OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEM DESCRIPTION DOCUMENT COVER SHEET

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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEM DESCRIPTION DOCUMENT REVISION HISTORY

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3. Revision	4. Description of Revision
00	Initial Issue (issued using document identifier BCB000000-01717-1705-00032).
01	This revision is a complete rewrite of the previous issuance, driven largely by the use of an alternate source of regulatory requirements, the implementation of the License Application Design Selection effort, and the use of a new document development procedure.
01 ICN 01	This revision updates Section 1 for references that have changed, deletes the contents of Section 1.4 as directed by management, and adds Section 2.

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SUMMARY

The Waste Package Remediation System remediates waste packages (WPs) and disposal containers (DCs) in one of two ways: preparation of rejected DC closure welds for repair or opening of the DC/WP. DCs are brought to the Waste Package Remediation System for preparation of rejected closure welds if testing of the closure weld by the Disposal Container Handling System indicates an unacceptable, but repairable, welding flaw. DC preparation of rejected closure welds will require removal of the weld in such a way that the Disposal Container Handling System may resume and complete the closure welding process. DCs/WPs are brought to the Waste Package Remediation System for opening if the Disposal Container Handling System testing of the DC closure weld indicates an unrepairable welding flaw, or if a WP is recovered from the subsurface repository because suspected damage to the WP or failure of the WP has occurred. DC/WP opening will require cutting of the DC/WP such that a temporary seal may be installed and the waste inside the DC/WP removed by another system.

The system operates in a Waste Package Remediation System hot cell located in the Waste Handling Building that has direct access to the Disposal Container Handling System. One DC/WP at a time can be handled in the hot cell. The DC/WP arrives on a transfer cart, is positioned within the cell for system operations, and exits the cell without being removed from the cart. The system includes a wide variety of remotely operated components including a manipulator with hoist and/or jib crane, viewing systems, machine tools for opening WPs, and equipment used to perform pressure and gas composition sampling. Remotely operated equipment is designed to facilitate DC/WP decontamination and hot cell equipment maintenance, and interchangeable components are provided where appropriate.

The Waste Package Remediation System interfaces with the Disposal Container Handling System for the receipt and transport of WPs and DCs. The Waste Handling Building System houses the system, and provides the facility, safety, and auxiliary systems required to support operations. The system receives power from the Waste Handling Building Electrical System. The system also interfaces with the various DC 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. SYSTEM FUNCTIONS AND DESIGN CRITERIA

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

1.1 SYSTEM FUNCTIONS

1.1.1 The system receives, transports, and returns DCs/WPs containing uncanistered spent nuclear fuel and canistered waste to and from the Disposal Container Handling System for remediation.

1.1.2 The system unseals normal, defective, and/or partially welded DCs/WPs.

1.1.3 The system prepares rejected, but repairable, closure welds for re-welding.

1.1.4 The system provides a temporary lid for opened DCs/WPs.

1.1.5 The system collects process remediation operation fines and waste.

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

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

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

1.1.9 The system provides features and equipment for reducing the risk of, responding to, and recovering from abnormal events and credible accidents.

1.1.10 The system decontaminates DCs/WPs prior to transport to the Disposal Container Handling System.

1.1.11 The system limits the spread of radioactive contamination from the system.

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

1.1.13 The system provides features to stage removed DC/WP lids to support system operations.

1.1.14 The system provides features to transfer DC/WP lids for disposal.

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

1.2 SYSTEM DESIGN CRITERIA

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

1.2.1 System Performance Criteria

1.2.1.1 The system shall have an operational life of 50 years after initiation of waste emplacement.

[F 1.1.1, 1.1.2, 1.1.3][MGR RD 3.2.C, 3.2.H, 3.3.L]

1.2.1.2 The system shall include provisions that support a deferral of closure for up to 300 years after initiation of waste emplacement with appropriate maintenance.

[F 1.1.2][MGR RD 3.2.H, 3.3.L]

1.2.1.3 The system shall unseal and prepare for rewelding normal, defective, partially welded, and weld rejected DCs/WPs.

[F 1.1.2, 1.1.3][MGR RD 3.2.C, 3.3.L]

1.2.1.4 Reserved

1.2.1.5 The system shall prepare a DC with a rejected weld such that it may be rewelded.

[F 1.1.3][MGR RD 3.2.C]

1.2.1.6 The system shall open uncanistered spent nuclear fuel DCs/WPs in a way that the waste may be removed and to accommodate the installation of a temporary lid.

[F 1.1.2, 1.1.4, 1.1.11][MGR RD 3.3.L]

1.2.1.7 The system shall provide a temporary lid for opened uncanistered spent nuclear fuel DCs/WPs.

[F 1.1.4, 1.1.11][MGR RD 3.3.L]

1.2.1.8 The system shall handle and store DC/WP lids.

[F 1.1.13][MGR RD 3.3.L]

1.2.1.9 The system shall be capable of remediating up to nine DCs/WPs per year during the first 40 years of the system's operational life and one WP per year during the remaining years of the system's operational life.

