OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEM DESCRIPTION DOCUMENT COVER SHEET

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2. SDD Title
Carrier/Cask Handling System Description Document

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3. Revision	4. Description of Revision
00	Initial Issue (issued using document identifier BCB000000-01717-1705-00025).
01	This revision is a complete rewrite of the previous issuance (superseded by this issuance), driven largely by the use of an alternate source of regulatory requirements, the implementation of the License Application Design Selection effort, and the use of a new document development procedure.
ICN 01	The purpose of ICN 01 is to incorporate initial design description input into Section 2 of the SDD. All changes in the document that have been made as a result of this ICN are indicated by revision bars. Major changes are as follows: • All page headers list the document identifier as SDD-CCH-SE-000001 REV 01 ICN01. • Deleted Sections 1.4.1 and 1.4.2. Reason for deletion - management direction • Added Section 2. • Added acronyms to Section C.1. • Added/deleted references. • Changes necessary to comply with current procedures were made as needed. • Editorial changes were made to the document as needed.

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SUMMARY

The Carrier/Cask Handling System receives casks on railcars and legal-weight trucks (LWTs) (transporters) that transport loaded casks and empty overpacks to the Monitored Geologic Repository (MGR) from the Carrier/Cask Transport System. Casks that come to the MGR on heavy-haul trucks (HHTs) are transferred onto railcars before being brought into the Carrier/Cask Handling System. The system is the interfacing system between the railcars and LWTs and the Assembly Transfer System (ATS) and Canister Transfer System (CTS).

The Carrier/Cask Handling System removes loaded casks from the cask transporters and transfers the casks to a transfer cart for either the ATS or CTS, as appropriate, based on cask contents. The Carrier/Cask Handling System receives the returned empty casks from the ATS and CTS and mounts the casks back onto the transporters for reshipment. If necessary, the Carrier/Cask Handling System can also mount loaded casks back onto the transporters and remove empty casks from the transporters.

The Carrier/Cask Handling System receives overpacks from the ATS loaded with canisters that have been cut open and emptied and mounts the overpacks back onto the transporters for disposal. If necessary, the Carrier/Cask Handling System can also mount empty overpacks back onto the transporters and remove loaded overpacks from them.

The Carrier/Cask Handling System is located within the Carrier Bay of the Waste Handling Building System. The system consists of cranes, hoists, manipulators, and supporting equipment. The Carrier/Cask Handling System is designed with the tooling and fixtures necessary for handling a variety of casks. The Carrier/Cask Handling System performance and reliability are sufficient to support the shipping and emplacement schedules for the MGR.

The Carrier/Cask Handling System interfaces with the Carrier/Cask Transport System, ATS, and CTS as noted above. The Carrier/Cask Handling System interfaces with the Waste Handling Building System for building structures and space allocations. The Carrier/Cask Handling System interfaces with the Waste Handling Building Electrical System for electrical power.

QUALITY ASSURANCE

The quality assurance (QA) program applies to the development of this document. The "SDD Development/Maintenance (Q SDDs) (WP# 16012126M5)" activity evaluation has determined the development of this document to be subject to "Quality Assurance Requirements and Description" requirements. This document was developed in accordance with AP-3.11Q, "Technical Reports."

1. SYSTEM FUNCTIONS AND DESIGN CRITERIA

The functions and design criteria for the system are identified in the following sections. Throughout this document the term "system" shall be used to indicate the Carrier/Cask Handling System. The system architecture and classification are provided in Appendix B.

1.1 SYSTEM FUNCTIONS

1.1.1 The system accommodates carriers with empty or loaded casks or overpacks from the Carrier/Cask Transport System.

1.1.2 The system transfers casks between the cask carrier and the ATS and CTS.

1.1.3 The system transfers overpacks between the overpack carrier and the ATS.

1.1.4 The system supports the collection of material control and accounting data.

1.1.5 The system operates within the environmental conditions of the Waste Handling Building.

1.1.6 The system provides features to minimize radiation exposure to workers.

1.1.7 The system provides features and equipment for reducing the risk of, responding to, and recovering from off-normal events and credible design basis events.

1.1.8 The system provides features for the inspection, testing, and maintenance of system equipment.

1.1.9 The system facilitates decontamination and decommissioning at repository closure.

1.2 SYSTEM DESIGN CRITERIA

This section presents the design criteria for the system. Each criterion in this section has a corresponding Criterion Basis Statement in Appendix A that describes the need for the criterion as well as a basis for the performance parameters imposed by the criterion. Each criterion in this section also contains bracketed traces indicating traceability, as applicable, to the functions (F) in Section 1.1, the "Monitored Geologic Repository Requirements Document" (MGR RD), and "Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22, 1999), for Yucca Mountain, Nevada." In anticipation of the interim guidance being promulgated as a Code of Federal Regulations, it will be referred to as "10 CFR 63" in this system description document. For the applicable version of the codes, standards, and regulatory documents, refer to Appendix E.

1.2.1 System Performance Criteria

1.2.1.1 The system shall have an operational life of 40 years.

[F 1.1.1][MGR RD 3.2.C]

1.2.1.2 The system shall handle the rail and truck transportation casks and associated carriers identified in Table 1.

Table 1. Transportation Systems

Cask Designation/Proposed System Name	Manufacturer or Owner	NRC Docket Number	Mode of Transportation	Transfer Cask to/from
GA-9	GA	71-9221	LWT	ATS
GA-4		71-9226	LWT	ATS
NAC-LWT	NAC	71-9225	LWT	ATS
NAC-STC		71-9235	Rail	ATS & CTS (TBV-3692)
NUHOMS® MP-187	Vectra	71-9255	Rail	ATS & CTS (TBV-3692)
HI-STAR 100	Holtec	71-9261	Rail	ATS & CTS (TBV-3692)
Large MPC (21P/44B)	WGESCO	71-9264 and 71-9265	HHT* or Rail	ATS & CTS (TBV-3692)
Small MPC (12P/24B)		71-9266 and 71-9267	HHT* or Rail	ATS & CTS (TBV-3692)
WESFLEX	-	-	-	ATS & CTS (TBV-3692)
TranStor™	SNC	71-9268	Rail	ATS & CTS (TBV-3692)
NAC-UMS™ UTC (MPC)	NAC	71-9270	Rail	ATS & CTS (TBV-3692)
Navy 192- and 160-Canister System	Bettis	-	Rail	CTS
Proposed SRS and WVDP HLW System	-	-	-	CTS
Proposed Hanford 15-ft HLW System	-	-	Rail	CTS
Proposed Long South Texas Project	-	-	Rail	ATS

See Appendix C for acronym definitions
* Casks arriving at the MGR on HHT will be transferred to railcars prior to the cask delivery to the system

[F 1.1.1, 1.1.2][MGR RD 3.2.C, 3.3.D, 3.3.H, 3.4.2.B]

1.2.1.3 The system shall remove empty overpacks from transporters, position empty overpacks for receipt by the ATS, receive loaded overpacks from the ATS, and mount loaded overpacks on transporters. (TBV-3692)

[F 1.1.3][MGR RD 3.2.C]

1.2.1.4 The system shall have the capability to handle transportation casks at the annual throughput rates specified in Sections 5.1.4.3 and 5.1.4.4 of the "Monitored Geologic Repository Project Description Document."

