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00	Initial Issue. This document was previously issued using document identifier BCB000000-01717-1705-00024. This document supersedes the previous issuance. This document is a complete rewrite of the superseded document, driven largely by the use of an alternate source of regulatory requirements, the implementation of the License Application Design Selection effort,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	1) All Table titles changed from "Table I"- to "Table". 2) Section 2 has been added. 3) Updated and added references. 4) Updated criteria in 1.2. 5) Content of section 1.4 has been deleted.

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1. Canister Transfer System Operations 27

SUMMARY

The Canister Transfer System receives transportation casks containing large and small disposable canisters, unloads the canisters from the casks, stores the canisters as required, loads them into disposal containers (DCs), and prepares the empty casks for re-shipment. Cask unloading begins with cask inspection, sampling, and lid bolt removal operations. The cask lids are removed and the canisters are unloaded. Small canisters are loaded directly into a DC, or are stored until enough canisters are available to fill a DC. Large canisters are loaded directly into a DC. Transportation casks and related components are decontaminated as required, and empty casks are prepared for re-shipment.

One independent, remotely operated canister transfer line is provided in the Waste Handling Building System. The canister transfer line consists of a Cask Transport System, Cask Preparation System, Canister Handling System, Disposal Container Transport System, an off-normal canister handling cell with a transfer tunnel connecting the two cells, and Control and Tracking System.

The Canister Transfer System operating sequence begins with moving transportation casks to the cask preparation area with the Cask Transport System. The Cask Preparation System prepares the cask for unloading and consists of cask preparation manipulator, cask inspection and sampling equipment, and decontamination equipment. The Canister Handling System unloads the canister(s) and places them into a DC. Handling equipment consists of a bridge crane/hoist, DC loading manipulator, lifting fixtures, and small canister staging racks. Once the cask has been unloaded, the Cask Preparation System decontaminates the cask exterior and returns it to the Carrier/Cask Handling System via the Cask Transport System. After the DC is fully loaded, the Disposal Container Transport System moves the DC to the Disposal Container Handling System for welding. To handle off-normal canisters, a separate off-normal canister handling cell is located adjacent to the canister transfer cell and is interconnected to the transfer cell by means of the off-normal canister transfer tunnel. All canister transfer operations are controlled by the Control and Tracking System.

The system interfaces with the Carrier/Cask Handling System for incoming and outgoing transportation casks. The system also interfaces with the Disposal Container Handling System, which prepares the DC for loading and subsequently seals the loaded DC. The system support interfaces are the Waste Handling Building System and other internal Waste Handling Building (WHB) support systems.

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. 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 Canister Transfer System. The system architecture and classification are provided in Appendix B.

1.1 SYSTEM FUNCTIONS

1.1.1 The system receives and transports loaded casks containing waste in disposable canisters from the Carrier/Cask Handling System for processing.

1.1.2 The system samples and vents transportation casks containing canister waste.

1.1.3 The system opens transportation casks for unloading.

1.1.4 The system unloads canisters from the transportation casks.

1.1.5 The system provides features to stage canister waste to support DC loading.

1.1.6 The system decontaminates transportation casks and off-normal canisters.

1.1.7 The system returns empty casks to the Carrier/Cask Handling System.

1.1.8 The system receives empty DCs configured for loading from the Disposal Container Handling System.

1.1.9 The system loads canister waste into DCs.

1.1.10 The system delivers loaded DCs to the Disposal Container Handling System.

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

1.1.12 The system operates within the environmental conditions within the Waste Handling Building System.

1.1.13 The system provides remote handling and control features to minimize radiation exposure to workers.

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

1.1.15 The system ensures criticality control is maintained during all waste handling operations.

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

1.1.17 The system provides features that facilitate decontamination and decommissioning at repository closure.

1.1.18 The system provides for the monitoring and control of its operation by either local or remote means.

1.1.19 The system provides safety features to protect personnel and equipment during normal and off-normal conditions.

1.1.20 The system provides off-normal canister handling.

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 imposed on the design of this system, 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, 1.1.10][MGR RD 3.2.C]

1.2.1.2 The system shall transfer the canister waste defined in Table 1.

Table 1. Types of Canister Waste

Type	Canister Name
Commercial SNF Disposable Canisters	MPC Small (TBV-3692)
	MPC Large (TBV-3692
	NAC STC (TBV-3692)
	NAC MPC (TBV-3692)
	NAC UMSTM/UTC (TBV-3692)
	NUHOMS® MP 187 (TBV-3692)
	TranStor™ (TBV-3692)
	WESFLEX (TBV-3692)
DOE Waste Form & SNF Disposable Canisters	NNPP Long
	NNPP Short
	NSNFP Standard Canister (18 inch/10 foot long)
	NSNFP Standard Canister (18 inch/15 foot long)
	NSNFP Standard Canister (24 inch/10 foot long)
	NSNFP Standard Canister (24 inch/15 foot long)
	Multi-Canister Overpack (MCO)
High Level Waste Canisters	West Valley Demonstration Project (TBV-455)
	Savannah River Site (TBV-455)
	Hanford Site (TBV-455)
	INEEL (TBV-455)

NOTE: See Appendix C for acronym definitions.

[F 1.1.1, 1.1.4, 1.1.9][MGR RD 3.2.C, 3.3.D]

1.2.1.3 The system shall transfer canisters from the transportation casks defined in Table 2.

Table 2. Transportation Systems

Cask Designation/Proposed System Name	Manufacturer or Owner	NRC Docket Number	Mode of Transportation
NAC-STC	NAC	71-9235	Rail
NAC-MPC	NAC	-	Rail
NUHOMS® MP-187	Vectra	71-9255	Rail
Large MPC (21P/44B)	WGESCO	71-9264 and 71-9265	HHT or Rail
Small MPC (12P/24B)	WGESCO	71-9266 and 71-9267	HHT or Rail
WESFLEX (21P/44B)	WGESCO	-	-
TranStor™	SNC	71-9268	Rail
NAC-UMS™ UTC	NAC	71-9270	Rail
Navy Long/Short (192- and 160)	Bettis	-	Rail
Proposed SRS and WVDP HLW System	-	-	-
Proposed Hanford 15-ft HLW System	-	-	Rail

NOTE: The Proposed SRS and WVDP HLW System, and Proposed Hanford 15-ft HLW System are part of the NSNFP.

NOTE: See Appendix C for acronym definitions.

NOTE: The manufacturer, NRC docket number, and mode of transportation information are provided where available.

[F 1.1.1, 1.1.4][MGR RD 3.3.D, 3.3.H, 3.4.2.B]

1.2.1.4 The system shall have the capability to transfer canister waste at a (TBD-3897) annual throughput.

[F 1.1.4, 1.1.9][MGR RD 3.2.C, 3.2.E]

1.2.1.5 The system shall support an average transportation cask turnaround time to the Regional Servicing Contractor as identified in the Table 3.