[F 1.1.1, 1.1.2, 1.1.3][MGR RD 3.2.C, 3.2.K, 3.3.L]

1.2.1.10 The system shall decontaminate the DC/WP external surfaces to less than (TBD-169) dpm/100 cm^2 prior to leaving the system.

[F 1.1.1, 1.1.10][MGR RD 3.1.B, 3.1.C, 3.3.L][10 CFR 63.111(a)(1)]

1.2.1.11 The system design shall include provisions for decommissioning and decontamination including the removal of potentially contaminated structures, systems, and components (SSCs).

[F 1.1.15][MGR RD 3.1.B, 3.1.C][10 CFR 63.21(c)(17)]

1.2.1.12 The system shall provide a means to collect solid, liquid, and gaseous waste resulting from WP remediation operations.

[F 1.1.5][MGR RD 3.3.G]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

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

[F 1.1.9][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.2 The system cranes and hoists shall be designed to retain suspended loads during and after Frequency Category 1 (TBV-1246) design basis earthquake.

[F 1.1.9][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

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

[F 1.1.9][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

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

[F 1.1.9][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

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

[F 1.1.9][MGR RD 3.1.B, 3.1.C, 3.4.2.C][10 CFR 63.111(a)(1), 63.111(a)(2), 63.111(b)(2), 63.112(e)(10), 63.112(e)(8)]

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

[F 1.1.8, 1.1.9][MGR RD 3.1.B, 3.1.C][10 CFR 63.111(a)(1)]

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

[F 1.1.8, 1.1.9][MGR RD 3.1.B, 3.1.C, 3.1.G][10 CFR 63.111(a)(1)]

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

[F 1.1.9][MGR RD 3.1.C][10 CFR 63.112(e)(10)]

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

[F 1.1.9][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(8)]

1.2.2.2 Non-nuclear Safety Criteria

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

1.2.3 System Environment Criteria

1.2.3.1 The system components shall be designed to withstand and operate in the temperature environment defined in Table 1 for the area in which the component is located.

Table 1. Temperature Environment

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

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

[F 1.1.7][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 2 for the area in which the component is located.

Table 2. Humidity Environment

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

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

[F 1.1.7][MGR RD 3.3.A]

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

[F 1.1.7][MGR RD 3.3.A]

1.2.4 System Interfacing Criteria

1.2.4.1 The system shall receive and provide the operational information, status, and control data defined in Table 3 to the Monitored Geologic Repository Operations Monitoring and Control System.

Table 3. System Inputs/Outputs

Inputs	Outputs
Radiation monitoring system data and status	Equipment status and status of operations
WP identification and 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
Monitored Geologic Repository (MGR) operational alarm status	Control loads left in improper states (suspended loads, unattended controls, etc.)
Supervisory control	

[F 1.1.1, 1.1.2, 1.1.3][MGR RD 3.2.C, 3.3.K, 3.3.L]

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

[F 1.1.1, 1.1.2, 1.1.3][MGR RD 3.2.C, 3.3.A, 3.3.L]

1.2.4.3 The system shall limit handling and dynamic loads to the waste forms, DCs/WPs, facility, and support systems to within their design limits.

[F 1.1.1, 1.1.2, 1.1.3][MGR RD 3.3.A, 3.4.2.C]

1.2.4.4 The system shall be designed to transfer DC/WP lids to the Disposal Container Handling System.

[F 1.1.2, 1.1.13, 1.1.14][MGR RD 3.3.L]

1.2.4.5 The system shall transfer collected process fines and wastes to the Site Generated Radiological Waste Handling System.

[F 1.1.2, 1.1.3, 1.1.5][MGR RD 3.1.C, 3.3.G][10 CFR 63.21(c)(17)]

1.2.4.6 Reserved

1.2.4.7 The system shall accommodate a WP maximum surface dose rate of 1410 rad/hr (TBV-248).

[F 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.13, 1.1.14][MGR RD 3.2.C, 3.3.L]

1.2.4.8 The system shall accommodate a maximum WP thermal output of 11.8 kW (calculated at the time of emplacement).

[F 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.13, 1.1.14][MGR RD 3.2.C, 3.3.L]

1.2.4.9 The system shall accommodate DC/WP inner barriers constructed of stainless steel (nuclear grade 316) a minimum of 5-cm thick, and outer barriers constructed of alloy 22 a minimum of 2-cm thick.

[MGR RD 3.2.C, 3.3.L]

1.2.4.10 The system shall provide features to obtain the WP unique identifiers and storage locations for data input into the Safeguards and Security System.

