

- Demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20, *Standards for Protection Against Radiation*, Section 103. The restricted areas are shown in Figure 4.2.1.1-1. The estimated concentrations in each restricted area is provided in Table 4.2.1.1-1. [INN 4.2.1.1-1]
- Each source term used to estimate these concentrations is provided in Table 4.2.1.1-2. [INN 4.2.1.1-2]
- Those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel are shown in Figure 4.2.1.1-2. [INN 4.2.1.1-2]
- Estimates of maximum individual and total person-hours of occupancy are provided in Table 4.2.1.1-3. [INN 4.2.1.1-3] Anticipated concentrations during occupancy are provided in Table 4.2.1.1-2.
- Projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure are provided in Table 4.2.1.1-4. [INN 4.2.1.1-3]
- Models and model parameters used in calculations are provided in Table 4.2.1.1-5. [INN 4.2.1.1-4]
- A comparison of projected intakes to intake limits in 10 CFR 20 are provided in Table 4.2.1.1-6. [INN 4.2.1.1-4]
- Indicate provisions for personnel protective measures such as respiratory equipment or exhaust hoods. [INN 4.2.1.1-5]

4.2.1.2 Occupancy Time [INN 4.2.1.2-1]

- Demonstrate the means to limit the occupancy time required to perform work in restricted areas.
- Ensure each system is designed for compliance with 10 CFR 20 requirements for occupancy time.

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4.2.1.3 Shielding [INN 4.2.1.3-1]

- Demonstrate that each system is provided with suitable shielding. Refer to Section 4.1 for locations of shielding.
- Provide cost/benefit analysis for each shield to demonstrate compliance with ALARA conditions of 10 CFR 20 and dose limitations requirements of 10 CFR 20.101.

4.2.1.4 Contamination Control [INN 4.2.1.4-1]

- Demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. The radiation zones are illustrated in Figure 4.1.4.1-1.
- Ensure compliance with ALARA requirements in 10 CFR 20.1(c), dose limitations in 10 CFR 20.101, and concentration in air required by 10 CFR 20.103.

4.2.1.5 Access Control [INN 4.2.1.5-1]

- Describe means to control access to high-radiation areas or airborne radioactivity areas.
- Describe the monitoring of access.

4.2.1.6 Radiation Alarm Systems [INN 4.2.1.6-1]

- Describe radiation alarm systems that warn operating personnel of:
 - Significant increases in radiation levels
 - Significant increases in airborne material concentrations
 - Increased radioactivity in effluents.
- Describe provisions for calibration and operability testing.
[INN 4.2.1.6-2]

4.2.1.7 Dose Rates in Restricted Areas

- Demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20.101. [INN 4.2.1.7-1]
- Provide the objectives and criteria for design dose rates in various areas.
[What are various areas?] [INN 4.2.1.7-1]

- Estimates of the annual collective person-rem doses are provided in Table 4.2.1.7-1. [INN 4.2.1.7-2]
- Estimated annual occupancy times for each restricted area are provided in Table 4.2.1.1-3. Provide the bases, models, assumptions for values presented. [See Subsection 4.2.1.1] [INN 4.2.1.7-3]
- Identify dose conversion factors and illustrate how they are used to calculate exposure. [INN 4.2.1.7-4]
- Describe biological and dosimetry models and ensure compliance with 10 CFR 20. [INN 4.2.1.7-5]

4.2.1.8 ALARA

- Describe how exposures and effluent discharges are ALARA for each system per 10 CFR 20.1(c). [INN 4.2.1.8-1]
- Describe management policy regarding ALARA in sources and with respect system design and operation. [INN 4.2.1.8-2]
- Describe how guidelines in Reg Guide 8.8 were used for each individual system. If not used, justify. [INN 4.2.1.8-3]

4.2.1.9 Natural Phenomena and Environmental Conditions

- Demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions. [INN 4.2.1.9-1]

4.2.1.10 Dynamic Effects

- Demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability. [INN 4.2.1.10-1]

4.2.1.11 Performance During and After Fires and Explosions

- Demonstrate that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions. [Reference Subsection 4.1.1.3.] [INN 4.2.1.11-1]

4.2.1.12 Noncombustible and Heat-resistant Materials

- Demonstrate that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials. [Reference Subsection 4.1.1.3.] [INN 4.2.1.12-1]

4.2.1.13 Fire and Explosion Protection Systems

- Demonstrate that the GROA is designed with sufficient fire and explosion system capacity and redundancy to reduce adverse effects of fires and explosions on SSCs important to safety. [Reference Subsection 4.1.1.3.] [INN 4.2.1.13-1]

4.2.1.14 Adverse Safety Effects of Fire and Explosion System Operation or Failure

- Demonstrate that GROA surface facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function. [Reference Subsection 4.1.1.3.] [INN 4.2.1.14-1]

4.2.1.15 Control of Radioactive Materials

- Demonstrate that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency. [Reference Subsection 4.1.1.4.] [INN 4.2.1.15-1]

4.2.1.16 Response to Emergency Conditions [INN 4.2.1.16-1]

- Demonstrate how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions. [Reference Subsection 4.1.1.4.]
- Demonstrate that emergency system facilitates the use of off-site services such as:
 - Fire
 - Police
 - Medical
 - Ambulance.

4.2.1.17 Utility System Performance During Normal and Accident Conditions

- Demonstrate that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions. [Reference Subsection 4.1.1.6.] [INN 4.2.1.17-1]

4.2.1.18 Utility System Redundancy

- Demonstrate that utility system design incorporates adequate redundancy to perform safety functions. [Reference Subsection 4.1.1.6.] [INN 4.2.1.18-1]

4.2.1.19 Emergency Power [INN 4.2.1.19-1]

- Demonstrate that emergency power is available in the event of a loss of primary power for the following:
 - Instruments
 - Utility systems
 - Operating systems
 - Alarm systems.

4.2.1.20 SSC Operability Verification

- Demonstrate that SSCs important to safety have been design to facilitate periodic inspection, testing, and maintenance to ensure operability. [INN 4.2.1.20-1]

4.2.1.21 Criticality

- Demonstrate that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality. [INN 4.2.1.21-1]
- Demonstrate that each system has been designed for criticality safety under normal and accident conditions. [INN 4.2.1.21-1]
- Ensure that k_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. The effective multiplication factor for all masses and configurations of radioactive material is shown in Table 4.2.1.21-1. [INN 4.2.1.21-2]

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4.2.1.22 Instrumentation

- Demonstrate that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions. [Reference Subsection 4.1.1.7.] [INN 4.2.1.22-1]

4.2.1.23 Worker Protection

- Demonstrate that the design includes adequate provisions for worker protection to ensure that SSCs important to safety can perform intended function. [Reference *Federal Mine Safety and Health Act*, 30 USC 801.] [INN 4.2.1.23-1]
- Note any deviations from the design requirements of 30 CFR Chapter I, *Mine Safety and Health Administration*, subchapters D, E, and N. [INN 4.2.1.23-2]

4.2.1.24 Hoists [INN 4.2.1.24-1]

- Demonstrate that hoists important to safety are designed to:
 - Preclude cage freefall
 - Have a reliable cage location system
 - Have a reliable system of interlocks that will fail safely upon malfunction

4.2.1.25 Handling and Storage of Wastes

- Demonstrate that GROA surface facilities are designed to allow safe handling and storage of wastes during emplacement and retrieval operations. [INN 4.2.1.25-1]

4.2.1.26 Ventilation Systems [INN 4.2.1.26-1]

- Demonstrate that surface facility ventilation systems are designed to protect against radiation exposures and off-site release during the following operations:
 - Waste transfer
 - Waste inspection
 - Decontamination

- Waste processing
- Waste packaging.

- [Reference Subsection 4.1.1.9.]

4.2.1.27 Radioactive Effluents

- Demonstrate that surface facilities are designed to control the release of radioactive materials on effluents during normal operations in compliance with 10 CFR 60.111(a). [INN 4.2.1.27-1]

4.2.1.28 Effluent Monitoring

- Demonstrate that the effluent monitoring systems are designed to measure the amount and concentration of radionuclides with adequate precision. [INN 4.2.1.28-1] The accuracy and effluent monitoring equipment is provided in Table 4.2.1.28-1. [INN 4.2.1.28-2]
- Demonstrate that the monitoring systems include alarms that can be periodically tested. [INN 4.2.1.28-3]

4.2.1.29 Radioactive Waste Treatment

- Demonstrate that the radioactive waste treatment systems are designed to process all radioactive wastes at the GROA into forms suitable for safe storage onsite or transportation off-site, meeting all applicable regulations. [INN 4.2.1.29-1]

4.2.2 System Specific Compliance with Applicable Requirements and Criteria

- [The purpose of this subsection is to document how specific designs or design features, as embodied in the structures, systems, and components selected for the surface facilities, meet or exceed compliance requirements. This subsection will discuss compliance of each of the major elements comprising the surface facilities (as listed in FCRG Subsections 4.1.1.1 through 4.1.1.12 and 4.2.2.1 through 4.2.2.12) with the preclosure performance objectives of 10 CFR 60.111(a) and the applicable requirements from the general design criteria for the GROA (10 CFR 60.131), including the referenced compliance requirements from Part 20, and with the applicable requirements from the additional design criteria for the Surface Facilities (10 CFR 60.132) as listed in the FCRG, Subsections 4.2.1.1 through 4.2.1.29. Assessment of compliance with 10 CFR 60.137, general requirements for performance confirmation, will be presented.

Table 4.2.2-1 is a representation of how compliance requirements are allocated to the major surface facility elements. The demonstration of compliance by each system element with each applicable requirement shown in Table 4.2.2-1 is discussed below.] [INN 4.2.2-1]

4.2.2.1 Hot Cell

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.2 Onsite Radioactive

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.3 Fire and Explosion Protection Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.4 Emergency Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.5 Communication Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.6 Utility Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.7 Instrumentation and Controls

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.8 Onsite Transportation System

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.9 Ventilation Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.10 Operations Support Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.11 Decommissioning System

- Demonstrate compliance with all applicable requirements and criteria.

4.2.2.12 Other Surface Systems

- Demonstrate compliance with all applicable requirements and criteria.

REFERENCES

10 CFR 20, Standards for Protection Against Radiation

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

30 CFR Chapter 1, Mine Safety and Health Administration, Department of Labor

30 USC 801, Federal Mine Safety and Health Act

Date: 03/31/95

Table 4.2.0.1-1 Surface Facility SSCs and Applicable 10 CFR 60 Requirements

SSC	Reference to 10 CFR 60 Requirements	Description of Requirement
Systems	10 CFR 60.20i [ex]	
Structures		
Component		

[INN 4.2.0.1-1]

Table 4.2.0.4-1 Analytical Models for Surface Facilities

Model	Analysis

[INN 4.2.0.4-1]

Table 4.2.0.4-2 Data for Surface Facility Models and Codes

Code or Model	Input Data	Output Data

[INN 4.2.0.4-5]

Table 4.2.1.1-1 Estimated Concentration of Airborne Radioactive Materials for the Restricted Areas in Surface Facilities

Area	Concentration

[INN 4.2.1.1-1]

Date: 03/31/95

Table 4.2.1.1-2 Source Terms in Surface Facilities

Source Solubility Term	Quantity Discharged per Unit time	Particle Size (AMAD)	Chemical Form	Physical Form	Lung Class

[INN 4.2.1.1-2]

Table 4.2.1.1-3 Maximum Individual and Total Person-Hours of Occupancy in the Surface Facilities

Area	Individual Person-Hours/yr.	Total Person-Hours/yr.

[INN 4.2.1.1-3]

Table 4.2.1.1-4 Radionuclide Concentration and Intake Estimates During Operational Activities in the Surface Facilities

Operation Activity	Projected Concentration	Estimated Intake
Handling		
Storage		
Retrieval		
Emplacement Isolation		

[INN 4.2.1.1-3]

Table 4.2.1.1-5 Analytical Models and Model Parameters for the Surface Facilities

Analysis	Model	Model Parameters
Concentration Estimates		
Intake Estimates		
Etc.		

[INN 4.2.1.1-4]

Table 4.2.1.1-6 Comparison of Projected Intakes to 10 CFR 20 Limits in the Surface Facilities

Area	Projected Intake	Intake Limit

[INN 4.2.1.1-4]

Table 4.2.1.7-1 Collective Person - Rem Doses by Function in the Surface Facilities

Function	Annual Collective	Estimated Annual Time (Person Hours)
Spent Fuel Transfer		
HLW Transfer		
Off-Gas Handling		
Waste Treatment		
Maintenance		
Rad Waste Handling		
Decontamination		
In-Service Inspections		

[INN 4.2.1.7-2]

Table 4.2.1.21-1 Multiplication Factors (K_{eff}) for the Surface Facilities

System or Component	Worst Case Calculated K_{eff}
Transportation Cask	0.9
Radwaste Storage Container	0.6
Etc.	Etc.
Etc.	

[INN 4.2.1.21-2]

Table 4.2.1.28-1 Effluent Monitoring Equipment in the Surface Facilities

Effluent	Equipment	Accuracy Quantity/Concentration	Setpoint	Alarm

[INN 4.2.1.28-2]

Date: 03/31/95

Table 4.2.2-1 Applicable Requirements and Criteria for Surface Facility Structures, Systems, and Components [INN 4.2.2-1]

[Note: This table is a preliminary representation, shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria.]

	4.2.2.1 Waste Handling System	4.2.2.2 Rad. Waste Manage- ment System	4.2.2.3 Fire & Explo- sion Pro- tection System	4.2.2.4 Emer- gency Systems	4.2.2.5 Communi- cation Systems	4.2.2.6 Utility Systems	4.2.2.7 Instru- ment. & Control Systems	4.2.2.8 Onsite Transpor- -tation System	4.2.2.9 Ventila- tion Systems	4.2.2.10 Opera- tions Support system	4.2.2.11 Decomi- ssion- ing System	4.2.2.12 Other Support Systems
4.2.1.1 Air- borne Radio- active Mat'ls	Shaded	Shaded		Shaded		Shaded	Shaded	Shaded	Shaded		Shaded	
4.2.1.2 Occu- pancy Time	Shaded	Shaded						Shaded		Shaded	Shaded	
4.2.1.3 Shiel- ding	Shaded	Shaded						Shaded			Shaded	
4.2.1.4 Contam- ination Control	Shaded	Shaded		Shaded			Shaded					
4.2.1.5 Access Control	Shaded	Shaded					Shaded				Shaded	
4.2.1.6 Rad. Alarm Systems	Shaded	Shaded		Shaded					Shaded		Shaded	
4.2.1.7 Dose Rates in Restric- ted Areas	Shaded	Shaded		Shaded				Shaded	Shaded		Shaded	
4.2.1.8 ALARA	Shaded	Shaded									Shaded	
4.2.1.9 Natural Phenom- ena & Environ- -mental Condi- tions	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded		Shaded	
4.2.1.10 Dyna- mic Effects	Shaded	Shaded		Shaded	Shaded	Shaded	Shaded	Shaded	Shaded		Shaded	

Date: 03/31/95

Table 4.2.2-1 Applicable Requirements and Criteria for Surface Facility Structures, Systems, and Components (continued) [INN 4.2.2-1]

[Note: This table is a preliminary representation, shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria]

	4.2.2.1 Waste Handling System	4.2.2.2 Rad. Waste Manage- ment System	4.2.2.3 Fire & Explo- sion Pro- tection System	4.2.2.4 Emer- gency Systems	4.2.2.5 Communi- cation Systems	4.2.2.6 Utility Systems	4.2.2.7 Instru- ment. & Control Systems	4.2.2.8 Onsite Transpor- -tation System	4.2.2.9 Ventila- tion Systems	4.2.2.10 Opera- tions Support system	4.2.2.11 Decom- mission- ing System	4.2.2.12 Other Support Systems
4.2.1.11 Perf. During & After Fires & Explo- sions	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.12 Non- combust- ible & Heat- resistant Mat'ls.	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.13 Fire & Explo- sion Pro- tection Systems	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.14 Adverse Safety Effects	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.15 Control of Rad. Mat'ls.	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.16 Res- ponse to Emerg. Cond.	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.17 Utility System Perf.	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.18 Utility System Redund.	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.19 Emerg. Power	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
4.2.1.20 SSC Oper- ability Verifi- cation	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded

Date: 03/31/95

Table 4.2.2-1 Applicable Requirements and Criteria for Surface Facility Structures, Systems, and Components (continued) [INN 4.2.2-1]

[Note: This table is a preliminary representation, shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria]

	4.2.2.1 Waste Handling System	4.2.2.2 Rad. Waste Manage- ment System	4.2.2.3 Fire & Explo- sion Pro- tection System	4.2.2.4 Emer- gency Systems	4.2.2.5 Communi- cation Systems	4.2.2.6 Utility Systems	4.2.2.7 Instru- ment. & Control Systems	4.2.2.8 Onsite Transpor- -tation System	4.2.2.9 Ventila- tion Systems	4.2.2.10 Opera- tions Support system	4.2.2.11 Decom- mission- ing System	4.2.2.12 Other Support Systems
4.2.1.21 Critical- ity												
4.2.1.22 Instru- men- tation												
4.2.1.23 Worker Protect.												
4.2.1.24 Hoists												
4.2.1.25 Hand- ling & Storage of Wastes												
4.2.1.26 Vent. Systems												
4.2.1.27 Rad. Effl'nts												
4.2.1.28 Effl'nt Mon- itoring												
4.2.1.29 Rad waste Treat- ment												

FIGURE CAPTIONS

Figure 4.2.1.1-1 Restricted Areas in the Surface Facilities

Plant layout showing restricted areas with legend. [INN 4.2.1.1-1]

Figure 4.2.1.1-2 Areas Potentially Contaminated with Radioactive Materials that are Accessible to Operating Personnel in the Surface Facilities

Layout drawing of GROA surface facilities with subject areas cross-hatched.
[INN 4.2.1.1-2]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.1-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.0.1-1
Explicit description of the needed information:	Provide a table containing surface facility SSCs that are subject to 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.1-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.</p> <ul style="list-style-type: none"> - Demonstrate compliance with general requirements applicable to all GROA SSCs - Demonstrate compliance with individual design requirements applicable to GROA systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.1-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.1-4
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a justification of how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.2-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Provide description of overall approach to accident analyses including the selection of the accident scenarios.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.2-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Provide discussion and a list of accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.2-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Provide an analysis that demonstrates that surface facility SSCs are designed to withstand the effects of each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.2-4
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Provide a description of the design features that prevent accidents, including those caused by natural phenomena.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.3-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide the bases for the SSCs important to safety, waste isolation, and retrievability. (These SSCs are listed in Table 4.1.0.5-1.)
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.3-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.4-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.0.4-1
Explicit description of the needed information:	Provide a table containing the models used to perform the compliance assessments for the surface facilities.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.4-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an explanation of measures supporting models used in both design applications and accident analyses. In addition, provide documentation to support analyses and models used to predict future conditions with an appropriate combination of field tests, in situ tests, laboratory tests, monitoring data, and natural analog studies.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.4-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion on the variability and uncertainty of data and the propagation of errors. In addition, provide a discussion on the representativeness of data and uncertainties associated with extrapolation of data.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.4-4
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a discussion on the conceptualizations, documentation, and validation of models and codes with respect to uncertainties in the input data, applicability of specific models, appropriateness of assumptions, and sensitivity of results to the uncertainty of input data.</p> <p>In addition, provide interpretations of input and output data along with the basis of interpretations and provide sufficient detail to facilitate independent analysis of results.</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.0.4-5
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.0.4-2
Explicit description of the needed information:	Provide a table containing the input and output data for the models used to assess compliance of the surface facilities with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.1-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.1-1, Figure 4.2.1.1-1
Explicit description of the needed information:	Provide an analysis to demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20. In addition, provide a drawing of the restricted areas (Figure 4.2.1.1-1) and a listing of the estimated concentrations in each restricted area (Table 4.2.1.1-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.1-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.1-2, Figure 4.2.1.1-2
Explicit description of the needed information:	Provide a table listing each source term used to estimate these concentrations including anticipated concentrations during occupancy (Table 4.2.1.1-2). In addition, provide a drawing showing those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel (Figure 4.2.1.1-2).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.1-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.1-3, Table 4.2.1.1-4
Explicit description of the needed information:	<p>Provide a table of estimates of maximum individual and total person-hours of occupancy (Table 4.2.1.1-3).</p> <p>Provide a table of projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure (Table 4.2.1.1-4).</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.1-4
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.1-5, Table 4.2.1.1-6
Explicit description of the needed information:	Provide a table listing the models and model parameters used in calculations (Table 4.2.1.1-5). In addition, provide a table comparing projected intakes of radionuclides to the intake limits of 10 CFR 20 for restricted areas until permanent closure (Table 4.2.1.1-6).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.1-5
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the provisions for personnel protective measures such as repository equipment or exhaust hoods.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.2-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates the means to limit the occupancy time required to perform work in restricted areas. In addition, provide a discussion that shows that each system is designed for compliance with 10 CFR 20 requirements for occupancy time.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.3-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that each system is provided with suitable shielding. (Refer to Section 4.1 for locations of shielding.) In addition, provide a cost/benefit analysis for each shield to demonstrate compliance with ALARA conditions of 10 CFR 20 and dose limitations requirements of 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.4-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. (The radiation zones are illustrated in Figure 4.1.4.1-1). In addition, provide a discussion and analysis to demonstrate compliance with ALARA requirements in 10 CFR 20, dose limitations in 10 CFR 20, and concentration in air required by 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.5-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the means to control access to high-radiation areas or airborne radioactivity areas. In addition, provide a description of access monitoring to be used.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.6-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the radiation alarm systems that warn operating personnel of: <ul style="list-style-type: none"> - Significant increases in radiation levels - Significant increases in airborne material concentrations - Increased radioactivity in effluents
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.6-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the provisions for calibration and operability testing for the radiation alarm systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.7-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20. In addition, provide a discussion of the objectives and criteria for design dose rates in various areas.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.7-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.7-1
Explicit description of the needed information:	Provide a table containing estimates of the annual collective person-rem doses (Table 4.2.1.7-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.7-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion of the bases, models, assumptions for values presented. [See Subsection 4.2.1.1 and Table 4.2.1.1-3.]
Information will be used to support:	
The information is needed by/for (date or event):	
Most likely source of the information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.7-4
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that identifies dose conversion factors and illustrates how they are used to calculate exposure.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.7-5
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the biological and dosimetry models and how compliance with 10 CFR 20 is ensured.
Information will be used to support:	
The information is needed by/for (date or event):	
Most likely source of the information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.8-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes how exposures and effluent discharges are ALARA for each system per 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.8-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes management policy regarding ALARA sources and with respect to system design and operation.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.8-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes how guidelines in Reg Guide 8.8 were used for each individual system. If not used, justify.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.9-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.10-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.11-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.12-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.13-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the GROA is designed with sufficient fire and explosion system capacity and redundancy to reduce adverse effects of fires and explosions on SSCs important to safety. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.14-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that GROA surface facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.15-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency. [Provide a reference to Subsection 4.1.1.4.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.16-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions. [Provide a reference to Subsection 4.1.1.4.] In addition, provide a discussion that demonstrates that emergency systems facilitate the use of offsite services such as Fire, Police, Medical, and Ambulance.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.17-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions. [Provide a reference to Subsection 4.1.16.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.18-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that utility system design incorporates adequate redundancy to perform safety functions. [Provide a reference to Subsection 4.1.1.6.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.19-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems, and alarm systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.20-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.21-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality and that each system has been designed for criticality safety under normal and accident conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.21-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.21-1
Explicit description of the needed information:	Provide a discussion that demonstrates that K_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. In addition, provide a table that shows the effective multiplication factor for all masses and configurations of radioactive material (Table 4.2.1.21-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.22-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions. [Provide a reference to Subsection 4.1.1.7.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.23-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the design includes adequate provisions for worker protection to ensure that SSCs important to safety can perform their intended function. [Reference <i>Federal Mine Safety and Health Act</i> , 30 USC 801.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.23-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	List any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N, and provide rationale for these deviations.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.24-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that hoists important to safety are designed to: <ul style="list-style-type: none"> - Preclude cage freefall - Have a reliable system of interlocks that will fail safely upon malfunction
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.25-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that GROA surface facilities are designed to allow safe handling and storage of wastes during emplacement and retrieval operations.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.26-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that surface facility ventilation systems are designed to protect against radiation exposures and offsite release during waste transfer, waste inspection, decontamination, waste processing, and waste packaging.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.27-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the surface facilities are designed to control the release of radioactive materials on effluents during normal operations in compliance with 10 CFR 60.111(a).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.28-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the effluent monitoring systems are designed to measure the amount and concentration of radionuclides with adequate precision.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.28-2
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.1.28-1
Explicit description of the needed information:	Provide a table that shows the accuracy of effluent monitoring equipment with respect to design requirements (Table 4.2.1.28-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.28-3
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the monitoring systems include alarms that can be periodically tested.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.1.29-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the radioactive waste treatment systems are designed to process all radioactive wastes at the GROA into forms suitable for safe storage onsite or transportation offsite, meeting all applicable regulations.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.2.2-1
Section Number and Title:	4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.2.2-1
Explicit description of the needed information:	<p>Provide an assessment of (demonstrate) how specific designs or design features of the surface facilities comply with (meet or exceed) the general and specific 10 CFR 60 requirements that are applicable to the surface facilities (contained in 10 CFR 60.131 and 10 CFR 60.132 and listed in FCRG Subsections 4.2.1.1 through 4.2.1.29). <i>[Note: The compliance demonstration should discuss how each major structure, system, or component (SSC) of the surface facilities complies with each of the applicable requirements of 10 CFR 60.131 and 60.132. Although all of the 10 CFR 60 requirements contained in FCRG Subsections 4.2.1.1 through 4.2.1.29 are applicable to the surface facilities when considered as a complete system, all of these requirements are not necessarily applicable to individual elements of the surface facilities. Also, many of these 10 CFR 60 requirements are applicable only to SSCs important to safety.]</i></p> <p>The physical system architecture developed for the surface facilities should be compared with the system structure already provided in the FCRG for the LA (Subsections 4.2.2.1 through 4.2.2.12). Make any changes to the FCRG system structure to reflect the actual surface facility design. The level of detail (within the physical system architecture for the surface facilities) selected for the compliance demonstration in Subsection 4.2.2 of the LA should be commensurate with that needed to show which aspects or elements of the design actually provide the functions required to satisfy each compliance requirement (i.e., those system elements that actually demonstrate compliance).</p>

Date: 03/31/95

<p>Explicit description of the needed information (continued):</p>	<p>Provide/revise Table 4.2.2-1 that shows which elements of the physical system architecture (the SSCs for the surface facilities) demonstrate compliance with each of the 10 CFR 60 requirements for the surface facilities. The system elements selected for the table should be the same as those discussed in the text for the compliance demonstration in Subsection 4.2.2. The 10 CFR 60 requirements selected for the table are those listed in Subsections 4.2.1.1 through 4.2.1.29 of the FCRG for the LA.</p>
<p>Information will be used to support:</p>	
<p>The Information is needed by/for (date or event):</p>	
<p>Most likely source of the Information:</p>	
<p>Information Source Description:</p>	
<p>Does the supporting data need to be QA?</p>	

<p>INTEGRATOR (PMO):</p>	
<p>Date information will be available:</p>	
<p>Deliverable providing information:</p>	
<p>If the data needed is QA, then the QA source document number is:</p>	

MGDS License Application Annotated Outline

Section 4.3 Assessment of Compliance for Shafts or Ramps

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- 4.3.1.1-6 Comparison of Projected Intakes to 10 CFR 20 Limits in Shafts and
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- 4.3.1.3-1 Collective Person - Rem Doses by Function in Shafts and Ramps
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LIST OF INFORMATION NEEDS

- 4.3.0-1 Provide a general description of the regulatory requirements and overall methods for assessing compliance.
- 4.3.0.1-1 Identify all of the shaft and ramp SSCs in Section 4.1 that are subject to 10 CFR 60 requirements.
- 4.3.0.1-2 Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.
- 4.3.0.1-3 Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
- 4.3.0.1-4 Provide a justification of how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements.
- 4.3.0.2-1 Provide a description of the overall approach to accident analyses including the selection of the accident scenarios.
- 4.3.0.2-2 Provide a discussion (list) of the accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
- 4.3.0.2-3 Provide the analysis that demonstrates that shaft and ramp SSCs are designed to withstand the effects of each accident.
- 4.3.0.2-4 Provide a description of the design features that prevent accidents, including those caused by natural phenomena.
- 4.3.0.3-1 Provide the basis for the SSCs important to safety, waste isolation, and retrievability.
- 4.3.0.3-2 Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
- 4.3.0.4-1 Identify the models used to perform the analyses.
- 4.3.0.4-2 Provide a discussion on the variability and uncertainty of data and the propagation of errors, and the representativeness of data and uncertainties associated with the extrapolation of data.
- 4.3.0.4-3 Identify the input and output parameters for each of the models used.