Table 3. Cask Turnaround Time

Waste Type	Transportation Mode	Waste Form	Turnaround Time (Days)
CSNF	Rail	Canistered	7 (TBV-098)
HLW	Rail	Canistered	7 (TBV-098)
NAVY SNF	Rail	Canistered	7 (TBV-098)
DOE SNF	Rail	Canistered	7 (TBV-098)

Note: See Appendix C for acronym definitions.

[F 1.1.7][MGR RD 3.4.2.A]

1.2.1.6 The system shall provide lag storage to accommodate (TBD-266) canisters.

[F 1.1.5][MGR RD 3.2.C, 3.2.E]

1.2.1.7 The system shall provide features to sample, measure, and monitor the transportation cask parameters prior to opening, as defined in Table 4.

Table 4. Parameters

Parameters	Measurement Range
Temperature	TBD-317
Pressure	TBD-317
Radiation Levels	TBD-317
Gas Analysis	TBD-317

[F 1.1.3][MGR RD 3.2.C, 3.3.A]

1.2.1.8 The system shall limit the canister temperatures to less than (TBD-3899) degrees-F while staged in the storage racks.

1.2.1.9 The system shall provide capability for off-normal canister handling.

[F 1.1.20] [MGR RD 3.4.2.D]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

1.2.2.1.1 The system shall be designed to ensure that canisters cannot be breached from any credible drop, considering each type of canister handled.

[F 1.1.14][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.2 The canister staging racks shall be designed to maintain their geometry during following a Frequency Category 2 (TBV-1246) design basis earthquake.

[F 1.1.14][MGR RD 3.1.C][10 CFR 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.3 The system design shall prevent the drop of suspended canisters during and following a Frequency Category 1 (TBV-1246) design basis earthquake.

[F 1.1.2, 1.1.14][MGR RD 3.1.C][10 CFR 63.111(b)(2), 63.112(e)(8)]

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

[F 1.1.14][MGR RD 3.1.C, 3.1.G][10 CFR 63.111(b)(2), 63.112(e)(8)]

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

[F 1.1.14][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.112(e)(8)]

1.2.2.1.6 The system shall be designed for criticality safety under normal and accident conditions. Criticality safety analyses for accident conditions are based on two unlikely, independent, and concurrent or sequential changes occurring in the conditions essential to nuclear criticality safety. Safety limits for criticality are met with a calculated effective multiplication factor (k_{eff}) below 0.95 after allowance for the bias in the method of calculation and the uncertainty in the experiments used to validate the method of calculation.

[F 1.1.14, 1.1.15][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(6)]

1.2.2.1.7 The system shall be designed to maintain control of canistered waste and permit prompt termination of operations during an emergency.

[F 1.1.14][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(10)]

1.2.2.1.8 The system shall be designed to ensure that occupational doses are as low as is reasonably achievable (ALARA) in accordance with the project ALARA 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 1.1.13, 1.1.14][MGR RD 3.1.B, 3.1.C, 3.1.G][10 CFR 63.111(a)(1), 63.112(e)(2)]

1.2.2.1.9 The system design shall define safe load paths for the movement of heavy loads to minimize the potential for drops on canister waste.

[F 1.1.14][MGR RD 3.1.C, 3.1.G][10 CFR 63.111(a)(2), 63.112(e)(8)]

1.2.2.1.10 The maximum allowable removable contamination level on the exterior surfaces of transportation casks to be shipped from the repository, as assessed by the "wiping" method, shall be less than 22 dpm/cm^2 for beta-gamma emitting radionuclides and low toxicity alpha emitting radionuclides; and 2.2 dpm/cm^2 for all other alpha emitting radionuclides. If assessment methods of equal or greater efficiency are employed, the efficiency must be considered and the maximum contamination limit may not exceed ten times the values above.

[F 1.1.6][MGR RD 3.1.G, 3.4.2.H]

1.2.2.1.11 The system shall decontaminate external surfaces of off-normal canisters to less than (TBD-3925) dpm/100 cm^2 prior to remediation.

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

1.2.2.2 Non-nuclear Safety Criteria

1.2.2.2.1 The system shall be designed to incorporate the use of noncombustible and heat resistant materials to the extent practicable.

[MGR RD 3.1.G]

1.2.2.2.2 The system design shall include provisions for decommissioning and decontamination, including the removal of potentially contaminated SSCs.

[F 1.1.17][MGR RD 3.1.C, 3.1.G][10 CFR 63.21(c)(17)]

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

[F 1.1.14, 1.1.19][MGR RD 3.1.C, 3.1.G, 3.3.A][10 CFR 63.111(a)(2), 63.112(e)(8)]

1.2.2.2.4 The system shall enable reverse operations to close casks containing canisters, return canisters from storage to casks, unload canister(s) from the DC, and place and release loads in a safe manner.

[F 1.1.14][MGR RD 3.3.A]

1.2.3 System Environmental Criteria

1.2.3.1 The system components shall be designed to withstand and operate in the temperature environment defined in Table 5, for the area in which the component is located.

Table 5. Temperature Environment

Location of System Component	Normal Environment	Off-Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	78 – 70°F Note 1	(TBD-395) °F for (TBD-395) Hours
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	92- 63°F Note 1	(TBD-395) °F for (TBD-395) Hours
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells)	106 – 63°F Note 1	(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)	74 - 70°F Note 1	74 – 70°F Note 2

See Appendix C for acronym definitions.

Note 1: Special provisions shall be provided if the specified temperature environment is not within the limits specified by the equipment manufacturer.

Note 2: 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 1.1.12][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 6, for the area in which the component is located:

Table 6. Humidity Environment

Location of System Component	Normal Environment	Off-Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	30% - 60% Note 1	Humidity Not Controlled Note 2
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	(TBD-409) Note 1	Humidity Not Controlled Note 2
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells)	(TBD-409) Note 1	Humidity Not Controlled Note 2
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	40% - 50% Note 1	Humidity Not Controlled Note 2

See Appendix C for acronym definitions.
Note 1: Special provisions shall be provided if the specified humidity environment is not within the limits specified by the equipment manufacturer.
Note 2: Humidity control is not provided due to the mild humidity environment at the repository, and the expected short duration of off-normal conditions.

[F 1.1.12][MGR RD 3.3.A]

1.2.3.3 The system shall be designed such that components susceptible to radiation can operate in and withstand the radiation environment (TBD-405) in which the component is located.

[F 1.1.12][MGR RD 3.3.A]

1.2.4 System Interfacing Criteria

1.2.4.1 The system shall receive empty DCs configured for loading from the Disposal Container Handling System.

[F 1.1.8][MGR RD 3.2.C]

1.2.4.2 The system shall receive transportation casks from the Carrier/Cask Handling System for unloading.

[F 1.1.1][MGR RD 3.2.C]

1.2.4.3 The system shall return decontaminated transportation casks to the Carrier/Cask Handling System.

[F 1.1.6][MGR RD 3.2.C]

1.2.4.4 The system shall deliver loaded DCs to the Disposal Container Handling System.

[F 1.1.10][MGR RD 3.2.C]

1.2.4.5 The system shall receive and provide the operational information, status, and control data defined in Table 7 to the Monitored Geologic Repository (MGR) Operations Monitoring and Control System.