[F 1.1.6][MGR RD 3.1.C, 3.1.D, 3.3.K][10 CFR 63.78]

1.2.5 Operational Criteria

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

[F 1.1.12][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(13)]

1.2.6 Codes and Standards Criteria

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

[MGR RD 3.1.E]

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

[MGR RD 3.1.G]

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

[MGR RD 3.1.G]

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

[MGR RD 3.1.G]

1.2.6.6 The system shall be designed in accordance with the applicable provisions of "Design Objectives for Highly Radioactive Solid Material Handling and Storage Facilities in a Reprocessing Plant" (ANSI N305-1975).

[MGR RD 3.1.G]

1.2.6.7 Overhead and gantry cranes, if used, shall be designed in accordance with "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" (ASME NOG-1-1995).

[MGR RD 3.1.G]

1.2.6.8 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]

1.2.6.9 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]

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

[MGR RD 3.3.A]

1.2.6.11 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]

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

[MGR RD 3.3.A]

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

Requirements" (ISO 9241-3), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours" (ISO 9241-8).

[MGR RD 3.3.A]

1.2.6.14 The system shall be designed in accordance with applicable sections of "Guidelines for Designing User Interface Software" (ESD-TR-86-278, January 1986), "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]

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

[MGR RD 3.3.A]

1.2.6.16 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]

1.2.6.17 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]

1.2.6.18 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]

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

[MGR RD 3.3.A]

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

1.2.6.21 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 3.3.A]

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

[MGR RD 3.1.G]

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

This section will be provided in a future revision.

2. DESIGN DESCRIPTION

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

2.1 SYSTEM DESIGN SUMMARY

The description given in this section is taken from "Engineering Files for Site Recommendation," Attachment II, Sections 1.1.4.1 and 1.1.4.2.

The system performs remedial action on defective DCs and recovered WPs (a DC becomes a WP after the DC closure welds are accepted). The system receives DCs and WPs from, and delivers them to, the Disposal Container Handling System. The system receives only DCs that have failed the weld examination processes in the Disposal Container Handling System and any WPs selected to be recovered from the subsurface and opened. This system is located inside the Waste Handling Building (WHB) and is directly connected to the Disposal Container Handling System. All remedial operations are performed remotely in a shielded system hot cell. Due to an expected low closure weld inspection failure frequency and WP recovery frequency, only one DC or WP at a time will be handled in the system cell.

If examination of the closure weld in the Disposal Container Handling System indicates an unacceptable, but repairable, welding defect, the DC is transferred to the Waste Package Remediation System for preparation for re-welding. Correction of rejected closure welds will require removal of the weld material in such a way that the Disposal Container Handling System may resume and complete the closure welding process. If examinations by the Disposal Container Handling System indicate that the DC closure weld defect cannot be repaired, the DC is opened in the system cell. If a WP is recovered from the subsurface repository due to suspected damage or WP failure, the WP is also opened in the system cell. WP and DC opening require remote cutting of the closure weld for each of the lids, collection and processing of the cutting waste, and removal and staging of the lids. Spent nuclear fuel and high-level waste removal from an opened WP and DC is facilitated by transferring the opened DC/WP to either the Assembly or Canister Transfer System, where the waste is removed and loaded into a new DC.

The current conceptual design of the system addresses only operation during the WHB design life of 40 years, which encompasses the MGR emplacement period. Future conceptual designs will address the remaining operating life of the system, which could include a modification and re-qualification of the WHB, or all of the system capabilities would have to be provided in a separate facility constructed

prior to the end of the WHB 40-year life. The system is capable of remedial operations for up to nine DCs/WPs per year during the first 40 years of the system's operational life and one WP per year for the remaining years of its operational life (the system capacity reduction is due to the cessation of emplacement operations).

The system interfaces with the Disposal Container Handling System for the receipt and delivery of WPs and DCs. The Waste Handling Building System houses the system, and provides the facility, safety, and auxiliary systems supporting the operations. The system receives power from the Waste Handling Building Electrical System.

2.2 DESIGN ASSUMPTIONS

The description given in this section is taken from "Engineering Files for Site Recommendation," Attachment II, Section 1.1.4.2.2.

2.2.1 The DC/WP preparation, staging, examination, repair, opening, and decontamination operations will be performed in a shielded hot cell using remote handling equipment. Remote/robotic technology readily available in the nuclear industry will be used to perform or support these operations to ensure that personnel radiation exposure rates are consistent with ALARA principles.