LIST OF INFORMATION NEEDS (continued)

- 4.3.1.1-1 Provide an analysis that demonstrates that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20.
- 4.3.1.1-2 Provide the source term used to estimate these concentrations.
- 4.3.1.1-3 Provide an estimate of maximum individual and total person-hours of occupancy.
- 4.3.1.1-4 Provide a description of the models and model parameters used in the calculations.
- 4.3.1.2-1 Identify the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas.
- 4.3.1.3-1 Provide a discussion on how to comply with the requirements in 10 CFR 20 for the levels of radiation in restricted areas.
- 4.3.1.3-2 Provide an estimate of the annual collective person-rem doses.
- 4.3.1.3-3 Identify the dose conversion factors used in dose rate calculations, and illustrate how they are used to calculate exposures.
- 4.3.1.4-1 Provide an analysis that demonstrates that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
- 4.3.1.5-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.
- 4.3.1.6-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions.
- 4.3.1.7-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials.

LIST OF INFORMATION NEEDS (continued)

- 4.3.1.8-1 Provide an analysis that demonstrates that the GROA fire protection and suppression systems have sufficient capacity to reduce adverse effects on SSCs important to safety.
- 4.3.1.9-1 Provide an analysis that demonstrates that the GROA shaft and ramp SSCs important to safety are designed to withstand the effects of fire protection system operation or failure and still perform their safety function.
- 4.3.1.10-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency.
- 4.3.1.11-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to perform their intended safety functions under both accident and normal conditions.
- 4.3.1.12-1 Provide an analysis that demonstrates that utility system design incorporates adequate redundancy to perform their safety functions.
- 4.3.1.13-1 Provide an analysis that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems and alarm systems.
- 4.3.1.14-1 Provide an analysis that demonstrates that the SSCs important to safety are designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
- 4.3.1.15-1 Provide an analysis that demonstrates that all systems dealing with nuclear material are designed in compliance with the double contingency principle precluding nuclear criticality.
- 4.3.1.16-1 Provide an analysis that demonstrates that all instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions.
- 4.3.1.17-1 Provide an analysis that demonstrates that the design includes adequate provisions for worker protection to assure that SSCs important to safety can perform intended functions.
- 4.3.1.18-1 Provide an analysis that demonstrates that the seals for the shafts and boreholes are designed so that they do not become pathways that

LIST OF INFORMATION NEEDS (continued)

compromise the GROA's ability to meet performance objectives following permanent closure.

- 4.3.1.19-1 Provide an analysis that demonstrates that the seal materials and placement methods were selected to reduce the creation of a pathway for water to contact waste packages and radionuclide migration through existing pathways.
- 4.3.2-1 Provide an assessment of how specific designs or design features of the shafts and ramps comply with the general and specific 10 CFR 60 requirements that are applicable to shafts and ramps.

4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS

- This section and subsequent subsections provide DOE's demonstration of compliance for the GROA shafts and ramps with 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, requirements. Compliance of the shafts and ramps with the preclosure performance objectives of 10 CFR 60.111(a) and the general and specific design requirements contained in 10 CFR 60.130, 60.131, 60.134, and 60.137 is discussed in the following two subsections: Subsection 4.3.1 identifies the general and specific design requirements and discusses overall system compliance and Subsection 4.3.2 provides the structure, system, and component detail needed to demonstrate how compliance will be achieved.
- Descriptive information for the GROA shafts, ramps, and boreholes is contained in Section 4.1.2. An assessment of the shafts and ramps to permit the retrieval option is contained in Section 4.5.2 of the license application.

4.3.0 Introduction

- Refer to shaft and ramp descriptions in Section 4.1.
- Add a note that "shafts and ramps" include boreholes; borehole seals are addressed in Subsection 4.3.1.18.
- Provide a general description of the regulatory requirements and overall methods for assessing compliance. [INN 4.3.0-1]

4.3.0.1 Compliance with 10 CFR 60 Requirements

- All of the shaft and ramp SSCs in each subsection of Section 4.1 that are subject to 10 CFR 60 requirements are listed in Table 4.3.0.1-1. [INN 4.3.0.1-1]
- Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.
 - Demonstrate compliance with general requirements applicable to all GROA SSCs.
 - Demonstrate compliance with individual design requirements applicable to GROA systems. [INN 4.3.0.1-2]

- Describe how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements. [INN 4.3.0.1-3]
- Justify how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements. [INN 4.3.0.1-4]

4.3.0.2 Accident Analyses

- Describe overall approach to accident analyses including the selection of the accident scenarios [INN 4.3.0.2-1]
- Discuss (list) accidents that SSCs are designed to withstand and how each system is intended to perform during each accident [INN 4.3.0.2-2]
- Demonstrate that shaft and ramp SSCs are designed to withstand the effects of each accident [INN 4.2.0.2-3]
- Describe design features that prevent accidents, including those caused by natural phenomena. [INN 4.3.0.2-4]

4.3.0.3 Basis for Identification of SSCs Important to Safety

- Provide the basis for the SSCs important to safety, waste isolation, and retrievability. [INN 4.3.0.3-1] These SSCs are listed in Table 4.1.0.5-1.
- Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin. [INN 4.3.0.3-2]

4.3.0.4 Description of Models

- The models used to perform the analyses are listed in Table 4.3.0.4-1. [INN 4.3.0.4-1]
- Explain measures supporting models used in both design applications and accident analyses. [INN 4.3.0.4-1]
- Support analyses and models used to predict future conditions with an appropriate combination of the following: [INN 4.3.0.4-1]
 - Field tests
 - In situ tests
 - Laboratory tests

- Monitoring data
- Natural analog studies.

- Discuss variability and uncertainty of data and the propagation of errors. [INN 4.3.0.4-2]

- Discuss the representativeness of data and uncertainties associated with extrapolation of data. [INN 4.3.0.4-2]

- Discuss conceptualizations, documentation, and validation of models and codes should be discussed with respect to: [INN 4.3.0.4-2]
 - Uncertainties in the input data
 - Applicability of specific models
 - Appropriateness of assumptions
 - Sensitivity of results to the uncertainty of input data.

Input and output data for each of the models are provided in Table 4.3.0.4-2. [INN 4.3.0.4-3]

Provide interpretations of input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of results. [INN 4.3.0.4-3]

- Document role of expert judgement.

4.3.1 Applicable Requirements and Criteria

- This subsection identifies the general and specific design requirements and discusses overall compliance of the shafts and ramp systems with each of the general design criteria for the GROA (10 CFR 60.130 and 60.131), including the referenced compliance requirements from Part 20, with each of the additional design criteria for the Shafts and Ramps (10 CFR 60.134), and with the general requirements for performance confirmation (10 CFR 60.137) as listed in Subsections 4.3.1.1 through 4.3.1.19.

- [Consider FCRG comment to bulletize list of SSC's listed in Section 4.1]

Date: 03/31/95

- In this subsection, compliance is demonstrated for all shaft and ramp subsystems with the additional requirements and criteria presented herein, as applicable.

[Note that organization of this subsection differs from Subsection 4.2.1.]

4.3.1.1 Airborne Radioactive Materials

- Demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20, *Standards for Protection Against Radiation*. The restricted areas are shown in Figure 4.3.1.1-1. The estimated concentrations in each restricted area is provided in Table 4.3.1.1-1. [INN 4.3.1.1-1]
 - Each source term used to estimate these concentrations is provided in Table 4.3.1.1-2. [INN 4.3.1.1-2]
 - Those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel are shown in Figure 4.3.1.1-2. [INN 4.3.1.1-2]
 - Estimates of maximum individual and total person-hours of occupancy are provided in Table 4.3.1.1-3. [INN 4.3.1.1-3] Anticipated concentrations during occupancy are provided in Table 4.3.1.1-1. [INN 4.3.1.1-1]
 - Projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure are provided in Table 4.3.1.1-4. [INN 4.3.1.1-3]
 - Models and model parameters used in calculations are provided in Table 4.3.1.1-5. [INN 4.3.1.1-4]
 - A comparison of projected intakes to intake limits in 10 CFR 20 are provided in Table 4.3.1.1-6. [INN 4.3.1.1-4]
 - Indicate provisions for personnel protective measures such as respiratory equipment or exhaust hoods.
- Ensure compliance with ANSI N13.1-1969.

Date: 03/31/95

4.3.1.2 Contamination Control

- Demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. The radiation zones are illustrated in Figure 4.1.4.1-1.
- Ensure compliance with ALARA requirements in 10 CFR 20, dose limitations in 10 CFR 20, and concentration in air required by 10 CFR 20. [INN 4.3.1.2-1]

4.3.1.3 Dose Rates in Restricted Areas

- Demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20.
- Provide the objectives and criteria for design dose rates in various areas. [What are various areas?] [INN 4.3.1.3-1]
- Estimates of the annual collective person-rem doses are provided in Table 4.3.1.3-1. [INN 4.3.1.3-2]
- Estimated annual occupancy times for each restricted area are provided in Table 4.3.1.1-3. [INN 4.3.1.1-3] Provide the bases, models, assumptions for values presented. (See Subsection 4.3.1.1)
- Identify dose conversion factors and illustrate how they are used to calculate exposure.
- Describe biological and dosimetry models and ensure compliance with 10 CFR 20. [INN 4.3.1.3-3]

4.3.1.4 Natural Phenomena and Environmental Conditions

Demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions. [INN 4.3.1.4-1]

4.3.1.5 Dynamic Effects

- Demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc, without loss of safety function operability. [INN 4.3.1.5-1]

4.3.1.6 Performance During and After Fires and Explosions

- Demonstrate that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions. [INN 4.3.1.6-1]

4.3.1.7 Noncombustible and Heat-resistant Materials

Demonstrate that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials. [INN 4.3.1.7-1]

4.3.1.8 Fire and Explosion Protection Systems

- Demonstrate that the GROA fire protection and suppression systems have sufficient capacity to reduce adverse effects on SSCs important to safety. [INN 4.3.1.8-1] (Reference Subsection 4.1.1.3)

4.3.1.9 Adverse Safety Effects of Fire and Explosion System Operation or Failure

- Demonstrate that GROA shaft and ramp SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function. (Reference Subsection 4.1.1.3.) [INN 4.3.1.9-1]

4.3.1.10 Control of Radioactive Materials

- Demonstrate that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency. (Reference Subsection 4.1.1.4.) [INN 4.3.1.10-1]

4.3.1.11 Utility System Performance During Normal and Accident Conditions

- Demonstrate that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions. (Reference Subsection 4.1.1.6.) [INN 4.3.1.11-1]

4.3.1.12 Utility System Redundancy

- Demonstrate that utility system design incorporates adequate redundancy to perform safety functions. (Reference Subsection 4.1.1.6.) [INN 4.3.1.12-1]

4.3.1.13 Emergency Power

- Demonstrate that emergency power is available in the event of a loss of primary power for the following:
 - Instruments
 - Utility systems
 - Operating systems
 - Alarm systems.[INN 4.3.1.13-1]

4.3.1.14 SSC Operability Verification

- Demonstrate that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability. [INN 4.3.1.14-1]

4.3.1.15 Criticality

Demonstrate that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality. [INN 4.3.1.15-1]

- Demonstrate that each system has been designed for criticality safety under normal and accident conditions.
- Ensure that K_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. The effective multiplication factor for all masses and configurations of radioactive material is shown in Table 4.2.1.21-1. [Assume that shaft and ramp configurations are bounded by surface facility configurations.]

4.3.1.16 Instrumentation

- Demonstrate that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions. (Reference Subsection 4.1.1.7.) [INN 4.3.1.16-1]

4.3.1.17 Worker Protection

- Demonstrate that the design includes adequate provisions for worker protection to assure that SSCs important to safety can perform intended functions. (Reference Federal Mine Safety and Health Act of 1977.)

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- Note any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N. [INN 4.3.1.17-1]

4.3.1.18 Shaft and Borehole Seals

- Demonstrate that seals for shafts and boreholes are designed so that they do not become pathways that compromise the GROA's ability to meet performance objectives following permanent closure. (Reference NRC technical position on seals.) [INN 4.3.1.18-1]

4.3.1.19 Seal Materials and Placement Methods

- Demonstrate that seal materials and placement methods are selected to reduce:
 - Creation of a pathway for water to contact waste packages
 - Radionuclide migration through existing pathways.[INN 4.3.1.19-1]

4.3.2 System Specific Compliance with Applicable Requirements and Criteria

- The purpose of this subsection is to document how specific designs or design features, as embodied in the structures, systems, and components selected for the shafts and ramps, meet or exceed compliance requirements. This subsection will discuss compliance of each of the major elements comprising the shafts and ramps (as listed in FCRG Subsections 4.1.2.1 through 4.1.2.7 and 4.3.2.1 through 4.3.2.7) with the preclosure performance objectives of 10 CFR 60.111(a), and the applicable requirements from the general design criteria for the GROA (10 CFR 60.130 and 60.131), including the referenced compliance requirements from Part 20, with the applicable requirements from the additional design criteria for the Shafts and Ramps (10 CFR 60.134), and with the general requirements for performance confirmation (10 CFR 60.137) as listed in the FCRG, Subsections 4.3.1.1 through 4.3.1.19.

Table 4.3.2-1 is a representation of how compliance requirements are allocated to the major shaft and ramp elements. The demonstration of compliance by each system element with each applicable requirement shown in Table 4.3.2-1 is discussed below.] [INN 4.3.2-1]

- Provide a general description of shaft and ramp design requirements and the procedures for identifying regulatory requirements and ensuring compliance. System-specific compliance is demonstrated in this section for all shafts or ramps systems.

[The FCRG outline requirement for system-specific treatment of requirements will be repetitive.]

4.3.2.1 Waste Shaft or Ramp

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.2 Muck Shaft or Ramp

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.3 Ventilation Intake Shafts

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.4 Ventilation Exhaust Shafts

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.5 Personnel and Materials Shafts

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.6 Decommissioning System

- Demonstrate compliance with all applicable requirements and criteria.

4.3.2.7 Other Shaft or Ramp Systems

- Demonstrate compliance with all applicable requirements and criteria.

REFERENCES

10 CFR 20, Standards for Protection Against Radiation

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

Date: 03/31/95

Table 4.3.0.1-1 Shaft and Ramp SSCs and Applicable 10 CFR 60 Requirements

SSC	Reference to 10 CFR 60 Requirements	Description of Requirement
Systems	10 CFR 60.20i [ex]	
Structures		
Component		

[INN 4.3.0.1-1]

Table 4.3.0.4-1 Analytical Models for Shafts and Ramps

Model	Analysis

[INN 4.3.0.4-1]

Table 4.3.0.4-2 Data for Shaft and Ramp Models and Codes

Code or Model	Input Data	Output Data

[INN 4.3.0.4-3]

Table 4.3.1.1-1 Estimated Concentration of Airborne Radioactive Materials for the Restricted Areas in Shafts and Ramps

Area	Concentration

[INN 4.3.1.1-1]

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Table 4.3.1.1-2 Source Terms in Shafts or Ramps

Source Solubility Term	Quantity Discharged per Unit time	Particle Size (AMAD)	Chemical Form	Physical Form	Lung Class

[INN 4.3.1.1-2]

Table 4.3.1.1-3 Maximum Individual and Total Person-Hours of Occupancy in Shafts and Ramps

Area	Individual Person-Hours/yr.	Total Person-Hours/yr.

[INN 4.3.1.1-3]

Table 4.3.1.1-4 Radionuclide Concentration and Intake Estimates During Operational Activities in Shafts and Ramps

Operation Activity	Projected Concentration	Estimated Intake
Handling		
Storage		
Retrieval		
Emplacement		
Isolation		

[INN 4.3.1.1-3]

Table 4.3.1.1-5 Analytical Models and Model Parameters for Shaft and Ramp Analyses

Analysis	Model	Model Parameters
Concentration Estimates		
Intake Estimates		
Etc.		

[INN 4.3.1.1-4]

Table 4.3.1.1-6 Comparison of Projected Intakes to 10 CFR 20 Limits in Shafts and Ramps

Area	Projected Intake	Intake Limit

[INN 4.3.1.1-4]

Table 4.3.1.3-1 Collective Person - Rem Doses by Function in Shafts and Ramps

Function	Annual Collective	Estimated Annual Time (Person Hours)
Spent Fuel Transfer		
HLW Transfer		
Off-Gas Handling		
Waste Treatment		
Maintenance		
Rad Waste Handling		
Decontamination		
In-Service Inspections		

[INN 4.3.1.3-2]

Date: 03/31/95

Table 4.3.2-1 Applicable Requirements and Criteria for Shaft and Ramp Structures, Systems, and Components [INN 4.3.2-1]

[Note: This table is a preliminary representation. Shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria.]

	4.3.2.1 Waste Ramp (Emplacement Intake)	4.3.2.2 Muck Ramp (Development Intake)	4.3.2.3 Emplacement Ventilation Exhaust Shaft	4.3.2.4 Development Ventilation Exhaust Shaft	4.3.2.5 Personnel & Material Ramp	4.3.2.6 Decommissioning System	4.3.2.7 Other Shaft/Ramp Systems
4.3.1.1 Airborne Radioactive Materials	Shaded		Shaded	Shaded		Shaded	
4.3.1.2 Contamination Mon. & Control	Shaded		Shaded	Shaded		Shaded	
4.3.1.3 Dose Rates in Restricted Areas	Shaded		Shaded	Shaded		Shaded	
4.3.1.4 Natural Phenomena and Environmental Conditions	Shaded		Shaded	Shaded		Shaded	
4.3.1.5 Dynamic Effects	Shaded		Shaded	Shaded		Shaded	
4.3.1.6 Performance During and After Fires and Explosions	Shaded		Shaded	Shaded		Shaded	
4.3.1.7 Noncombustible and Heat- Resistant Materials	Shaded		Shaded	Shaded		Shaded	
4.3.1.8 Fire & Explosion Protection System	Shaded		Shaded	Shaded		Shaded	
4.3.1.9 Adverse Safety Effects	Shaded		Shaded	Shaded		Shaded	
4.3.1.10 Control of Radioactive Materials	Shaded		Shaded	Shaded		Shaded	
4.3.1.11 Utility System Performance	Shaded		Shaded	Shaded		Shaded	
4.3.1.12 Utility System Redundancy	Shaded		Shaded	Shaded		Shaded	
4.3.1.13 Emergency Power	Shaded		Shaded	Shaded		Shaded	

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Date: 03/31/95

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Table 4.3.2-1 Applicable Requirements and Criteria for Shaft and Ramp Structures, Systems, and Components [INN 4.3.2-1] (continued)

[Note: This table is a preliminary representation. Shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria.]

	4.3.2.1 Waste Ramp (Emplacement Intake)	4.3.2.2 Muck Ramp (Development Intake)	4.3.2.3 Emplacement Ventilation Exhaust Shaft	4.3.2.4 Development Ventilation Exhaust Shaft	4.3.2.5 Personnel & Material Ramp	4.3.2.6 Decommissioning System	4.3.2.7 Other Shaft/Ramp Systems
4.3.1.14 SSC Operability Verification							
4.3.1.15 Criticality							
4.3.1.16 Instrumentation							
4.3.1.17 Worker Protection							
4.3.1.18 Shaft and Borehole Seals							
4.3.1.19 Seal Materials and Placement Methods							

FIGURE CAPTIONS

Figure 4.3.1.1-1 Restricted Areas in Shafts and Ramps

Plant layout showing restricted areas with legend. [INN 4.3.1.1-1]

Figure 4.3.1.1-2 Areas Potentially Contaminated with Radioactive Materials that are Accessible to Operating Personnel in Shafts and Ramps [INN 4.3.1.1-2]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a general description of the regulatory requirements and overall methods for assessing compliance.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.1-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.0.1-1
Explicit description of the needed information:	Identify all of the shaft and ramp SSCs in Section 4.1 that are subject to 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.1-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC. <ul style="list-style-type: none"> - Demonstrate compliance with general requirements applicable to all GROA SSCs - Demonstrate compliance with individual design requirements applicable to GROA systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.1-3
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.1-4
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a justification of how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.2-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the overall approach to accident analyses including the selection of the accident scenarios.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.2-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion (list) of the accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.2-3
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide the analysis that demonstrates that shaft and ramp SSCs are designed to withstand the effects of each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.2-4
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the design features that prevent accidents, including those caused by natural phenomena.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.3-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide the basis for the SSCs important to safety, waste isolation, and retrievability. (See Table 4.1.0.5-1.)
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.3-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.4-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.0.4-1
Explicit description of the needed information:	Identify the models used to perform the analyses. In addition, explain measures supporting models used in both design applications and accident analyses. Use field tests, in situ test, laboratory test, monitoring data, and natural analog studies to support the analyses and models.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.4-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a discussion on the variability and uncertainty of data and the propagation of errors, and the representativeness of data and uncertainties associated with extrapolation of data. In addition, discuss conceptualizations, documentation, and validation of models and codes should be discussed with respect to:</p> <ul style="list-style-type: none"> - Uncertainties in the input data - Applicability of specific models - Appropriateness of assumptions - Sensitivity of results to the uncertainty of input data.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.0.4-3
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.0.4-2
Explicit description of the needed information:	Identify the input and output parameters for each of the models used. In addition, provide an interpretation of the input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of the results.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.1-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.1.1-1 and Figure 4.3.1.1-1
Explicit description of the needed information:	<p>Provide an analysis that demonstrates that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20.</p> <p>Identify the restricted areas and estimated concentrations in each (Figure 4.3.1.1-1 and Table 4.3.1.1-1).</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.1-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.1.1-2, Figure 4.3.1.1-2
Explicit description of the needed information:	Provide the source term used to estimate these concentrations (Table 4.3.1.1-2). Identify those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel (Figure 4.3.1.1-2).
Information will be used to support:	
The information is needed by/for (date or event):	
Most likely source of the information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.1-3
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.1.1-3 and Table 4.3.1.1-4
Explicit description of the needed information:	<p>Provide an estimate of maximum individual and total person-hours of occupancy (Table 4.3.1.1-3). Anticipated concentrations during occupancy are provided in Table 4.3.1.1-1.</p> <p>Provide projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure (Table 4.3.1.1-4).</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.1-4
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.1.1-5 and 4.3.1.1-6
Explicit description of the needed information:	Provide a description of the models and model parameters used in the calculations (Table 4.3.1.1-5). Provide a comparison of projected intakes to intake limits in 10 CFR 20 (Table 4.3.1.1-6).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.2-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Identify the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. In addition, provide a discussion on how you will ensure compliance with ALARA requirements in 10 CFR 20, dose limitations in 10 CFR 20, and concentrations in air required by 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.3-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion on how to comply with the requirements in 10 CFR 20 for the levels of radiation in restricted areas. In addition, provide the objectives and criteria for design dose rates.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.3-2
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.1.3-1
Explicit description of the needed information:	Provide an estimate of the annual collective person-rem doses. In addition provide the basis, models and assumptions for values of estimated annual occupancy times provided in the previously identified Table 4.3.1.1-3.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.3-3
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Identify the dose conversion factors used in dose rate calculations, and illustrate how they are used to calculate exposures. Describe the biological and dosimetry models used to ensure compliance with 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.4-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.5-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.6-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.7-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.8-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the GROA fire protection and suppression systems have sufficient capacity to reduce adverse effects on SSCs important to safety (reference section 4.1.1.3).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.9-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the GROA shaft and ramp SSCs important to safety are designed to withstand the effects of fire protection system operation or failure and still perform their safety function.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.10-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.11-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to perform their intended safety functions under both accident and normal conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.12-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that utility system design incorporates adequate redundancy to perform their safety functions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.13-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems and alarm systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.14-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the SSCs important to safety are designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.15-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that all systems dealing with nuclear material are designed in compliance with the double contingency principle precluding nuclear criticality. Provide an analysis that demonstrates that each system has been designed for criticality safety under normal and accident conditions. In addition, provide an analysis that ensures that K_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. The effective multiplication factor for all masses and configurations of radioactive material is shown in Table 4.2.1.21-1.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.16-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that all instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group.
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.17-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the design includes adequate provisions for worker protection to ensure that SSCs important to safety can perform intended functions. Note any deviations from the design requirements of 30 CFR Chapter I, Subchapters D, E and N.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.18-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the seals for the shafts and boreholes are designed so that they do not become pathways that compromise the GROA's ability to meet performance objectives following permanent closure.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.1.19-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the seal materials and placement methods were selected to reduce the creation of a pathway for water to contact waste packages and radionuclide migration through existing pathways.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Sub-surface design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.3.2-1
Section Number and Title:	4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.3.2-1
Explicit description of the needed information:	<p>Provide an assessment of (demonstrate) how specific designs or design features of the shafts and ramps comply with (meet or exceed) the general and specific 10 CFR 60 requirements that are applicable to shafts and ramps (contained in 10 CFR 60.131 and 10 CFR 60.133 and listed in FCRG Subsections 4.3.1.1 through 4.3.1.19). <i>[Note: The compliance demonstration should discuss how each major structure, system, or component (SSC) of the shafts and ramps complies with each of the applicable requirements of 10 CFR 60.131 and 60.133. Although all of the 10 CFR 60 requirements contained in FCRG Subsections 4.3.1.1 through 4.3.1.19 are applicable to the shafts and ramps when considered as a complete system, all of these requirements are not necessarily applicable to individual elements of the shafts and ramps. Also, many of these 10 CFR 60 requirements are applicable only to SSCs <u>important to safety</u>.]</i></p> <p>The physical system architecture developed for the shafts and ramps should be compared with the system structure already provided in the FCRG for the LA (Subsections 4.3.2.1 through 4.3.2.7). Make any changes to the FCRG system structure to reflect actual shaft and ramp designs. The level of detail (within the physical system architecture for the shafts and ramps) selected for the compliance demonstration in Subsection 4.3.2 of the LA should be commensurate with that needed to show which aspects or elements of the design actually provide the functions required to satisfy each compliance requirement (i.e., those system elements that actually demonstrate compliance).</p>