Table 7. System Inputs/System 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 1.1.18][MGR RD 3.2.C, 3.3.K]

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

[MGR RD 3.2.C]

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

[F 1.1.11][MGR RD 3.1.C, 3.1.D, 3.3.K][10 CFR 63.78]

1.2.4.8 The system shall limit static and dynamic loads to the transportation casks, disposable canisters, DCs, facility, and support systems to within their design limits.

[F 1.1.19][MGR RD 3.3.A]

1.2.4.9 The system shall interface with the Waste Handling Building System for operating space and support services.

[MGR RD 3.2.C]

1.2.4.10 The system shall receive canister storage and loading assignments from the material control and accounting subsystem of the Safeguards and Security System to ensure thermal loading constraints are met.

[F 1.1.9]

1.2.5 Operational Criteria

1.2.5.1 The inherent availability for the Canister Transfer System shall be greater than 0.9711 (TBV-4655)

[F 1.1.1, 1.1.9, 1.1.10][MGR RD 3.2.C, 3.3.A]

1.2.5.2 The system shall include provisions for the maintenance, periodic inspection, testing, and decontamination of system equipment including recovery of remotely operated equipment.

[F 1.1.16][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(13)]

1.2.6 Codes and Standards Criteria

1.2.6.1 The system shall be designed in accordance with the applicable sections of "Occupational Safety and Health Standards" (29 CFR 1910, 1998).

[F 1.1.19][MGR RD 3.1.E]

1.2.6.2 The system shall be designed in accordance with the applicable sections of "Standard Guide for Design of Equipment for Processing Nuclear and Radioactive Materials" (ASTM C 1217-92).

[MGR RD 3.1.G]

1.2.6.3 The system shall be designed in accordance with the applicable sections of "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" (ASME NOG-1-1995).

[MGR RD 3.1.G]

1.2.6.4 The system shall be designed in accordance with the applicable sections of "Design Requirements for Light Water Reactor Fuel Handling Systems" (ANSI/ANS-57.1-1992).

[MGR RD 3.1.G]

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

[MGR RD 3.1.G]

1.2.6.6 The system shall be designed in accordance with the applicable sections of "Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes" (CMAA–70-94).

[MGR RD 3.1.G]

1.2.6.7 The system shall be designed in accordance with the applicable sections of "Specification for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist" (CMAA-74-1994).

[MGR RD 3.1.G]

1.2.6.8 The system shall be designed in accordance with the applicable sections of "Standard Specification for Boron-Based Neutron Absorbing Material Systems for Use in Nuclear Spent Fuel Storage Racks" (ASTM C992-89).

[MGR RD 3.1.G]

1.2.6.9 The system shall be designed in accordance with the applicable sections of "Design Objectives for Highly Radioactive Solid Material Handling and Storage Facilities in a Reprocessing Plant" (ANSI N305).

[MGR RD 3.1.G]

1.2.6.10 The system shall be designed in accordance with the applicable sections of "American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 Kg) or More" (ANSI N14.6-1993).

[MGR RD 3.1.G]

1.2.6.11 The system shall be designed in accordance with the applicable sections of "Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources" (IEEE Std 518-1982).

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

1.2.6.13 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]

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

[MGR RD 3.1.G, 3.3.A]

1.2.6.15 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]

1.2.6.16 The system shall be designed in accordance with applicable sections "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]

1.2.6.17 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]

1.2.6.18 The system shall be designed in accordance with the applicable sections of the "National Electrical Code" (NFPA 70, 1999).

[MGR RD 3.3.A]

1.2.6.19 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]

1.2.6.20 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]

1.2.6.21 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]

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

[MGR RD 3.3.A]

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

1.2.6.24 The system shall be constructed in accordance with the applicable sections of "Safety and Health Regulations for Construction" (29 CFR 1926).

[MGR RD 3.1.F]

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

This section will be provided 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.

Section 2 is based on "Engineering Files for Site Recommendation," Attachment II, Section 1.1.2.

2.1 SYSTEM DESIGN SUMMARY

The Canister Transfer System (CTS) receives rail transportation casks from the Carrier/Cask Handling System (CCHS) as well as empty DCs from the Disposal Container Handling System (DCHS). The system is located in the WHB. The system unloads the canisters from a cask, stages canisters (as required), loads canisters into the DC, and prepares the empty cask for offsite shipment. Cask unloading begins with cask inspection, gas sampling, and lid bolt removal operations. One or more cask lids are removed and the canisters are unloaded inside shielded hot cells. Small defense high-level waste (DHLW) or U.S. Department of Energy (DOE) spent nuclear fuel (DOE SNF) canisters are either loaded directly into a DC or are staged in the hot cell until enough canisters are available to fill a DC. Large naval DOE SNF canisters are loaded directly into a DC. Canisters that are damaged, contaminated, or received that do not meet acceptance specifications are considered off normal. Off-normal canisters are transferred to the off-normal canister handling cell for remedial processing. The system delivers a loaded DC to the DCHS. Empty transportation casks and associated components are decontaminated as required, closed, and delivered to the CCHS.

One CTS line is provided in the WHB. The line is configured to handle disposable DHLW and DOE SNF canisters and load them into a DC. The CTS line contains an airlock, cask preparation and decontamination area, canister transfer cell, and an off-normal canister handling cell. The cask preparation and decontamination area includes a cask preparation station and a cask decontamination station. The canister transfer cell consists of canister transfer upper and lower rooms, a cask unloading port, a DC loading port, an off-normal canister transfer port, a small canister staging area, and a crane maintenance area. Canister staging is provided for the accumulation of small canisters in a shielded area.

All radioactive canister transfer operations are performed remotely in the shielded canister transfer or off-normal canister handling cells. The canisters are removed from a cask one at a time using in-cell remote equipment and placed in the DC, the canister staging area, or the off-normal canister port to be transported to the off-normal canister handling cell. The equipment in the off-normal canister handling cell is provided to receive, handle and, if necessary, repackage off-normal canisters prior to final disposal in the repository. Once a DC is loaded, it is transported to the DCHS. The empty cask is returned to the cask preparation and decontamination area and the CCHS for offsite shipment.

The CTS interfaces with the CCHS for incoming and outgoing transportation casks. The CTS also interfaces with the DCHS by receiving an empty DC prepared for loading and returning a loaded DC for sealing and eventual emplacement. The CTS also interfaces with the WHB System, the WHB Electrical System, and other WHB utility systems for operational support.

2.2 DESIGN ASSUMPTIONS

The principal assumptions that were used in addition to the design criteria defined in Section 1) to develop the CTS design concept and features are provided below:

2.2.1 The canister transfer cell is divided into an upper and lower level to reduce the canister lift height (drop height) above the cell floor when moving a canister from a cask to a DC or to a canister staging position.