[F 1.1.1][MGR RD 3.2.C, 3.2.E]

1.2.1.5 The system shall support a transportation cask turnaround time TBD-4443.

[F 1.1.1][MGR RD 3.4.2.B]

1.2.1.6 The system shall provide features to facilitate permanent closure and decontamination or dismantlement.

[F 1.1.9][MGR RD 3.1.C][10 CFR 63.21(c)(17)]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

1.2.2.1.1 The system cranes and hoists shall be designed to retain suspended loads during and after a loss of electrical power.

[F 1.1.7][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

1.2.2.1.2 The system cranes and hoists shall be designed to retain suspended loads during and after Frequency Category 2 (TBV-1246) design basis earthquake.

[F 1.1.7][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

1.2.2.1.3 The system cranes and hoists shall be designed to remain on their rails during and after a Frequency Category 2 (TBV-1246) design basis earthquake.

[F 1.1.7][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

1.2.2.1.4 The system shall ensure a cask tipover is not initiated by the system as a result of a loss of electrical power.

[F 1.1.7][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

1.2.2.1.5 The system shall ensure a cask tipover is not initiated by the system as a result of a Frequency Category 2 (TBV-1246) design basis earthquake.

[F 1.1.7][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

1.2.2.1.6 The system remote manipulators shall provide features to recover from loss of power and Frequency Category 1 (TBV-1246) design basis earthquakes, including backup measures to place and release loads, fixtures, instruments, and tooling in a safe manner.

[F 1.1.6, 1.1.7][MGR RD 3.1.B, 3.1.C][10 CFR 63.111(a)(1)]

1.2.2.1.7 The system shall be designed in accordance with the project ALARA (as low as reasonably achievable) program goals (TBD-406) and the applicable guidelines in "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable" (Regulatory Guide 8.8).

[F 1.1.6, 1.1.7][MGR RD 3.1.B, 3.1.C, 3.1.G][10 CFR 63.111(a)(1)]

1.2.2.1.8 The system shall maintain at least 20 ft (6 m) separation between loaded transportation casks.

[F 1.1.6, 1.1.7][MGR RD 3.1.B, 3.1.C][10 CFR 63.111(a)(1)]

1.2.2.1.9 The system shall permit prompt termination of operations and evacuation of personnel during an emergency.

[F 1.1.7][MGR RD 3.1.C][10 CFR 63.112(e)(10)]

1.2.2.1.10 The system shall provide overload limit sensing and alarming capabilities to automatically stop handling operations and warn operators of unsafe conditions.

[F 1.1.7][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(8)]

1.2.2.2 Non-nuclear Safety Criteria

Non-nuclear safety criteria for this system will be provided in a future revision, if required.

1.2.3 System Environment Criteria

1.2.3.1 The system components shall be designed to withstand and operate in the temperature environment defined in Table 2 for the area in which the component is located.

Table 2. Temperature Environment

Location of System Component	Normal Environment	Off-Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	70 - 78°F	(TBD-395) °F for (TBD-395) Hours
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	63 - 92°F	(TBD-395) °F for (TBD-395) Hours
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells, Emergency Generator Room)	63 - 106°F	(TBD-395) °F for (TBD-395) Hours
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	70 - 74°F Note 1	70 - 74°F Note 1

Note 1: It is intended to maintain these areas at the specified temperature under all anticipated conditions. However, due to economic or design impracticability, areas that house less sensitive electronic components may not be maintained at this temperature. In these cases, cooling will be provided for the electronic components, but not necessarily the entire area.

[F 1.1.5][MGR RD 3.3.A]

1.2.3.2 The system components shall be designed to withstand and operate in the humidity environment defined in Table 3 for the area in which the component is located.

Table 3. Humidity Environment

Location of System Component	Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	30% - 60%
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	Humidity Not Controlled (TBD-409) Note 1
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells Emergency Generator Room)	Humidity Not Controlled (TBD-409) Note 1
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	40% - 50%

Note 1: Humidity control is not provided in most of these areas. Therefore, components susceptible to extreme humidity conditions must be evaluated for low and/or high humidity environments since special provisions (e.g., heater strips, humidifier) may be necessary.

[F 1.1.5][MGR RD 3.3.A]

1.2.3.3 All structures, systems, and components (SSCs) that exist or are operating within 6.6 ft (2 m) of the surface of transportation casks/carriers, shall be designed such that components susceptible to radiation can withstand and operate in a 1 rad/hr environment.

[F 1.1.5][MGR RD 3.3.A]

1.2.4 System Interfacing Criteria

1.2.4.1 The system shall receive and provide the operational information, status, and control data defined in Table 4 to the Monitored Geologic Repository Operations Monitoring and Control System.

Table 4. System Inputs/Outputs

Inputs	Outputs
Radiation monitoring system data and status	Equipment status and status of operations
Transportation cask and carrier tracking data	Equipment alarm status
Facility system status	Control equipment status and alarms
Facility, interfacing and support system readiness status	Interlock status
Operational message advisory	Video signals
Activity plans and procedures	Communications equipment status
Emergency response commands	Timeout warnings for handling equipment
MGR operational alarm status	Control loads left in improper states (suspended loads, unattended controls, etc.)
Supervisory control	

[F 1.1.4, 1.1.7][MGR RD 3.2.C, 3.3.K]

1.2.4.2 The system shall receive electrical power from the Waste Handling Building Electrical System.

[MGR RD 3.2.C]

1.2.4.3 The system shall be compatible with the handling and dynamic load limits of shipping casks, carriers, and interfacing systems.

[F 1.1.1][MGR RD 3.3.A, 3.4.2.C]

1.2.4.4 The system shall interface with the Carrier/Cask Transport System to provide adequate clearance for the on-site prime movers.

[F 1.1.1][MGR RD 3.2.C]

1.2.4.5 The system shall receive and return loaded and unloaded railcars and LWTs to/from the Carrier/Cask Transport System.

[F 1.1.1][MGR RD 3.2.C]

1.2.4.6 The system shall be designed in accordance with the interface agreements defined in "Interface Control Document for the Transportation System and the Mined Geologic Disposal System Surface Repository Facilities and Systems for Mechanical and Envelope Interfaces."