<p>Explicit description of the needed information (continued):</p>	<p>Provide/revise Table 4.3.2-1 that shows which elements of the physical system architecture (the SSCs for the shafts and ramps) demonstrate compliance with each of the Part 60 requirements for the shafts and ramps. The system elements selected for the table should be the same as those discussed in the text for the compliance demonstration in Subsection 4.3.2. The 10 CFR 60 requirements selected for the table are those listed in Subsections 4.3.1.1 through 4.3.1.19 of the FCRG for the LA.</p>
<p>Information will be used to support:</p>	
<p>The Information is needed by/for (date or event):</p>	
<p>Most likely source of the Information:</p>	
<p>Information Source Description:</p>	
<p>Does the supporting data need to be QA?</p>	

<p>INTEGRATOR (PMO):</p>	
<p>Date information will be available:</p>	
<p>Deliverable providing information:</p>	
<p>If the data needed is QA, then the QA source document number is:</p>	

MGDS License Application Annotated Outline

Section 4.4 Assessment of Compliance for Underground Facilities

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- 4.4.1.21-1 **Effective Multiplication Factors (k_{eff}) for the Underground Facilities [INN 4.4.1.21-2]**
- 4.4.2-1 **Applicable Requirements and Criteria for Underground Facility Structures, Systems, and Components [INN 4.4.2-1]**

LIST OF FIGURES

- 4.4.1.1-1 Restricted Areas in the Underground Facilities [INN 4.4.1.1-1]
- 4.4.1.1-2 Areas Potentially Contaminated with Radioactive Materials that are
 Accessible to Operating Personnel in the Underground Facilities
 [INN 4.4.1.1-2]

LIST OF INFORMATION NEEDS

- 4.4.0-1 Provide a general description of the regulatory requirements and overall methods for assessing compliance.
- 4.4.0.1-1 Provide a table containing all of the underground facility SSCs in each subsection of Section 4.1 that are subject to 10 CFR 60 requirements.
- 4.4.0.1-2 Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.
- 4.4.0.1-3 Provide a description that describes how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
- 4.4.0.1-4 Provide a description that justifies how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements.
- 4.4.0.2-1 Provide a description of the overall approach to accident analyses including the selection of the accident scenarios.
- 4.4.0.2-2 Provide a discussion that demonstrates that underground facility SSCs are designed to withstand the effects of each accident.
- 4.4.0.3-1 Provide a description of the basis for the SSCs important to safety, waste isolation, and retrievability.
- 4.4.0.4-1 Provide a table containing the models used to perform the analyses.
- 4.4.0.4-2 Provide support analyses and models used to predict future conditions with an appropriate combination of the field tests, in situ tests, laboratory tests, monitoring data, and natural analog studies.
- 4.4.0.4-3 Provide a discussion on the variability and uncertainty of data and the propagation of errors, the representativeness of data and uncertainties associated with extrapolation of data.
- 4.4.0.4-4 Provide a table containing input and output data for each of the models.
- 4.4.0.4-5 Provide interpretations of input and output data along with the basis of interpretations.

LIST OF INFORMATION NEEDS (continued)

- 4.4.1.1-1 Provide an analysis to demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges for other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20.
- 4.4.1.1-2 Provide a table listing each source term used to estimate these concentrations including anticipated concentrations during occupancy.
- 4.4.1.1-3 Provide a table of estimates of maximum individual and total person-hours of occupancy.
- 4.4.1.1-4 Provide a table listing the models and model parameters used in calculations.
- 4.4.1.1-5 Provide a description of the provisions for personnel protective measures such as respiratory equipment or exhaust hoods.
- 4.4.1.2-1 Provide a discussion that demonstrates the means to limit the occupancy time required to perform work in restricted areas.
- 4.4.1.3-1 Provide a discussion to demonstrate that each system is provided with suitable shielding.
- 4.4.1.4-1 Provide a discussion to demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas.
- 4.4.1.5-1 Provide a description of the means to control access to high-radiation areas or airborne radioactivity areas.
- 4.4.1.6-1 Provide a description of the radiation alarm systems that warn operating personnel of:
- Significant increases in radiation levels
 - Significant increases in airborne material concentrations
 - Increased radioactivity in effluents
- 4.4.1.6-2 Provide a description of the provisions for calibration and operability testing for the radiation alarm systems.
- 4.4.1.7-1 Provide a discussion to demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20.

LIST OF INFORMATION NEEDS (continued)

- 4.4.1.7-2 Provide a table containing estimates of the annual collective person-rem doses.
- 4.4.1.7-3 Provide a discussion of the bases, models, assumptions for values presented.
- 4.4.1.7-4 Provide a discussion that identifies dose conversion factors and illustrates how they are used to calculate exposure.
- 4.4.1.7-5 Provide a description of the biological and dosimetry models and how compliance with 10 CFR 20 is ensured.
- 4.4.1.8-1 Provide a discussion that describes how exposures and effluent discharges are ALARA for each system per 10 CFR 20.1(c).
- 4.4.1.8-2 Provide a discussion that describes management policy regarding ALARA in sources and with respect system design and operation.
- 4.4.1.8-3 Provide a discussion that describes how guidelines in Reg Guide 8.8 were used for each individual system.
- 4.4.1.9-1 Provide a discussion to demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
- 4.4.1.10-1 Provide a discussion to demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.
- 4.4.1.11-1 Provide a discussion that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions.
- 4.4.1.12-1 Provide a discussion that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials.
- 4.4.1.13-1 Provide a discussion that demonstrates that the GROA is designed with sufficient fire and explosion system capacity and redundancy to reduce adverse effects of fires and explosions on SSCs important to safety.

LIST OF INFORMATION NEEDS (continued)

- 4.4.1.14-1 Provide a discussion that demonstrates that GROA surface facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function.
- 4.4.1.15-1 Provide a discussion that demonstrates that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency.
- 4.4.1.16-1 Provide a discussion that demonstrates how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions.
- 4.4.1.17-1 Provide a discussion that demonstrates that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions.
- 4.4.1.18-1 Provide a discussion that demonstrates that utility system design incorporates adequate redundancy to perform safety function.
- 4.4.1.19-1 Provide a discussion that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems, and alarm systems.
- 4.4.1.20-1 Provide a discussion that demonstrates that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
- 4.4.1.21-1 Provide a discussion that demonstrates that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality and that each system has been designed for criticality safety under normal and accident conditions.
- 4.4.1.21-2 Provide a discussion that demonstrates that k_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation.
- 4.4.1.22-1 Provide a discussion that demonstrates that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions.

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LIST OF INFORMATION NEEDS (continued)

- 4.4.1.23-1 Provide a discussion that demonstrates that the design includes adequate provisions for worker protection to assure that SSCs important to safety can perform their intended function.
- 4.4.1.23-2 List any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N, and provide rationale for these deviations
- 4.4.1.24-1 Provide a discussion that demonstrates that the orientation, layout, and depth of the underground facility and the design of the underground facility engineered barriers contribute to the containment and isolation of radionuclides.
- 4.4.1.25-1 Provide a discussion that demonstrates that the underground facility design ensures that credible disruptive events during the period of operations do not spread through the facility.
- 4.4.1.26-1 Provide a discussion that demonstrates that the underground facility has been designated with sufficient flexibility to allow adjustments to accommodate site specific conditions identified through in situ monitoring, testing, and excavation.
- 4.4.1.27-1 Provide a discussion that demonstrates that the underground facility has been designed to permit retrieval of waste in accordance with the performance objective of 10 CFR 60.11.
- 4.4.1.28-1 Provide a discussion that demonstrates that the underground facility design controls water or gas intrusion.
- 4.4.1.29-1 Provide a discussion that demonstrates that openings in the underground facility are designed for safe operations and retrievability.
- 4.4.1.30-1 Provide discussions that demonstrate that openings are designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock.
- 4.4.1.31-1 Provide a discussion that demonstrates that the excavation methods do not create a preferential pathway for groundwater to contact the waste packages and contribute to radionuclide migration to the accessible environment.

LIST OF INFORMATION NEEDS (continued)

- 4.4.1.32-1 Provide discussions that demonstrate that the ventilation systems are designed to:
- Control transport of radioactive particulate and gases from the underground facility in accordance with 10 CFR 60.111(a)
 - Ensure continued functions during normal operations and under accident conditions
 - Separate the ventilation of excavation and waste emplacement areas.
- 4.4.1.33-1 Provide a discussion that demonstrates that the engineered barriers in the underground facility are designed to assist the natural setting in meeting the performance objectives after permanent closure.
- 4.4.1.34-1 Provide a discussion that demonstrates that the underground facility design meets performance objectives taking into account predicted thermal and thermochemical responses of the:
- Host rock
 - Surrounding area
 - Groundwater system
- 4.4.2-1 Provide an assessment of how specific designs or design features of the underground facilities comply with the general and specific 10 CFR 60 requirements that are applicable to underground facilities.

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4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES

This section and subsequent subsections provide DOE's demonstration of compliance for the GROA underground facilities with 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, preclosure requirements. Compliance of the underground facilities with the preclosure performance objectives of 10 CFR 60.111(a) and the general and specific design requirements contained in 10 CFR 60.130, 60.131, 60.133, and 60.137 is discussed in the following two subsections: Subsection 4.4.1 identifies the general and specific design requirements and discusses overall system compliance and Subsection 4.4.2 provides the structure, system, and component detail needed to demonstrate how compliance will be achieved. [10 CFR 60.134 will be addressed to the extent that underground facilities affect compliance with sealing of shafts, ramps, and boreholes.]

[A statement similar to the following should be made in a potential LA: Analyses provided in this section demonstrate that GROA underground facility SSCs comply with all applicable regulations.]

4.4.0 Introduction

- Refer to underground facility descriptions in Section 4.1.3
- Refer to assessment of radiation compliance in Section 4.5.1.
- Refer to retrievability option compliance in Section 4.5.2.
- Refer to EBS performance in Chapter 5.0.
- Refer to overall system performance in Chapter 6.0.
- Refer to radiation compliance during performance confirmation in Section 8.4.
- Provide a general description of the regulatory requirements and overall methods for assessing compliance. [INN 4.4.0-1]

4.4.0.1 Compliance with 10 CFR 60 Requirements

- All of the underground facility SSCs in each subsection of Section 4.1 that are subject to 10 CFR 60 requirements are listed in Table 4.4.0.1-1. [INN 4.4.0.1-1]

- Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.
 - Demonstrate compliance with general requirements applicable to all GROA SSCs
 - Demonstrate compliance with individual design requirements applicable to GROA systems. [INN 4.4.0.1-2]
- Describe how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements. [INN 4.4.0.1-3]
- Justify how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements. [INN 4.4.0.1-4]

4.4.0.2 Accident Analyses

- Describe overall approach to accident analyses including the selection of the accident scenarios. [INN 4.4.0.2-1]
- Discuss (list) accidents that SSCs are designed to withstand and how each system is intended to perform during each accident. [INN 4.4.0.2-1]
- Demonstrate that underground facility SSCs are designed to withstand the effects of each accident. [INN 4.4.0.2-2]
- Describe design features that prevent accidents, including those caused by natural phenomena. [INN 4.4.0.2-2]

4.4.0.3 Basis for Identification of SSCs Important to Safety

Provide the basis for the SSCs important to safety, waste isolation, and retrievability. These SSCs are listed in Table 4.1.0.5-1.

Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin. [INN 4.4.0.3-1]

4.4.0.4 Description of Models

- The models used to perform the analyses are listed in Table 4.4.0.4-1. [INN 4.4.0.4-1]
- Explain measures supporting models used in both design applications and accident analyses. [INN 4.4.0.4-1]

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- Support analyses and models used to predict future conditions with an appropriate combination of the following:
 - Field tests
 - In situ tests
 - Laboratory tests
 - Monitoring data
 - Natural analog studies. [INN 4.4.0.4-2]
- Discuss variability and uncertainty of data and the propagation of errors.
- Discuss the representativeness of data and uncertainties associated with extrapolation of data.
- Discuss conceptualizations, documentation, and validation of models and codes with respect to:
 - Uncertainties in the input data
 - Applicability of specific models
 - Appropriateness of assumptions
 - Sensitivity of results to the uncertainty of input data. [INN 4.4.0.4-3]
- Input and output data for each of the models are provided in Table 4.4.0.4-2. [INN 4.4.0.4-4]
- Provide interpretations of input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of results. [INN 4.4.0.4-5]
- Document role of expert judgement. [INN 4.4.0.4-5]

4.4.1 Applicable Requirements and Criteria

- This subsection identifies the general and specific design requirements and discusses overall compliance of the underground facility systems with each of the general design criteria for the GROA (10 CFR 60.131), including the referenced compliance requirements from Part 20, and with each of the additional design criteria for the Underground Facilities (10 CFR 60.133) as listed in Subsections 4.4.1.1 through 4.4.1.34.
- The general requirements for performance confirmation, contained in 10 CFR 60.137 are identified.

- [Consider FCRG comment to bulletize list of SSCs in Section 4.1]
- Compliance is demonstrated for all underground subsystems with the additional requirements and criteria presented herein, as applicable.

4.4.1.1 Airborne Radioactive Materials

- Demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20.103. The restricted areas are shown in Figure 4.4.1.1-1. The estimated concentrations in each restricted area is provided in Table 4.4.1.1-1. [INN 4.4.1.1-1]
- Each source term used to estimate these concentrations is provided in Table 4.4.1.1-2. [INN 4.4.1.1-2]
- Those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel are shown in Figure 4.4.1.1-2. [INN 4.4.1.1-2]
- Estimates of maximum individual and total person-hours of occupancy are provided in Table 4.4.1.1-3. [INN 4.4.1.1-3] Anticipated concentrations during occupancy are provided in Table 4.4.1.1-1.
- Projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure are provided in Table 4.4.1.1-4. [INN 4.4.1.1-3]
- Models and model parameters used in calculations are provided in Table 4.4.1.1-5. [INN 4.4.1.1-4]
- A comparison of projected intakes to intake limits in 10 CFR 20 are provided in Table 4.4.1.1-6. [INN 4.4.1.1-4]
- Indicate provisions for personnel protective measures such as respiratory equipment or exhaust hoods. [INN 4.4.1.1-5]

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4.4.1.2 Personnel Occupancy Time

- Demonstrate the means to limit the occupancy time required to perform work in restricted areas.
- Ensure each system is designed for compliance with 10 CFR 20 requirements for occupancy time. [INN 4.4.1.2-1]

4.4.1.3 Shielding

- Demonstrate that each system is provided with suitable shielding. Refer to Section 4.1 for locations of shielding.
- Provide cost/benefit analysis for each shield to demonstrate compliance with ALARA conditions of 10 CFR 20 and dose limitations requirements of 10 CFR 20.101. [INN 4.4.1.3-1]

4.4.1.4 Contamination Control

- Demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. The radiation zones are illustrated in Figure 4.1.4.1-1.
- Ensure compliance with ALARA requirements in 10 CFR 20.1(c), dose limitations in 10 CFR 20.101, and concentration in air required by 10 CFR 20.103. [INN 4.4.1.4-1]

4.4.1.5 Access Control

- Describe means to control access to high-radiation areas or airborne radioactivity areas. [INN 4.4.1.5-1]
- Describe the monitoring of access. [INN 4.4.1.5-1]

4.4.1.6 Radiation Alarm Systems

- Describe radiation alarm systems that warn operating personnel of:
 - Significant increases in radiation levels
 - Significant increases in airborne material concentrations
 - Increased radioactivity in effluents. [INN 4.4.1.6-1]
- Describe provisions for calibration and operability testing [Reference provided here.] [INN 4.4.1.6-2]

4.4.1.7 Dose Rates in Restricted Areas

- Demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20.101. [INN 4.4.1.7-1]
- Provide the objectives and criteria for design dose rates in various areas. [INN 4.4.1.7-1]
- Estimates of the annual collective person-rem doses are provided in Table 4.4.1.7-1. [INN 4.4.1.7-2]
- Estimated annual occupancy times for each restricted area are provided in Table 4.4.1.1-3. Provide the bases, models, assumptions for values presented. [INN 4.4.1.7-3] [See Subsection 4.4.1.1.]
- Identify dose conversion factors and illustrate how they are used to calculate exposure. [INN 4.4.1.7-4]
- Describe biological and dosimetry models and ensure compliance with 10 CFR 20. [INN 4.4.1.7-5]

4.4.1.8 ALARA

- Describe how exposures and effluent discharges are ALARA for each system per 10 CFR 20.1(c). [INN 4.4.1.8-1]
- Describe management policy regarding ALARA in sources and with respect system design and operation. [INN 4.4.1.8-2]
- Describe how guidelines in Reg Guide 8.8 were used for each individual system. If not used, justify. [INN 4.4.1.8-3]

4.4.1.9 Natural Phenomena and Environmental Conditions

- Demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions. [INN 4.4.1.9-1]

4.4.1.10 Dynamic Effects

- Demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability. [INN 4.4.1.10-1]

4.4.1.11 Performance During and After Fires and Explosions

- Demonstrate that the SSCs important to safety are designed to performed safety functions during and after credible fires and explosions. [Reference Subsection 4.1.1.3.] [INN 4.4.1.11-1]

4.4.1.12 Noncombustible and Heat-resistant Materials

- Demonstrate that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials. [Reference Subsection 4.1.1.3.] [INN 4.4.1.12-1]

4.4.1.13 Fire and Explosion Protection Systems

- Demonstrate that the GROA fire protection and suppression systems have sufficient capacity to reduce adverse effects on SSCs important to safety. [Reference Subsection 4.1.1.3.] [INN 4.4.1.13-1]

4.4.1.14 Adverse Safety Effects of Fire and Explosion System Operation or Failure

- Demonstrate that GROA underground facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function. [Reference Subsection 4.1.1.3.] [INN 4.4.1.14-1]

4.4.1.15 Control Of Radioactive Materials

- Demonstrate that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency. [Reference Subsection 4.1.1.4.] [INN 4.4.1.15-1]

4.4.1.16 Use of Offsite Services

- Demonstrate how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions. [Reference Subsection 4.1.1.4.]

- Demonstrate that emergency system facilitate the use of offsite services such as:
 - Fire
 - Police
 - Medical
 - Ambulance. [INN 4.4.1.16-1]

4.4.1.17 Utility System Performance During Normal and Accident Conditions

- Demonstrate that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions. [Reference Subsection 4.1.1.6.] [INN 4.4.1.17]

4.4.1.18 Utility System Redundancy

- Demonstrate that utility system design incorporates adequate redundancy to perform safety function. [Reference Subsection 4.1.1.6.] [INN 4.4.1.18-1]

4.4.1.19 Emergency Power

- Demonstrate that emergency power is available in the event of a loss of primary power for the following:
 - Instruments
 - Utility systems
 - Operating systems
 - Alarm systems. [INN 4.4.1.19-1]

4.4.1.20 SSC Operability Verification

- Demonstrate that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability. [INN 4.4.1.20-1]

4.4.1.21 Criticality

- Demonstrate that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality. [INN 4.4.1.21-1]
- Demonstrate that each system has been designed for criticality safety under normal and accident conditions. [INN 4.4.1.21-1]

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- Ensure k_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. The effective multiplication factor for all masses and configurations of radioactive material is shown in Table 4.4.1.21-1. [INN 4.4.1.21-2]

4.4.1.22 Instrumentation

- Demonstrate that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions. [Reference Subsection 4.1.1.7.] [INN 4.4.1.22-1]

4.4.1.23 Worker Protection

- Demonstrate that the design includes adequate provisions for worker protection to ensure that SSCs important to safety can perform intended function. [Reference 30 USC 801] [INN 4.4.1.23-1]
- Note any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N. [INN 4.4.1.23-2]

4.4.1.24 Orientation and Depth

- Demonstrate that the orientation, layout, and depth of the underground facility and the design of the underground facility engineered barriers contribute to the containment and isolation of radionuclides. [INN 4.4.1.24-1]

4.4.1.25 Disruptive Events

- Demonstrate that the underground facility design ensures that credible disruptive events during the period of operations do not spread through the facility.
 - Fires
 - Floods
 - Explosions. [INN 4.4.1.25-1]

4.4.1.26 Flexibility

- Demonstrate that the underground facility has been designed with sufficient flexibility to allow adjustments to accommodate site specific conditions identified through:

- In situ monitoring
- Testing
- Excavation. [INN 4.4.1.26-1]

4.4.1.27 Retrieval of Waste

- Demonstrate that the underground facility has designed to permit retrieval of waste in accordance with the performance objective of 10 CFR 60.11. [INN 4.4.1.27-1]

4.4.1.28 Water or Gas Intrusion

- Demonstrate that the underground facility design controls water or gas intrusion. [INN 4.4.1.28-1]

4.4.1.29 Openings

- Demonstrate that openings in the underground facility are designed for safe operations and retrievability. [INN 4.4.1.29-1]

4.4.1.30 Structural Integrity of Openings

- Demonstrate that openings are designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock. [INN 4.4.1.30-1]

4.4.1.31 Excavation Methods

- Demonstrate that the excavation methods do not create a preferential pathway for ground water to contact the waste packages and contribute to radionuclide migration to the accessible environment. [INN 4.4.1.31-1]

4.4.1.32 Ventilation Systems

- Demonstrate that the ventilation systems are designed to:
 - Control transport or radioactive particulate and gases within the underground facility in accordance with 10 CFR 60.111(a)
 - Control transport of radioactive particulate and gases from the underground facility in accordance with 10 CFR 60.111(a)
 - Ensure continued functions during normal operations and under accident conditions
 - Separate the ventilation of excavation and waste emplacement areas. [INN 4.4.1.32-1]

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4.4.1.33 Engineered Barriers

- Demonstrate that the engineered barriers in the underground facility are designed to assist the natural setting in meeting the performance objectives after permanent closure. [INN 4.4.1.33-1]

4.4.1.34 Thermal and Thermochemical Response

- Demonstrate that the underground facility design meets performance objectives taking into account predicted thermal and thermochemical response of the:
 - Host rock
 - Surrounding area
 - Groundwater system. [INN 4.4.1.34-1]

4.4.2 System-Specific Compliance with Applicable Requirements and Criteria

- The purpose of this subsection is to document how specific designs or design features, as embodied in the structures, systems, and components selected for the underground facilities, meet or exceed compliance requirements. This subsection discusses compliance of each of the major elements comprising the underground facilities (as listed in FCRG Subsections 4.1.3.1 through 4.1.3.10 and 4.4.2.1 through 4.4.2.10) with the applicable requirements from the general design criteria for the GROA (10 CFR 60.131), including the referenced compliance requirements from Part 20, and with the applicable requirements from the additional design criteria for the Underground Facilities (10 CFR 60.133) as listed in the FCRG, Subsections 4.4.1.1 through 4.4.1.34. Assessment of compliance with 10 CFR 60.137, general requirements for performance confirmation is presented.

[A statement similar to the following should be made in a potential LA: Analyses provided in this section demonstrate that GROA underground facility SSCs comply with all applicable regulatory requirements. Therefore, there are no credible circumstances by which underground facility operations threaten the health or safety of plant personnel or the public.]

Table 4.4.2-1 is a representation of how compliance requirements are allocated to the major underground facility elements. The demonstration of compliance by each system element with each applicable requirement shown in Table 4.4.2-1 is discussed below. [INN 4.4.2-1]

- Provide a general description of underground facility design requirements and the procedures for identifying regulatory requirements and ensuring compliance. System specific compliance is demonstrated in this section for all underground facility systems. [The FCRG outline requirements for system specific treatment of requirements will be repetitive.]

4.4.2.1 Excavation and Ground Support Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.2 Muck Handling System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.3 Ventilation System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.4 Waste Emplacement System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.5 Waste Retrieval System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.6 Emergency Systems

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.7 Communication System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.8 Operations Support System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.9 Decommissioning System

- Demonstrate compliance with all applicable requirements and criteria.

4.4.2.10 Other Underground Systems

- Demonstrate compliance with all applicable requirements and criteria.

REFERENCES

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

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Table 4.4.0.1-1 Underground Facility SSCs and Applicable 10 CFR 60 Requirements

SSC	Reference to 10 CFR 60 Requirements	Description of Requirement
Systems	10 CFR 60.20i [ex]	
Structures		
Component		

[INN 4.4.0.1-1]

Table 4.4.0.4-1 Analytical Models for Underground Faulting

Model	Analysis

[INN 4.4.0.4-1]

Table 4.4.0.4-2 Data for Underground Facility Models and Codes

Code or Model	Input Data	Output Data

[INN 4.4.0.4-4]

Table 4.4.1.1-1 Estimated Concentration of Airborne Radioactive Materials for the Restricted Areas in the Underground Facilities

Area	Concentration

[INN 4.4.1.1-1]

Table 4.4.1.1-2 Source Terms in the Underground Facilities

Source Solubility Term	Quantity Discharged per Unit time	Particle Size (AMAD)	Chemical Form	Physical Form	Lung Class

[INN 4.4.1.1-2]

Table 4.4.1.1-3 Maximum Individual and Total Person-Hours of Occupancy in the Underground Facilities

Area	Individual Person-Hours/yr.	Total Person-Hours/yr.