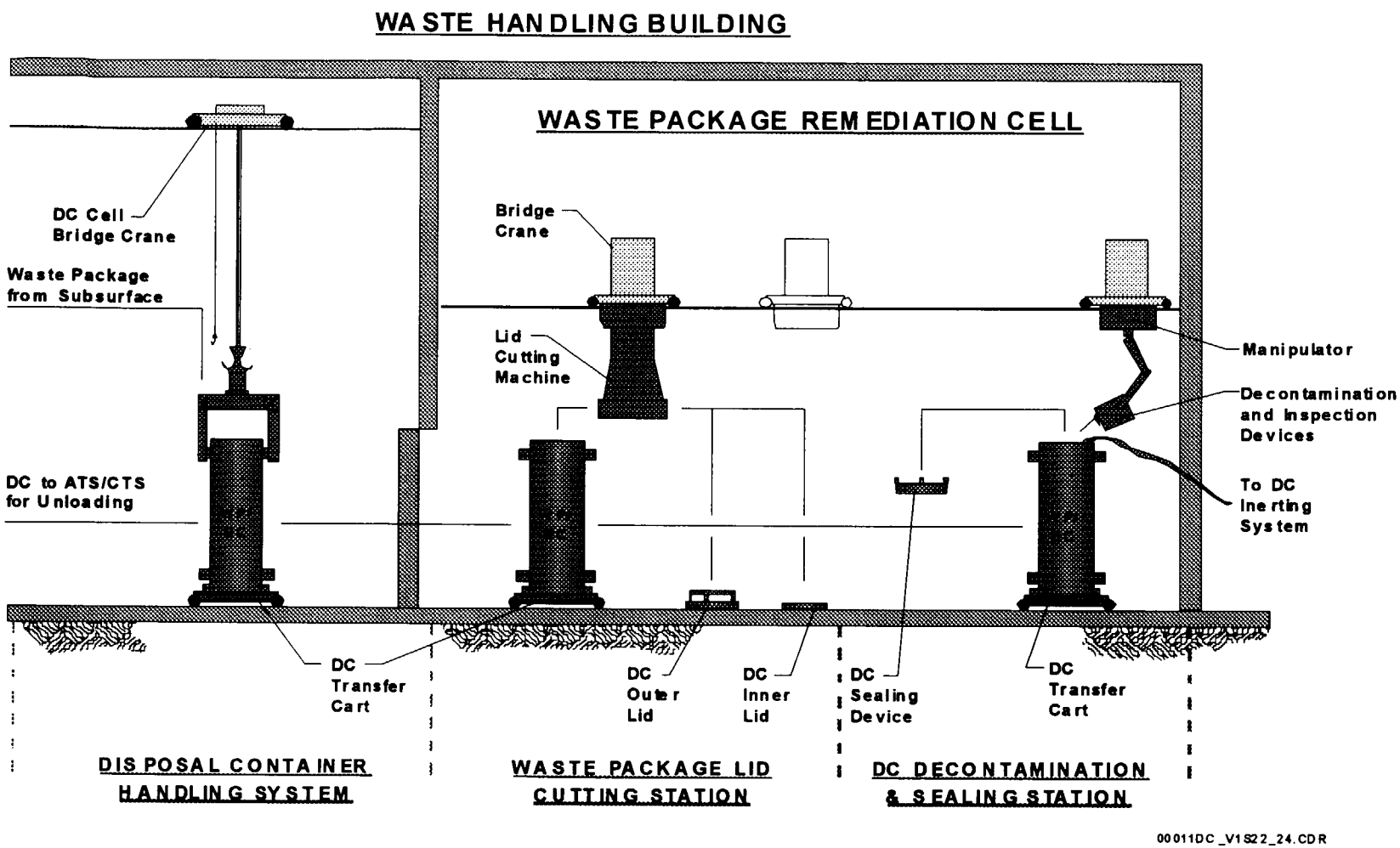
2.2.2 The System will install a temporary DC lid sealing device (to compensate for an absent innermost lid) to prevent spread of contamination to other systems, to permit evacuation of internal DC gases, and to permit backfill of opened DCs with inert gas that excludes oxygen from spent nuclear fuel assemblies.

2.3 DETAILED DESIGN DESCRIPTION

The description given in this section is taken from "Engineering Files for Site Recommendation," Attachment II, Sections 1.1.4.2.3 and 1.1.4.2.4.

Figure 1 provides a mechanical flow diagram for the operations of the system. The operational steps in the diagram for the system are described below.

One DC or WP at a time can be handled in the system cell. The system operations are all performed remotely in a shielded hot cell. All remotely operated equipment is designed to facilitate decontamination, removal or in-cell manual maintenance, and replacement of interchangeable components, as required.



DC - Disposal Container
WP - Waste Package
ATS - Assembly Transfer System
CTS - Canister Transfer System

Figure 1. Waste Package Remediation System Mechanical Flow Diagram

The system cell is accessed directly from the Disposal Container Handling System hot cell by opening a shielding door. The DCs/WPs are delivered to the system hot cell from the Disposal Container Handling System for remedial action only if the DC fails the weld acceptance tests, or if WP failure or damage has been detected or suspected. The DC/WP arrives on a DC transfer cart and is remotely positioned at one of two workstations within the cell. One of the workstations is for DC/WP weld preparation and lid removal; and the other workstation is for DC/WP inspection, temporary sealing, decontamination, purging, and backfill of the DC/WP interior with inert gas.