[F 1.1.1, 1.1.2][MGR RD 3.2.C]

1.2.4.7 The system shall provide features to obtain the transportation cask identification numbers and cask locations for data input into the Safeguards and Security System.

[F 1.1.4][MGR RD 3.1.C, 3.1.D, 3.3.K, 3.4.2.F][10 CFR 63.78]

1.2.5 Operational Criteria

1.2.5.1 The system shall include provisions for the inspection, testing, and maintenance of system equipment.

[F 1.1.8][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(13)]

1.2.5.2 The Inherent Availability for the system shall be greater than 0.9711 (TBV-4655).

[MGR RD 3.2.C, 3.2.E, 3.3.A]

1.2.6 Codes and Standards Criteria

1.2.6.1 The system shall provide for worker safety and maintenance in accordance with "Occupational Safety and Health Standards" (29 CFR 1910).

[MGR RD 3.1.E]

1.2.6.2 Top running bridge and gantry type multiple girder electric overhead traveling cranes, if used, shall be designed in accordance with "Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes" (CMAA-70-94).

[MGR RD 3.1.G]

1.2.6.3 Top running and under running single girder electric overhead traveling cranes utilizing under running trolley hoists, shall be designed in accordance with "Specifications for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist" (CMAA-74-1994).

[MGR RD 3.1.G]

1.2.6.4 The system shall be designed in accordance with the applicable provisions of "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992).

[MGR RD 3.1.G]

1.2.6.5 The system shall be designed in accordance with applicable sections of "Department of Defense Design Criteria Standard, Human Engineering" (MIL-STD-1472E).

[MGR RD 3.3.A]

1.2.6.6 The system shall be designed in accordance with applicable sections of "Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities" (UCRL-15673).

[MGR RD 3.3.A]

1.2.6.7 The system shall be designed in accordance with applicable sections of Volume 1 of "Human-System Interface Design Review Guideline" (NUREG-0700).

[MGR RD 3.3.A]

1.2.6.8 The system shall be designed in accordance with applicable sections of "Safety Color Code" (ANSI Z535.1-1998), "Environmental and Facility Safety Signs" (ANSI Z535.2-1998), "Criteria for Safety Symbols" (ANSI Z535.3-1998), "Product Safety Signs and Labels" (ANSI Z535.4-1998), and "Accident Prevention Tags (for Temporary Hazards)" (ANSI Z535.5-1998).

[MGR RD 3.3.A]

1.2.6.9 The system shall be designed in accordance with applicable sections of "Accessible and Usable Buildings and Facilities" (CABO/ANSI A117.1-1992), and "Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities" (36 CFR 1191, Appendix A).

[MGR RD 3.3.A]

1.2.6.10 The system shall be designed in accordance with applicable sections of "American National Standard for Human Factors Engineering of Visual Display Terminal Workstations" (ANSI/HFS 100-1988), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 3: Visual Display Requirements" (ISO 9241-3), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours" (ISO 9241-8).

[MGR RD 3.3.A]

1.2.6.11 The system shall be designed in accordance with applicable sections of "Guidelines for Designing User Interface Software" (ESD-TR-86-278), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles" (ISO 9241-10), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues" (ISO 9241-14), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 15: Command Dialogues" (ISO 9241-15).

[MGR RD 3.3.A]

1.2.6.12 The system shall be designed in accordance with the applicable sections of the "National Electrical Code" (NFPA 70).

[MGR RD 3.3.A]

1.2.6.13 The system shall be designed in accordance with the applicable sections of "Standard for the Protection of Electronic Computer/Data Processing Equipment" (NFPA 75).

[MGR RD 3.3.A]

1.2.6.14 The system shall be designed in accordance with the applicable sections of "IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment" (IEEE Std 1100-1992).

[MGR RD 3.3.A]

1.2.6.15 The system shall be designed in accordance with the applicable sections of "IEEE Standard for Information Technology - Open Systems Interconnection (OSI) Abstract Data Manipulation - Application Program Interface (API) [Language Independent]" (IEEE Std 1224-1993).

[MGR RD 3.3.A]

1.2.6.16 The system shall be designed in accordance with the applicable sections of "Application of Safety Instrumented Systems for the Process Industries" (ANSI/ISA-S84.01-1996).

[MGR RD 3.3.A]

1.2.6.17 The system shall comply with the applicable assumptions contained in the "Monitored Geologic Repository Project Description Document."

1.2.6.18 The design and construction of electric overhead and gantry multiple girder cranes with top running bridge and trolley shall be in accordance with the applicable sections of "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" (ASME NOG-1-1995) for Type II cranes.

[MGR RD 3.1.G]

1.2.6.19 Crane structures and their support systems that are important to radiological safety shall be in accordance with the applicable sections of "Design Objectives for Highly Radioactive Solid Material Handling and Storage Facilities in a Reprocessing Plant" (ANSI N305-1975).

[MGR RD 3.1.G]

1.2.6.20 The design, fabrication, acceptance testing, maintenance, and assurance of continuing compliance of special lifting devices for shipping containers weighing 10,000 pounds or more (including special lifting devices for critical loads) shall be in accordance with applicable sections of "American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10000 Pounds (4500 Kg) or More" (ANSI N14.6-1993).

[F 1.1.8][MGR RD 3.1.G]

1.2.6.21 Design of steel SSCs shall be in accordance with "Manual of Steel Construction, Allowable Stress Design" or "Manual of Steel Construction, Load and Resistance Factor Design."

[MGR RD 3.1.G]

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

This section will be completed in a future revision.

2. DESIGN DESCRIPTION

Section 2 of this SDD summarizes information which is contained in other references. By assembling system specific information contained elsewhere (i.e., analyses, technical reports, etc.), Section 2 provides insight into the current state of the design of this system. However, due to the nature of design development, the information contained in this section will continue to change as the design matures.

2.1 SYSTEM DESIGN SUMMARY

The system design summary provided below is based on Sections 1.1.3.1 and 1.1.3.4 contained in Attachment II of the "Engineering Files for Site Recommendation" and Section 6.2.1.1 of the "WHB/WTB Space Program Analysis for Site Recommendation." The transportation cask characteristics and parameters are defined in Tables 7-3 through 7-10 of the "Interface Control Document for the Transportation System and the Mined Geological Disposal System Surface Repository Facilities and Systems for Mechanical and Envelope Interfaces."

The system is located in the carrier bay of the Waste Handling Building (WHB). The system interfaces with the Carrier/Cask Transport System (CCTS) that provides the rails and roads for the site prime movers (transport vehicles) to tow and haul rail and truck carriers to the system. The system also interfaces with the Assembly Transfer System (ATS) and the Canister Transfer System (CTS) for delivering loaded casks, shipping empty casks, receiving empty dual-purpose canister (DPC) overpacks, and shipping DPC overpacks off-site. Additionally, the system interfaces with WHB Electrical System to meets its electrical power needs, the Monitored Geological Repository Operations Monitoring and Control System for supervisory monitoring from the Central Control Center (CCC), the Safeguards and Security System, and the WHB Ventilation System.