[INN 4.4.1.1-3]

Table 4.4.1.1-4 Radionuclide Concentration and Intake Estimates During Operational Activities in the Underground Facilities

Operation Activity	Projected Concentration	Estimated Intake
Handling		
Storage		
Retrieval		
Emplacement		
Isolation		

[INN 4.4.1.1-3]

Date: 03/31/95

Table 4.4.1.1-5 Analytical Models and Model Parameters for the Underground Facilities

Analysis	Model	Model Parameters
Concentration Estimates		
Intake Estimates		
Etc.		

[INN 4.4.1.1-4]

Table 4.4.1.1-6 Comparison of Projected Intakes to 10 CFR 20 Limits in the Underground Facilities

Area	Projected Intake	Intake Limit

[INN 4.4.1.1-4]

Table 4.4.1.7-1 Collective Person - Rem Doses by Function in the Underground Facilities

Function	Annual Collective	Estimated Annual Time (Person Hours)
Spent Fuel Transfer		
HLW Transfer		
Off-Gas Handling		
Waste Treatment		
Maintenance		
Rad Waste Handling		
Decontamination		
In-Service Inspections		

[INN 4.4.1.7-2]

Table 4.4.1.21-1 Effective Multiplication Factors (k_{eff}) for the Underground Facilities

System or Component	Worst Case Calculated k_{eff}
Transportation Cask	0.9
Radwaste Storage Container	0.6
Etc.	Etc.
Etc.	

[INN 4.4.1.21-2]

Date: 03/31/95

Table 4.4.2-1 Applicable Requirements and Criteria for Underground Facility Structures, Systems, and Components [INN 4.4.2-1]

[Note: This table is a preliminary representation. Shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria]

	4.4.2.1 Excavation & Ground Support Systems	4.4.2.2 Muck Handling System	4.4.2.3 Ventilation Systems	4.4.2.4 Waste Emplace- ment System	4.4.2.5 Waste Retrieval System	4.4.2.6 Emergency Systems	4.4.2.7 Communi- cation System	4.4.2.8 Operations Support System	4.4.2.9 Decommis- sioning System	4.4.2.10 Other Under- ground Systems
4.4.1.1 Airborne Rad Mat'ls										
4.4.1.2 Personnel Occupancy Time										
4.4.1.3 Shielding										
4.4.1.4 Contamin- ation Mon & Control										
4.4.1.5 Access Control										
4.4.1.6 Radiation Alarm System										
4.4.1.7 Dose Rates Restricted Areas										
4.4.1.8 ALARA										
4.4.1.9 Natural Pheno- mena & Environ- mental Conditions										
4.4.1.10 Dynamic Effects										
4.4.1.11 Perfor- mance During & After Fires Explosions										
4.4.1.12 Noncom- bustible & Heat- Resistant Materials										

Table 4.4.2-1 Applicable Requirements and Criteria for Underground Facility Structures, Systems, and Components (continued) [INN 4.4.2-1]

[Note: This table is a preliminary representation. Shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria.]

	4.4.2.1 Excavation & Ground Support Systems	4.4.2.2 Muck Handling System	4.4.2.3 Ventilation Systems	4.4.2.4 Waste Emplacement System	4.4.2.5 Waste Retrieval System	4.4.2.6 Emergency Systems	4.4.2.7 Communication System	4.4.2.8 Operations Support System	4.4.2.9 Decommissioning System	4.4.2.10 Other Underground Systems
4.4.1.13 Fire & Explosion Protection System										
4.4.1.14 Adverse Safety Effects of Fire and Explosion System Operation or Failure										
4.4.1.15 Control of Rad Mat'ls										
4.4.1.16 Response to Emerg. Conditions										
4.4.1.17 Utility Sys Perform. During Normal & Accident Conditions										
4.4.1.18 Utility Sys.Redundancy										
4.4.1.19 Emergency Power										
4.4.1.20 SSC Operability Verification										
4.4.1.21 Criticality										
4.4.1.22 Instrumentation										
4.4.1.23 Worker Protection										

Date: 03/31/95

Table 4.4.2-1 Applicable Requirements and Criteria for Underground Facility Structures, Systems, and Components (continued) [INN 4.4.2-1]

[Note: This table is a preliminary representation. Shaded areas indicate which SSCs address 10 CFR 60 requirements and criteria.]

	4.4.2.1 Excavation & Ground Support Systems	4.4.2.2 Muck Handling System	4.4.2.3 Ventilation Systems	4.4.2.4 Waste Emplacement System	4.4.2.5 Waste Retrieval System	4.4.2.6 Emergency Systems	4.4.2.7 Communication System	4.4.2.8 Operations Support System	4.4.2.9 Decommissioning System	4.4.2.10 Other Underground Systems
4.4.1.24 Orientation & Depth										
4.4.1.25 Disruptive Events										
4.4.1.26 Flexibility										
4.4.1.27 Retrieval of Waste										
4.4.1.28 Water or Gas Intrusion										
4.4.1.29 Safety of Operations & Retrieval										
4.4.1.30 Structural Integrity of Openings										
4.4.1.31 Excavation Methods										
4.4.1.32 Ventilation Systems										
4.4.1.33 Engineered Barriers										
4.4.1.34 Thermal & Thermo-mechanical Response										

FIGURE CAPTIONS

Figure 4.4.1.1-1 Restricted Areas in the Underground Facility

Plant layout showing restricted areas with legend. [INN 4.4.1.1-1]

Figure 4.4.1.1-2 Areas Potentially Contaminated with Radioactive Materials that are Accessible to Operating Personnel in the Underground Facility

Layout drawing of GROA surface facilities with subject areas cross-hatched.
[INN 4.4.1.1-2]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a general description of the regulatory requirements and overall methods for assessing compliance. (Refer to underground facility descriptions in Section 4.1.)
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.1-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.0.1-1
Explicit description of the needed information:	Provide a table containing all of the underground facility SSCs in each subsection of Section 4.1 that are subject to 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.1-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide an analysis demonstrating compliance with applicable 10 CFR 60 requirements for each SSC.</p> <ul style="list-style-type: none"> - Demonstrate compliance with general requirements applicable to all GROA SSCs - Demonstrate compliance with individual design requirements applicable to GROA systems
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.1-3
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description that describes how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.1-4
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description that justifies how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 requirements.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.2-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the overall approach to accident analyses including the selection of the accident scenarios. In addition, provide a discussion that lists accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.2-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that underground facility SSCs are designed to withstand the effects of each accident. In addition, provide a description of the design features that prevent accidents, including those caused by natural phenomena.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.3-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a description of the basis for the SSCs important to safety, waste isolation, and retrievability. [Refer to the table containing the SSCs important to safety, waste isolation, and retrievability (Table 4.1.0.5-1).]</p> <p>Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.4-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.0.4-1
Explicit description of the needed information:	Provide a table containing the models used to perform the analyses (Table 4.4.0.4-1). In addition, provide an explanation of the measures supporting the models used in both design applications and in accident analyses.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.4-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide support analyses and models used to predict future conditions with an appropriate combination of the field tests, in situ tests, laboratory tests, monitoring data, and natural analog studies.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.4-3
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion on the variability and uncertainty of data and the propagation of errors, the representativeness of data and uncertainties associated with extrapolation of data. In addition discuss conceptualizations, documentation, and validation of models and codes with respect to uncertainties in the input data, applicability of specific models, appropriateness of assumptions, and sensitivity of results to the uncertainty of input data.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.4-4
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.0.4-2
Explicit description of the needed information:	Provide a table containing input and output data for each of the models (Table 4.4.0.4-2).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.0.4-5
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide interpretations of input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of results. Document role of expert judgment if used.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.1-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.1.1-1 and Figure 4.4.1.1-1
Explicit description of the needed information:	Provide an analysis to demonstrate that the concentrations of airborne radioactive materials in restricted areas (including discharges from other GROA systems) are consistent with the inhalation limits as required by 10 CFR 20. In addition provide a drawing of the restricted areas (Figure 4.4.1.1-1) and a listing the estimated concentrations in each restricted area (Table 4.4.1.1-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.1-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.1.1-2 and Figure 4.4.1.1-2
Explicit description of the needed information:	Provide a table listing each source term used to estimate these concentrations including anticipated concentrations during occupancy (Table 4.4.1.1-2). In addition, provide a drawing showing those areas potentially contaminated with airborne radioactivity that are accessible to operating personnel (Figure 4.4.1.1-2).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.1-3
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Tables 4.4.1.1-3 and 4.4.1.1-4
Explicit description of the needed information:	Provide a table of estimates of maximum individual and total person-hours of occupancy (Table 4.4.1.1-3). Provide a table of projected concentrations and estimated intake of radionuclides in restricted areas until permanent closure (Table 4.4.1.1-4).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.1-4
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Tables 4.4.1.1-5 and 4.4.1.1-6
Explicit description of the needed information:	Provide a table listing the models and model parameters used in calculations (Table 4.4.1.1-5). In addition, provide a table comparing projected intakes of radionuclides to the intake limits of 10 CFR 20 for restricted areas until permanent closure (Table 4.4.1.1-6).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.1-5
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the provisions for personnel protective measures such as respiratory equipment or exhaust hoods.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.2-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates the means to limit the occupancy time required to perform work in restricted areas. In addition, provide a discussion that shows that each system is designed for compliance with 10 CFR 20 requirements for occupancy time.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.3-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that each system is provided with suitable shielding. (Refer to Section 4.1 for locations of shielding.) In addition, provide a cost/benefit analysis for each shield to demonstrate compliance with ALARA conditions of 10 CFR 20 and dose limitations requirements of 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.4-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate the means to monitor and control the dispersal of radioactive contamination between radiation zones in restricted areas. (The radiation zones are illustrated in Figure 4.1.4.1-1.) In addition, provide a discussion and analysis to demonstrate compliance with ALARA requirements in 10 CFR 20, dose limitations in 10 CFR 20, and concentration in air required by 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.5-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the means to control access to high-radiation areas or airborne radioactivity areas. In addition provide a description of access monitoring to be used.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.6-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a description of the radiation alarm systems that warn operating personnel of:</p> <ul style="list-style-type: none"> - Significant increases in radiation levels - Significant increases in airborne material concentrations - Increased radioactivity in effluents
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.6-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the provisions for calibration and operability testing for the radiation alarm systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.7-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the levels of radiation in restricted areas are in compliance with 10 CFR 20. In addition, provide a discussion of the objectives and criteria for design dose rates in various areas.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.7-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.1.7-1
Explicit description of the needed information:	Provide a table containing estimates of the annual collective person-rem doses (Table 4.4.1.7-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.7-3
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion of the bases, models, assumptions for values presented. [See Subsection 4.4.1.1 and Table 4.4.1.1-3]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.7-4
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that identifies dose conversion factors and illustrates how they are used to calculate exposure.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.7-5
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the biological and dosimetry models and how compliance with 10 CFR 20 is ensured.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.8-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes how exposures and effluent discharges are ALARA for each system per 10 CFR 20.1(c).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.8-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes management policy regarding ALARA in sources and with respect system design and operation,
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.8-3
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that describes how guidelines in Reg Guide 8.8 were used for each individual system. If not used, justify.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.9-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the SSCs important to safety are designed so that natural phenomena and environmental conditions do not interfere with safety functions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.10-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion to demonstrate that the SSCs important to safety are designed to withstand missile impacts, etc., without loss of safety function operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.11-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the SSCs important to safety are designed to perform safety functions during and after credible fires and explosions. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.12-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the SSCs important to safety are designed to incorporate the use of noncombustible and heat-resistant materials. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.13-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the GROA is designed with sufficient fire and explosion system capacity and redundancy to reduce adverse effects of fires and explosions on SSCs important to safety. [Provide a reference to Subsection 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.14-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that GROA surface facility SSCs are designed to withstand the effects of fire protection system operation or failure and still perform safety function. [Provide a reference to Section 4.1.1.3.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.15-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that SSCs important to safety are designed to maintain control of radioactive waste and effluents, safely shutdown, and permit safe evacuation during an emergency. [Provide a reference to Subsection 4.1.1.4.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.16-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND-FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates how emergency systems are designed to include facilities and services that ensure safe and timely response to emergency conditions. [Provide a reference to Subsection 4.1.1.4.] In addition, provide a discussion that demonstrates that emergency systems facilitate the use of offsite services such as fire, police, medical, and ambulance.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.17-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that each utility system important to safety is designed to perform intended safety functions under both accident and normal conditions. [Provide a reference to Subsection 4.1.1.6.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.18-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that utility system design incorporates adequate redundancy to perform safety function. [Provide a reference to Subsection 4.1.1.6.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.19-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that emergency power is available in the event of a loss of primary power for instruments, utility systems, operating systems, and alarm systems.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.20-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that SSCs important to safety have been designed to facilitate periodic inspection, testing, and maintenance to ensure operability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.21-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that all systems dealing with nuclear material are designed in compliance with the Double Contingency Principle precluding nuclear criticality and that each system has been designed for criticality safety under normal and accident conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.21-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.1.21-1
Explicit description of the needed information:	Provide a discussion that demonstrates that k_{eff} is sufficiently below unity to show at least 5% margin after allowances for the bias in calculation methods and validation. In addition, provide a table that shows the effective multiplication factor for all masses and configurations of radioactive material (Table 4.4.1.21-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.22-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that instrumentation and control systems include adequate provisions to monitor and control systems important to safety over anticipated ranges of normal operation and accident conditions. [Provide a reference to Subsection 4.1.1.7.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.23-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the design includes adequate provisions for worker protection to assure that SSCs important to safety can perform their intended function. [Reference <i>Federal Mine Safety and Health Act</i> , 30 USC 801.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.23-2
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	List any deviations from the design requirements of 30 CFR Chapter I, subchapters D, E, and N, and provide rationale for these deviations.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.24-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the orientation, layout, and depth of the underground facility and the design of the underground facility engineered barriers contribute to the containment and isolation of radionuclides.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.25-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a discussion that demonstrates that the underground facility design ensures that credible disruptive events during the period of operations do not spread through the facility.</p> <ul style="list-style-type: none"> - Fires - Floods - Explosions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.26-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the underground facility has been designed with sufficient flexibility to allow adjustments to accommodate site specific conditions identified through in situ monitoring, testing, and excavation.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.27-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the underground facility has been designed to permit retrieval of waste in accordance with the performance objective of 10 CFR 60.11.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.28-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the underground facility design controls water or gas intrusion.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.29-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that openings in the underground facility are designed for safe operations and retrievability.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.30-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide discussions that demonstrate that openings are designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.31-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the excavation methods do not create a preferential pathway for groundwater to contact the waste packages and contribute to radionuclide migration to the accessible environment.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.32-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide discussions that demonstrate that the ventilation systems are designed to:</p> <ul style="list-style-type: none"> - Control transport of radioactive particulate and gases from the underground facility in accordance with 10 CFR 60.111(a) - Ensure continued functions during normal operations and under accident conditions - Separate the ventilation of excavation and waste emplacement areas.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

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Date: 03/31/95

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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	:
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.33-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion that demonstrates that the engineered barriers in the underground facility are designed to assist the natural setting in meeting the performance objectives after permanent closure.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.1.34-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	<p>Provide a discussion that demonstrates that the underground facility design meets performance objectives taking into account predicted thermal and thermochemical responses of the:</p> <ul style="list-style-type: none"> - Host rock - Surrounding area - Groundwater system.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.4.2-1
Section Number and Title:	4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.4.2-1
Explicit description of the needed information:	<p>Provide an assessment of (demonstrate) how specific designs or design features of the underground facilities comply with (meet or exceed) the general and specific 10 CFR 60 requirements that are applicable to underground facilities (contained in 10 CFR 60.131 and 10 CFR 60.133 and listed in FCRG Subsections 4.4.1.1 through 4.4.1.34). <i>[Note: The compliance demonstration should discuss how each major structure, system, or component (SSC) of the underground facilities complies with each of the applicable requirements of 10 CFR 60.131 and 60.133. Although all of the 10 CFR 60 requirements contained in FCRG Subsections 4.4.1.1 through 4.4.1.34 are applicable to the underground facilities when considered as a complete system, all of these requirements are not necessarily applicable to individual elements of the underground facilities. Also, many of these 10 CFR 60 requirements are applicable only to SSCs important to safety.]</i></p> <p>The physical system architecture developed for the underground facilities should be compared with the system structure already provided in the FCRG for the LA (Subsections 4.4.2.1 through 4.4.2.10). Make any changes to the FCRG system structure to reflect actual underground facilities design. The level of detail (within the physical system architecture for the underground facilities) selected for the compliance demonstration in Subsection 4.4.2 of the LA should be commensurate with that needed to show which aspects or elements of the design actually provide the functions required to satisfy each compliance requirement (i.e., those system elements that actually demonstrate compliance).</p>

Date: 03/31/95

<p>Explicit description of the needed information (continued):</p>	<p>Provide/revise Table 4.4.2-1 that shows which elements of the physical system architecture (the SSCs for the underground facilities) demonstrate compliance with each of the 10 CFR 60 requirements for the underground facilities. The system elements selected for the table should be the same as those discussed in the text for the compliance demonstration in Subsection 4.4.2. The 10 CFR 60 requirements selected for the table are those listed in Subsections 4.4.1.1 through 4.4.1.34 of the FCRG for the LA.</p>
<p>Information will be used to support:</p>	
<p>The Information is needed by/for (date or event):</p>	
<p>Most likely source of the Information:</p>	
<p>Information Source Description:</p>	
<p>Does the supporting data need to be QA?</p>	

<p>INTEGRATOR (PMO):</p>	
<p>Date information will be available:</p>	
<p>Deliverable providing information:</p>	
<p>If the data needed is QA, then the QA source document number is:</p>	

MGDS License Application Annotated Outline

Section 4.5 Integrated Geologic Repository Operations Area Compliance with Performance Objectives

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- 4.5.1.4-1 **ALARA Organization Structure [INN 4.5.1.4-1]**

LIST OF INFORMATION NEEDS

- 4.5.0-1 Provide a general description of the performance objectives and overall methods for accessing compliance with the performance objectives in 10 CFR 60.
- 4.5.0.1-1 Provide an analysis that demonstrates compliance with general requirements applicable to all GROA systems discussed in previous sections.
- 4.5.0.1-2 Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 performance objectives.
- 4.5.0.1-3 Provide a justification of how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 objectives.
- 4.5.0.2-1 Provide a description of the overall approach to accident analyses including the selection of the accident scenarios. Include a discussion (list) of accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
- 4.5.0.2-2 Provide an analysis that demonstrates that GROA SSCs are designed to withstand the effects of each accident. In addition, describe design features that prevent accidents, including those caused by natural phenomena.
- 4.5.0.3-1 Provide the basis for the SSCs importance to safety, waste isolation, and retrievability. These SSCs are listed in Table 4.1.0.5-1. In addition, provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
- 4.5.0.4-1 Provide a description of the models used to perform the analyses (Table 4.5.0.4-1). In addition, explain measures supporting models used in both design applications and accident analyses. Use field tests, in situ tests, laboratory tests, monitoring data, and natural analog studies to support the analyses and models used to predict future conditions.
- 4.5.0.4-2 Provide a discussion on the variability and uncertainty of data and the propagation of errors, the representatives of data and uncertainties associated with extrapolation of data.

LIST OF INFORMATION NEEDS (continued)

- 4.5.1-1 Provide an analysis that demonstrates that the design of the GROA complies with the requirements for radiological safety of the public in 10 CFR 60.
- 4.5.1-2 Provide the projected levels of radiation and the concentrations of radionuclides expected for normal operations and anticipated operational occurrences (Table 4.5.1.0-1).
- 4.5.1-3 Provide an analysis that demonstrates that the GROA is designed to maintain radiation exposures and levels, and concentrations of radioactive materials released to unrestricted areas within limits specified in 10 CFR 20.
- 4.5.1-4 Provide a description of the models used to estimate concentrations and exposures for the GROA as a system (Table 4.5.1-2), including references to Chapter 3 for meteorological data.
- 4.5.1-5 Provide a discussion on the compliance with ALARA requirements of 10 CFR 20.
- 4.5.1-6 Provide a description of the mathematical or physical models required to perform analyses of radiological consequences of the activities associated with the GROA.
- 4.5.1.1-1 Provide an analysis that demonstrates compliance with 10 CFR 20 for airborne gaseous and particulate effluents, liquid effluents, and solid waste discharged from the GROA.
- 4.5.1.1-2 Provide the consequences analyses for effluents. Each analysis is supported by each effluent and type of waste (Table 4.5.1.1-1), source terms for each radionuclide discharged (Table 4.5.1.1-2), the locations beyond the restricted areas that are potentially impacted by radioactive materials in effluents (Figure 4.5.1.1-1), the anticipated concentrations of each radionuclide at the boundary of the restricted areas and the contribution of each to the radiation dose to humans (Table 4.5.1.1-3).
- 4.5.1.2-1 Provide an analysis that demonstrates that the levels of radiation in unrestricted areas comply with the dose limits in 10 CFR 20.
- 4.5.1.2-2 Describe the characteristics pertinent to its release and eventual biological impact for each radionuclide that contributes more than 10% of the total dose in unrestricted areas.

LIST OF INFORMATION NEEDS (continued)

- 4.5.1.3-1 Provide estimates of the largest annual dose equivalent to any member of the public (Table 4.5.1.3-1) for discharge of radioactive material, direct radiation, and all operations covered by 40 CFR 190.
- 4.5.1.3-2 Provide the annual whole body collective doses (and affected organ doses) attributable to effluents and direct radiation for each compass section and radii (Table 4.5.1.3-2).
- 4.5.1.4-1 Provide an evaluation to demonstrate that radiation exposures and releases of radioactive materials in effluents to unrestricted areas are ALARA as required by 10 CFR 20.
- 4.5.1.4-2 Provide a description of the applicable activities of individuals having responsibility for radiation protection.
- 4.5.2-1 Provide an analysis that demonstrates that the GROA is designed to preserve the option of waste retrieval throughout emplacement, until the completion of a performance conformation program and subsequent NRC review of performance conformation program, and within the same time devoted to construction of the GROA and the emplacement of wastes.

Date: 03/31/95

4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES

Skeleton Text Has Not Been Developed For This Section

[Analyses of integrated GROA systems are provided in this section to demonstrate compliance with the performance objectives in 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, related to radiation protection for the public and waste retrievability. Appropriate design parameters are provided and the bases for their compliance with 10 CFR 60 are discussed. Specific requirements other than those established by 10 CFR 60 are identified for the GROA as a system, and compliance with each is demonstrated. Sufficient information is provided to facilitate an independent verification of compliance with 10 CFR 60 performance objectives.]

4.5.0 Introduction

- Refer to the general description of the GROA in Section 4.0.
- Provide a general description of the performance objectives and overall methods for assessing compliance. [INN 4.5.0-1]
- Compliance with 10 CFR 60 performance objectives associated with public radiation protection is demonstrated for the GROA as a system in Subsection 4.5.1.
- Compliance with 10 CFR 60 performance objectives associated with waste retrievability is demonstrated for the GROA as a system in Subsection 4.5.2.

4.5.0.1 Compliance with 10 CFR 60 Performance Objectives

- Provide a general description of the performance objectives and overall methods for assessing compliance with the performance objectives in 10 CFR 60. [INN 4.5.0-1]
- Demonstrate compliance with applicable 10 CFR 60 performance objectives as follows:
 - Demonstrate compliance with general requirements applicable to all GROA systems discussed in previous sections

- Demonstrate compliance with individual design requirements applicable to specific GROA systems.

Include those engineered barrier subsystems described in Chapter 5 that interact with or otherwise affect the ability of the GROA to meet performance objectives. [INN 4.5.0-1]

- Describe how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 performance objectives. [INN 4.5.0.1-2]
- Justify how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 objectives. [INN 4.5.0.1-3]

4.5.0.2 Accident Analyses and Prevention

- Describe overall approach to accident analyses including the selection of the accident scenarios. Include a discussion (list) accidents that SSCs are designed to withstand and how each system is intended to perform during each accident. [INN 4.5.0.2-1]
- Demonstrate that GROA SSCs are designed to withstand the effects of each accident. [INN 4.5.0.2-2]
- Describe design features that prevent accidents, including those caused by natural phenomena. [INN 4.5.0.2-2]

4.5.0.3 Basis for Identification of SSCs Importance to Safety

- Provide the basis for the SSCs importance to safety, waste isolation, and retrievability. These SSCs are listed in Table 4.1.0.5-1.
- Provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin. [INN 4.5.0.3-1]

4.5.0.4 Description of Models

- The models used to perform the analyses are listed in Table 4.5.0.4-1. [INN 4.5.0.4-1]
- Explain measures supporting models used in both design applications and accident analyses. [INN 4.5.0.4-1]

- Support analyses and models used to predict future conditions with an appropriate combination of the following:
 - Field tests
 - In situ tests
 - Laboratory tests
 - Monitoring data
 - Natural analog studies.[INN 4.5.0.4-1]
- Discuss variability and uncertainty of data and the propagation of errors. [INN 4.5.0.4-2]
- Discuss the representativeness of data and uncertainties associated with extrapolation of data. [INN 4.5.0.4-2]
- Discuss conceptualizations, documentation, and validation of models and codes with respect to:
 - Uncertainties in the input data
 - Applicability of specific models
 - Appropriateness of assumptions
 - Sensitivity of results to the uncertainty of input data.[INN 4.5.0.4-2]
- Input and output data for each of the models are provided in Table 4.5.0.4-2. [INN 4.5.0.4-2]
- Provide interpretations of input and output data along with the basis of interpretations. Provide sufficient detail to facilitate independent analysis of results. [INN 4.5.0.4-2]
- Document role of expert judgement. [INN 4.5.0.4-2]

4.5.1 Protection Against Radiation Exposures and Releases of Radioactive Material to Unrestricted Areas

- Demonstrate that the design of the GROA complies with the requirements for radiological safety of the public in 10 CFR 60. [INN 4.5.1-1]
- The projected levels of radiation and the concentrations of radionuclides expected are provided in Table 4.5.1-1 for normal operations and anticipated operational occurrences. [INN 4.5.1-2]

- Demonstrate that the GROA is designed to maintain radiation exposures and levels, and concentrations of radioactive materials released to unrestricted areas within the limits specified in 10 CFR 20. Also demonstrate compliance with applicable standards for radioactivity established by EPA. [INN 4.5.1-3]
- Refer to the Subsection 4.1.4 for additional information concerning radiation protection.
- The models used to estimate concentrations and exposures for the GROA as a system are provided in Table 4.5.1-2, including references to Chapter 3 for meteorological data. [INN 4.5.1-4]
- The estimated values are compared to numerical limits to demonstrate compliance in Table 4.5.1-3. [INN 4.5.1-4]
- Discuss compliance with ALARA requirements of 10 CFR 20. [INN 4.5.1-5]
- Describe mathematical or physical models required to perform analyses of radiological consequences of the activities associated with the GROA. Include simplifications and assumptions and provide sufficient detail for independent verification of results.
 - Discuss uncertainties in calculational methods and equipment performance.
 - Describe conservatism in assumptions.
 - Reference published data used in analyses.
 - Identify computer programs used in analyses.
 - Provide computer listings of input data and output from all analytical models. [INN 4.5.1-6]

[This will add many tables to the section or make up an Appendix.]