Remedial operations for rejected DC/WP closure welds may require removal of the weld in such a way that the re-welding of the DC closure can be performed in the DC handling cell weld station in the Disposal Container Handling System. If the examination of the DC closure weld indicates an irreparable welding defect, or suspected failure or damage to a retrieved WP, opening operations will be required. WP and DC opening require remote cutting of the closure weld for each of the lids, removal and staging of the lids, collection and processing of cutting fines, and removal and disposal of cutting-waste. Additional operations include installation of a temporary sealing device to confine contamination inside the DC/WP, purging of oxidizing gases, and backfill of the DC with inert gas. After temporary sealing, the DC/WP is sampled for contamination, decontaminated as required, and returned to the Disposal Container Handling System, where the DC is transferred to the Assembly Transfer System for fuel assembly unloading or to the Canister Transfer System for canister unloading. The DC/WP exits the system cell after remedial operations without being removed from the DC transfer cart. The emptied DC is removed from the WHB using the Disposal Container Handling System or the Canister Transfer System.

2.3.1 System Arrangement

All radioactive DC/WP remedial operations within the system are performed remotely inside a shielded hot cell. An operating gallery surrounds the cell on three sides. The design, configuration, and equipment arrangement for the cell are based on the design and layout of the WHB. The system includes a wide variety of remotely operated equipment including an overhead bridge crane, an in-cell multi-purpose electromechanical manipulator, a lid cutting machine, and closed-circuit television monitoring systems ("WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.1.5).

Specialized tools and remotely controlled equipment are used to remove defective welds and lids, temporarily seal an open DC, collect cutting-waste, and decontaminate the DC. All remotely operated equipment is designed to facilitate decontamination, equipment maintenance, and replacement of interchangeable components ("Engineering Files for Site Recommendation," Attachment II, Section 1.1.4.2.3; and "WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.1.5).

Maintenance access to the cell for removal of large equipment components is achieved by removing the cell ceiling access hatch and transferring the equipment to a contaminated equipment room using the overhead transfer corridor bridge crane ("WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.2.2).

2.3.2 Other System Features or Characteristics

The system incorporates the enhancements described in the following sections.

2.3.2.1 Direct Viewing

In addition to strategically located, remotely controlled video cameras inside the cell and closed-circuit television monitors in the galleries, a number of shielding windows are placed at different elevations and locations. The windows give the operators a direct view of the work being performed on the DC/WP ("WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.2.1).

2.3.2.2 Maintenance

Operating items that require maintenance attention and that cannot be serviced remotely in-cell are remotely removed from the cell and transferred to the contaminated equipment rooms in the WHB. These items exit the cell by removing the ceiling hatch and by using the WHB transfer corridor bridge crane ("WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.2.2).

2.3.2.3 Personnel Access

Occasionally, personnel may have to enter the cell for corrective or scheduled maintenance. Personnel access doors and shielded entries will be provided to allow human entries conducted according to maintenance procedures and established safety and radiation protection programs ("WHB/WTB Space Program Analysis for Site Recommendation," Section 6.2.4.5).

2.4 COMPONENT DESCRIPTION

This section will be provided in a future revision.

2.5 CRITERIA COMPLIANCE

This section will be provided in a future revision.

3. SYSTEM OPERATIONS

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

4. SYSTEM MAINTENANCE

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

APPENDIX A CRITERION BASIS STATEMENTS

This section presents the criterion basis statements for criteria in Section 1.2. Descriptions of the traces to 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 SDD.

1.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support the waste handling operations at the repository as required by MGR RD 3.2.C. In addition, the system must continue operations until repository closure to support the WP recovery contingency of MGR RD 3.3.L.

II. Criterion Performance Parameter Basis

The operational life is taken directly from MGR RD 3.2.H.

1.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the additional length of time the system may be asked to operate to allow future generations to continue monitoring the repository. The system must continue operations until repository closure to support the WP recovery contingency of MGR RD 3.3.L.

II. Criterion Performance Parameter Basis

The provisional life is taken directly from MGR RD 3.2.H.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the basic function of the system. This criterion supports MGR RD 3.2.C and 3.3.L.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 6.5g6.

II. Criterion Performance Parameter Basis

N/A

1.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the need for the system to prepare a DC with a rejected weld so that it may be sent back to the Disposal Container Handling System and rewelded. This capability supports the packaging of waste as required by MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the need for the system to open DCs/WPs in such a manner that a temporary lid may be installed (for limiting the spread of contamination prior to DC/WP unloading) in support of MGR RD 3.3.L.