As shown in the mechanical flow diagram, Figure 1, the system receives rail and truck transportation cask carriers from the CCTS, unloads casks from carriers, and loads empty casks onto carriers for off-site shipment. Loaded casks are transferred to the ATS or the CTS. Empty casks are received from the ATS and the CTS for off-site shipment. The system operates to handle the waste transfer throughput and to support maintenance operations. The system receives empty DPC overpacks from the CCTS. The system unloads and transfers empty overpacks. The system receives overpacks with empty DPCs from the ATS and loads them onto carriers for off-site shipment. Two carrier transport lines are specified to accommodate either truck or rail carriers in the WHB.

The system is completely enclosed and housed in the WHB, which provides the utility and safety structures, systems, and components (SSCs) required for support of maintenance and operations

2.2 DESIGN ASSUMPTIONS

The principal assumptions that were used, in addition to the design criteria described in Section 1, to develop the system features are provided below: (refer to Section 7 of the "Interface Control Document for the Transportation System and the Mined Geologic Disposal System Surface Repository Facilities and Systems for Mechanical and Envelope Interfaces" and Attachment II Sections 1.1.3.2.2.1 through 1.1.3.2.2.3 of the "Engineering Files for Site Recommendation").

2.2.1 Rail and truck carriers will be used to haul waste transportation casks. The carrier dimensional envelopes are based on existing and planned designs for U.S. Nuclear Regulatory Commission (NRC)-docketed cask transportation systems.

2.2.1.1 Rail carrier dimensions and overall dimensions are based on data provided for the largest transportation cask.

2.2.1.2 The legal-weight truck carrier dimensions are based on data provided for the largest legal-weight transportation cask.

2.2.2 Since the system is used on nearly a full time basis, the system must be regularly maintained over its operating life. Adequate tools, spares, maintenance personnel, storage area, and equipment must be readily available to immediately repair failed system equipment.

2.2.3 Cask unloading/loading in the system will occur in a contact operation area using manual and remote handling equipment. Readily available remote/robotic technology in the nuclear industry will be used to support cask unloading/loading operations and ensure that radiation exposure rates for manual operation are as low as is reasonably achievable.

2.3 DETAILED DESIGN DESCRIPTION

The detailed design description provided below is based on Attachment II Sections 1.1.3.3 and 1.1.3.4 of the "Engineering Files for Site Recommendation." and Section 6.2.1.1 of the "WHB/WTB Space Program Analysis for Site Recommendation."

2.3.1 System and Operation Description

The system operations begin when loaded truck or rail transportation casks are delivered to the WHB by the CCTS. The system operates 120 hours per week and 50 weeks per year to handle the waste transfer throughput and to support maintenance operations. Since the system is used on nearly a full time basis, it must be regularly maintained over its operating life. Adequate tools, spares, maintenance personnel, storage area, and equipment are assumed to be available to repair failed system equipment in a timely manner.

Two carrier transport lanes enter and leave the WHB providing unloading-loading stations in the carrier bay, each of which can accommodate either truck or rail carriers. Truck carriers can enter and leave the carrier bay in one direction (one-way drive through) to minimize handling time in the carrier bay. Rail carriers enter and leave from the same end of the carrier bay. The truck or rail carrier is towed into the carrier bay unloading-loading area of the system using a site prime mover.

The WHB carrier bay is configured and sized to accommodate two lanes, a carrier unloading/loading area, three cask transfer carts, an overhead bridge crane, gantry-mounted manipulators, and other support equipment. In the carrier bay unloading area, the overhead bridge crane is used to upright and transfer the cask to a cask transfer cart. The reverse operation is used to load an empty cask onto the carrier. The carrier unloading/loading area is also equipped with support equipment such as cask lifting yokes, tooling, and maintenance equipment required to support normal and off normal recovery activities

The bridge crane is mounted on overhead rails in the carrier bay. The bridge crane consists of a double bridge-girder, trolley, main hoist, and auxiliary hoist. The crane's main hoist, rated for lifting a 160-ton load, is equipped with an electrically powered rotating hook to rotate the cask, if required. The crane's main hoist is used in conjunction with the cask lifting yoke. The auxiliary hoist is used for lighter lifting operations. The cask's lifting yoke is suspended from the crane's main hoist and is equipped with two lifting arms designed to engage the cask trunnions. The cask lifting yoke facilitates tilting the cask to a vertical orientation and transfer of the cask to the transfer cart. The distance between the lifting arms is adjustable to accommodate the various diameters of the transportation casks. The lifting arm adjustment is accomplished by means of an electromechanical device incorporated into the lifting yoke. Multiple lifting yokes may be required to support the different cask designs.

The crane bridge and trolley move in a rectangular (X-Y coordinate) pattern inside the carrier bay loading/unloading area, the main hoist rotates 360 degrees, and both the main and auxiliary hoists move in a vertical (Z coordinate) lifting motion. The crane is equipped with platforms for contact maintenance in the carrier bay.

A gantry-mounted manipulator is provided for each carrier transport lane to assist cask unloading/loading operations and allow partial remote handling to reduce radiation exposure. Each gantry-mounted manipulator consists of an electromechanical manipulator and a telescoping mast installed on a rail-mounted gantry and trolley system. The manipulator can be equipped with a variety of tools and accessories such as a robotic arm and hand assembly to assist in cask unloading and inspection operations.

2.3.2 System Arrangement

The design, configuration, and equipment arrangement for the system is based on the design and layout of the WHB. The system includes a wide variety of cask-handling equipment including the overhead bridge crane gantry-mounted electromechanical manipulators, and remote/manual operations designed for heavy material handling work environments.

Figure 1 provides a mechanical flow diagram for the operations of the system. The system is housed in the carrier bay of the WHB.

The truck or rail carrier is towed into the carrier bay unloading/loading area of the system using a site prime mover. The cask is lifted off the carrier using the large carrier bay bridge crane and a lifting yoke. The overhead bridge crane is used to engage the cask trunnions with the cask lifting yoke and rotate the cask to an upright position. After the cask is in the upright position, the crane lifts the cask high enough to clear the carrier trunnion cradle and move the cask to a position for placement onto either an ATS or CTS cask transfer cart. If necessary, the cask will be rotated about its vertical axis and then placed onto the rail-mounted transfer carts. The transfer cart will be used to transfer the cask into the ATS or CTS lines. The system is configured and sized to accommodate the waste transportation and receiving schedules established for the repository.