2.2.2 Due to the classified nature of some DOE SNF and the complexity and variety of DOE waste, the transfer and repackaging of DOE disposable canister waste is infeasible at the Monitored Geologic Repository (MGR). This approach is based on the assumption that solidified DHLW cannot be effectively removed from its canister and repackaged in a replacement canister. In addition, it is assumed that DOE SNF cannot be repackaged due to criticality concerns and the potential for extensive cell contamination during repackaging.

2.2.3 During the life of the repository, several canisters will be classified as off normal and will require remedial processing before they are accepted for loading into a DC.

2.2.4 Forty DHLW and DOE SNF canister staging area positions are required to provide in-process storage capacity for small canisters. Twenty positions are required for normal operations and twenty are required for off-normal waste handling operations.

2.3 DETAILED DESIGN DESCRIPTION

One CTS line is provided in the WHB to handle canister waste transfer throughputs and to support CTS maintenance. The CTS includes an airlock, a cask preparation and decontamination area, canister transfer cell, and an off-normal canister handling cell with a transfer tunnel connecting the two cells.

Remote handling equipment in the cask preparation and decontamination area consists of a cask transfer cart, cask preparation manipulator, and tools required to perform cask unbolting, venting, lid removal, and decontamination.

The canister transfer cell is divided into a lower and an upper with canister transfer ports employed to allow vertical canister lifts from the cask to the DC, staging area, or off-normal transfer tunnel. The upper room of the canister transfer cell includes a cask unloading port, a DC loading port, an off-normal canister transfer port, off-normal canister transfer tunnel, the staging area canister ports, and an in-cell maintenance bay. The canister transfer cell lower room includes a canister transfer station and a DC loading station. The lower room of the canister transfer cell also includes the canister staging area and the off-normal canister transfer tunnel. A canister staging rack is provided for the accumulation of 20 small canisters. This arrangement reduces the potential canister drop height during the canister transfer operation.

Remote handling equipment in the canister transfer cell includes a 65-ton overhead bridge crane (sized to handle the large naval canisters), an in-cell electromechanical manipulator, and a suite of small canister lifting fixtures. The remote equipment is designed to facilitate in-cell operations, maintenance, and recovery from off-normal events. A maintenance bay inside the canister transfer cell is used to perform contact maintenance operations. Interchangeable components are provided to support maintenance, repair, and replacement of equipment. Lay-down areas are included, as required for fixtures, tooling, and canister grapples. In the event of in-cell equipment failures, the crane and manipulator can be remotely withdrawn to the maintenance bay using off-normal and recovery operations.

A separate off-normal canister handling cell is located adjacent to the canister transfer cell and is interconnected to the transfer cell by means of the off-normal canister transfer tunnel. The cell is equipped with a small overhead crane, a bridge-mounted electromechanical manipulator, and two overpack loading and welding stations (for canisters with different diameters and heights). The loading and welding stations are located in a pit to reduce the canister lift height above the cell floor when placing a canister into the overpack. Fixtures are used at the loading and welding stations to properly position, load, and weld the various-height overpacks. A robotic welding machine, positioned between the pits, performs remote welding of a loaded overpack in either station. The cell is also equipped with a canister transfer tunnel cart, storage racks for 20 small canisters, a canister repair station, canister overpacks, remote handling fixtures, a decontamination station, and strategically located CCTV systems and shield windows.

The CTS interfaces with the CCHS to receive and transfer casks. The system interfaces with the DCHS to receive empty DCs for loading and to provide loaded DCs for welding. The WHB houses the equipment and provides the facility, utility, maintenance, safety, and auxiliary systems required to support operations, shield radioactive sources from workers, and confine contamination.

2.3.1 System Arrangement

Figure 1 provides a mechanical flow diagram for the operation of the CTS. The following subsections describe the operational steps for each CTS area in the WHB.

2.3.1.1 Airlock

A DHLW or DOE SNF transportation cask is unloaded from its rail carrier and is transferred into the CTS line from the CCHS using the carrier bay crane. The cask is upended on the rail carrier, lifted vertically, transferred to the CTS line cask transfer cart, and secured against overturning. The cask transfer cart is moved through a cask transfer corridor into the CTS line airlock. The airlock is provided with isolation doors at both ends to maintain a slightly negative air pressure in the CTS work areas compared to the carrier bay. The cask transfer cart is then used to move the cask to the cask preparation area.

2.3.1.2 Cask Preparation and Decontamination Area

One cask preparation and one cask decontamination workstation, per CTS line, is required to meet all DHLW or DOE SNF transportation cask throughput and maintenance support operations. The cask preparation operations consist of cask seal test port gas sampling, venting and purging, cask outer lid bolt de-tensioning and removal, and positioning the cask outer lid lifting fixture over the cask. The cask outer lid is removed and staged in the cask preparation area using a manipulator and hoist.

The cask preparation operations also include cask internal cavity gas sampling, cask venting and purging, cask inner lid bolt de-tensioning, positioning the cask inner lid lifting fixture over the cask, and securing the lifting fixture to the cask inner lid. For naval fuel casks, a naval fuel canister-lifting fixture is installed on the canister using the manipulator and hoist to secure the lifting fixture to the canister. The cask then is moved to the canister transfer cell using the cask transfer cart.

Once the DHLW and DOE SNF canisters are removed from the cask, empty cask preparation operations consist of moving the cask transfer cart to the cask decontamination area, removing the cask inner lid lifting fixture, and installing and tensioning the cask inner lid bolts.

For the naval fuel cask, the operations only include installing the cask outer lid, installing and tensioning the lid bolts, removing the cask outer lid lifting fixture, and performing decontamination operations on the empty cask.

The cask preparation area involves contact or remote operations using the cask preparation manipulator, hoist, and tooling. Remote operations will be performed when radiation exposure rates exceed ALARA guidelines. Upon completion of cask preparation, decontamination, and radiation protection operations, the cask is move to the carrier bay for loading onto its rail carrier.

2.3.1.3 Canister Transfer Cell

The canister transfer cell consists of an upper and lower shielded hot cell area. Casks are moved into the canister transfer cell lower level, one at a time, on the cask transfer cart. For casks containing small DHLW and DOE SNF canisters, the cask inner lid is removed and stored in the cask lid staging area in the canister transfer cell using an overhead bridge crane. Canisters are lifted vertically using the bridge crane, a grapple, and loading ports for unloading the cask and loading the DC. The bridge crane auxiliary hoist, canister grapple, and in-cell manipulator is used to grapple and lift the canister out of the cask, transfer the canister to a DC loading port position, and lower the canister directly into the DC. If canister staging is required prior to DC loading, the canisters are unloaded and transferred to staging rack positions located under ports in the floor over the canister lag storage area. The canisters staged are loaded into the next available DC to ensure available lag storage locations.