II. Criterion Performance Parameter Basis

N/A

1.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This requirement establishes the need for a temporary seal for an opened DC/WP. The temporary seal will limit the spread of contamination during DC/WP transfer. This requirement is a lower level decomposition of the DC/WP opening and transfer ability required by MGR RD 3.3.L.

II. Criterion Performance Parameter Basis

N/A

1.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the need for the system to handle and store the lids that are removed from opened DCs/WPs. This criterion is a lower level decomposition of the DC/WP opening ability required in MGR RD 3.3.L

II. Criterion Performance Parameter Basis

N/A

1.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the minimum ability for the system to properly support MGR operations for packaging waste (through weld repair support, MGR RD 3.2.C) and opening recovered WPs on a contingency basis (MGR RD 3.3.L).

II. Criterion Performance Parameter Basis

The throughput numbers are taken from the following Criterion Basis Statement Analysis. The length of time used for the initial throughput is established after the analysis.

Criterion Basis Statement Analysis: Waste Package Remediation System Throughput

Purpose

The purpose of this analysis is to establish the maximum yearly rate at which the system must handle DCs/WPs.

Assumptions

1. The probability of a welding defect in the closure weld requiring WP remediation is 1/100. This is a reasonable estimate based on engineering judgement and welding industry experience.

2. The system will not be needed for full scale retrieval operations. This assumption is consistent with MGR RD 3.2.K.

Criteria Analysis

The required throughput capability of the system should be enough to handle the maximum yearly demand on the system. This maximum yearly demand is dominated by

the need for repairing defective DC closure welds detected upon inspection of the weld just after the welding operation. Additional minor demand on the system may come from the recovery of a breached, damaged, or malfunctioning WP.

The probability of expected closure weld defects is 1/100 (Assumption 1). The peak number of WPs emplaced for the baseline waste stream per year and the extended baseline waste stream per year as considered in the "Waste, Quantity, Mix and Throughput Study Report" are as follows (from Tables K-1 and K-3):

	Co-disposal	No co-disposal
Baseline waste stream	531	660
Extended baseline waste stream	588	775

Thus, the range of DCs that can be expected to be remediated by the system per year due to a weld defect will be between (1/100 x 531) 5.31 DCs and (1/100 x 775) 7.75 DCs.

The probability of a preclosure early failure of a WP is equal to 1 x 10E-5 ("Design Basis Frequency and Dose Calculation for Site Recommendation," Table 7). The total number of WPs emplaced for the baseline waste stream and the extended baseline waste stream as considered in the "Waste, Quantity, Mix and Throughput Study Report" are as follows (from Tables K-2 and K-4):

	Co-disposal	No co-disposal
Baseline waste stream	10,310	12,384
Extended baseline waste stream	15,030	18,112

Thus, the maximum number of WPs that could be expected to be remediated by the system per year due to a preclosure early failure of a WP will be between (1 x 10E-5 x 10,310) 0.1031 WPs and (1 x 10E-5 x 18,112) 0.18122 WPs. Accepting that the probability of a remediation due to preclosure early failure of a WP is non-zero, the maximum number used in this analysis will be rounded up to one WP per year.

The maximum yearly rate at which the system must handle DCs is the sum of the number of DCs with flawed welds and the number of WPs that have failed. This number ranges from (5.31 + 1) 6.31 DCs/WPs to (7.75 + 1) 8.75 DCs/WPs per year. Rounding up to the nearest whole number gives a maximum rate of seven to nine DCs/WPs per year. The difference of two DCs/WPs per year is due to the inclusion of the extended baseline waste stream. This does not cause a great difference in the maximum expected number of DCs to be handled by the system and provides a reasonable upper bound to the expected throughput of the system. Thus, it is the recommendation of this analysis that the capability to handle the increased load due to the extended baseline waste stream (which should additionally handle any perturbations in the baseline waste stream) be required of the system.

Since the system will be called upon to remediate closure weld defects only during the emplacement period, it is recommended that an emplacement period throughput of nine

DCs/WPs per year be specified, and a caretaker period throughput of one WP per year be specified.

Conclusion

The system shall be capable of processing nine DCs/WPs per year during the emplacement period and one WP per year during the caretaker period.

* The use of unqualified input in this analysis was necessary to establish the bounding characteristics for the design criteria. The inclusion of this input does not disqualify the results of the analysis due to the conservative margin used in establishing the bounding design criteria.

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

1.2.1.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.B, 3.1.C, and 10 CFR 63.111(a)(1). 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), Subpart C. Decontamination of DCs/WPs is also required by MGR RD 3.3.L.

II. Criterion Performance Parameter Basis

N/A

1.2.1.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and 10 CFR 63.21(c)(17) for the need to facilitate decommissioning at the end of the system life. This criterion also supports MGR RD 3.1.B and "Standards for Protection Against Radiation" (10 CFR 20, Subpart E).