The cask unloading/loading procedure for the system is a contact or remote operation using manual and remote equipment. To reduce radiation exposure rates for manual operation, operators will remotely operate the overhead bridge crane or the gantry-mounted manipulators (with the assistance of remote tools) from a safe distance by a radio control, a portable control console, or a crane overhead cab.

2.3.3 Other System Features or Characteristics

To reduce the cask lift height during cask transfer operations and the potential damage to the cask if a cask is accidentally dropped, the transport lanes are recessed below the carrier bay floor.

2.4 COMPONENT DESCRIPTION

This information will be provided in a future issue.

2.5 CRITERIA COMPLIANCE

The surface facility is developed conceptually at this time without criteria compliance analyses. The criteria compliance for this system will be addressed in future issues of this SDD as the design and analysis of the system matures.

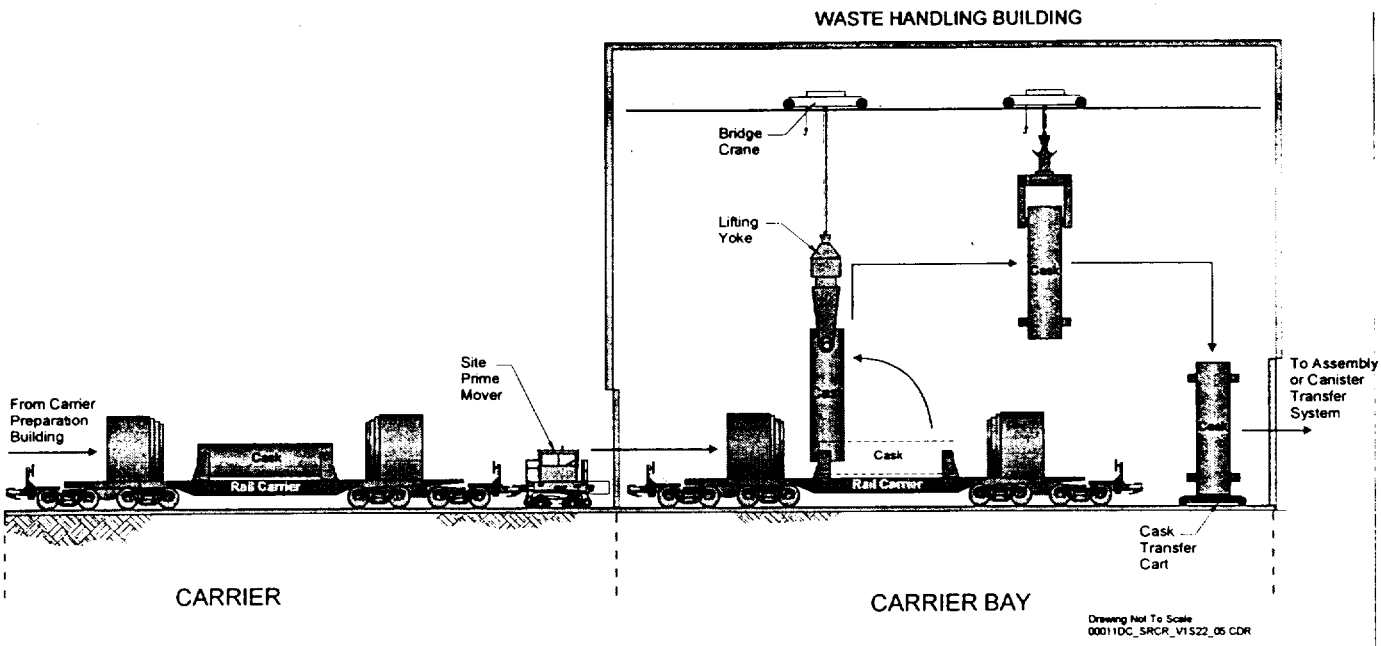

Figure 1. Carrier/Cask Handling System

3. SYSTEM OPERATIONS

A system operations description for this system will be provided in a future revision.

4. SYSTEM MAINTENANCE

A system maintenance description for this system will be provided in a future revision.

APPENDIX A CRITERION BASIS STATEMENTS

This section presents the criterion basis statements for criteria in Section 1.2. Descriptions of the traces to "Monitored Geologic Repository Requirements Document" (MGR RD) and "Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22, 1999), for Yucca Mountain, Nevada" are shown as applicable. In anticipation of the interim guidance being promulgated as a Code of Federal Regulations, it will be referred to as "10 CFR 63" in this document.

1.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the operational life of the system. This criterion is required because this system supports the waste handling operations at the repository as required by MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

MGR RD 3.2.C requires the MGR to be capable of receiving, packaging, emplacing, and isolating nuclear waste at the annual rates specified in Table 3-2 of the MGR RD. Table 3-2 of the MGR RD indicates that waste receipt will commence in the year 2010 and is expected to be completed by the year 2041, spanning a total of 32 years. To account for future potential schedule fluctuations caused by uncertainties in waste remediation, early receipt, and nuclear power plant life extensions, a 25 percent margin is added, resulting in an operational life of 40 years.

1.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion explicitly identifies the transportation casks that the system must be able to handle. This criterion is needed to ensure that the system is able to handle the transportation systems that will be received at the surface repository. This criterion supports MGDS RD 3.2.C, 3.3.D, 3.3.H, and 3.4.2.B.

II. Criterion Performance Parameter Basis

The casks and associated information, except the mode of transportation, is identified in the "Interface Control Document for the Transportation System and the Mined Geologic Disposal System Surface Repository Facilities and Systems for Mechanical Envelope Interfaces," Table 7-2. The mode of transportation for each cask is identified in Tables 7-3, 7-4, and 7-5 of the same document.

The WESFLEX transportation system was also added to the list in the interface control document because it is known that a transportation system with that name will potentially

be developed and may be used to deliver spent nuclear fuel to the repository, based on Section 5.20 of the interface control document.

Assignment of transfer capability was made based on the transportation system's contents, using Section 5.20 and Tables 7-7, 7-8, and 7-9 of the interface control document. Assignment of cask transfer to both the ATS and CTS is due to the uncertain disposability of the multi-purpose canisters and dual-purpose canisters contained in that type of cask, based on Sections 5.10 and 5.20 of the interface control document.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support the capability to dispose of multi-purpose canisters and dual-purpose canisters that have been unloaded by the ATS, if multi-purpose canisters and dual-purpose canisters are not disposed of within a waste package. This criterion supports MGDS RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines how fast the system has to annually process Truck, SPC Rail, and DPC Rail casks so that the overall MGR rates can be met. This criterion supports MGR RD 3.2.C and 3.2.E.