An empty DC is moved into the canister transfer cell, one at a time, on a DC transfer cart. The empty DC is brought to the lower level of the canister transfer cell from the DCHS. The canister is loaded into the DC either directly from the cask or from the canister lag storage area. If the DC is loaded with a large naval canister, the in-cell crane and manipulator are used to unbolt, remove, and stage the canister-lifting fixture. If the cask is loaded with small DHLW or DOE SNF canisters, the cask inner lid and lifting fixture are reinstalled. The loaded DC is then moved to the DC handling cell for DC closure welding, inspection, and testing. The lifting fixture, cask, and cask cart are returned to the cask preparation area.

In the cask preparation area, the cask, fixtures, and cask cart are checked for contamination. Any decontamination operations required are performed before the cask is transferred to the CCHS for offsite shipment.

2.3.1.4 Small Canister Staging

If space in the DC will not accommodate all of the DHLW or DOE SNF canisters from the incoming cask, canisters are stored in the canister staging area for subsequent loading in the next available DC. It has been determined, by simulation analyses, that 20 canister storage positions are adequate to accommodate the canisters that require staging.

2.3.1.5 Off-Normal Canister Handling

During the operating life of the repository, it is anticipated that several canisters will be classified as off-normal and handled in a manner described in this section. Only small DHLW and DOE SNF canisters are handled and remedial processing is limited to minor weld repairs, simple cutting operations, loading the canisters into disposable overpacks, and welding the overpack lid for subsurface disposal.

When required, an off-normal canister is removed using the canister transfer cell overhead crane and transferred to the off-normal canister transfer tunnel port and transfer cart. The off-normal canister is then moved to the off-normal canister cell for repair or placement into an overpack. If the canister requires only weld repair or surface repair, the canister is placed in the cell weld station and the weld repair is performed using the electromechanical manipulator and a remote welding tool. If it is determined that the canister must be placed into an overpack; it is loaded into an overpack positioned in one of the welding pits (the appropriately sized empty overpack is placed in one of the welding pits prior to loading).

An overpack lid is installed and seal-welded using the remote manipulator and welder. After weld repairs to the canister or seal welding the overpack, the weld is inspected using the appropriate non-destructive examination method. The canister or overpack is then placed in the decontamination station and decontamination operations are performed using the manipulator and the appropriate tooling. Off-normal canisters with a contamination level higher than is acceptable for DC loading are also decontaminated at the decontamination station. The repaired canisters or canister overpack is then returned to the CTS canister transfer cell using the off-normal canister transfer tunnel and cart and processed in the same manner as a standard canister.

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.

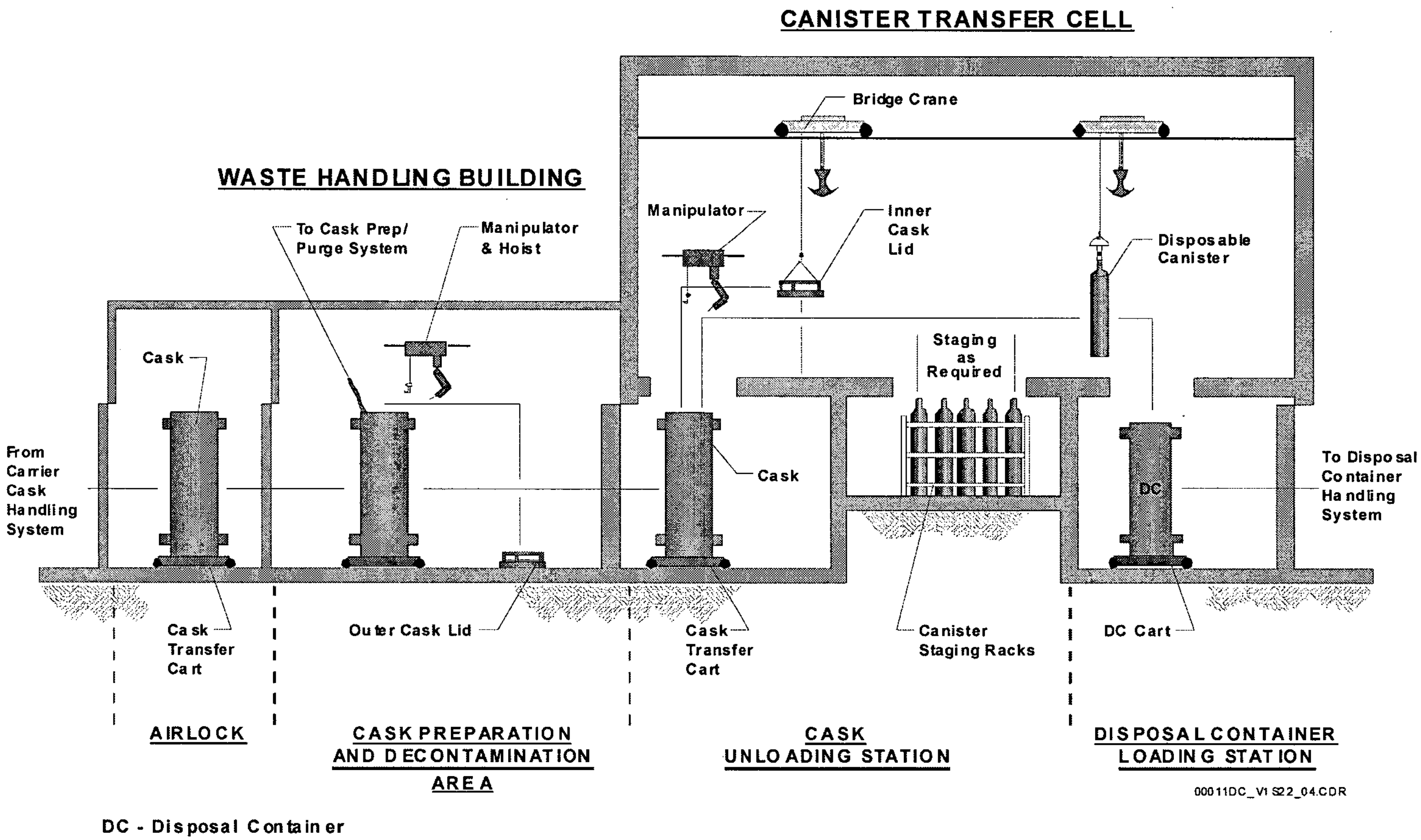

Figure 1. Canister Transfer System Operations

3. SYSTEM OPERATIONS

This section will be completed in a later revision.

4. SYSTEM MAINTENANCE

This section will be completed in a later 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 system description 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. Additional system operating life that may be needed to support performance confirmation or retrieval operations conducted after cessation of waste emplacement operations, is not covered by this criterion. To meet the operational life requirement, system components may require replacement in addition to any required preventive maintenance program.

II. Criterion Performance Parameter Basis

Performance requirement 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 plant life extensions, a 25 percent margin is added, resulting in an operational life of 40 years.