4.5.1.1 Radioactivity in Effluents to Unrestricted Areas

- Demonstrate compliance with 10 CFR 20 for the following wastes discharged from the GROA:

- Airborne gaseous and particulate effluents
 - Liquid effluents
 - Solid wastes. [INN 4.5.1.1-1]
- The consequence analyses for effluents are supported by the following information [INN 4.5.1.1-2]:
 - Each effluent and type of waste is identified in Table 4.5.1.1-1.
 - Source terms for each radionuclide discharged are provided in Table 4.5.1.1-2.
 - The locations beyond the restricted areas that are potentially impacted by radioactive materials in effluents are shown in Figure 4.5.1.1-1.
 - The anticipated concentrations of each radionuclide at the boundary of the restricted areas and the contribution of each to the radiation dose to humans is provided in Table 4.5.1.1-3.
 - Provide sample calculations and explain measures to support biological and transport models, emphasizing critical pathways to humans.
 - Describe the constraints imposed on process systems and equipment for each effluent to ensure compliance with 10 CFR 60.111(a) performance objectives.

4.5.1.2 Compliance with Permissible Levels of Radiation in Unrestricted Areas

- Demonstrate that the levels of radiation in unrestricted areas comply with the dose limits in 10 CFR 20. [INN 4.5.1.2-1]
- Anticipated average radiation levels and occupancy times are provided for each unrestricted area in Table 4.5.1.2-1. [INN 4.5.1.2-1]
- Describe the characteristics pertinent to its release and eventual biological impact for each radionuclide that contributes more than 10% of the total dose in unrestricted areas. [INN 4.5.1.2-2]
- Provide details of assumptions and sample calculations with emphasis on critical pathways to humans. [INN 4.5.1.2-2]

4.5.1.3 Compliance with Environmental Radiation Protection Standards

- Demonstrate that the GROA complies with 40 CFR 191, Section 191.03. [FCRG comment]
- Estimates of the largest annual dose equivalent to any member of the public are provided in Table 4.5.1.3-1 for the following:
 - Discharge of radioactive material
 - Direct radiation
 - All operations covered by 40 CFR 190. [INN 4.5.1.3-1]
- The annual whole body collective doses (and affected organ doses) attributable to effluents and direct radiation for each compass section and radii are provided in Table 4.5.1.3-2. The GROA compass sectors are illustrated in Figure 4.5.1.3-1. [INN 4.5.1.3-2]

4.5.1.4 Compliance with ALARA Principles

- Demonstrate that radiation exposures and releases of radioactive materials in effluents to unrestricted areas are ALARA as required by 10 CFR 20. [INN 4.5.1.4-1]
- Describe the management policy that ensures that radiation exposure to the public is ALARA. The ALARA organizational structure is shown in Figure 4.5.1.4-1. [INN 4.5.1.4-1]
- Describe the applicable activities of individuals having responsibility for radiation protection. [INN 4.5.1.4-2]
- Describe the policy with respect to designing and operating the GROA to achieve ALARA objectives. [INN 4.5.1.4-2]

4.5.2 Retrievability of Waste

- Demonstrate that the GROA is designed to preserve the option of waste retrieval:
 - Throughout emplacement

- Until the completion of a performance conformation program and subsequent NRC review of performance conformation program.
- Within the same time devoted to construction of the GROA and the emplacement of wastes. [INN 4.5.2-1]

REFERENCES

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

Table 4.5.0.4-1 Analytical Models for Integrated GROA

Model

Analysis

[INN 4.5.0.4-1]

Table 4.5.0.4-2 Projected Levels of Radiation and Concentrations of Radionuclides after Failure of Radiological Monitoring Equipment During Accident Conditions

<u>Accident</u>	<u>Discharge of Radioactive Materials</u> (Concentration of Radionuclides)		<u>Radiation Fields</u> (Radiation Levels)	
	Unrestricted Areas	General Environment	Unrestricted Areas	General Environment
Waste Handling Equipment Failure #1 Equipment Failure #2				
Waste Storage Equipment Failure #1 Equipment Failure #2				
Waste Retrieval Equipment Failure #1 Equipment Failure #2				
Waste Emplacement Equipment Failure #1 Equipment Failure #2				
Waste Isolation Equipment Failure #1 Equipment Failure #2				
Anticipated Operational Occurrences Equipment Failure #1 Equipment Failure #2				

[INN 4.5.0.4-2]

Date: 03/31/95

Table 4.5.1-1 Projected Levels of Radiation and Concentrations of Radionuclides for Discharges of Radioactive Materials During Normal Operations and Anticipated Operational Occurrences Until Permanent Clósures [INN 4.5.1-2]

Operations (Normal Operations)	Discharge of Radioactive Materials (Concentration of Radionuclides)		Radiation Fields (Radiation Levels)	
	Unrestricted Areas	General Environment	Unrestricted Areas	General Environment
Waste Handling				
Waste Storage				
Waste Retrieval				
Waste Emplacement				
Waste Isolation				
Anticipated Operational Occurrences				

Table 4.5.1-2 Computer Codes and Models Used in Radiological Analyses [INN 4.5.1-4]

Analysis	Computer Codes or Model	Release Rate (Source Term)	Meteorological Data (Reference to Chapter 3)

Table 4.5.1-3 Analytical Results of Radiological Calculations vs. Numerical Limits [INN 4.5.1-4]

Analysis	Results	Regulatory Requirements Numerical Limits	Margin of Compliance

Date: 03/31/95

Table 4.5.1.1-1 Effluents and Types of Wastes

Effluent Source	Types of Wastes	Amount of Effluent Generated Per Metric Ton of Waste Stored per Unit Time
Treated Process Effluents		
Sewage		
Drinking Water		
Rain Runoff		
Laundry Waste		
Others		

[INN 4.5.1.1-2]

Table 4.5.1.1-2 Source Terms for Radionuclides Discharged as Airborne or Liquid Effluent

Effluent Stream Radionuclide	Particle Size (AMAD)	Chemical Form	Physical Form	Lung Solubility Classes	Total Quantity and Concentration of Radionuclide Discharged per Unit time
Treated Process Effluents	StU Co				
Sewage	N/A				
Drinking Water	N/A				
Rain Runoff					
Laundry Wastes					

[INN 4.5.1.1-2]

Table 4.5.1.1-3 Radionuclide Concentrations at Restricted Area Boundary

Radionuclide	Concentration	Contribution to Total Dose (%)	Characteristics Pertinent to Release (If >10% Dose)	Biological Impact (If >10% Dose)
St90				
C060				
U238				
etc.				

[INN 4.5.1.1-2]

Table 4.5.1.2-1 Anticipated Average Radiation Levels and Occupancy Times in Unrestricted Areas

Unrestricted Area	Anticipated Average Radiation Level	Average Occupancy Time

[INN 4.5.1.2-1]

Table 4.5.1.3-1 Estimated Maximum Annual Dose Equivalents

To be provided

[INN 4.5.1.3-1]

Date: 03/31/95

Table 4.5.1.3-2 Annual Collective Whole Body Doses Estimates Attributable to Effluents and Direct Radiation

<u>Compass Sector</u>	<u>Radii (mi)</u>	<u>Whole Body Dose (person-rem/SV)</u>	<u>Thyroid</u>	<u>Organ Dose Kidney</u>	<u>Lung P&C</u>
1	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
	2	1			
2					
3					
4					
5					
10					
20					
30					
40					
50					
3		1			
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
	4	1			
2					
3					
4					
5					
10					
20					
30					
40					
50					
5		1			
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				

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Table 4.5.1.3-2 Annual Collective Whole Body Doses Estimates Attributable to Effluents and Direct Radiation (continued)

<u>Compass Sector</u>	<u>Radii (mi)</u>	<u>Whole Body Dose (person-rem/SV)</u>	<u>Thyroid</u>	<u>Organ Dose Kidney</u>	<u>Lung P&C</u>
6	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
	7	1			
2					
3					
4					
5					
10					
20					
30					
40					
50					
8		1			
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
	9	1			
2					
3					
4					
5					
10					
20					
30					
40					
50					
10		1			
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				

Date: 03/31/95

Table 4.5.1.3-2 Annual Collective Whole Body Doses Estimates Attributable to Effluents and Direct Radiation (continued)

<u>Compass Sector</u>	<u>Radii (mi)</u>	<u>Whole Body Dose (person-rem/SV)</u>	<u>Thyroid</u>	<u>Organ Dose Kidney</u>	<u>Lung P&C</u>
11	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
12	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
13	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
14	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				
15	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				

Date: 03/31/95

Table 4.5.1.3-2 Annual Collective Whole Body Doses Estimates Attributable to Effluents and Direct Radiation (continued)

<u>Compass Sector</u>	<u>Radii (mi)</u>	<u>Whole Body Dose (person-rem/SV)</u>	<u>Thyroid</u>	<u>Organ Dose Kidney</u>	<u>Lung P&C</u>
16	1				
	2				
	3				
	4				
	5				
	10				
	20				
	30				
	40				
	50				

[INN 4.5.1.3-2]

FIGURE CAPTIONS

Figure 4.5.1.1-1 Locations Beyond the Restricted Areas that are Potentially Affected by Radioactive Materials in Effluents

General arrangement drawing showing cross-hatched areas. [INN 4.5.1.1-2]

Figure 4.5.1.3-1 GROA Compass Sectors

General arrangements drawing overlaid by 16 compass sectors. Each radii should be shown as a circle out to 50 mi. (1,2,3,4,5,10,20,30,40,50 mi.) [INN 4.5.1.3-2]

Figure 4.5.1.4-1 ALARA Organization Structure

Organizational chart of ALARA group. [INN 4.5.1.4-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a general description of the performance objectives and overall methods for accessing compliance with the performance objectives in 10 CFR 60.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.1-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates compliance with general requirements applicable to all GROA systems discussed in previous sections. In addition, provide an analysis that demonstrates compliance with individual design requirements applicable to specific GROA systems. Include those engineered barrier subsystems described in Chapter 5 that interact with or otherwise effect the ability of the GROA to meet performance objectives.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.1-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of how design parameters presented in Section 4.1 result in compliance with 10 CFR 60 performance objectives.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.1-3
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a justification of how applicable industry codes and standards used in the design result in compliance with 10 CFR 60 objectives.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.2-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the overall approach to accident analyses including the selection of the accident scenarios. Include a discussion (list) of accidents that SSCs are designed to withstand and how each system is intended to perform during each accident.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.2-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that GROA SSCs are designed to withstand the effects of each accident. In addition, describe design features that prevent accidents, including those caused by natural phenomena.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.3-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide the basis for the SSCs importance to safety, waste isolation, and retrievability. These SSCs are listed in Table 4.1.0.5-1. In addition, provide an analysis that demonstrates the margin of safety in the design under normal conditions and anticipated operational occurrences, including those of natural origin.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.4-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.0.4-1
Explicit description of the needed information:	Provide a description of the models used to perform the analyses (Table 4.5.0.4-1). In addition, explain measures supporting models used in both design applications and accident analyses. Use field tests, in situ tests, laboratory tests, monitoring data, and natural analog studies to support the analyses and models used to predict future conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.0.4-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.0.4-2
Explicit description of the needed information:	<p>Provide a discussion on the variability and uncertainty of data and the propagation of errors, the representatives of data and uncertainties associated with extrapolation of data. In addition discuss conceptualizations, documentation, and validation of models and codes with respect to uncertainties in the input data, applicability of specific models, appropriateness of assumptions, and sensitivity of results to the uncertainty of input data.</p> <p>Provide a discussion of the input and output data for each of the models along with interpretations of the models and the basis of the interpretations. (Table 4.5.0.4-2). Provide sufficient detail to facilitate independent analysis of results. Document role of expert judgment if used.</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the design of the GROA complies with the requirements for radiological safety of the public in 10 CFR 60.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.1-1
Explicit description of the needed information:	Provide the projected levels of radiation and the concentrations of radionuclides expected for normal operations and anticipated operational occurrences (Table 4.5.1-1). The projected levels of radiation and the concentrations of radionuclides expected are provided in Table 4.5.0.4-2 [INN 4.5.0.4-2] for accident conditions.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-3
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the GROA is designed to maintain radiation exposures and levels, and concentrations of radioactive materials released to unrestricted areas within limits specified in 10 CFR 20. Also demonstrate compliance with applicable standards for radioactivity established by EPA. (Refer to subsection 4.1.4 for additional information concerning radiation protection.)
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-4
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Tables 4.5.1-2 and 4.5.1-3
Explicit description of the needed information:	Provide a description of the models used to estimate concentrations and exposures for the GROA as a system (Table 4.5.1-2), including references to Chapter 3 for meteorological data. In addition, provide the estimated values compared to numerical limits to demonstrate compliance (Table 4.5.1-3).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-5
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a discussion on the compliance with ALARA requirements of 10 CFR 20.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1-6
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the mathematical or physical models required to perform analyses of radiological consequences of the activities associated with the GROA. Include simplifications and assumptions and provide sufficient detail for independent verification of results. Discuss uncertainties in calculational methods and equipment performance. Describe conservatism in assumptions. Reference published data used in analyses. Identify computer programs used in analyses. Provide computer listings of input data and output from all analytical models. [This will add many tables to the section or make up an Appendix.]
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.1-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates compliance with 10 CFR 20 for airborne gaseous and particulate effluents, liquid effluents, and solid waste discharged from the GROA.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.1-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Tables 4.5.1.1-1, 4.5.1.1-2, 4.5.1.1-3 and Figure 4.5.1.1-1.
Explicit description of the needed information:	<p>Provide the consequences analyses for effluents. Each analysis is supported by each effluent and type of waste (Table 4.5.1.1-1), source terms for each radionuclide discharged (Table 4.5.1.1-2), the locations beyond the restricted areas that are potentially impacted by radioactive materials in effluents (Figure 4.5.1.1-1), the anticipated concentrations of each radionuclide at the boundary of the restricted areas and the contribution of each to the radiation dose to humans (Table 4.5.1.1-3).</p> <p>Provide sample calculations and explain measures to support biological and transport models, emphasizing critical pathways to humans. In addition, provide a description of the constraints imposed on process systems and equipment for each effluent to ensure compliance with 10 CFR 60.111(a) performance objectives.</p>
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.2-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.1.2-1
Explicit description of the needed information:	Provide an analysis that demonstrates that the levels of radiation in unrestricted areas comply with the dose limits in 10 CFR 20. Provide the anticipated average radiation levels and occupancy times for each unrestricted area.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.2-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Describe the characteristics pertinent to its release and eventual biological impact for each radionuclide that contributes more than 10% of the total dose in unrestricted areas. In addition, provide details of assumptions and sample calculations with emphasis on critical pathways to humans.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.3-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.1.3-1
Explicit description of the needed information:	Provide estimates of the largest annual dose equivalent to any member of the public (Table 4.5.1.3-1) for discharge of radioactive material, direct radiation, and all operations covered by 40 CFR 190.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.3-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Table 4.5.1.3-2 and Figure 4.5.1.3-1
Explicit description of the needed information:	Provide the annual whole body collective doses (and affected organ doses) attributable to effluents and direct radiation for each compass section and radii (Table 4.5.1.3-2). In addition, provide a figure that shows the GROA compass sectors (Figure 4.5.1.3-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.4-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	Figure 4.5.1.4-1
Explicit description of the needed information:	Provide an evaluation to demonstrate that radiation exposures and releases of radioactive materials in effluents to unrestricted areas are ALARA as required by 10 CFR 20. In addition, provide a description of the management policy that ensures that radiation exposure to the public is ALARA. Identify the ALARA organizational structure (Figure 4.5.1.4-1).
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.1.4-2
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide a description of the applicable activities of individuals having responsibility for radiation protection. In addition, provide a description of the policy with respect to designing and operating the GROA to achieve ALARA objectives.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 4.5.2-1
Section Number and Title:	4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA COMPLIANCE WITH PERFORMANCE OBJECTIVES
Lead Author/Support Author and Phone:	Ken Ashe (702) 794-7665
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Provide an analysis that demonstrates that the GROA is designed to preserve the option of waste retrieval throughout emplacement, until the completion of a performance conformation program and subsequent NRC review of performance conformation program, and within the same time devoted to construction of the GROA and the emplacement of wastes.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	GROA design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
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Chapter 5.0 Engineered Barrier Systems

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5.0 ENGINEERED BARRIER SYSTEMS

Chapter 5 provides a description and evaluation of the Engineered Barrier Systems (EBS). A discussion of the overall purpose and function of the EBS is included, and the EBS is shown to fulfill the relevant requirements of 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*.

Chapter 5 is divided into Section 5.1, Description of the Engineered Barrier Systems, and Section 5.2, Assessment of Compliance with 10 CFR 60.

Section 5.1, Description of the EBS, provides complete information on the selected EBS including the waste containers and the waste forms [and fillers] contained therein, the methods of emplacement of the waste packages in the repository, and the backfill and other materials surrounding them. The waste forms discussed include both spent nuclear fuel (SNF) and high-level waste (HLW) glass. Other types of U.S. Department of Energy high-level waste and spent nuclear fuel, including Navy spent fuels, may be emplaced and are discussed. Design parameters and operational considerations of the repository which affect the waste packages are presented and discussed. Topics include the hydrological and geochemical attributes and processes which will, in part, determine the long-term performance of the waste packages.

Section 5.2, Assessment of Compliance with 10 CFR 60, is divided into three subsections. The first subsection discusses compliance with the design criteria, and the second evaluates compliance with the performance objectives of 10 CFR 60. The third subsection provides information pertaining to radiation protection.

The EBS discussed in Chapter 5 fulfills the relevant requirements of 10 CFR 60. This is accomplished by the following general means:

- a. A robust waste package is provided that is compatible with the multi-purpose canister and maintains substantially complete containment (SCC) for at least 1,000 years through design of a waste package with mean lifetime well in excess of 1,000 years in the worst case near field environment.
- b. Control of release of radioactive material from the EBS is attained by relying on the following:
 - low ambient flux and saturation in the host rock to limit the amount of water that can reach the EBS,
 - robust waste container to delay contact between waste and water,
 - inherently low solubility of the waste form to limit mobilization of radionuclides,

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- possible use of a diffusion barrier to retard transport of radionuclides to the host rock.
- c. Long-term criticality control is ensured by taking credit for principal isotope burnup and by providing supplemental neutron absorbers as needed.

In order to provide the necessary containment to meet 10 CFR 60, disposal containers are required to provide a barrier to transport of radionuclides. Disposal Containers have corrosion-resistant and corrosion allowance barriers. In order to control the release rate of radionuclides, backfill material around the disposal containers may be required. Detailed discussion of analyses performed to verify compliance with the regulations is provided in Chapter 6.

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REFERENCES

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

ACRONYMS AND ABBREVIATIONS

BWR	Boiling Water Reactor
DWPF	Defense Waste Processing Facility
EBDRD	Engineered Barrier Design Requirements Document
EBS	Engineered Barrier System
HLW	High-level Waste
MGDS	Mined Geologic Disposal System
MPC	Multi-purpose Canister
NRC	Nuclear Regulatory Commission
PWR	Pressurized Water Reactor
SCC	Substantially Complete Containment
SNF	Spent Nuclear Fuel
TBD	To Be Determined
UNS	Unified Numbering System for Metals and Alloys
WP	Waste Package

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Section 5.1 Description of Engineered Systems and Components That Provide a Barrier Between the High-Level Waste and the Geologic Setting

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5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING

This section provides a description of the EBS and components as well as their intended functions and relations in the overall repository design. Structures, systems, and components of the EBS are identified and it is indicated whether or not they have been classified as important to safety, retrievability, or isolation.

The EBS consists of waste packages (WP) and the underground facility. WPs will be emplaced horizontally in drifts. The outer boundary of the EBS is at the walls of the emplacement drifts.

5.1.1 WP

Waste packages are defined in 10 CFR 60 as: the waste form and any containers, shielding, packaging and other absorbent materials immediately surrounding an individual waste container.

Because of the variety of wastes to be emplaced, there will be several types of WPs. This section describes the types of WPs. Multi-purpose canisters, uncanistered SNF, and canistered HLW glass will be loaded into waste package containers.

SNF will arrive at the repository in multi-purpose canisters (MPCs), which will be used only for intact (non-failed) fuel. All MPC's will arrive at the repository by rail. Some uncanistered fuel will also be received at the repository; this will be placed in disposal containers that are specifically designed for uncanistered fuel. Uncanistered fuel may arrive by truck since some nuclear facilities do not have rail lines.

HLW glass will arrive in metal pour canisters. [INN 5.1.1-1] These canisters will be sealed in disposal containers before disposal.

Packing material may be provided to immediately surround the waste containers.
[INN 5.1.1.5-1]

5.1.1.1 MPC

MPCs are metal canisters that will be loaded with spent fuel at the utilities. Loaded MPCs will be placed in dry storage devices for on-site storage, then transferred to transportation casks for delivery to the repository. Finally, the MPCs will be placed in disposal containers before disposal. The baseline material for the MPC shell and closure lids is low-carbon austenitic stainless steel or stabilized austenitic stainless steel. MPCs contain baskets that provide mechanical support for the assemblies, control criticality, and conduct heat to the shell.

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Several types of MPCs will be produced. Specifications for the MPCs are given in a Request For Proposal for manufacturing the first lot of MPCs. Details of design and analyses of thermal and structural characteristics are as follows: [INN 5.1.1.1-1]

5.1.1.2 Disposal container for SNF in MPCs

The utilities will choose MPCs that are suitable for their facilities. The MPCs are placed intact into correspondingly sized disposal containers for disposal. [As needed, moderator-displacing filler material and/or disposal control rod assemblies will be added to prevent criticality events.] [INN 5.1.1.2-1]

The disposal containers [will] consist of metallic barriers, including a corrosion-resistant barrier with a thickness of about _____ mm, and a corrosion-allowance barrier with a thickness of about _____ mm. [INN 5.1.1.2-1] The corrosion-resistant material [will be/was] selected from those under study and [is/may be] one of the following:

- Unified Numbering System for Metals and Alloys (UNS) N08825 (Alloy 825)
- UNS N06030 (Alloy G-30) (Alloy 825 with more Cr and Mo)
- UNS N06455 (Hastelloy C-4)
- UNS N06022 (Hastelloy C-22) [INN 5.1.1.2-1]

The corrosion-allowance material [will also be/was] selected from those under study and [is/may be] one of the following:

- UNS K21590 (2 1/4 Cr - 1 Mo alloy steel)
- UNS G10200 or similar designations (carbon steel) [INN 5.1.1.2-1].

For each layer, the ends of the WPs are closed with lids of the same material and thickness, and sealed with full-penetration welds. Weld inspection methods are_____. [INN 5.1.1.2-1]

Empty space in the disposal container will be filled with helium or argon gas. [INN 5.1.1.2-1]

In addition to the WPs described above, alternative materials and types of disposal containers were evaluated in accordance with the requirements of 10 CFR 60.21(c)(1)(ii)(D). The alternative packages are _____. [INN 5.1.1.2-1]

5.1.1.3 Disposal container for Uncanistered SNF

Disposal containers for uncanistered SNF are similar to those described in Subsection 5.1.1.2; however, these disposal containers have a basket to provide mechanical support for the assemblies, heat conduction to the shell of the package, and criticality control. Locating

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devices ensure proper positioning of the basket. Materials and thicknesses are similar to those of disposal containers for fuel in MPCs. [INN 5.1.1.3-1]

Empty space in the disposal container will be filled with helium or argon gas.
[INN 5.1.1.3-1]

In addition to the WPs described above, alternative materials and types of disposal containers were evaluated in accordance with the requirements of 10 CFR 60.21(c)(1)(ii)(D). The alternative packages were _____. [INN 5.1.1.3-1]

Analysis of the standard and alternative disposal containers shows that _____.
[INN 5.1.1.3-1]

5.1.1.4 Disposal container for Glass HLW

Disposal containers for glass HLW consist of a corrosion-resistant barrier with a thickness of about _____ mm and a corrosion-allowance barrier with a thickness of about _____ mm.
[INN 5.1.1.4-1] [The following corrosion-resistant materials are under consideration:]

- UNS N08825 (Alloy 825)
- UNS R53400 (Titanium Grade 12) [INN 5.1.1.4-1]

The corrosion-allowance material will also be selected from those under study, and may be:

- UNS C71500 (70/30 Copper-Nickel)
- UNS N04400 (Monel 400). [INN 5.1.1.4-1]

The structural internals of the disposal containers will consist of _____ [INN 5.1.1.4-1]

Empty space in the disposal container will be filled with helium or argon gas.
[INN 5.1.1.4-1]

In addition to the WPs described above, alternative materials and types of disposal containers were evaluated, in accordance with the requirements of 10 CFR 60.21(c)(1)(ii)(D). The alternative packages were _____. [INN 5.1.1.4-1]

Analysis of the standard and alternative disposal containers shows that _____.
[INN 5.1.1.4-1]

5.1.1.5 Packing Materials

[The volume immediately surrounding the waste container may be filled with a packing material. The packing material, if used, will be designed to enhance the performance of the EBS by prolonging containment or reducing the rate of radionuclide transport away from the waste container. The packing may perform one or more functions, including reducing the

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oxidation potential (possibly with wüstite ($\text{Fe}_{0.95}\text{O}$) or iron particles), increasing the alkalinity of groundwater in contact with the disposal container (possibly with concrete), and sorbing radionuclides (possibly with zeolites) that are released from the package. The packing must resist degradation from exposure to heat and radiation, must not cause significant degradation of the disposal container or waste form by providing nutrients for bacteria, and must have satisfactory heat transfer properties to prevent excessive waste form and waste package temperatures.] [INN 5.1.1.5-1]

5.1.2 Waste Form

Waste forms to be received and packaged for disposal include both SNF from commercial power reactors and canisters of solidified high-level wastes from commercial and defense fuel reprocessing operations. DOE-owned SNF may also be received. The waste form for SNF is specified in Appendix E of 10 CFR 961, *Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste*. This regulation states that the general specifications for high-level radioactive waste will be issued later. The commercial high-level waste will be received from the West Valley Demonstration Project in New York. High-level wastes from the defense program activities at Savannah River, Hanford, and the Idaho National Engineering Laboratory may also be disposed of in the repository.