II. Criterion Performance Parameter Basis

Three annual arrival scenarios for CSNF are presented in Tables 5-1 through 5-3 and the annual cask receipt rates of DOE SNF and HLW are shown in Table 5-4 of Sections 5.1.4.3 and 5.1.4.4 of the "Monitored Geologic Repository Project Description Document."

1.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the figure of merit for how fast the system must return transportation casks to the Carrier/Cask Transport System in support of the higher level requirement for returning a usable transportation cask to service for the Regional Servicing Contractor. This criterion supports the MGR RD 3.4.2.B.

II. Criterion Performance Parameter Basis

N/A

1.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that features to facilitate permanent closure and decontamination or dismantlement are incorporated into the design of the system, as required by MGR RD 3.1.C and 10 CFR 63.21(c)(17).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, 3.1.C, and 3.4.2.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8), and 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, 3.1.C, and 3.4.2.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8), and 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, 3.1.C, and 3.4.2.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8), and 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, 3.1.C, and 3.4.2.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8), and 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, 3.1.C, and 3.4.2.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8), and 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to the identified design basis event. This criterion supports the implementation of MGR RD 3.1.B, and

3.1.C; "Standards for Protection Against Radiation" (10 CFR 20); and 10 CFR 63.111(a)(1).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

MGR RD 3.1.C requires compliance with 10 CFR 63. MGR RD 3.1.B and 10 CFR 63.111(a)(1) require compliance with "Standards for Protection Against Radiation" (10 CFR 20). Section 1101(b) of 10 CFR 20 states: "The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to the members of the public that are as low as is reasonably achievable (ALARA)."

Compliance with "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable" (Regulatory Guide 8.8) is invoked because this regulatory guide is one of the primary regulatory documents that addresses ALARA and is acceptable to the NRC. This regulatory guide provides guidelines on achieving the occupational ALARA goals during the planning, design, and operations phases of a nuclear facility. According to Section B of this guide, "Effective design of facilities and selection of equipment for systems that contain, collect, store, process, or transport radioactive material in any form will contribute to the effort to maintain radiation doses to station personnel ALARA." Section C.2 addresses facility and equipment design features. The design process of each system must include an evaluation of the applicable requirements in Section C.2 of Regulatory Guide 8.8.

In addition to compliance with the applicable guidelines in Regulatory Guide 8.8, the design of the system must meet the project ALARA program goals. The project ALARA program will include both qualitative and quantitative goals. Regarding the ALARA program of a licensee, Section C.1.a(2) of Regulatory Guide 8.8 states: "The policy and commitment should be reflected in written administrative procedures and instructions for operations involving potential exposures of personnel to radiation and should be reflected in station design features. Instructions to designers, constructors, vendors, and station personnel specifying or reviewing station features, systems, or equipment should reflect the goals and objectives to maintain occupational radiation exposures ALARA."

This criterion supports MGR RD 3.1.G. This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statements 6.5g1 and 6.6g1.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This requirement is needed to ensure that occupational exposures are not unnecessarily high due to close spacing of loaded transportation casks. Materials handing operations will require some personnel in the general vicinity of the casks (e.g., a crane operator). Close spacing of loaded casks will increase occupational exposures. Limiting the minimum distances between loaded transportation casks will reduce the dose rate for those personnel working in the vicinity, and therefore should reduce the occupational exposures contributing to compliance with "Standards for Protection Against Radiation" (10 CFR 20, Subpart C), as required by MGR RD 3.1.B, 3.1.C, and 10 CFR 63.111(a)(1).

II. Criterion Performance Parameter Basis

The spacing between transportation casks is taken from "General Requirements for Shipments and Packagings" (49 CFR 173, Section 447(a)). No fundamental change in the nuclear properties of a transportation cask take place upon its receipt at the repository, and the same occupational exposure limits that are considered in transportation also apply to materials handling at the repository. Thus, the spacing required for storage incident to transportation is considered valid for storage and handling at the surface repository.

1.2.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the required response of the system to an emergency. This criterion supports the implementation of MGR RD 3.1.C, and 10 CFR 63.112(e)(10).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, 3.3.A, and 10 CFR 63.112(e)(8) for the identification of applicable regulatory requirements to reduce the potential for design basis events. Specifically, this criterion identifies the need to detect changes in lifting loads during handling to protect SSCs from damage and reduce the potential for design

basis events. This criterion is supported by "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988, paragraph 6.5.2.16).

II. Criterion Performance Parameter Basis

N/A

1.2.3.1 Criterion Basis Statement

I. Criterion Need Basis

Temperature can directly affect the performance or result in advanced degradation of a component. To ensure proper performance, many equipment manufacturers specify the normal temperature environment in which the component must operate. Manufacturers may also specify the maximum off-normal temperature environment that the components can be exposed to or operate in for a limited time. The off-normal condition may be caused by loss of electric power or failure of the ventilation system.

This criterion supports MGR RD 3.3.A

II. Criterion Performance Parameter Basis

Temperature values are obtained from Criterion 1.2.1.1 in the "Waste Handling Building Ventilation System Description Document."

1.2.3.2 Criterion Basis Statement

I. Criterion Need Basis

Humidity can affect performance of computers, electronic, electrical, and mechanical components. Low humidity may result in static discharge in electrical and electronic equipment. High humidity can result in advanced corrosion or biological growth within the component. High humidity may also affect the operation of recorders that use paper. High humidity is not expected to be a major concern at the MGR due to the generally dry climate; however, depending on the nature of the operations, some areas may exhibit high humidity conditions. To ensure proper performance, many equipment manufacturers specify the humidity environment in which the component must operate. This criterion establishes the indoor humidity environment in which components are expected to operate based on the intended installation location.

Humidity is not controlled during off-normal conditions because of the generally mild humidity environment at the repository, and the expected short-term duration of off-normal conditions, such as loss of power or ventilation system failure.
This criterion supports MGR RD 3.3.A.

II. Criterion Performance Parameter Basis

Humidity values are obtained from Criterion 1.2.1.2 in the "Waste Handling Building Ventilation System Description Document."

1.2.3.3 Criterion Basis Statement

I. Criterion Need Basis

Radiation from fuel assemblies, HLW canisters, or other radioactive sources can affect electrical and electronic components. Accumulated doses of radiation (also referred to as Total Integrated Dose) can cause eventual degradation of components containing organic compounds, such as electrical insulation and lubricants. Accumulated doses can also cause damage to components containing polymers. In addition to the material degradation issue, real-time operation of an electronic device may be compromised by the type of radiation it receives, such as neutrons colliding with the lattice atoms of the semiconductor.

Most of the electronic and electrical components will be located in mild environments with small radiation doses. Components that will be installed in radiation environments should be evaluated for the radiation doses that they can receive, and, where applicable, susceptibility to the type of radiation (X-ray, Gamma, neutron) should also be considered.