1.2.1.2 Criterion Basis Statement

1.2.1.3

I. Criterion Need Basis

This criterion defines the types and characteristics of waste to be handled by the system in support of the overall repository mission. This criterion supports MGR RD 3.2.C, and 3.3.D.

II. Criterion Performance Parameter Basis

Commercial Spent Nuclear Fuel (SNF) Disposable Canisters

The supporting analysis to confirm the disposability of the commercial SNF disposable canisters has not been performed. Preliminary information (TBV-3692) has been provided utilizing the "Monitored Geologic Repository Project Description Document"

U.S. Department of Energy (DOE) Waste Form & SNF Disposable Canisters

SNF received from the DOE Office of Environmental Management and the Navy Nuclear Propulsion Program (NNPP), will be received in disposable canisters as defined in the specific types are from the same reference as follows: Navy Nuclear Propulsion Program, National Spent Nuclear Fuel Program Standardized Canisters and Multi-Canister Overpack (MCO)

High-Level Waste (HLW) Canisters

The HLW canisters are identified in the "Characteristics of Potential Repository Wastes," Volume I, as follows: West Valley Demonstration Project Parameters - Section 3.2; Savannah River Project Parameters - Section 3.3; Hanford Site - Section 3.4; and Idaho National Engineering Laboratory - Section 3.5. The information obtained from this reference has been identified with TBV-455.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion explicitly identifies the transportation systems 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 MGR RD 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, are identified in the "Monitored Geologic Repository Project Description Document". The mode of transportation and the possible waste forms for each cask are identified in the same document.

1.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines how fast the system has to process canister waste so that the overall MGR receipt rates can be met. This criterion supports MGR RD 3.2.C and 3.2.E.

II. Criterion Performance Parameter Basis

The annual throughput quantities for Site Recommendation have not been defined. This criterion has been identified as TBD-3897.

1.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

The cask turnaround time values were obtained from input transmittal "Monitored Geologic Repository System Throughput and Cask Turnaround Rates" Table 7.2-5. This criterion contains TBV-098.

1.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the system's ability to load canister waste and to accommodate unplanned shutdowns. The need to have an acceptable mix of waste ready prior to loading the DC drives the need to stage waste until the appropriate types and numbers are available for loading. This criterion supports MGR RD 3.2.C and 3.2.E. This criterion also supports the blending requirements identified in "Monitored Geologic Repository Project Description Document" (Section 5.2.14) to meet the waste package heat output limit.

II. Criterion Performance Parameter Basis

This criterion has been identified with TBD-266. The analysis to define the storage quantities has not been performed.

1.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the MGR waste preparation process by determining the cask condition prior to opening. This criterion supports MGR RD 3.2.C and 3.3.A. The need to perform cask inspection is identified in "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988, paragraphs 6.4.2.2 and 6.4.2.3).

II. Criterion Performance Parameter Basis

The actual parameters to be evaluated have not been confirmed and, therefore, are identified with TBD-317.

1.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion has been developed to protect canisters from damage due to high temperatures. Exceeding the design basis temperature for canisters could effect the long-term performance of the disposal container.

II. Criterion Performance Parameter Basis

The temperature limit for the canisters has not be determined. This has been identified with TBD-3899.

1.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the MGR waste acceptance and transportation process by handling any canistered waste forms that require remedial processing. This criterion supports MGR RD 3.4.2.D.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from MGR RD 3.1.C, 10 CFR 63.111(a)(2), 63.111(b)(2), and 63.112(e)(8) requirements to mitigate the effects from design basis events and ensure the SSCs important to safety will perform their necessary safety functions. The drop of any canister beyond the design basis limits for breach is the bounding consequence Category 2 event for the system as identified in Table 8 of the "Preliminary Selection of MGR Design Basis Events." This criterion provides requirements for the handling of SSCs to ensure that the drop and breach of a canister is beyond a design basis event. This criterion is consistent with ALARA objectives and provides a safety margin for establishing compliance with annual dose limits for Category 1 design basis events.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from MGR RD 3.1.C, 10 CFR 63.111(b)(2), and 63.112(e)(8) requirements to mitigate the effects from design basis events and ensure the SSCs important to safety will perform their necessary safety functions. This criterion establishes a requirement on canister staging racks to withstand a Frequency Category 2 design basis earthquake to prevent criticality. The need to design SSCs important to safety to withstand the effects of a design basis earthquake is identified in Section 6.1.3.2 of the "Preliminary Selection of MGR Design Basis Events." The need to maintain criticality as a Beyond Design Basis Event is identified in Table 10 and 6.2.5.12 of the "Preliminary Selection of MGR Design Basis Events."

II. Criterion Performance Parameter Basis

The design basis earthquake frequency category has not been confirmed; therefore it has been identified with TBV-1246.

1.2.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from MGR RD 3.1.C, 10 CFR 63.111(b)(2), and 63.112(e)(8) requirements to mitigate the effects from design basis events and ensure the SSCs important to safety will perform their necessary safety functions. This criterion prevents failure of the canister staging racks by maintaining canister drops as a Beyond Design Basis Event as identified in Section 6.2.5.12 and Table 10 of the "Preliminary Selection of MGR Design Basis Events" to prevent criticality. In addition, this criterion provides requirements on canister lifting systems to prevent a radiological release in the event of a Frequency Category 1 design basis earthquake. The need to design SSCs important to safety to withstand the effects of a design basis earthquake is identified in Section 6.1.3.2 of the "Preliminary Selection of MGR Design Basis Events."

II. Criterion Performance Parameter Basis

The design basis earthquake frequency category has not been confirmed; therefore, it has been identified with TBV-1246.

1.2.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from the MGR RD 3.1.C, 3.1.G, 10 CFR 63.111(b)(2), and 63.112(e)(8) requirements to mitigate the effects from design basis events and ensure that SSCs important to safety will perform their necessary safety functions. This criterion provides requirements to prevent cranes/hoists from falling onto canister waste in the event of a Frequency Category 2 design basis earthquake. The need to design SSCs important to safety to withstand the effects of a design basis earthquake is identified in Section 6.1.3.2 of the "Preliminary Selection of MGR Design Basis Events." This criterion was also identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statement 6.3g1.

II. Criterion Performance Parameter Basis

The design basis earthquake frequency category has not been confirmed; therefore, it has been identified with TBV-1246.

1.2.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from MGR RD 3.1.C, 10 CFR 63.111(a)(2), and 63.112(e)(8) requirements to mitigate the effects from design basis events and ensure that SSCs important to safety will perform their necessary safety functions. This criterion reduces the probability of design basis events due to a loss of electrical power. The need to design SSCs important to safety to retain the load during loss of electrical power is identified in section 6.1.3.1 of the "Preliminary Selection of MGR Design Basis Events."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports criticality control for the system. This criterion is derived from MGR RD 3.1.C, 3.3.A, and 10 CFR 63.112(e)(6). The need for criticality control is identified in Section 6.2.5.12 of the "Preliminary Selection of MGR Design Basis Events."