Requirements for acceptable wastes are given in the *Waste Acceptance System Requirements Document*, DOE/RW-0351P. Wastes that do not meet the specifications of that document may not be accepted into the Civilian Radioactive Waste Management System.

5.1.2.1 Waste Forms Descriptions and Sources

Waste to be received includes SNF from commercial power reactors and reprocessing waste immobilized in glass from the Defense Waste Processing Facility (DWPF), the West Valley Demonstration project, and the Hanford and Idaho projects. These waste forms are described below.

5.1.2.1.1 SNF

The Characteristics Database (Oak Ridge National Laboratory) presents detailed descriptions of the chemical, physical, thermal, isotopic, and radiological characteristics of SNF to be received at the repository. The age of spent fuel at the time of receipt is projected in _____. [INN 5.1.2.2-2] Forms of SNF and how they will be processed at the repository are discussed in Subsection 5.1.2.3.

10 CFR 961.11, *Text of the contract*, defines SNF as "fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing." This definition is made more specific in the *Waste Acceptance System Requirements Document*, DOE/RW-0351P, Section 6.1, which states that SNF includes" (1) intact, nondefective fuel assemblies; (2) failed fuel assemblies in canisters; (3) fuel assemblies in canisters; (4) consolidated fuel rods in canisters; (5) nonfuel components

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inserted in PWR fuel assemblies, including, but not limited to, control rod assemblies, burnable poison assemblies, thimble plug assemblies, neutron source assemblies, instrumentation assemblies; (6) fuel channels attached to BWR fuel assemblies; and (7) nonfuel components and structural parts of assemblies in canisters."

SNF can be characterized by its age, enrichment, and burnup. Age is the time since the fuel was discharged from a reactor. Enrichment is the initial fraction of uranium that was ^{235}U . Burnup of light water reactor fuel is the fission (thermal) energy released per unit of initial uranium mass loaded into a reactor core. A commonly used unit for burnup is megawatt-days per metric ton of initial uranium (MWd/MTU).

Disposal containers must be designed to accommodate the heat output and reactivity of the fuel. These quantities can be calculated from the age, enrichment, and burnup by relations that are tabulated in the Characteristics Database. In general, heat output is nearly independent of enrichment, increases with increasing burnup, and decreases with increasing age. Reactivity increases with increasing enrichment, decreases with increasing burnup, and depends in a complex manner on age that is discussed in Subsection 5.2.2.3.

Two design basis fuels have been chosen. Both are PWR fuels, which generally possess more stressing burnup and criticality characteristics than do BWR fuels. The design basis fuel for thermal analysis has a relatively high burnup of 48.1 GWD/MTU and an initial enrichment of 4.2%. This fuel has heat and radiation outputs that are larger than those of a majority of SNF. The design basis fuel for criticality has a relatively low burnup of 20 GWD/MTU and a moderate initial enrichment of 3%. This fuel has a higher nuclear reactivity than does most SNF.

Standard design waste containers that are based on the design basis fuels discussed above will accommodate approximately 93% of the 63,000 MTU of spent commercial nuclear fuel that is planned for emplacement in the repository. Fuel with more nuclear reactivity or higher thermal output than the design basis fuels may be accommodated by blending with less stressing fuel or through other means as discussed in Subsections 5.2.1.1.2.6 and 5.2.2.3.

5.1.2.1.2 HLW Glass

Table 5.1.2.1.2-1 [INN 5.1.2.1.2-1] presents a summary of the physical, chemical, thermal, and radiological characteristics of DWPF HLW glass to be received at the repository. As the table shows, _____ [INN 5.1.2.1.2-1] The pour canisters are 610 mm in diameter, 3.0 m long and nominally 10 mm thick, and are essentially identical for West Valley Demonstration Project and DWPF glass. Table 5.1.2.1.2-2 [INN 5.1.2.1.2-2] provides the same information for glass HLW forms from other sites. As this table shows, _____ [INN 5.1.2.1.2-2]

High-level radioactive wastes from the DWPF at Savannah River and the West Valley Demonstration Project will be received in solidified form. The radionuclides will be immobilized in a borosilicate glass matrix contained in UNS S30403 (Type 304L stainless steel) pour

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canisters. Because of thermal cycles associated with the glass pouring operation, the pour canisters may be highly stressed, and pour canisters will not be used as the primary barrier to meet the containment performance objective. Four HLW glass canisters may be emplaced in a single MPC-site disposal container. [INN 5.1.1-1].

Further details of glass HLW waste forms from the Savannah River site, including composition of the glass and construction of the canister may be found in the *DWPF Waste Form Compliance Plan*, WSRC-IM-91-116-0. Further details of glass HLW waste forms from other sites are found in _____. [INN 5.1.2.1.2-2]

5.1.2.1.3 DOE-Owned Spent Nuclear Fuel

Table 5.1.2.1.3-1 [INN 5.1.2.1.3-1] presents a summary of the physical, chemical, thermal, and radiological characteristics of DOE-owned spent nuclear fuel including Navy fuel, to be received at the repository. As the Table shows, _____. [INN 5.1.2.1.3-1]

5.1.2.2 Quantity of Waste to be Emplaced

SNF. A summary of the quantities of SNF expected to be received at the repository is shown in Table 5.1.2.2-1 [INN 5.1.2.2-1]. After the repository start-up phase, a receipt rate of _____ kg U per year is anticipated. Table 5.1.2.2-2 [INN 5.1.2.2-2] gives a tabulation of the anticipated burnup distribution and age at repository receipt of SNF as a function of time from 2010 to 2032.

HLW Glass. Delivery of high-level waste glass to the repository is scheduled to begin approximately 5-6 years after repository start-up. A summary of the quantities of HLW glass to be received at the repository is provided in Table 5.1.2.2-3 [INN 5.1.2.2-3]. After the repository start-up phase, a receipt rate of _____ glass canisters per year is anticipated.

5.1.2.3 Waste Form Acceptance and Handling

SNF may be received at the repository in any of four forms. Most will be intact assemblies containing undamaged fuel rods. Some of the fuel rods may have minor cladding breach defects, but would not be structurally damaged to the extent that the fuel is not safely contained by the cladding. Such fuel may either be in MPCs or uncanistered. The third form is fuel that has been consolidated by being disassembled at the reactors or other facilities, with the rods packaged in canisters whose dimensions approximate those of an intact assembly. The reference consolidation factor is 2:1 (i.e., a canister contains the fuel rods from two fuel assemblies). [No reference form for the configuration of nonfuel hardware resulting from these consolidation operations has been established. Hence, no provisions have been made for this material in the conceptual designs for either the disposal containers or repository surface facilities.] [INN 5.1.2.3-1] The fourth form in which SNF is expected to be received is "failed fuel" that has been structurally damaged to the extent that the fuel assemblies must be placed in a canister to contain the particulate fuel materials during handling and shipment from the reactor. [No reference dimensions have been established as

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yet for this category. It is assumed that the canisters will be only slightly larger than the assemblies they contain.] [INN 5.1.2.3-1]

Processing of SNF at the repository will be minimal. No rod consolidation will be performed. Single assemblies, either canistered or bare, will be placed intact into disposal containers. The entire assemblies, including the non-fuel hardware components, will be packaged for repository disposal. Sealed MPCs will be opened only if it is necessary to insert additional material to provide long-term criticality control.

Details of how the HLW and SNF waste will be physically handled and treated are found in Subsection 7.0.1. This section also describes acceptance processes and activities. Treatments, manufacturing processes, and acceptance procedures ensure the waste form is consistent with the repository performance objectives by _____. [INN 5.1.2.3-1]

5.1.3 Underground Facility Design

A complete description of the underground facility is given in Subsection 4.1.3. The description here includes only those parts that are relevant to WP performance.

The WPs will be emplaced in drifts. Emplacement hardware will be supported by an invert (floor). The remainder of the drift may be filled with backfill. [INN 5.1.3.2-1]

Further details of backfill and drift construction are provided in Subsection 4.1.3.4.

5.1.3.1 Invert Materials

To support the weight of the WPs, an invert will be installed in the bottom of the emplacement drift. The invert will provide for drainage of water away from the WPs. [INN 5.1.3.1-1]

5.1.3.2 Backfill Materials

At the end of the emplacement period, the drifts may be backfilled. The [proposed] backfill is coarsely crushed tuff. This backfill performs several important functions, notably protecting the disposal container from rock fall.

Adding backfill will increase WP temperatures. The heat production of HLW glass is small enough that thermal degradation of the WP will not occur. [INN 5.1.3.2-1]. For SNF, however, certain combinations of age, burnup, package size, and thermal loading can result in excessive temperatures, which may lead to degradation of the fuel and possibly the disposal container. To limit WP temperatures, the backfill will not be emplaced immediately, but the fuel will be allowed to age and its thermal output to drop for some time. [INN 5.1.3.2-1]

Emplacement machinery for backfill consists of _____. [INN 5.1.3.2-1] Removal of backfill will only occur as a part of waste retrieval; this is described in Subsection 4.1.3.5.

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5.1.3.3 Waste Emplacement Openings

Waste emplacement opening stability as a function of rock mass characteristics has been studied. Results of this study indicate that _____. [INN 5.1.3.3-1]

5.1.4 EBS/WP Emplacement Environment

The following subsections describe the Yucca Mountain Site conditions as they exist at the waste emplacement horizon and as they would be modified as a result of WP emplacement.

5.1.4.1 Pre-Emplacement Environment

The Yucca Mountain Site Characterization Project has selected the Topopah Spring Tuff of the Paintbrush Group as the recommended repository horizon. The investigations that led to this selection are discussed in the unit evaluation report (Johnstone et al., 1984). The selected horizon is the welded, devitrified section of Topopah Spring tuff that lies above the basal vitrophyre of the unit. The pre-emplacement site conditions are discussed in _____. [INN 5.1.4-1]

5.1.4.2 Postemplacement Environment

Construction of a repository and the emplacement of heat and radiation generating waste in the repository will cause changes in the physical and chemical characteristics of the environment. A thorough understanding of the changes in the environment that will occur with time as affected by repository construction and waste emplacement has been developed. The effects from development of the repository and emplacement of the WPs are discussed below. They are:

- a. Heat-induced mechanical effects, and modification of the ambient rock/water system and hydrodynamic regime due to the thermal load generated by the WPs;
- b. Changes in the physical and chemical properties of the rock and vadose water due to the waste-related radiation field;
- c. Changes in the chemical properties of the water due to man-made materials;
- d. Physical changes in the rock unit and modification of moisture conditions due to mining activities.

In addition to the changes these effects impose on the near field host rock, the environment within the emplacement drifts and surrounding the WPs is also discussed in this section.

Anticipated Thermal History and Effects. A 21 PWR MPC with disposal container, loaded with average fuel, will have a heat output of _____ W at emplacement (unless the fuel is aged for an extended period). For an unventilated emplacement drift, the rock at the

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emplacement opening would reach a maximum temperature of _____ at _____ years after package emplacement. [INN 5.1.4.2-1] Thermal histories for various locations in and near such a package are shown in Figure 5.1.4.2-1. These results are for a package near the center of the repository. Owing to edge effects, WP environments along the perimeter of a repository will have lower temperatures than those plotted in Figure 5.1.4.2-1. Similarly, smaller SNF WPs, or WPs containing BWR fuel or HLW glass will have lower temperatures, so their thermal environments are less severe. Temperature calculations for various types of WPs in various locations are reported in _____. [INN 5.1.4.2-1]

Expected geochemical reaction paths during evaporation, boiling, and condensation of reference waters have been determined by _____ to assess their corrosive potential, and to determine limiting solubilities of waste components. It has been shown that _____. [INN 5.1.4.2-1]

If boiling occurs, a dehydration zone will develop around some or all WPs, the width and duration of which will depend on the migration behavior of the boiling point isotherm. The thermal profile history presented in Figure 5.1.4.2-1 suggests that the rock will be at temperatures in excess of the boiling point, and therefore dehydrated, for at least _____ years. The effect of large scale heterogeneities that could provide liquid pathways from zones of fluid accumulation back to the repository is evaluated, and _____. The role of such heterogeneities as gas pathways has been shown to be _____. [INN 5.1.4.2-1]

Modeling of the effect of the thermal perturbation on local hydrologic transport must demonstrate that _____. Experimental studies and numerical analysis of the effects of liquid-vapor cycling phenomena on near field water chemistry shows that _____. [INN 5.1.4.2-1]

Water transport within the repository horizon occurs by a combination of vapor transport, water migration through the matrix, and fracture flow (Montazer and Wilson, 1984). The relative importance of each flow mechanism is a function of the bulk saturation, flux of water through the rock, temperature gradients, fracture network characteristics, and matrix permeability. It has been established that the fracture density within this lower nonlithophysal zone varies between _____ and _____ fractures per cubic meter, with a mean matrix porosity of _____ percent and a mean saturation of _____ percent. [INN 5.1.4.2-3]

The net flux of water through the repository has been determined to be _____ mm/year in the upward direction, although a downward flux of _____ to _____ mm/year occurs as matrix flow and _____ to _____ mm/year as fracture flow. The current matrix potential of the Topopah Spring Tuff is approximately _____ kPa, which results in _____ fracture flow, except during episodic fracture flow events. This conclusion is based on the assumption of a fracture-matrix equilibrium, which has been shown to exist except _____. [INN 5.1.4.2-3] It is concluded that the geohydrology in the vicinity of the WP is acceptable for waste disposal, as discussed in Subsection 5.2.2.

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Radiation Field Effects. The types of ionizing radiation that interact with the rock/water/vapor system will be neutron and gamma radiation; alpha and beta radiation will not penetrate the intact waste container. The total radiation field at the container outer surface will be less than _____ Gy/s. [INN 5.1.4.2-2] The gamma radiation is expected to result in negligible damage to silicate rock (Durham et al., 1985). The neutron radiation is expected to result in _____. [INN 5.1.4.2-2]

The disposal container has been designed to prevent significant radiolysis effects on the environment at the outer surface of the containment barrier(s). Experimental and numerical analysis of the effects of radiolysis work shows that _____. [INN 5.1.4.2-2]

Man-Made Materials Effects. Because water enhances the corrosion of metal barriers and is the main agent for the transport of radionuclides, experimental and numerical modeling studies were conducted to characterize fluid flow and the geochemistry of water/rock interactions in the Topopah Spring Tuff. The effects of man-made materials on the ground water chemistry were determined also. These studies have shown that _____. [INN 5.1.4.2-4]

Mining Activities Effects. Mining activities have the potential to modify the moisture conditions in the rock units. These effects are _____ [INN 5.1.4.2-5]
Physical changes in the rock unit occur due to the mining activities. These changes are _____ [INN 5.1.4.2-5]

5.1.5 Underground Operations Radiation Protection

Measures to be taken to maintain the radiological safety of workers in the underground facility are provided in Subsection 4.1.4. This section discusses measures to be taken to minimize contamination and maintain radiological safety during all normal repository activities, as well as during anticipated operational occurrences and accident conditions.

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REFERENCES

BC0000000-01717-6700-00001, Management and Operating Contractor Thermal Loading System Study

DOE/RW-0199, Site Characterization Plan

DOE/RW-0351P, Waste Acceptance System Requirements Document

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

10 CFR 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste

Characteristics Data Base, Oak Ridge National Laboratory, Oak Ridge, TN
[Revision No. TBD]

Durham, N. B., J. M. Beiriger, M. Axelrod, and S. Tretle, 1985. The Effect of Gamma Irradiation on the Strength and Elasticity of Climax Stock and Westerly Granites, UCRL-92526, Reprint, Lawrence Livermore National Laboratory, Livermore, Calif.

Johnstone, J. K., R. R. Peters, and P. F. Gnirk, 1984. Unit Evaluation at Yucca Mountain, Nevada Test Site: Summary Report and Recommendation, SAND83-0372, Albuquerque, N. Mex. (NNA.870519.0052)

Montazer, P., and W. E. Wilson, 1984. Conceptual Hydrologic Model of Flow in the Unsaturated Zone, Yucca Mountain, Nevada, USGS-WRI-84-4345, Denver, Colo. (NNA.870519.0109)

WSRC-IM-91-116-0, DWPF Waste Form Compliance Plan, Rev. 2; June, 1993; Westinghouse Savannah River Co., Savannah River Site, Aiken, SC

TABLE TITLES

Table 5.1.2.1.2-1 Typical Characteristics of DWPF HLW Glass Received at the Repository
[INN 5.1.2.1.2-1]

Table 5.1.2.1.2-2 Typical Characteristics of HLW Glass from Sources other than DWPF
received at the Repository [INN 5.1.2.1.2-2]

Table 5.1.2.1.3-1 Typical Characteristics of DOE-owned Spent Nuclear Fuel
[INN 5.1.2.1.3-1]

Table 5.1.2.2-1 Summary of Quantity of SNF to be Received at Repository [INN 5.1.2.2-1]

Table 5.1.2.2-2 Anticipated Burn-up Distribution and Age at Repository for Calendar Years
2010-2032 [INN 5.1.2.2-2]

Table 5.1.2.2-3 Summaries of the Quantities of HLW Glass Expected to be Received at the
Repository [INN 5.1.2.2-3]

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Content: This figure depicts the temperature history of a typical reference SNF WP, its components and the surrounding environment. The temperature will be plotted as a function of time for 10,000 years.



Figure 5.1.4.2-1. Typical Thermal History for SNF WP and Surroundings [INN 5.1.4.2-1]
F-5.1-1

The above Annotated Outline text is guidance that may be used for the future development of an MGDS facility License Application.

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Description of containers used to ship HLW glass and DOE-owned spent nuclear fuel to the repository.
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	OWAST
Information Source Description:	None identified
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1.1-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on design, materials, fabrication, and structural characteristics of MPC. Following information is needed:</p> <ul style="list-style-type: none"> • Materials specifications and manufacturing methods • Thermal, structural, and corrosion characteristics of all materials • Behavior of all materials over time in a radiation field • Dissolution of moderator-displacing filler materials or neutron absorbers • Details of fabrication and welding methods, and of inspection methods to verify adequacy of design and construction • Details on any coatings, liners, or fillers used • For each component, classification as to whether or not important to safety, retrievability, or isolation, and why • Alternative designs and materials to those chosen, with comparative evaluations, and with particular emphasis on features that would provide longer containment and isolation- and why the alternative was not chosen. Discuss aspects such as fabricability, handling, closure, inspection, emplacement, retrievability, criticality, containment, isolation, and reliability. <p>The above information is needed for all types, sizes, and configurations of MPCs to be emplaced at the repository.</p> <p>Ensure Nuclear Regulatory Commission (NRC) FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.

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The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Transportation
Information Source Description:	MPC specifications
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1.2-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on design, materials, fabrication, and structural characteristics of disposal container for MPC.</p> <p>Following information is needed:</p> <ul style="list-style-type: none"> • Purpose and function for the container (i.e., its performance allocation) • Materials specifications and manufacturing methods • Thermal, structural, and corrosion characteristics of all materials • Material of choice and thickness for corrosion-resistant and corrosion-allowance barriers • Behavior of all materials over time in a radiation field • Details of fabrication and welding methods, and of inspection methods to verify adequacy of design and construction. • Choice of filler gas, reason for choice, and near- and long-term properties of chosen gas • Details on any coatings, liners, or fillers used. • For each component, classification as to whether or not important to safety, retrievability, or isolation, and why • Alternative designs and materials to those chosen, with comparative evaluations, and with particular emphasis on features that would provide longer containment and isolation- and why the alternative was not chosen. Discuss aspects such as fabricability, handling, closure, inspection, emplacement, retrievability, criticality, containment, isolation, and reliability.
	The above information is needed for all types, sizes, and configurations of MPC containers to be emplaced at the repository.

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	Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	Disposal container specifications.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1.3-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on design, materials, fabrication, and structural characteristics of disposal container, basket, and filler for uncanistered fuel.</p> <p>Following information is needed:</p> <ul style="list-style-type: none"> • Purpose and function for the container (i.e., its performance allocation) • Materials specifications and manufacturing methods • Thermal, structural, and corrosion characteristics of all materials • Material of choice and thickness for corrosion-resistant and corrosion-allowance barriers • Behavior of all materials over time in a radiation field • Dissolution of moderator-displacing filler materials or neutron absorbers • Details of fabrication and welding methods, and of inspection methods to verify adequacy of design and construction • Choice of filler gas, reason for choice, and near- and long-term properties of chosen gas • Details on any coatings, liners, or fillers used • Details on construction and properties of basket and its locating devices • For each component, classification as to whether or not important to safety, retrievability, or isolation, and why • Alternative designs and materials to those chosen, with comparative evaluations, and with particular emphasis on features that would provide longer containment and isolation- and why the alternative was not chosen. <p>Discuss aspects such as fabricability, handling, closure, inspection, emplacement, retrievability, criticality, containment, isolation, and reliability.</p>

Date: 03/31/95

	<p>The above information is needed for all types, sizes, and configurations of uncanistered fuel containers to be emplaced at the repository.</p> <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	Disposal container specifications.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1.4-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on design, materials, fabrication, and structural characteristics of disposal container and structural internals for HLW glass.</p> <p>Following information is needed:</p> <ul style="list-style-type: none"> • Purpose and function for the container (i.e., its performance allocation) • Materials specifications and manufacturing methods • Thermal and structural properties of all materials • Material of choice and thickness for corrosion-resistant and corrosion-allowance barriers • Behavior of all materials over time in a radiation field • Dissolution of moderator-displacing filler materials or neutron absorbers • Details of fabrication and welding methods, and of inspection methods to verify adequacy of design and construction • Specifications for structural internals • Choice of filler gas, reason for choice, and near- and long-term properties of chosen gas • Details on any coatings, liners, or fillers used • For each component, classification as to whether or not important to safety, retrievability, or isolation, and why

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	<ul style="list-style-type: none"> Alternative designs and materials to those chosen, with comparative evaluations, and with particular emphasis on features that would provide longer containment and isolation- and why the alternative was not chosen. Discuss aspects such as fabricability, handling, closure, inspection, emplacement, retrievability, criticality, containment, isolation, and reliability. <p>The above information is needed for all types, sizes, and configurations of HLW containers to be emplaced at the repository.</p> <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	Disposal container specifications.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.1.5-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Determination of whether area immediately surrounding the waste container will be packed, and description of packing material.</p> <p>Provide the following information:</p> <ul style="list-style-type: none"> • Description and purpose of packing • Analysis supporting why packing is or is not to be added. If no decision is to be made prior to LA submittal, provide plan/schedule for reaching decision and explain why absence of a decision at construction commencement is acceptable from a safety standpoint • Detailed description of packing material, including mechanical, physical, chemical, thermomechanical, and other properties (including density) over time in the expected environment (radiation field, heat, possible moisture intrusion). Include discussion of particle size distribution • Statement of when packing is to be performed and why that time was chosen, considering aspects such as package temperature as affected by packing and the effect of the higher temperature on the waste and waste container • Behavior of packing with regard to radionuclide migration • Expected behavior of packing in normal, off-normal, and accident conditions • Provisions of packing that prevent providing hospitable environment (such as nutrients) for microbiologically-induced corrosion

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	<ul style="list-style-type: none"> • Description and operation of emplacement machinery for packing, including discussion of how packing emplacement will not cause damage to the waste container • Provisions for waste retrieval that apply to packing • Discussion of the effect of packing on temperature of waste and WP • Discussion of the effect of packing on water flow toward or away from waste container • Analysis that supports conclusion that packing will not cause unacceptable effects on the waste and/or waste container, for both SNF and HLW • Description of inspection approach taken to ensure adequacy and completeness of packing installation <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.1.2-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.1.2-1
Explicit description of the needed information:	<p>Table and text describing physical, chemical, thermal, and radiological characteristics of DWPF (Savannah River) HLW glass to be received at the repository.</p> <ul style="list-style-type: none"> • Composition of glass, its near-term and its long-term properties • Construction details of canisters encasing the glass • Description of all waste types and their specific sources • Physical, chemical, thermal, and radiological characteristics of each type of waste. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Savannah River DWPF
Information Source Description:	DWPF Waste Form Compliance Plan, WSRC-IM-91-116-0
Does the supporting data need to be QA?	Yes

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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.1.2-2
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.1.2-2
Explicit description of the needed information:	<p>Table and text describing physical, chemical, thermal, and radiological characteristics of waste glasses from sources other than Savannah River.</p> <ul style="list-style-type: none"> • Composition of glass, its near-term and its long-term properties • Construction details of canisters encasing the glass • Description of all waste types and their specific sources • Physical, chemical, thermal, and radiological characteristics of each type of waste. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste producers
Information Source Description:	None identified
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.1.3-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.1.3-1
Explicit description of the needed information:	<p>Table and text describing physical, chemical, thermal, and radiological characteristics of DOE-owned spent nuclear fuel, including Navy fuel. Information needed includes:</p> <ul style="list-style-type: none"> • Quantity of each type of waste to be emplaced • Thermal and radiological profiles vs amount of each type waste and vs time • Physical and chemical description of each type of waste and its source. <p>Approach to providing necessary information for Navy fuel will also need to be determined, in view of its classified nature.</p> <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste producers
Information Source Description:	None identified
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.2-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.2-1
Explicit description of the needed information:	Table summarizing the quantities of SNF to be received at the MGDS as a function of time and total cumulative amount. Also, determine anticipated receipt rate of K_gU for use in text of Subsection 5.1.2.2 or for possible inclusion in Table 5.1.2.2-1.
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste Acceptance, Storage, and Transportation
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.2-2
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.2-2
Explicit description of the needed information:	Table showing anticipated burnup distribution/age of SNF received at the repository as a function of time and cumulative total from 2010 to 2032.
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste Acceptance, Storage, and Transportation
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.2-3
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Table 5.1.2.2-3
Explicit description of the needed information:	Table showing a summary of the quantities of HLW glass to be received at the repository as a function of time and cumulative total. Include waste from all known sources (DWPF, Idaho, West Valley, Hanford). Provide receipt rate of glass canisters for use in text of Subsection 5.1.2.2 or for inclusion in table.
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste Acceptance, Storage, and Transportation
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.2.3-1
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Details on waste form handling, treatment, and acceptance processes and activities for HLW and SNF. The following information is needed:</p> <ul style="list-style-type: none"> • Waste acceptance specifications • Description of how treatments, manufacturing processes, and acceptance procedures ensure high quality of the packaged waste form • Reference design for containers and surface facilities to handle "loose" hardware resulting from SNF consolidation • Design of container or other device for dealing with failed SNF. Description to include definition of what type of fuel failure would require use of this special container or device. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Waste Acceptance, Storage, and Transportation
Information Source Description:	WA-SRD, WAPS
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.3.1-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Description of invert and provisions for drainage of water away from waste containers. Provide the following information:</p> <ul style="list-style-type: none"> • Description and purpose of invert • Mechanical, physical, chemical, thermomechanical, and other properties (including density) of invert material over time in the expected environment (radiation field, heat, possible moisture intrusion) • Construction/fabrication/installation process • Description of inspection approach taken to ensure adequacy of installation and design • Analysis of ability of invert to satisfactorily support waste and waste container in normal, anticipated operational, and accident occurrences • Aspects of construction intended to keep water from pooling and/or contacting waste container. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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If the data needed is QA, then the QA source document number is:	