Shielding, distance, and duration of exposure can significantly reduce the radiation dose and type of radiation that a component receives. Therefore, detailed analyses on a case by case basis will determine the economic feasibility and practicability of providing shielding, distance from the source, minimizing exposure time, frequent replacement of the affected component, or qualification of the component for the radiation environment.

It should be emphasized that this criterion addresses the radiation doses that can affect operability of the components during normal operations, and is not intended to invoke environmental qualification requirements for post-accident operability.

This criterion supports MGR RD 3.3.A.

II. Criterion Performance Parameter Basis

The 1 rad/hr radiation level given in this paragraph is obtained from "General Requirements For Shipments And Packagings" (49 CFR 173, Section 441). The maximum surface dose of 1000 mrem/hr in 49 CFR 173.441(b) is converted to rad/hr for use in this criterion.

The 1 rad/hr SSCs design environment is only applied to SSCs that exist within 2 m of the cask/carrier since the dose rate at approximately 2 m (6.6 ft) from the edge of the vehicle (excluding the top and underside of the vehicle), are limited to 10 mrem/hr by 49

CFR 73.441. Thus, an additional criterion applicable to outside of the 2 m envelope is judged to be unnecessary for specific design consideration.

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Monitored Geologic Repository Operations Monitoring and Control System for centralized monitoring and control. This criterion supports the waste handling operations of MGR RD 3.2.C and 3.3.K.

II. Criterion Performance Parameter Basis

N/A

1.2.4.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with interfacing MGR systems. This criterion supports MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.4.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with transportation systems and interfacing MGR systems. This criterion implements MGR RD 3.3.A and 3.4.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.4.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is necessary to identify the physical clearance interface between the site prime movers of the Carrier/Cask Transport System and this system. This criterion supports MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.4.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, the criterion identifies the interfaces with the Carrier/Cask Transport System and supports MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.4.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure mechanical interface consistency between the design of this system and the transportation systems. This is done by specifying the design be done in accordance with the interface agreements defined in "Interface Control Document for the Transportation System and the Mined Geologic Disposal System Surface Repository Facilities and Systems for Mechanical Envelope Interfaces." This criterion supports MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.4.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion provides for the tracking of all transportation casks handled by the system. This criterion supports MGR RD 3.3.K and 3.4.2.F requirements to maintain nuclear inventories and support safeguards and security activities. This requirement supports the

MGR RD 3.1.D requirement to implement applicable provisions of "Physical Protection of Plants and Materials" (10 CFR 73, Section 45(d)(1)(iii)). This requirement also supports MGR RD 3.1.C for the interim guidance of 10 CFR 63.78 which invokes "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR 72, Section 72(a)).

II. Criterion Performance Parameter Basis

N/A

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies the need to perform inspection, testing, and maintenance on system equipment. This criterion responds to MGR RD 3.1.C, 3.3.A and 10 CFR 63.112(e)(13).

II. Criterion Performance Parameter Basis

N/A

1.2.5.2 Criterion Basis Statement

I. Criterion Need Basis

The subject requirement addresses and quantifies the parent requirement for availability. This criterion supports MGR RD 3.2.C, 3.3.A, and 3.2.E.

II. Criterion Performance Parameter Basis

The parameter is taken from "Bounded Minimum Inherent Availability Requirements for the System Description Documents," Table 7.2-1. This value is from an uncontrolled source and is therefore TBV.

1.2.6.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements MGR RD 3.1.E. This criterion requires that system safety criteria be considered in the design of the MGR. This criterion establishes the requirement that the system design meets the applicable requirements of "Occupational Safety and Health Standards" (29 CFR 1910).

II. Criterion Performance Parameter Basis

N/A

1.2.6.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes" (CMAA-70-94), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statements 6.8g7 and 7.14g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Specifications for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist" (CMAA-74-1994), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statement 7.15g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statement 7.1g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, arrangement, configuration, and integration of SSCs involve many elements, including monitoring, operating, maintaining, and observing the facilities and systems. To accomplish an effective and safe work environment, the human-system interface must incorporate human factors engineering (HFE) criteria. Use of the "Department of Defense Design Criteria Standard, Human Engineering" (MIL-STD-1472E), in conjunction with the other HFE standards and guidelines cited in this system description document, will provide a human-system interface that maximizes performance and minimizes risk to personnel.

In support of MGR RD 3.3.A, this criterion ensures that the system will be designed to be safely and effectively used by all expected users. The U.S. Department of Energy (DOE) Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraph 2.3.1), endorses the use of MIL-STD-1472E (GPG-FM-027 references the earlier version of MIL-STD-1472).

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

Maintainability of system equipment involves many factors, including the human-machine interface. This interface must address the design for maintainability through the incorporation of HFE criteria. In support of MGR RD 3.3.A, this criterion ensures that the system will be designed to be safely and effectively maintained through compliance with applicable industry standards. The DOE Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraph 2.3.1), endorses the use of "Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities" (UCRL-15673) for addressing HFE maintainability design criteria.

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, arrangement, configuration, and integration of control rooms, operating galleries, and related SSCs (e.g., controls, displays, labels, workspaces, human-computer interfaces) involve many factors, including the human-machine interface. Through compliance with Volume 1 of "Human-System Interface Design Review Guideline" (NUREG-0700), in conjunction with other HFE standards and guidelines, this criterion ensures that control rooms, operating galleries, and related SSCs will be designed in a safe and effective manner.

This criterion supports MGR RD 3.3.A. The DOE Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraph 2.3.1), supports the use of NUREG-0700. NUREG-0700, Sections 6.1 through 6.9, provide specific HFE design guidelines for control room elements.

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 Criterion Basis Statement

I. Criterion Need Basis

Information being communicated by safety signs and tags must be quickly and easily read and uniformly understood. The ANSI Z535 series (e.g., "Safety Color Code" (ANSI Z535.1-1998), "Environmental and Facility Safety Signs" (ANSI Z535.2-1998), "Criteria for Safety Symbols" (ANSI Z535.3-1998), "Product Safety Signs and Labels" (ANSI Z535.4-1998), and "Accident Prevention Tags (for Temporary Hazards)" (ANSI Z535.5-1998)) are recognized standards in the nuclear industry for the design and use of safety signs and tags. In support of MGR RD 3.3.A, this criterion ensures that, when used in conjunction with other HFE standards and guidelines, the design of safety signs and tags will help provide a safer working environment.

II. Criterion Performance Parameter Basis

N/A

1.2.6.9 Criterion Basis Statement

I. Criterion Need Basis

In support of MGR RD 3.3.A, the "Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities" (36 CFR 1191, Appendix A) provides specific HFE design guidelines for providing personnel with physical disabilities access to and

use of system resources. In addition, "Accessible and Usable Buildings and Facilities" (CABO/ANSI A117.1-1992) establishes configurations and design criteria for allowing accessibility to and usability of system components by persons with physical disabilities. When used in conjunction with other HFE standards and guidelines, these codes and standards will ensure a safe and efficient design.