II. Criterion Performance Parameter Basis

The performance parameters for this requirement are taken from Sections IV.1 and IV.2 (p. 6-1) of the "Standard Review Plan for Dry Cask Storage Systems" (NUREG-1536).

1.2.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies the need to provide for emergency shutdown of the system in a controlled manner. This criterion implements MGR RD 3.1.C, 3.3.A, and 10 CFR 63.112(e)(10). This criterion is also identified in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS 57.9-1992, paragraph 6.2.1.1.2).

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements the requirements from MGR RD 3.1.B for the identification of "Standards for Protection Against Radiation" (10 CFR 20); MGR RD 3.1.C for the identification of 10 CFR 63.111(a)(1) and 10 CFR 63.112(e)(2); and MGR RD 3.1.G for the need to address radiological health and safety. This criterion is also supported by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statements 6.5g1 and 6.6g1.

The primary requirement for ALARA is contained in 10 CFR 20.1101(b), which 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 Nuclear Regulatory Commission. 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 following the 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."

II. Criterion Performance Parameter Basis

The ALARA program goals are TBD-406.

1.2.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, 3.1.G, 10 CFR 63.111(a)(2), and 63.112(e)(8) for the identification of applicable criteria to reduce the potential for design basis events. Specifically, this criterion reduces the potential effects of dropping transportation casks on canister waste located below. This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statement 6.8g4.

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.G and 3.4.2.H, and defines the allowable levels of radiological contamination on the exterior surface of packages offered for shipment.

II. Criterion Performance Parameter Basis

"Shippers. General Requirements for Shipments and Packagings." (49 CFR 173, Ch. 1, Section 443) relates to allowable levels of fixed-plus removable contamination on packages of radioactive materials offered for shipment.

1.2.2.1.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.B and 3.1.C. This criterion reduces the spread of radioactive contamination and supports radiological safety for personnel as defined in "Standards for Protection Against Radiation" (10 CFR 20 (all)) and 10 CFR 63.111(a). This criterion defines the need for decontamination of canisters that are received in an off-normal condition prior to remediation.

II. Criterion Performance Parameter Basis

The actual parameters to be evaluated have not been confirmed. As a result, this criterion is identified with a TBD-3925.

1.2.2.2.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.G for fire safety requirements derived from NRC regulatory guides. The subject criterion is specifically identified in "General Fire Protection Guide for Fuel Reprocessing Plants" (Regulatory Guide 3.38), Sections C.2a and C.4a.

II. Criterion Performance Parameter Basis

N/A

1.2.2.2.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, 3.1.G, and 10 CFR 63.21(c)(17) for the need to facilitate decommissioning and decontamination at the end of the system life. This criterion was also identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statement 6.3g2.

II. Criterion Performance Parameter Basis

N/A

1.2.2.2.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, 3.1.G, 3.3.A, 10 CFR 63.111(a)(2), and 63.112(e)(8) for the identification of applicable criteria 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 was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statement 6.13g1. This criterion is also 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

1.2.2.2.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A for the identification of recovery features for equipment failures, off-normal events, and accidents. Specifically, the need for recovery features is identified in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, paragraph 6.2.1.1.11).

II. Criterion Performance Parameter Basis

N/A

1.2.3.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the flowdown of codes and standards from 3.3.A. Temperature is one of the primary environmental parameters that can 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.

II. Criterion Performance Parameter Basis

Temperature values are based on input from, "Waste Handling Building Ventilation System Description Document."

Temperature environment during off-normal conditions for all areas (except the electronics equipment areas) are TBD.

1.2.3.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the flowdown of codes and standards from and 3.3.A. Humidity is considered to be one of the primary environmental parameters that can affect the 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 SSCs are expected to operate based on the intended installation location.

Humidity is not controlled during off-normal conditions because of the generally low humidity environment at the repository, and the expected short-term duration of off-normal conditions, such as loss of power or ventilation system failure.

II. Criterion Performance Parameter Basis

Humidity values for occupied areas and electronics equipment areas are based on input from, "Waste Handling Building Ventilation System Description Document."

Humidity values for other areas are TBD.

1.2.3.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling requirements of MGR RD 3.3.A by identifying the radiation environment in which the waste handling equipment will be exposed. 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) 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.

II. Criterion Performance Parameter Basis

The radiation environment is TBD-405.

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, the empty DC needs to be received from the Disposal Container Handling System prior to SNF loading by the system.

II. Criterion Performance Parameter Basis

N/A

1.2.4.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Carrier/Cask Handling System for receiving transportation casks containing SNF for unloading.

II. Criterion Performance Parameter Basis

N/A

1.2.4.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Carrier/Cask Handling System for returning transportation casks.

II. Criterion Performance Parameter Basis

N/A

1.2.4.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Disposal Container Handling System after the DC has been loaded.

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, this criterion identifies interfaces with MGR Operations Monitoring and Control System for centralized monitoring and control. This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion also supports the interface ability to provide communications and control of MGR RD 3.3.K with this waste handling system. This criterion identifies typical summary level inputs and outputs of the system.

II. Criterion Performance Parameter Basis

N/A

1.2.4.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Waste Handling Building Electrical System for facility power.

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 casks, assemblies, and DCs handled by the system. This criterion supports MGR RD 3.3.K 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.

II. Criterion Performance Parameter Basis

N/A

1.2.4.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A for engineering principles and practices. This criterion is needed to ensure that the system is compatible with external interfacing MGR systems. Specifically, this criterion identifies interfaces with system equipment for static and dynamic loads.

II. Criterion Performance Parameter Basis

N/A

1.2.4.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports the waste handling operations of MGR RD 3.2.C. This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with the Waste Handling Building System for operating space and support services.

II. Criterion Performance Parameter Basis

N/A

1.2.4.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived as a result of the License Application Design Selection effort. This criterion plays a role in the thermal loading of the repository. The waste package power output limitation of 11.8 kW was obtained from "Monitored Geologic Repository Project Description Document" (Section 5.2.13).

II. Criterion Performance Parameter Basis

N/A

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

The value for the availability is from the "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 (TBV-4566).

1.2.5.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements applicable regulatory guidance from MGR RD 3.1.C, 3.1.G, and 10 CFR 63.112(e)(13) for maintenance, periodic inspection, testing, and decontamination of system equipment. This criterion also addresses the recovery of remotely operated equipment located in radiation environments. This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 6.3g3.

This criterion also supports MGR RD 3.3.A for the need to recover failed equipment as identified in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, paragraph 6.2.1.1.11).

II. Criterion Performance Parameter Basis

N/A

1.2.6.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.E for the identification of applicable codes of federal regulations. This criterion requires that system safety criteria be considered in the design of the repository in accordance with "Occupational Safety and Health Standards" (29 CFR 1910, 1998).