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Information Need Number:	INN 5.1.3.2-1
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Determination of whether drifts will be backfilled, and description of backfill. Provide the following information:</p> <ul style="list-style-type: none"> • Description and purpose of backfill • Analysis supporting why backfill is or is not to be added. If no decision is to be made prior to LA submittal, provide plan/schedule for reaching decision and explain why absence of a decision at construction commencement is acceptable from a safety standpoint • Detailed description of backfill material, including mechanical, physical, chemical, thermomechanical, and other properties (including density) over time in the expected environment (radiation field, heat, possible moisture intrusion). Include discussion of particle size distribution • Statement of when backfill is to be performed and why that time was chosen, considering aspects such as package temperature as affected by backfill and the effect of the higher temperature on the waste and WP • Behavior of backfill with regard to radionuclide migration • Expected behavior of backfill in normal, off-normal, and accident conditions • Provisions of backfill that prevent providing hospitable environment (such as nutrients) for microbiologically-induced corrosion • Description and operation of emplacement machinery for backfill, including discussion of how backfill emplacement will not cause damage to WP • Provisions for waste retrieval that apply to backfill • Discussion of the effect of backfill on water flow toward or away from waste canister

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	<ul style="list-style-type: none"> • Analysis that supports conclusion that backfill will not cause unacceptable effects on the waste and/or waste canisters, for both SNF and HLW • Description of inspection approach taken to ensure adequacy and completeness of backfill installation <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.3.3-1
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Design information on waste emplacement openings. Include the following information:</p> <ul style="list-style-type: none"> • Physical, mechanical, thermal, thermomechanical chemical, and other properties of rock mass at openings • Analysis using the above data to conclude as to adequacy of stability of the openings. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the engineered barrier system
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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Information Need Number:	INN 5.1.4.1-1
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Discussion and reference on pre-placement site conditions in the near field (local scale). Information to be discussed or referenced includes the seismic and faulted environment, ambient temperature, mechanical, physical, and chemical properties of the host rock, "average" water chemistry, and water flow rate. Discuss the thermomechanical, thermohydraulic, and vapor conditions in the host rock. Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).
Information will be used to support:	Description of the environment to which the EBS will be exposed and for comparison with the environment after the waste is emplaced.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.4.2-1
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	Figure 5.1.4.2-1
Explicit description of the needed information:	<p>Information on heat-induced effects on the post-emplacment WP environment and the ambient rock/water system and hydrodynamic regime. Effects on the rock unit itself, the drift environment, and the WP should all be addressed. The following information is needed:</p> <ul style="list-style-type: none"> • Expected heat output profile of waste to be emplaced. Profile should show heat output at emplacement as a distribution of all types of waste and of variable burnups within each type to be emplaced. Also should show heat output as a function of time following emplacement for average and worst-case waste • Rock temperatures expected at emplacement openings as a function of time after emplacement • Spatial variation of temperature profile expected as a result of edge effects • Expected groundwater composition after emplacement, including concentrations of impurities over time as a result of evaporation, boiling, and condensation to allow assessment of corrosion potential and determination of limiting solubilities for waste components • Expected width and duration of dehydration zone around WP • Effect of thermal perturbation on local hydrologic transport • Effect of large-scale heterogeneities that could provide liquid and gas pathways • Heat-induced mechanical effects on rock mass. Include discussion of alpha-to-beta cristabolite transition in near-field rock, potential for its occurrence, and consequences for rock mass. Also, analysis of failure of intact rock or movement of rock along pre-existing discontinuity planes

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	<ul style="list-style-type: none"> • Post-closure temperature environment showing effect of backfill and/or packing • Characteristics of groundwater at outer boundary of WP compared with that at boundary between packing/backfill and remainder of package • Conclusion as to whether, based on spatial temperature profile in the repository horizon, waste loading needs to be controlled to achieve a more uniform profile. <p>Ensure that all information provided includes NRC-required documentation to support design, analysis, and testing as delineated in NRC FCRG Subsection 5.2.1.3, page 5-6.</p>
Information will be used to support:	Description of the environment to which the EBS will be exposed.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface, WP, Livermore (SIP-7)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.4.2-2
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Radiation field at rock face and effect of radiolysis on near field environment. Provide the following information:</p> <ul style="list-style-type: none"> • Neutron and gamma fields at the rock face as a function of time • Analysis to support conclusions as to damage or effects (such as radiolysis) likely to occur in the rock face as a result of the radiation exposure • Description and analysis of how disposal container will be designed to prevent significant radiolysis effects on the environment (if required). <p>Use the above to analyze and discuss end effects of the environmental changes caused by the radiation field on the rock unit itself, the drift environment, and the WP. Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of environment to which EBS is exposed.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Livermore (SIP-7)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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Deliverable providing information:	
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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.4.2-3
Section Number and Title:	5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Fracture density, porosity, and saturation in rock mass, and resultant effects on water transport. Include the following information:</p> <ul style="list-style-type: none"> • Fracture density, matrix porosity, and mean saturation at repository horizon • Net flux of water through repository • Current matrix potential of Topopah Spring Tuff and resulting fracture flow • Analysis of when fracture-matrix equilibrium exists and does not exist, and effects of this on fracture flow. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of environment to which EBS is exposed.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Site Characterization, Livermore (SIP-7)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.4.2-4
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Effects of changes in chemical properties of groundwater due to man-made materials. Discuss effects of changes on rock unit itself, drift environment, and WP. Include discussion of any affected corrosion mechanisms, including microbiologically-induced corrosion, on the EBS or other components affecting the EBS. Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).
Information will be used to support:	Description of environment to which EBS is exposed.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Site Characterization, Livermore (Study Plan for Characterization of Effects of Man-Made Materials on Chemical and Mineralogical Changes in the Postemplacement Environment)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.1.4.2-5
Section Number and Title:	5.1 DESCRIPTION OF THE ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Analysis of potential effects of mining on moisture conditions in the rock face, and physical changes occurring in the rock unit due to these activities. Discuss the end effects of these changes on the rock unit itself, the drift environment, and the WP.</p> <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Subsection 5.2.1, pg. 5-4).</p>
Information will be used to support:	Description of the environment to which the EBS is exposed.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 5.2 Assessment of Compliance with 10 CFR 60

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- 5.2.1.1.2.2-2 Data and models on oxidation of waste and WP materials.
- 5.2.1.1.2.3-1 Information on corrosion performance of corrosion-allowance barrier.
- 5.2.1.1.2.3-2 Information on corrosion performance of corrosion-resistant barrier.
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5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60

This section assesses the compliance of the EBS with 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*. Subsection 5.2.1 assesses compliance for particular components of the EBS such as the WP, waste form and underground facility. Subsection 5.2.2 assesses compliance with the performance objectives in the regulation.

The EBS discussed in Chapter 5 fulfills the relevant requirements of 10 CFR 60. This is accomplished by the following:

- a. A robust WP is provided that is compatible with the multi-purpose canister and maintains SCC for a least 1000 years in the worst case near field environment.
- b. Control of release of radioactive material from the EBS is attained by relying on the following:
 - low ambient flux and saturation in the host rock to limit the amount of water that can reach the EBS,
 - robust waste container to delay contact between waste and water,
 - inherently low solubility of the waste form to limit mobilization of radionuclides,
 - possible use of a diffusion barrier to retard transport of radionuclides to the host rock.
- c. Long-term criticality control is ensured by taking credit for principal isotope burnup and by providing supplemental neutron absorbers as needed.

In order to provide the necessary containment to meet 10 CFR 60, disposal containers are required to provide a barrier to transport of radionuclides. Disposal Containers have a corrosion resistant barrier and a corrosion allowance barrier. In order to control the release rate of radionuclides, backfill material around the disposal containers may be required.

Discussion of analyses performed to verify compliance with the regulations is provided in Chapter 6. This chapter covers performance assessments. These assessments provide quantitative analyses of overall system performance that demonstrate compliance with overall repository system performance requirements. The requirements are provided in 10 CFR 60.112. They pertain to limitations on the release of radioactive materials to the accessible environment.

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5.2.1 Assessment of Compliance for Particular Barriers**5.2.1.1 WP Design Requirements**

WP design requirements from 10 CFR 60 are divided here into three groups: (1) compatibility of the design with the waste and the natural barrier systems, (2) degradation mechanisms, and (3) materials, handling, and identification. These are discussed in the following three subsections. Compliance with 10 CFR 60.131(b)(1) is discussed _____.
[INN 5.2.1.1-1]

5.2.1.1.1 Compatibility of Design

The WPs have been designed for compatibility with themselves, the underground facility, and the geologic setting.

Incompatibility of the WP with itself can potentially occur if the disposal container promotes degradation of the waste to an unacceptable degree. Such effects may be caused by thermal degradation of the waste or chemical interaction of the waste with the disposal container or other component of the waste package; these are discussed in Subsections 5.2.1.1.2.6 and 5.2.1.1.2.15, respectively. Incompatibility between one kind or capacity of WP and another kind or capacity can potentially occur. Studies have shown that _____.
[INN 5.2.1.1.1-1]

Incompatibility of the WP with the underground facility can potentially occur if the WP experiences excessive mechanical load, as might be caused by rock fall, if the underground facility makes the environment more chemically aggressive, or if the underground facility causes the waste to reach excessive temperatures. These are discussed in Subsections 5.2.1.1.2.8, 5.2.1.1.2.15, and 5.2.1.1.2.6, respectively.

Incompatibility of the WP with the geologic setting can potentially occur if the rock is heated to such temperatures that its ability to isolate the waste is degraded. Such effects are discussed in Subsection 5.2.1.1.2.14.

5.2.1.1.2 Degradation Mechanisms

10 CFR 60.135(a)(2) requires consideration of solubility, oxidation/reduction reactions, corrosion, hydriding, gas generation, thermal effects, mechanical strength, mechanical stress, radiolysis, radiation damage, radionuclide retardation, leaching, fire and explosion hazards, thermal loads, and synergistic interactions. These are considered in turn below. [Additional factors will be included as necessary.]

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5.2.1.1.2.1 Solubility

Solubility effects include dissolution of SNF and HLW glass.

Matrix dissolution of SNF is congruent, i.e., all elements are dissolved uniformly, for a wide range of fuel types and burnups. The rate of dissolution depends on temperature and the characteristics, such as pH and carbonate concentration, of the water in contact with the fuel. The rate of dissolution is described in _____. [INN 5.2.1.1.2.1-1]

The dissolution is correlated to available surface area. The surface area is a function of the state of oxidation, with greater areas associated with increases in the oxidation state. Additional information is given in section 5.2.1.1.2.2 below.

Dissolution of other components of SNF is _____. [INN 5.2.1.1.2.1-1]

Experiments on the dissolution of HLW glass show that _____. [INN 5.2.1.1.2.1-1]
Models have been developed that describe the alteration of the glass surface by hot humid air and the long-term dissolution behavior of HLW glass over time. The models are validated partially through experiment and partially through the use of natural analogues of other glasses, e.g., basaltic glasses. Calculations with these models show that _____.
[INN 5.2.1.1.2.1-1]

Implications of dissolution rate for compliance with requirements for containment and controlled release are discussed in Section 5.2.2

5.2.1.1.2.2 Oxidation/Reduction Reactions

Since the proposed repository horizon is the unsaturated zone, the engineered barrier system will be exposed to oxidizing conditions. Because of the presence of air-filled pores in the unsaturated zone, reduction reactions will not be significant [INN 5.2.1.1.2.2-1]. Oxidation reactions of interest include atmospheric oxidation of the disposal container, oxidation of the basket materials, and oxidation of the SNF and its cladding. HLW glass is not subject to oxidation. [INN 5.2.1.1.2.2-2] Aqueous corrosion is discussed separately in section 5.2.1.1.2.3.

Atmospheric oxidation of the disposal container is not significant. Under design-basis conditions for the hottest WPs, the depth of oxidation is expected to be ____ μm in 10^4 years. This depth is not significant. [INN 5.2.1.1.2.2-2]

SNF can be oxidized by exposure to air at elevated temperatures. The oxidation state is a function of time and temperature. If the temperature is below _____, the matrix remains as UO_2 and no structural damage or increase in surface area occurs. On exposure to air at temperatures between _____ and _____, and times greater than _____, the fuel will gradually oxidize to $O/M \approx 2.4$, where O is the number of oxygen atoms and M is the number of metal

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(uranium) atoms. Such fuel has the crystallographic structure of U_4O_9 (with defects). Because of an associated volume decrease, the grain boundaries crack, and a modest increase in the surface area occurs. On exposure to temperatures above _____ and times exceeding _____, the fuel can oxidize to U_3O_8 or UO_3 . The volume of the fuel increases significantly, which results in powdering of the material and a much larger surface area. Testing on the effects of temperature and time on oxidation, surface area, and dissolution shows that _____, and a model has been developed that describes the mechanism. The models are confirmed through the use of natural analogues, e.g., of uraninite in natural reactor systems such as Oklo and Cigar Lake. [INN 5.2.1.1.2.2-2]

Oxidation of the SNF cladding is _____. [INN 5.2.1.1.2.2-2]

5.2.1.1.2.3 Corrosion

The outer containment barrier may be _____, one of the corrosion-allowance materials listed in Subsection 5.1.1.2 [INN 5.1.1.2-1]; for these materials the dominant corrosion mode is uniform oxidation/corrosion. [Localized corrosion, stress corrosion cracking, and mechanical failure are usually not important for this class of materials.] The environmental conditions to which the outer barrier is expected to be exposed are _____. These conditions help determine the dominant corrosion modes and the rates of corrosion in the outer barrier as follows: _____. Oxidation can take place during the period when the containers are exposed to hot humid air. The oxidation rate under these atmospheric conditions may be linear (non-protecting) or parabolic (protecting). The material selected for the outer barrier develops a protective oxide film which remains intact over time. The material is _____. [INN 5.1.1.2-1] The expected corrosion performance of the corrosion-allowance barrier is described in _____. [INN 5.2.1.1.2.3-1]

The inner containment barrier may be _____, one of the corrosion-resistant materials listed in Subsection 5.1.1.2. [5.1.1.2-1] The dominant corrosion mechanisms for these materials are more likely to be localized attack and stress corrosion cracking. [Mechanical failure and uniform oxidation/corrosion are not likely to be important degradation modes for these materials.]. The environmental conditions to which the inner barrier is expected to be exposed are _____. These conditions help determine the dominant corrosion modes and the corrosion rates for the inner barrier as follows: _____. The expected corrosion performance of the corrosion-resistant barrier is described in _____. [INN 5.2.1.1.2.3-2]

The HLW canister and the SNF cladding provide redundant containment barriers, although quantitative credit is not taken for either of these barriers in satisfying the SCC performance objective. The performance of these barriers was clarified by research on the barrier materials, UNS S30403 (Type 304L stainless steel), UNS R60802 (Zircaloy-2), and UNS R60804 (Zircaloy-4). These barriers provide added confidence that the containment and controlled release requirements will be met. Analysis of these barriers shows that _____. [INN 5.2.1.1.2.3-3] [INN 5.2.1.1.2.3-4]

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The corrosion-resistant barrier and the corrosion allowance barrier are employed to enhance the ability of the waste package to meet the containment requirements of 10 CFR 60. Discussion of the analyses performed to verify compliance with the regulations is provided in Chapter 6.

5.2.1.1.2.4 Hydriding

Zircaloy fuel cladding typically picks up hydrogen during exposure in a nuclear reactor. It has been suggested that temperature gradients along the axis of the fuel rods can produce axial hydrogen redistribution. Such effects could potentially embrittle the ends of the fuel rods. Even in dry storage, however, this effect has been found to be small (Cunningham, 1987). In disposal, the temperature gradients will be smaller, so effects of axial hydrogen redistribution will also be smaller. Hydriding after emplacement is considered not to have an impact on waste or WP integrity. [INN 5.2.1.1.2.4-1]

5.2.1.1.2.5 Gas Generation

Gases generated in the WP or on its surface include helium and hydrogen. Helium is generated by alpha decay in the waste, and hydrogen, which is generated by corrosion. Helium generation has been studied by Berggren (Berggren, 1980) and found to be quite slow. Pressurization of disposal containers due to helium generation will not be significant.

In acidic solutions, hydrogen gas may be released as a result of corrosion. Gas generation is so slow that significant hydrogen embrittlement of the disposal container will not occur. In microbiologically influenced corrosion, however, _____. [INN 5.2.1.1.2.5-1]

5.2.1.1.2.6 Thermal Effects

The temperature history of the waste depends on the heat output of an individual WP, the design and thermal loading of the repository, the thermal properties of the disposal container, and the backfilling strategy. Methods for controlling waste temperature after disposal include aging the waste, loading the disposal container incompletely, increasing WP spacing, drift spacing, or drift diameter, designing the disposal container (and MPC) with components that readily conduct heat to the container, and delaying backfilling or not using backfill. The Mined Geologic Disposal System has been designed to control thermal degradation. Thermal histories for WPs loaded with design basis fuel are shown in [INN 5.1.4.2-1]. This fuel is the design basis fuel for thermal evaluations as described in Section 5.1.2.1.1. The resulting thermal degradation of the SNF cladding is [INN 5.2.1.1.2.6-1]. Temperatures in individual WPs with unusually high heat outputs will be controlled by _____. [INN 5.2.1.1.2.6-1]

5.2.1.1.2.7 Mechanical Strength

The dynamic responses of WPs to operational loads, seismic events, and design basis accidents have been calculated. The calculations show that the packages can sustain

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operational loads and design basis accidents without loss of containment or release of radioactive materials. The design operational loads provide an upper bound for the actual operational loads because _____. Similarly, the design basis accidents provide an upper bound for actual accidents because _____. [INN 5.2.1.1.2.7-1]

The period of retrievability for the repository is _____ years. During this time, the predicted maximum corrosion depth for the disposal container is _____ mm. When the thickness of the disposal container and handling features are assumed to be decreased by that maximum corrosion depth, analysis shows that _____. Performance confirmation studies during the retrievability period will verify the corrosion rates of the disposal container. Thus the disposal container provides for safe containment of the waste during handling, at least to the end of the period of retrievability. [INN 5.2.1.1.2.7-1]

Analysis of the forces caused by rock fall shows that _____. Therefore, the WP is capable of sustaining mechanical loads from rock fall without breach during the retrievability period. [INN 5.2.1.1.2.7-1]

5.2.1.1.2.8 Mechanical Stress

Fabrication of disposal containers will require a closure weld for installation of the lid. Thermal stresses from welding will be _____ and their effect on stress corrosion cracking will be _____. [INN 5.2.1.1.2.8-1] [INN 5.2.1.1.2.3-1] [INN 5.2.1.1.2.3-2]

5.2.1.1.2.9 Radiolysis

Radiolysis can produce a variety of aggressive chemical compounds from moist air. The most significant of these is nitric acid. However, the shielding effect of the disposal container will limit the production of nitric acid to _____ mol/(m³·yr) near the surface of a 21 PWR WP containing the design basis fuel for thermal and shielding calculations. Other types of WPs will produce smaller amounts. [INN 5.2.1.1.2.9-1]

Because of radioactive decay, the total amount of nitric acid produced will be _____ mol/m³ over 10⁴ yr. For the few packages that breach early, additional nitric acid could be produced inside the WP. Even for the case of a breach at 100 years after emplacement, however, the amount of nitric acid produced in a 21 PWR WP containing the design basis fuel for thermal and shielding calculations will be only _____ mol during the first 10⁴ yr after emplacement. This quantity of acid will not significantly degrade the breached WP. [INN 5.2.1.1.2.9-1]

5.2.1.1.2.10 Radiation Damage

The most severely irradiated component of the engineered barrier system is the basket for a 21 PWR WP containing the design basis fuel for thermal and shielding calculations. Even this component experiences a neutron fluence of only _____ during the first 10⁴ years after

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emplacement. Accordingly, the amount of radiation damage to the EBS is negligible. [INN 5.2.1.1.2.10-1]

5.2.1.1.2.11 Radionuclide Retardation

Radionuclide retardation in the EBS is discussed in Subsection 5.2.2.2.

5.2.1.1.2.12 Leaching

The modeling of SNF must include the cladding, the gap (between the pellet and the cladding), the fuel grain boundaries, and the matrix. The gap and grain boundary radionuclide inventory is considered to be readily available for dissolution when contacted by water. The inventory of radionuclides in the gap and grain boundaries is about _____ percent of the total inventory of ^{14}C , _____ percent of the total inventory of ^{129}I , _____ percent of the total inventory of ^{135}Cs . [INN 5.2.1.1.2.1-1]

Leaching of neutron absorbers from the criticality control material is also of concern. Analysis of the corrosion and depletion of the neutron absorbers shows that _____. [INN 5.2.1.1.2.12-1]

Leaching and dissolution of vitrified HLW is discussed in Section 5.2.1.1.2.1.

5.2.1.1.2.13 Fire and Explosion Hazards

The WPs will not contain combustible or explosive materials, and the rate of hydrogen gas formation due to corrosion will be extremely small, as is discussed in section 5.2.1.1.2.5. Therefore, fires and explosions are not considered to be credible events.

Should a fire occur as a result of an externally induced event such as a fuel spill, analysis shows that _____. [INN 5.2.1.1.2.13-1]

5.2.1.1.2.14 Thermal Loads

The thermal loading of the repository will have significant effects on the hydrology of the far field. These effects will persist for tens of thousands of years, that is, until the heat output of the SNF becomes negligible and the far field again equilibrates with the environment. The effect of thermal loading on WP performance is discussed in Subsection 5.2.1.1.2.6.

Heating of the rock may also potentially affect the geochemistry of the far field. Changes in rock temperature [may] cause [formation/destruction] of zeolites in the CHn, with corresponding changes in radionuclide retardation. The thermal loading of the repository has been chosen so that the effects on geochemistry are _____. [INN 5.2.1.1.2.14-1]

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5.2.1.1.2.15 Synergistic Interactions

The underground facility will affect the chemistry of the groundwater that will come in contact with the WPs. Both direct effects, such as the leaching of alkalis from concrete, and indirect effects, such as production of acid by microbes that metabolize man-made materials, may occur. The effects on WP performance are _____. [INN 5.2.1.1.2.15-1]

Chemical interaction between the waste and the disposal container or other component of the waste package is a potentially important cause of enhanced waste degradation. Integrated experiments show that the effects of such interactions are _____. [INN 5.2.1.1.2.15-2]

5.2.1.1.3 Materials, Handling, and Identification

The *Waste Acceptance System Requirements Document*, DOE/RW-0351P, specifies that waste containing explosive or pyrophoric materials or chemically reactive materials will not be accepted. Neither SNF nor HLW glass is explosive, pyrophoric, or chemically reactive. No such materials are components of, or will be added to, the WP. [INN 5.2.1.1.3-1]

The waste itself, SNF and HLW glass, is solid, and no liquids will be added to the WP. However, SNF is to be loaded into MPCs in the SNF pool, under water, and the MPCs must be dried. Water outside of fuel cladding will be removed by _____. [INN 5.2.1.1.3-2]

The only remaining source for liquids inside the canister is water in failed ("waterlogged") fuel rods. If the breach in the cladding is plugged by products of corrosion, water inside the rods might not be removed by the procedure described above. This water will be removed by _____. [INN 5.2.1.1.3-2]

The disposal containers are designed to maintain waste containment during transportation at the Mined Geologic Disposal System, emplacement, and retrieval. Analysis of handling loads and accidents is discussed in section 5.2.1.1.2.7.

Each WP will be labeled with a unique identifier. The geometry of the label and procedures for applying it are _____. The expected corrosion rate of the label is _____, so the label will remain legible during the period of retrievability. [INN 5.2.1.1.3-3]

5.2.1.2 Waste Form

The basis of the waste forms involves principally the regulatory requirements of 10 CFR 60.135(c), which requires the solidification and consolidation of wastes and restricts the presence of combustibles. The wastes proposed for disposal meet all three of these requirements.

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Solidification: As is discussed in subsection 5.2.1.1.3, both SNF and HLW glass are in solid form. As is discussed in subsection 5.1.1, the waste will be placed in sealed containers.

Consolidation: Neither SNF nor HLW glass is particulate. Severe handling accidents may lead to disruption of the waste form and formation of particles, but these will be contained by the disposal container, since no credible handling accident causes breaching. [INN 5.2.1.1.2.7-1] Handling of damaged WPs is discussed in section 7.4.

Combustibles: Neither commercial SNF nor HLW glass is combustible. [INN 5.2.1.1.2.13-1]

5.2.1.3 Underground Facility

Design criteria for the portion of the underground facility that is considered part of the EBS are _____. [INN 5.2.1.3-1]

Since mechanical loads may contribute to WP degradation, stability of emplacement openings is of concern during the 1,000-year period following closure during which SCC must be achieved.

Emplacement opening thermomechanical analyses were conducted to establish the potential for rocks to fall onto WPs. Rock fall due to thermomechanical forces could result from either failure of intact rock (matrix) or by movement of rocks along preexisting discontinuity planes. The analyses show that _____. [INN 5.1.4.2-1]

The average isobaric coefficient of volume thermal expansion is about $3 \times 10^{-5} \text{K}^{-1}$ for Topopah Spring Tuff over the temperature range 198 K to 473 K (Wilder, 1993). The total volume expansion over this range is about 0.5% (Wilder, 1993). Because of the smallness of the thermal expansion, thermally induced rock fracture will be insignificant [INN 5.1.4.2-1]

Another potential source of stress, the cristobalite transition, was also investigated. Cristobalite, which is present in the near field rock, undergoes a structural transition from tetragonal (alpha-cristobalite) to cubic (beta-cristobalite) symmetry. This phase transition results in a volume increase of about five percent. The temperature at which this phase transition occurs has been measured for naturally occurring cristobalite at Yucca Mountain (Wolfsberg and Vaniman, 1984), and has been found to be $500 \pm 25 \text{ K}$. Because the alpha-to-beta cristobalite transition temperature falls above the temperature expected for the very near field rock, no effects are expected. [INN 5.1.4.2-1]

Design analysis for stability of emplacement openings, including analysis of failure of the intact rock matrix and movement of rock along pre-existing discontinuity planes, reveals that _____. [INN 5.2.1.3-2]

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5.2.2 Assessment of Compliance with Performance Objectives

This section discusses the compliance of the engineered barrier system with the performance objectives of 10 CFR 60.113 for containment and controlled release. In addition, long-term criticality control is discussed.