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 6.4g2 and 6.5g2.

II. Criterion Performance Parameter Basis

N/A

1.2.1.12 Criterion Basis Statement

I. Criterion Need Basis

Material will be removed during the preparation of closure welds for rewelding and during DC/WP examination and opening. These process fines and wastes must be collected and properly disposed of. This criterion implements the collection aspect of MGR RD 3.3.G.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 6.4g1 and 6.5g1.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

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

Compliance with "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable" (Regulatory Guide 8.8) is invoked because this regulatory guide is one of the primary regulatory documents that addresses ALARA and is acceptable to the U.S. 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 compliance with the applicable guidelines in Regulatory Guide 8.8, the design of the system must meet the project ALARA program goals. The project ALARA program will include both qualitative and quantitative goals. Regarding the ALARA program of a licensee, Section C.1.a(2) of Regulatory Guide 8.8 states: "The policy and commitment should be reflected in written administrative procedures and instructions for operations involving potential exposures of personnel to radiation and should be reflected in station design features. Instructions to designers, constructors, vendors, and station personnel specifying or reviewing station features, systems, or equipment should reflect the goals and objectives to maintain occupational radiation exposures ALARA."

This criterion supports MGR RD 3.1.G and is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 6.4g4, 6.5g4, 6.6g1, and 6.7g1.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, 3.3.A, and 10 CFR 63.112(e)(8) for the identification of applicable regulatory requirements to reduce the potential for design basis events. Specifically, this criterion identifies the need to detect changes in lifting loads during handling to protect SSCs from damage and reduce the potential for design basis events. This criterion is supported by "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988, paragraph 6.5.2.16).

II. Criterion Performance Parameter Basis

N/A

1.2.3.1 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion supports MGR RD 3.3.A

II. Criterion Performance Parameter Basis

Temperature values are based on Criterion 1.2.1.1 of "Waste Handling Building Ventilation System Description Document."

1.2.3.2 Criterion Basis Statement

I. Criterion Need Basis

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

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

This criterion supports MGR RD 3.3.A.

II. Criterion Performance Parameter Basis

Humidity values for occupied areas and electronics equipment areas are based on Criterion 1.2.1.2 of "Waste Handling Building Ventilation System Description Document."

1.2.3.3 Criterion Basis Statement

I. Criterion Need Basis

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

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

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

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

This criterion supports MGR RD 3.3.A.

II. Criterion Performance Parameter Basis

N/A

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with interfacing MGR systems. Specifically, this criterion identifies interfaces with Monitored Geologic Repository Operations Monitoring and Control System for centralized monitoring and supervisory control. This criterion supports MGR RD 3.2.C (communications supporting packaging of waste), 3.3.K (communications supporting material control, emergency response, and security and safeguards operations), and 3.3.L (communications supporting WP recovery and opening operations).

II. Criterion Performance Parameter Basis

N/A

1.2.4.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the system is compatible with the Waste Handling Building Electrical System. This criterion supports MGR RD 3.2.C, 3.3.A, and 3.3.L.

II. Criterion Performance Parameter Basis

N/A

1.2.4.3 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.4.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the need for the system to stage and transfer lids out of the system. The lids will then be dispositioned. This requirement is a lower level decomposition of MGR RD 3.3.L, which requires the capability to open the WP/DC. Disposal of the lid will be necessary after the opening operation.

II. Criterion Performance Parameter Basis

N/A

1.2.4.5 Criterion Basis Statement

I. Criterion Need Basis

Material removed during the preparation of closure welds for rewelding and during DC/WP examination and opening will need to be transferred to the appropriate system for processing and eventual disposal. This criterion identifies the interface between the system and the Site Generated Radiological Waste Handling System for the transfer of that material. This criterion supports the implementation of the packaging aspect of MGR RD 3.3.G, and supports MGR RD 3.1.C and 10 CFR 63.21(c)(17).

II. Criterion Performance Parameter Basis

N/A

1.2.4.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to identify the maximum surface dose rate to be expected at the WP surface. This criterion supports MGR RD 3.2.C and 3.3.L.

II. Criterion Performance Parameter Basis

The surface dose rate is obtained from "Dose Rate Calculation for the 44-BWR UCF Waste Package," Table 25. The results from the calculation are conservatively converted from rem/hr to rad/hr and rounded up to the nearest 10 rad/hr for use in this system's design.

1.2.4.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to identify the maximum WP thermal output. This criterion supports MGR RD 3.2.C and 3.3.L.

II. Criterion Performance Parameter Basis

The WP thermal output is obtained from "Monitored Geologic Repository Project Description Document," Section 5.2.13.