II. Criterion Performance Parameter Basis

N/A

1.2.6.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Standard Guide for Design of Equipment for Processing Nuclear and Radioactive Materials" (ASTM C 1217-92). This criterion was identified by specific guidance contained in the "Monitored Geologic

Repository (MGR) Compliance Guidance Package for the Canister Transfer System" Guidance Statement 7.18g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" (ASME NOG-1-1995). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.14g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Design Requirements for Light Water Reactor Fuel Handling Systems" (ANSI/ANS-57.1-1992). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.3g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992). This criterion was identified by specific guidance contained in the "Monitored Geologic

Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.4g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes" (CMAA-70-94). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.1g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Specification for Top Running & Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist" (CMAA-74-94). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.2g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Standard Specification for Boron-Based Neutron Absorbing Material Systems for Use in Nuclear Spent Fuel Storage Racks" (ASTM C992-89). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.17g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "Design Objectives for Highly Radioactive Solid Material Handling and Storage Facilities in a Reprocessing Plant" (ANSI N305). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.7g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards derived from NUREGs and Regulatory Guides and supports the requirements of MGR RD 3.1.G. This criterion requires the design of equipment to be in accordance with "American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 Kg) or More" (ANSI N14.6-1993). This criterion was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System" Guidance Statement 7.6g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. This criterion defines the engineering and installation practices that will be used in the design of the repository to protect against electromagnetic interference. This criterion requires the design of equipment to be in accordance with "Guide for the

Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources" (IEEE Std 518-1982).

The ability of the control system to perform according to the manufacturers' guarantees is dependent on the quality of the signal of the attached transducer. The signal quality will depend on the elimination or attenuation of noise on the transducers' signal. Two types of external noise that will be picked up on the signal leads are normal mode and common mode. Engineering practices do not intend to recommend an internal design of equipment or for the prevention of the generation of electrical noise resulting from equipment operation. All electrical noise can be protected against with proper installation. Most noise will be eliminated by following industry guides (such as IEEE) that suggest a systematic approach to eliminating noise interference with electrical controllers. Most popular guides on noise elimination follow simple industry rules such as spacing recommendations, shielded cable, separate instrument and safety ground systems. A large percentage of noise interference will be eliminated with adequate design guides and proper planning. However, even in the most stringent installations a small percentage of signals will be affected by external noise usually due to ground loops, improper installation, or an unshielded signal. The small percentage of affected signals are caught and corrected during system checkout.

II. Criterion Performance Parameter Basis

N/A

1.2.6.12 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 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 an earlier version of MIL-STD-1472).

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 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

1.2.6.14 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 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.

This criterion supports MGR RD 3.1.G and was identified by specific guidance contained in the "Monitored Geologic Repository (MGR) Compliance Program Guidance Package for the Canister Transfer System," Guidance Statement 6.9g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.15 Criterion Basis Statement

I. Criterion Need Basis

Information being communicated by safety signs and tags must be capable of being quickly and easily read and uniformly understood. The ANSI Z535 series (i.e., "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

1.2.6.16 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), 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

1.2.6.17 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), 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

1.2.6.18 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. The "National Electrical Code" (NFPA- 70, 1999) 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

1.2.6.19 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. 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

1.2.6.20 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. "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

1.2.6.21 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. 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

1.2.6.22 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies applicable codes and standards and supports the requirements of MGR RD 3.3.A. 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

1.2.6.23 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

1.2.6.24 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.F for the identification of applicable codes of federal regulations. This criterion requires that system safety criteria be considered in the construction of the repository in accordance with "Safety and Health Regulations for Construction" (29 CFR 1926).

II. Criterion Performance Parameter Basis

N/A

APPENDIX B ARCHITECTURE AND CLASSIFICATION

The System architecture and QA classification are identified in Table 8. The QA classifications are established in "Classification of the MGR Canister Transfer System."

Table 8. System Architecture and QA Classification

Canister Transfer System (CTS)	QL-1	QL-2	QL-3	CQ
Canister Handling System				
Bridge Crane/Hoist		X		
DC Loading Manipulator				X
Lifting Fixtures				X
Small Canister Staging Racks	X			
Cask Preparation System				
Cask Decontamination System		X		
Cask Inspection and Sampling System				X
Cask Preparation Manipulator			X	
Cask Transport System				X
Control and Tracking System		X		
DC Transport System				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
ALARA	As Low as Reasonably Achievable
CCHS	Carrier/Cask Handling System
CSNF	Commercial Spent Nuclear Fuel
CQ	Conventional Quality
CTS	Canister Transfer System
DC	Disposal Container
DCHS	Disposal Container Handling System
DOE	U.S. Department of Energy
DPC	Dual-Purpose Canister
EFSR	Engineering Files for Site Recommendation
F	Function
HFE	Human Factors Engineering
HHT	Heavy Haul Truck
HLW	High-Level Waste
IEEE	Institute of Electrical and Electronics Engineers
INEEL	Idaho National Engineering and Environmental Laboratory
IP	Immobilized Plutonium
MGR	Monitored Geologic Repository
MGR RD	Monitored Geologic Repository Requirements Document
MPC	Multi-Purpose Canister
NAC	Nuclear Assurance corporation (NAC) International, Inc.
NNPP	Navy Nuclear Propulsion Program
NSNFP	National Spent Nuclear Fuel Program
NUHOMS®	Nutech Horizontal Modular System®
QA	Quality Assurance
QL	Quality Level
SNC	Sierra Nuclear Corporation
SNF	Spent Nuclear Fuel
SRS	Savannah River Site
SSCs	Structures, Systems, and Components
STC	Storage and Transportation Cask or Canister
TBD	To Be Determined
TBV	To Be Verified
UCF	Uncanistered Commercial Fuel
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
cm	centimeters
dpm	disintegration per minute
k_{eff}	k effective
kW	kilowatt

APPENDIX D FUTURE REVISION RECOMMENDATIONS AND ISSUES

None.

APPENDIX E REFERENCES

This section provides a listing of references used in this SDD. References list the Accession number or Technical Information Catalog number at the end of the reference, where applicable.

"Accident Prevention Tags (for Temporary Hazards)." National Electrical Manufacturers Association. ANSI Z535.5-1998. 1998. Rosslyn, Virginia: National Electrical Manufacturers Association. TIC: 242949.

"American National Standard For Human Factors Engineering of Visual Display Terminal Workstations." American National Standards Institute. ANSI/HFS 100-1988. 1988. Santa Monica, California: The Human Factors Society, Inc. TIC: 211186.

"American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10000 Pounds (4500 Kg) or More." American National Standards Institute. ANSI N14.6-1993. 1993. New York, New York: American National Standards Institute. TIC: 236261.

"Application of Safety Instrumented Systems for the Process Industries." Instrument Society of America. ANSI/ISA-S84.01-1996. February 15, 1996. Research Triangle Park, North Carolina: Instrument Society of America. TIC: 244098.

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"Criteria for Safety Symbols." National Electrical Manufacturers Association. ANSI Z535.3-1998. 1998. Rosslyn, Virginia.: National Electrical Manufacturers Association. TIC: 242943.

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