5.2.2.1 Containment

To assure compliance with the requirements of 10 CFR 113(b), the U.S. Department of Energy has designed WPs to provide SCC for a period of 1000 years. This period is conservative with respect to any period the NRC might choose in compliance with 10 CFR 60.113(b). "Substantially complete containment" is interpreted as meaning that at least 99% of the waste containers are intact, and "intact" is defined as meaning that _____. [INN 5.2.2.1-1] Because of technological limitations and residual uncertainties, it is not possible to ensure that 100 percent of the containers will remain intact throughout the period of SCC. Similarly, because of limitations of the sensitivity of leak detection methods, it is not possible to guarantee perfect integrity of containment barriers. Containment performance is allocated entirely to the disposal container.

Anticipated conditions for WPs include "dry" conditions, in which the WP is in contact with air and/or unsaturated backfill, and "wet" conditions, in which groundwater drips onto the WP. Flooding of the drifts is not anticipated. [INN 5.2.2.1-2]

Degradation processes, events, and scenarios for the disposal container include:

- general corrosion,
- crevice corrosion,
- stress corrosion cracking,
- microbiologically influenced corrosion,
- pitting corrosion,
- galvanic corrosion,
- dry oxidation,
- metallurgical stability,
- mechanical loading by backfill,
- seismic loading,
- rock drop... . [INN 5.2.2.1-2]

The first [eight] of these are chemical degradation processes and have been addressed by corrosion and oxidation testing. The testing showed that _____. Corrosion testing results were extrapolated by _____ to provide conservative estimates of penetration for the entire containment period (1,000 years). In light of uncertainties, the maximum predicted penetration is _____, which is less than the thickness of the disposal container. Accordingly, compliance with containment requirements will not be compromised by chemical processes during the containment period. [INN 5.2.2.1-2]

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The remaining [three] processes are for mechanical degradation of the disposal container. They have been addressed by analysis and testing. The analysis and testing showed that _____. Accordingly, compliance with containment requirements will not be compromised by mechanical processes during the containment period. [INN 5.2.2.1-2]

WP PA shows that containment is substantially complete for _____ years. Detailed descriptions of the codes, assumed environments, and supporting test results used in these calculations are given in _____. [INN 5.2.2.1-2] Alternative WP designs are discussed in Subsections 5.1.1.2 through 5.1.1.4.

5.2.2.2 Release Rate

Because waste package component failures will involve localized corrosion that creates only limited paths for water intrusion and radionuclide egress, retardation of radionuclide migration in the EBS is significant.

Controlled release from the engineered barrier system is more complex than containment in that performance is allocated to _____ as well as the disposal container. [INN 5.2.2.2-1] The requirements of 10 CFR 60.113 on controlled release are applied to each radionuclide independently, and the release rate of a given nuclide at a given time depends on the rates of mobilization from the waste form and transport through the engineered barrier system. These in turn depend in a complex way upon the rate and kind of container failures, past history of container failures, water flux past the waste, WP environment, chemical nature of the nuclide, state of degradation of the waste form, and so on.

EBS PA has been performed for various environmental scenarios. The scenarios account for the following processes and events: _____. [INN 5.2.2.2-1] Because of the long period over which performance is required, models based on short term measurements must be used to make long-term predictions. The models and the predictions of radionuclide release from the EBS are described and justified in _____. [INN 5.2.2.2-1] The results of research described in _____ were incorporated into the _____ performance assessment model. [INN 5.2.2.2-1] This model contains the following uncertainties, which were accounted for in predictions of maximum expected release rate: _____. [INN 5.2.2.2-1] Performance assessment shows that the maximum expected fractional release rate for a single nuclide is one part in _____ per year for the radionuclide _____. [INN 5.2.2.2-1] Analysis of release rate performance for alternative engineered barrier system designs shows that _____. [INN 5.2.2.2-1]

5.2.2.3 Criticality Control

10 CFR 60.131(b)(7), requires that the internal waste distribution in waste emplacement packages "be designed to ensure that a nuclear criticality accident is not possible unless at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to criticality safety. Each system shall be designed for criticality safety

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under normal and accident conditions. The calculated effective multiplication factor (k_{eff}) must be sufficiently below unity to show at least a 5% margin, after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the method of calculation."

[This section demonstrates compliance with criticality control performance objectives for disposal of commercial and U.S. Department of Energy spent nuclear fuel and other HLW containing fissile material in the repository. The methodology presented is applicable to evaluating criticality in waste disposal packages, including the disposal package for the proposed MPC, the disposal package for uncanistered fuel, and the disposal packages containing DOE high-level waste.]

The repository criticality control strategy relies on taking credit for negative reactivity present in the spent fuel (burnup credit) and on the addition of supplemental neutron absorbers to add additional negative reactivity as needed. Demonstration of the validity of taking credit for both of these aspects of criticality control is provided in the following subsections.

[INN 5.2.2.3-1]

The following alternative criticality control approaches were considered but have been rejected for the reasons indicated. [INN 5.2.2.3-1] In addition, criticality control of alternative EBS designs has been considered. The results are _____. [INN 5.2.2.3-1]

The approach to dealing with fuel that is more reactive than design basis fuel is _____. [INN 5.2.2.3-1]

The three phases of repository operation are the operations, substantially complete containment, and isolation phases. Each is the subject of a specific approach to criticality analysis as described in the following subsections. The operations phase is the period prior to closure of the repository. The substantially complete containment phase is the period during which the waste package will provide substantially complete containment of the HLW (300 to 1,000 years as specified in 10 CFR 60). The isolation phase is the period during which the engineered barrier system and the geologic repository environment limit radionuclide release to the accessible environment.

5.2.2.3.1 Operations Phase

The methodology for performing criticality analyses for the repository operations phase is provided in the Disposal Criticality Analysis Topical Report. It is summarized here. [INN 5.2.2.3-1]

The results of the deterministic criticality analyses for the different waste types are as follows: [INN 5.2.2.3-1]. The resulting burnup credit loading curve for each waste type is presented in _____. [INN 5.2.2.3-1] These curves are used to determine the limitations on spent nuclear fuel burnup vs. initial enrichment for SNF to be emplaced. Acceptance of

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uncanistered fuel and U.S. Department of Energy HLW and SNF for loading and disposal is determined by _____. [INN 5.2.2.3-1]

5.2.2.3.2 SCC Phase

The methodology for performing criticality analyses for the repository SCC phase is provided in the Disposal Criticality Analysis Topical Report. It is summarized here. [INN 5.2.2.3-1]

The relatively long time (i.e., up to 1,000 years) involved in this phase as compared to the operations phase causes uncertainties in the performance of the waste package and the repository such that purely deterministic analyses cannot be relied upon to provide assurance of criticality control. Thus probabilistic analyses are used to account for the uncertainty and to provide the required assurance.

The results of the probabilistic and deterministic criticality analyses in the SCC phase are as follows: [INN 5.2.2.3-1].

5.2.2.3.3 Isolation Phase

The methodology for performing criticality analyses for the repository isolation phase is provided in the Disposal Criticality Analysis Topical Report. It is summarized here. [INN 5.2.2.3-1]

The longer time period (10,000 years) as compared to the SCC phase adds additional uncertainties, requiring greater reliance on probabilistic criticality analysis.

The results of the probabilistic criticality analyses in the isolation phase are as follows: [INN 5.2.2.3-1].

5.2.3 Radiation Protection

Design of the surface and subsurface facilities and operations maintains radiological dose to workers as low as is reasonably achievable. The expected radiation dose during handling, storage, emplacement, retrieval, and isolation are given in Subsection 4.1.4.

REFERENCES

- ASTM C 1174-91, Standard Practice for Prediction of the Long-Term Behavior of Waste Package Materials Including Waste Forms Used in the Geologic Disposal of High-Level Nuclear Waste, American Society of Testing and Materials Designation
- 10 CFR 20, Standards for Protection Against Radiation
- 10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories
- 10 CFR 60, Subpart F, Performance Confirmation Program
- 10 CFR 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste
- 40 CFR 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes
- Berggren, G., 1980. Helium Retention: Summary of Reports and Memoranda, SKBF Teknisk Rapport 80-04, Stockholm, Sweden
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- Engineered Barrier Design Requirements Document, YMP/CM-0024
- Wilder, D.G. 1993. Preliminary Near-Field Environment Report, Volume II: Scientific Overview of Near-Field Environment and Phenomenon; pg. 62 (UCRL-LR-107476, Vol. 2)
- Wolfsberg, K., and D.T. Vaniman (Comps.), 1984. Research and Development related to the Nevada Nuclear Waste Storage Investigations, October 1 - December 31, 1983, LA-10032-PR, Los Alamos, NM (NNA.870406.0074)

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MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Analysis to support compliance of design with 10 CFR 60.131(b)(1). Analysis must support conclusion that SSCs important to safety have been designed so that natural phenomena and environmental conditions anticipated at the GROA will not interfere with necessary safety functions.</p> <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Compliance with design requirements for safety
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

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Date: 03/31/95

YMP/94-05, Rev. 0

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.1-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Analysis of incompatibility between one WP type or size and a different type or size. Analyze potential incompatibilities introduced by putting different sized packages in proximity. Also address potential incompatibilities between SNF packages and HLW packages. Draw conclusions as to whether incompatibilities exist and, if they do, how the incompatibilities will be prevented from causing a problem (e.g., procedure controls, physical exclusion of one from another's area, etc.) Ensure documentation required by NRC to support design, analysis, and testing is provided (per FCRG Section 5.2.1, page 5-4).
Information will be used to support:	Analysis of WP compatibility
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.1-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Data and models on dissolution of waste and WP materials. Following information is needed:</p> <ul style="list-style-type: none"> • Analysis of potential for dissolution of all waste and WP materials and impurities expected to be on or in them. For SNF, determine inventories of C-14, Cs-135, and I-129 in gap and grain boundaries and on cladding surface. Analyze any other radioactive species whose dissolution might pose a problem for containment/release, or demonstrate that there are no others. • Support for conclusion that SNF dissolution at clad surface is congruent. • Analysis of dissolution rates in all waste and WP materials of concern. Discuss effect of varying water temperature, pH, carbonate concentrations, surface area, amount and type of surface oxidation, etc. • Conclusions as to effect of above calculated dissolution rates on ability of WP to contain radionuclides over required containment period and over 10,000 year period. • Analysis of HLW glass dissolution, including discussion of potential alteration of glass surface by humid air. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Determination of radionuclide release rate.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Activity Plans D-20-53a and D-20-53b for SNF and D-20-27 and D-20-65 for HLW), WP

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Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.2-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Analysis to support conclusion that reduction reactions will be insignificant in the repository horizon. Ensure NRC requirements for documentation to support design, analysis, and testing are met (FCRG Section 5.2.1, pg. 5-4).
Information will be used to support:	Predictions of WP containment life.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Scientific Investigation Plan SIP-CM-01), WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.2-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Data and models on oxidation of waste and WP materials. Following information is needed:</p> <ul style="list-style-type: none"> • Support for conclusion that atmospheric oxidation of disposal container is not significant. Include expected depth of oxidation after 10,000 years and nominal container thickness allowing for uncertainties. • Analysis of oxidation of fuel material at elevated temperatures. Include discussion of expected temperatures to be attained and times at those temperatures vs. fuel chemical composition, and oxidation rate of each chemical composition postulated to be credible. Conclusions are needed as to the impact of calculated oxidation rates on radioactivity containment and release, both with and without the presence of pre-existing through-wall clad defects. • Analysis of oxidation of other waste forms (HLW) and other WP materials including basket materials, with conclusions as to the effect of each on containment and release. • Information on how use of natural analogs such as Oklo and Cigar Lake confirms models for oxidation of fuel materials. • Analysis of oxidation of fuel cladding. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of WP containment life.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Activity Plan D-20-45), WP
Information Source Description:	None identified.

Date: 03/31/95

Does the supporting data need to be QA?	Yes
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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.3-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on corrosion performance of corrosion-allowance containment barrier.</p> <ul style="list-style-type: none"> • Support for conclusion that localized attack, stress corrosion cracking, and mechanical failure are not important for the specific material chosen. Include analysis of effect of residual weld and forming stress. • Description of environmental conditions to which this barrier is subjected and their effects on corrosion modes and rates. • Determination of whether oxidation under atmospheric conditions is linear or parabolic. • Conclusion as to corrosion expected in this barrier over required containment period and over 10,000 years. Comparison of maximum expected corrosion depth vs. minimum initial thickness allowing for uncertainties. If through-wall penetration is expected. approximate time of penetration after emplacement. • Overall contribution of this barrier to meeting containment and release requirements. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of WP containment life.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Scientific Investigation Plan SIP-CM-01)
Information Source Description:	None identified.

Date: 03/31/95

Does the supporting data need to be QA?	Yes
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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.3-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on corrosion performance of corrosion-resistant containment barrier. Following information is needed:</p> <ul style="list-style-type: none"> • Support for conclusion that mechanical failure and uniform corrosion are insignificant for the specific material chosen. • Description of environmental conditions to which this barrier is subjected and their effects on corrosion modes and rates. • Analysis of localized attack and stress corrosion cracking under expected conditions. Include discussion of residual weld and forming stresses and their effects on corrosion. • Conclusion as to corrosion expected in this barrier over required containment period and over 10,000 years. Comparison of maximum expected corrosion depth vs. minimum initial thickness allowing for uncertainties. If through-wall penetration is expected, approximate time of penetration after emplacement. • Overall contribution of this barrier to meeting containment and release requirements. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of WP containment life.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Scientific Investigation Plan SIP-CM-01, Activity Plan E-20-18(f)).
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.3-3
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Data and models for corrosion performance of SNF cladding. Following information is needed:</p> <ul style="list-style-type: none"> • Expected corrosion rate for each type of cladding material to be emplaced. Consider all potential corrosion modes to which each material is postulated to be susceptible. • Comparison of corrosion depth over 10,000 year period calculated above vs. minimum initial clad thickness. If through-wall penetration is expected, time of penetration after emplacement. • Effect of corrosion resistance of this barrier on containment and release, and conclusion as to what, if any, credit is taken for this barrier in meeting containment and release requirements. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Effect of corrosion performance of SNF cladding on radionuclide containment and release.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.3-4
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Data and models for corrosion performance of HLW pour canisters. Following information is needed:</p> <ul style="list-style-type: none"> • Analysis of corrosion models and rates for HLW canister materials to be emplaced. • Comparison of corrosion depth over 10,000 year period calculated above vs. minimum initial thickness. If through-wall penetration is expected, time of penetration after emplacement. • Effect of corrosion resistance of this barrier on containment and release, and conclusion as to what, if any, credit is taken for this barrier in meeting containment and release requirements. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Effect of corrosion performance of HLW pour canisters on radionuclide containment and release.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.4-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Analysis of effects of hydriding on zircaloy fuel cladding. Following information is needed:</p> <ul style="list-style-type: none"> • Expected severity of hydriding anticipated to occur over 10,000 year period. • Determination whether hydriding results from temperature gradients that produce axial hydrogen redistribution. • Analysis of consequence of hydriding in terms of potential for through-wall damage and embrittlement of fuel rod ends with possible subsequent cladding degradation. • Overall conclusion with regard to whether hydriding is a radiation containment concern. <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Effect of hydriding of fuel cladding on radionuclide containment and release.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Cunningham study (1987), WP
Information Source Description:	Study noted above; otherwise not identified.
Does the supporting data need to be QA?	Yes

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.5-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Data on gas production in the WP and its consequences. Following information is needed:</p> <ul style="list-style-type: none"> • Analysis determining amounts of all types of gases expected to be generated in and on the waste and WP materials. Include discussion of gaseous fission products and decay daughters. • Quantitative support for conclusion that helium generation in the waste is small and that the resulting pressurization of the disposal containers would be negligible. • Analysis on hydrogen gas production and consequent embrittlement of the waste container, including conclusion as to consequences of this effect on containment and controlled release. • Analysis of gases expected to be generated as a result of microbiologically-induced corrosion, including consequences of this effect on containment and controlled release. • Overall effect of gas production on ability of package to comply with containment and controlled release requirements. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of mechanical stability for disposal containers.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Scientific Investigation Plan E-20-18(f)).
Information Source Description:	None identified.

SKELETON TEXT

YMP/94-05, Rev. 0

Date: 03/31/95

Does the supporting data need to be QA?	Yes
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INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.6-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Analysis of thermal effects on waste and WP following emplacement. Need analysis of effects of design thermal profile in waste and WP on all components in waste and WP. Need to discuss embrittlement, corrosion, thermal stress, and any other postulated effects of elevated temperatures resulting from waste decay heat. Consider effects of backfilling or lack thereof. Also, need to discuss how to deal with elevated temperatures in WPs with unusually high heat outputs. Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).
Information will be used to support:	Conclusions regarding thermal effects on WP integrity and radioactivity containment.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Livermore (SIP PA-2)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.7-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Design and testing results for operations, handling, and impact loads. Following information is needed:</p> <ul style="list-style-type: none"> • Determination of the retrievability period on which subsequent analysis is based. • Analysis of waste and WP response to operational loads, seismic events, and design basis accidents. Include discussion of ability of package to sustain operational loads without loss of containment. Demonstrate that, under seismic event and design basis accident scenarios, release of radionuclides meets applicable requirements. • Analysis supporting conclusion that design basis accidents bound actual accidents without breaching. • Analysis that supports position that: with worst case corrosion of disposal container and handling fixtures over retrievability period, container still survives operational loads and design basis accidents. • Analysis regarding ability of WP to withstand worst-case rockfall. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Demonstration of mechanical integrity of WPs under normal and accident conditions.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	Design analyses on WP strength
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.8-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Welding stresses in disposal container. Provide analysis of weld stresses at closure lid-to-container weld, including comparison with allowables and analysis of increase in susceptibility of material to stress corrosion cracking as a result of residual weld stress.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5.4).</p>
Information will be used to support:	Predictions of WP containment life.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.9-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on production of aggressive species by radiolysis.</p> <ul style="list-style-type: none"> • For nitric acid, analysis of maximum expected production rate in moist air and in design radiation field. Production rate and integral production over 10,000 years. Also, production rate inside a package that is breached early (i.e., at time of emplacement). Provide conclusion as to worst case effect of nitric acid-induced corrosion and degradation in waste and WP, and as to effect on ability of package to meet containment/release requirements. • Discussion/analysis of other species produced by radiolysis (including potential sources in or on HLW), and conclusion as to whether they are aggressive. Analysis similar to that for nitric acid for any aggressive species. • Support for conclusion that 21-bundle PWR WP is worst-case for nitric acid generation. <p>Ensure NRC FCRG requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of WP containment life, predictions of long-term criticality control.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.10-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on radiation damage of WP materials. Discuss radiation field and 10,000-year fluence at each material or component of interest, and for each radiation type. Provide analysis to show damage this fluence causes to the material, including impact on ability of WP to meet containment/release requirements.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5.4)</p>
Information will be used to support:	Predictions of WP containment life, predictions of long-term criticality control.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Livermore
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.12-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Information on the corrosion and depletion of neutron absorbers. Determine rate of leaching/dissolution expected, and provide analysis of the effect of this loss of absorber material on criticality control over a 10,000-year period. Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5.4)
Information will be used to support:	Predictions of long-term criticality control.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Livermore
Information Source Description:	Topical Report on burnup credit.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.13-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Analysis of the potential for externally-induced fires that affect the waste and/or WP. Consequences of postulated fires and effect of the consequences on ability of the WP to meet containment requirements. Include analysis of maximum expected temperature in each component of waste and WP and damage to or changes in the material as a result. Also consider combustibility of all waste and WP materials.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Determination of radionuclide release rate.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.14-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Effect of repository heating on far-field geochemistry. Analysis of potential for formation or destruction of zeolite in CHn and corresponding changes in radionuclide retardation. Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5.4).
Information will be used to support:	Predictions of radionuclide release rate in the far field.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore, Site Characterization
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.15-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on effects of man-made materials on near-field water chemistry. Analysis as to how changes in water chemistry affect WP integrity and containment function. Include discussion of leaching of alkalis from concrete and acid production from microbes that metabolize man-made materials. Consider other possible chemical changes and their effects. Analyze effects on SNF and HLW also.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Predictions of WP containment life, radionuclide release rate.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (work on man-made materials), WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

Date: 03/31/95

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.2.15-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Information on effect of container materials on degradation of waste and WP materials. Consideration/analysis of how potential chemical reactions between waste and container or other component of the waste package affect WP integrity and ability to comply with containment and release requirements.</p> <p>Ensure NRC requirements for documentation to support design analysis, and testing are met (NRC FCRG Section 5.2.1 pg. 5-4).</p>
Information will be used to support:	Predictions of radionuclide release rate.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Livermore (Activity Plan D-20-27)
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.3-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Support for conclusion that SNF and HLW are not explosive, polyphoric, or chemically reactive. Analyze all pertinent environmental design conditions as they affect this conclusion. Ensure NRC-required documentation to support design, analysis, and testing is provided (per NRC FCRG Section 5.2.1, page 5-4).
Information will be used to support:	Integrity of WP and suitability for containment function.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.3-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>How to evacuate water from MPCs and SNF. Discuss water on surface of waste and/or WP after removal from temporary storage. Also, consider water remaining inside failed SNF rods. Discuss how water is to be removed and consequences of remaining unremovable water (if any) on waste/WP integrity and compliance with containment and release requirements.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Demonstration of compliance with restrictions on liquids in WPs.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Transportation, Surface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.1.3-3
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Unique label design and label durability. Description of label material and its method of marking and of attachment to WP. Analysis of expected duration of readability and of integrity of the label, including analysis of potential degradation modes such as corrosion.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1, pg. 5-4).</p>
Information will be used to support:	Demonstration of compliance with requirements for identification of WPs.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.3-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Design criteria, description, and performance of backfill and other parts of the underground facility that are part of the EBS. Discuss how backfill and other parts of the facility contribute to compliance with containment and controlled release requirements.</p> <p>Ensure NRC requirements for documentation to support design, analysis, and testing are met (NRC FCRG Section 5.2.1.3, pg. 5-6).</p>
Information will be used to support:	Predictions of WP containment life, radionuclide release rate.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP, Subsurface
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.1.3-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Design analysis for stability of emplacement openings. Need analysis of potential for and consequences of rockfall on WP and for retrievability concerns. Discuss failure of intact rock matrix and movement of rock along pre-existing discontinuity planes. Ensure NRC-required documentation to support design, analysis, and testing is provided (per FCRG Section 5.2.1, page 5-6).
Information will be used to support:	Determination of stability of emplacement openings
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Subsurface, Livermore (SIP-7)
Information Source Description:	None identified
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.2.1-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Definition of substantially complete containment and WP failure.
Information will be used to support:	Demonstration of compliance with requirements for substantially complete containment.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.2.1-2
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>PA on substantially complete containment of WP.</p> <p>Following information is needed:</p> <ul style="list-style-type: none"> • Analysis to support conclusion that flooding of drifts need not be anticipated. • Analysis of all degradation modes for waste containers not already discussed in FCRG Section 5.2.1. • Results of performance testing for all waste container mechanical and chemical degradation mechanisms, including those discussed in Section 5.2.1, or reference to other location in LA where such analysis appears. End result needed is maximum expected penetration of waste container vs. its minimum thickness considering all possible postulated degradation mechanisms. • Analysis showing for what time period WP containment is substantially complete. • Analysis of postulated uncertainties and their impact on the above analyses. • Analysis of containment performance of alternative EBS designs and explanation for why they were not chosen. • Evaluation of favorable and potentially adverse conditions per 10 CFR 60.122 as applicable to containment. <p>Ensure that NRC-required documentation to support design, analysis, and testing is provided (per NRC FCRG Section 5.2.2 listed items (1) through (5)).</p>
Information will be used to support:	Predictions of WP containment life, demonstration of compliance with requirements for substantially complete containment.
The Information is needed by/for (date or event):	TBD

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

Most likely source of the Information:	Performance Assessment, WP
Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.2.2-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>PA on controlled release from EBS. Following information is needed:</p> <ul style="list-style-type: none"> • Determination of what barriers will be credited (i.e., what barriers will have performance allotted to them) for controlled release and analysis to support the choice. • Description of processes and events for which Controlled Release PA has been performed. • Description of and justification for models based on short-term measurements used to make long-term predictions. • Analysis of postulated uncertainties and their impact on the above analyses. • Analysis of all radionuclides of interest showing fractional release rate per year. • Conclusion as to performance of credited barriers relative to regulatory requirements for release based on analysis for all radionuclides of interest. • Analysis of release rate performance of alternative EBS designs. • Evaluation of favorable and potentially adverse conditions per 10 CFR 60.122 as applicable to controlled release. <p>Ensure that NRC-required documentation to support design, analysis, and testing is provided (per NRC FCRG Section 5.2.2 listed items (1) through (5)).</p>
Information will be used to support:	Demonstration of compliance with requirements for control of release.
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Performance Assessment, WP

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

Information Source Description:	None identified.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 5.2.2.3-1
Section Number and Title:	5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60
Lead Author/Support Author and Phone:	Michael Scott (702) 295-9685
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>Criticality analysis of all types of fissile waste and their WPs. Following information is needed:</p> <ul style="list-style-type: none"> • Detailed analysis of how burnup credit is applied to meet the two regulatory criteria of concern (two unlikely events needed for criticality and k-eff less than .95 with biases and uncertainties). Analysis to include burnup of fissile isotopes, buildup of actinide absorbers, buildup of fission product absorbers. • Analysis of other means of achieving criticality control other than burnup credit, such as absorber material added to the waste form (e.g., disposable control rods) or absorber and moderator-displacing filler material in WP. • Summary analysis showing effect of all aspects of criticality control in meeting the overall performance objectives. • Approach to dealing with SNF that is more reactive than design basis fuel. • Criticality analysis for HLW glass, including methods used to ensure criticality is not possible or measures taken to prevent its occurrence • Analysis of postulated uncertainties and their impact on the above analyses. • Analysis of criticality control performance of alternative EBS designs. • Criticality analysis for DOE-owned spent fuel. <p>Ensure that NRC-required documentation to support design, analysis, and testing is provided (per NRC FCRG Section 5.2.2 listed items (1) through (5)).</p>
Information will be used to support:	Demonstration of compliance with requirements for criticality control.

Date: 03/31/95

The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	WP
Information Source Description:	Topical Report on burnup credit.
Does the supporting data need to be QA?	Yes

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	