1.2.4.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to identify the WP materials on which the system will have to perform remediation operations. This criterion supports MGR RD 3.2.C and 3.3.L.

II. Criterion Performance Parameter Basis

The DC/WP materials and thicknesses are obtained from "Monitored Geologic Repository Project Description Document," Section 5.2.12.

1.2.4.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion provides for the tracking of all WPs 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 which invokes "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR 72). This criterion specifically supports 10 CFR 72.72(a).

II. Criterion Performance Parameter Basis

N/A

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 6.4g3 and 6.5g3.

II. Criterion Performance Parameter Basis

N/A

1.2.6.1 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.2 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 6.9g5 and 7.19g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 7.20g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion ensures that the design complies with "Design Requirements for Light Water Reactor Fuel Handling Systems" (ANSI/ANS-57.1-1992), which supports MGR RD 3.1.G.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 7.1g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 7.2g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statements 7.5g1 and 7.5g2.

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 7.14g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 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 SDD, 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

1.2.6.9 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

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

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

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

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 6.10g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

Information being communicated by safety signs and tags must be quickly and easily read and uniformly understood. The ANSI Z535 series (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

1.2.6.12 Criterion Basis Statement

I. Criterion Need Basis

In support of MGR RD 3.3.A, the "Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities" (36 CFR 1191, Appendix A) provides specific HFE design guidelines for providing personnel with physical disabilities access to and use of system resources. In addition, "Accessible and Usable Buildings and Facilities" (CABO/ANSI A117.1-1992) establishes configurations and design criteria for allowing accessibility to and usability of system components by persons with physical disabilities. When used in conjunction with other HFE standards and guidelines, these codes and standards will ensure a safe and efficient design.

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.14 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, and integration of software supporting the user interface in computer systems must consider the characteristics of the user population. In support of MGR RD 3.3.A, the application of "Guidelines for Designing User Interface Software" (ESD-TR-86-278), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles" (ISO 9241-10), "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues" (ISO 9241-14), and "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 15: Command Dialogues" (ISO 9241-15), ensures that HFE criteria will be incorporated into the selection, design, and integration of user interface software.

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.15 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.16 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "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

1.2.6.17 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment" (IEEE Std 1100-1992) provides a consensus of recommended practices in an area where conflicting information and confusion, stemming primarily from different view points of the same problem, have dominated. IEEE Std 1100-1992 addresses electronic equipment performance issues while maintaining a safe installation.

II. Criterion Performance Parameter Basis

N/A

1.2.6.18 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.19 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.20 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

1.2.6.21 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which recommends compliance with industry codes and standards. The "Standard Guide for Design of Equipment for Processing Nuclear and Radioactive Materials" (ASTM C 1217-92) provides generalized criteria and guidelines for the design of equipment used in shielded cell or canyon facilities for the processing of nuclear and radioactive materials. It is the intent of ASTM C 1217-92 to set down the conditions and practices that have been found necessary to ensure against or to minimize the failures and outages of equipment used in a nuclear processing environment.

This criterion is supported by guidance contained in the "MGR Compliance Program Guidance Package for the Waste Package Remediation System," Guidance Statement 7.17g1.

II. Criterion Performance Parameter Basis

N/A

1.2.6.22 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion supports MGR RD 3.1.G.

II. Criterion Performance Parameter Basis

N/A

APPENDIX B ARCHITECTURE AND CLASSIFICATION

The system architecture and QA classification are identified in Table 4. The QA classifications are established in "Classification of the Waste Package Remediation System." Definitions of the QA classifications may be found in QAP-2-3, "Classification of Permanent Items."

Table 4. System Architecture and QA Classification

Waste Package Remediation System	QL-1	QL-2	QL-3	CQ
Control & Tracking System		X		
Decontamination System		X		
Handling/Transfer System				
Bridge Crane/Hoist		X		
Hot Cell Manipulator		X		
Lid Handling & Transfer Equipment		X		
Transfer Cart				X
WP/DC Inspection/Sampling System				X
WP/DC Weld Preparation & Opening System		X		
WP/DC Temporary Lid		X		

APPENDIX C ACRONYMS, SYMBOLS, AND UNITS

C.1 ACRONYMS

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

ALARA	as low as reasonably achievable
CQ	Conventional Quality
DC	disposal container
F	Function
HFE	human factors engineering
MGR RD	Monitored Geologic Repository Requirements Document
MGR	Monitored Geologic Repository
N/A	not applicable
QA	Quality Assurance
QL	Quality Level
SDD	system description document
SSCs	structures, systems, and components
TBD	to be determined
TBV	to be verified
WP	waste package
WHB	Waste Handling Building

C.2 SYMBOLS AND UNITS

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

C	Celsius
°F	degrees Fahrenheit
%	percent
kW	kilowatt
cm	centimeter
dpm	disintegration's per minute

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.

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