This criterion is not applicable to facility workspaces and activities (e.g., walking underground) where physical disabilities endanger the individual or other personnel, preclude execution of tasks, or cannot be economically accommodated.

II. Criterion Performance Parameter Basis

N/A

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, and integration of computer display terminals and workstations, equipment, and workspaces involve many factors including the human-computer interface. "American National Standard for Human Factors Engineering of Visual Display Terminal Workstations" (ANSI/HFS 100-1988), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 3: Visual Display Requirements" (ISO 9241-3), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours" (ISO 9241-8) support MGR RD 3.3.A by ensuring that HFE criteria will be incorporated into the selection and design of computer equipment and workspaces through compliance with applicable industry standards. The DOE Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraph 2.3.1.3) endorses use of the ISO 9241 standard. When used in conjunction with other HFE standards and guidelines, these codes and standards will ensure a safe and efficient design.

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, and integration of software supporting the user interface in computer systems must consider the characteristics of the user population. In support of MGR RD 3.3.A, the application of "Guidelines for Designing User Interface Software" (ESD-TR-86-278), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles" (ISO 9241-10), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues" (ISO

9241-14), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 15: Command Dialogues" (ISO 9241-15), ensures that HFE criteria will be incorporated into the selection, design, and integration of user interface software.

The DOE Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraphs 2.3.1.3 and 2.3.1.8) endorses the use of the ISO 9241 standard. When used in conjunction with other HFE standards and guidelines, these codes and standards will ensure a safe and efficient design implementation.

II. Criterion Performance Parameter Basis

N/A

1.2.6.12 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "National Electrical Code" (NFPA 70) contains provisions considered necessary for safeguarding of personnel and SSCs from hazards arising from the use of electricity.

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "Standard for the Protection of Electronic Computer/Data Processing Equipment" (NFPA 75) provides minimum requirements for the protection of electronic computer/data processing equipment from damage by fire or its associated effects; i.e., smoke, corrosion, heat, water.

II. Criterion Performance Parameter Basis

N/A

1.2.6.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "IEEE Recommended Practice for Powering and Grounding

Sensitive Electronic Equipment" (IEEE Std 1100-1992) provides a consensus of recommended practices in an area where conflicting information and confusion, stemming primarily from different view points of the same problem, have dominated. IEEE Std 1100-1992 addresses electronic equipment performance issues while maintaining a safe installation.

II. Criterion Performance Parameter Basis

N/A

1.2.6.15 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "IEEE Standard for Information Technology - Open Systems Interconnection (OSI) Abstract Data Manipulation - Application Program Interface (API) [Language Independent]" (IEEE Std 1224-1993) provides a language-independent specification of an interface and environment to support application portability at the source code level.

II. Criterion Performance Parameter Basis

N/A

1.2.6.16 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "Application of Safety Instrumented Systems for the Process Industries" (ANSI/ISA-S84.01-1996) provides design requirements for safety instrumented systems for process industries.

II. Criterion Performance Parameter Basis

N/A

1.2.6.17 Criterion Basis Statement

I. Criterion Need Basis

The "Monitored Geologic Repository Project Description Document" allocates controlled project assumptions to systems. This criterion identifies the need to comply with the applicable assumptions identified in the subject document. The approved assumptions will provide a consistent basis for continuing the system design.

II. Criterion Performance Parameter Basis

N/A

1.2.6.18 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" (ASME NOG-1-1995), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statement 7.10g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.19 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Design Objectives for Highly Radioactive Solid Material Handling and Storage Facilities in a Reprocessing Plant" (ANSI N305-1975), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statement 7.4g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.20 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10000 Pounds (4500 Kg) or More" (ANSI N14.6-1993), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Carrier/Cask Handling System," Guidance Statements 6.8g4 and 7.3g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.21 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Manual of Steel Construction, Allowable Stress Design" or "Manual of Steel Construction, Load and Resistance Factor Design."

This criterion supports MGR RD 3.1.G.

II. Criterion Performance Parameter Basis

N/A

APPENDIX B ARCHITECTURE AND CLASSIFICATION

The system architecture and QA classification are identified in Table 5. The QA classifications are established in "Classification of the Carrier/Cask Handling System," Item 1. Definitions of the QA classifications may be found in QAP-2-3, "Classification of Permanent Items."

Table 5. System Architecture and QA Classification

Carrier/Cask Handling System	QL-1	QL-2	QL-3	CQ
Control and Tracking System		X		
Handling System				
Cranes and Hoists		X		
Remote Manipulators			X	
Tooling and Fixtures				X

APPENDIX C ACRONYMS, SYMBOLS, AND UNITS

C.1 ACRONYMS

This section provides a listing of acronyms used in this document.

ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ATS	Assembly Transfer System
ALARA	As Low as is Reasonably Achievable
CCC	Central Control Center
CCTS	Carrier/Cask Transport System
CQ	Conventional Quality
CTS	Canister Transfer System
DOE	U.S. Department of Energy
DPC	dual-purpose canister
F	Function
GA	General Atomics
HFE	Human Factors Engineering
HHT	Heavy Haul Trucks
HI-STAR	Holtec International-Storage, Transport, and Repository
HLW	High-Level Waste
IEEE	Institute of Electrical and Electronics Engineers
LWT	Legal-Weight Truck
MGR RD	Monitored Geologic Repository System Requirements Document
MGR	Monitored Geologic Repository
MPC	Multi-Purpose Canister
NAC	Nuclear Assurance Corporation (NAC) International, Inc.
NRC	U.S. Nuclear Regulatory Commission
NUHOMS®	Nutech Horizontal Modular System®
QA	Quality Assurance
QL	Quality Level
SDD	System Description Document
SSCs	Structures, Systems, and Components
SNC	Sierra Nuclear Corporation
SRS	Savannah River Site
STC	Storage and Transportation Cask or Canister
TBD	To Be Determined
TBV	To Be Verified
UMS™	Universal MPC System™
UTC	Universal Transport Canister
WGESCO	Westinghouse Government and Environmental Services Company
WHB	Waste Handling Building
WVDP	West Valley Demonstration Project

C.2 SYMBOLS AND UNITS

This section provides a listing of symbols and units used in this document.

%	percent
°F	degrees Fahrenheit
ft	feet
m	meters
mrem/hr	milli-Roentgen equivalent man per hour
rad/hr	radiation absorbed dose per hour

APPENDIX D FUTURE REVISION RECOMMENDATIONS AND ISSUES

None.

APPENDIX E REFERENCES

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